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Revitalizing Islamic Education Through STEAM to Achieve the SDGS: A Pathway to Higher-Order Thinking and Academic Excellence

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Abstract

Objective: This study aims to examine the effectiveness of integrating the STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach into Islamic Religious Education (IRE) to enhance students' higher-order thinking skills (HOTS) and academic performance, while promoting value-based character development. **Theoretical framework:** The study is grounded in Bloom's Taxonomy, focusing on cognitive levels C3 (application), C4 (analysis), and C5 (evaluation), combined with Islamic epistemology and constructivist learning theory, which emphasize holistic and contextual knowledge. **Literature review:** Existing literature highlights the success of STEAM in scientific disciplines, but its application in religious education remains limited. Classical Islamic scholars advocated the integration of rational, empirical, and spiritual knowledge. Embedding STEAM in IRE aligns with this legacy and supports Sustainable Development Goal 4.7, promoting inclusive, ethical, and future-ready education. **Methods:** Using a quasi-experimental pretest-posttest control group design, this study involved eighth-grade students at SMP Negeri 13 Surakarta. The experimental group received STEAM-based instruction on muamalah (Islamic economic ethics), while the control group followed traditional methods. Quantitative data were analyzed using t-tests; qualitative insights were drawn from student journals and reflections. **Results:** Students in the STEAM group showed significant improvements in HOTS, with mastery levels reaching 96%, alongside notable academic gains and deeper engagement. **Implications:** Integrating STEAM into IRE fosters critical, creative, and ethically grounded learners. It offers a transformative model for modern Islamic education that bridges tradition and innovation. **Novelty:** This study pioneers an interdisciplinary framework merging STEAM with Islamic values, providing empirical support for its relevance in 21st-century education.

Keywords: steam education, innovation, cognitive, sustainable development goals, interdisciplinary learning.

INTRODUCTION

Entering the 21st century, the global education system is confronted with the challenge of preparing learners who are capable of higher-order thinking, creativity, and interdisciplinary competence [1]. Education is no longer merely about the transmission of knowledge but aims to shape individuals who can think critically, solve real-world problems, and actively participate as global citizens [2]. In this context, Islamic religious

education—which has traditionally emphasized memorization and the transmission of normative values—faces a significant challenge to remain relevant and responsive to the demands of the times [3].

The *Global Education Monitoring Report* by UNESCO (2023) notes that more than 70% of students in developing countries still experience passive, teacher-centered learning, with less than 30% of instructional time dedicated to critical and creative thinking activities [4]. In both madrasahs and public schools offering Islamic Religious Education (IRE), the learning process remains largely textual, with limited contextualization, and is rarely linked to real-life issues or global challenges such as sustainability, social justice, and digital literacy [5].

The STEAM approach (Science, Technology, Engineering, Arts, and Mathematics) offers an innovative strategy to address these needs [6]. STEAM promotes the integration of interrelated disciplines and emphasizes project-based, collaborative, and contextual learning [7]. Arce et al. (2022) demonstrate that this approach enhances critical thinking and teamwork skills in engineering, while Aguayo et al. (2023) have developed a STEAM framework grounded in ethics and immersive technology to support inclusive and value-oriented learning. However, there is still a paucity of research examining the application of STEAM within the context of Islamic religious education, particularly in supporting the development of higher-order thinking skills (C3–C5) and the achievement of the Sustainable Development Goals (SDGs) [8], [9].

This research gap is evident in the dominance of STEAM studies in science or technology subjects and the scarcity of cross-disciplinary approaches that integrate Islamic values within a 21st-century educational framework. As a result, a dichotomy persists between religious education and global educational innovation, hindering the active contribution of Islamic religious education to the achievement of the SDGs, particularly SDG 4: Quality Education. This study stems from the problem that conventional IRE instruction has not been optimal in fostering higher-order thinking skills and students' academic performance, primarily because it has not yet adopted interdisciplinary approaches such as STEAM. Global challenges require religious instruction to be not only normative but also practical, creative, and reflective of real-life contexts [8], [9].

The urgency of this research is reinforced by the global commitment to achieving the Sustainable Development Goals (SDGs) by 2030. The integration of STEAM into Islamic religious education may serve as a strategic solution to develop learners who are both devout and capable of critical thinking, digitally competent, and aware of global issues such as sustainability, justice, and social responsibility. Therefore, this study proposes a contextual, innovative, and impactful model for revitalizing religious education, with the aim of enhancing learning quality and student character in this era of educational transformation.

LITERATURE REVIEW

In contemporary education, the cultivation of higher-order thinking skills (HOTS)—including application, analysis, and evaluation—is increasingly emphasized to equip learners with the capacity for critical reasoning and real-world problem-solving. However, in many developing countries, including Indonesia, Islamic Religious Education (IRE) remains heavily oriented toward rote memorization and teacher-centered approaches, leaving little room for analytical and contextual learning [8]. This gap is particularly problematic in the face of 21st-century challenges, where education must foster not only religious knowledge but also reflective, creative, and socially responsible individuals.

The STEAM (Science, Technology, Engineering, Arts, and Mathematics) approach has emerged as a promising interdisciplinary method to address these needs [2]. By emphasizing project-based learning, collaboration, and the integration of diverse fields, STEAM encourages students to engage deeply with content and apply it in meaningful ways. Although its application is well-documented in scientific and technical education, its use in IRE is still rare. Nonetheless, Islamic intellectual tradition supports such integration; classical scholars like Al-Farabi and Ibn Sina exemplified a harmonious relationship between faith, reason, and empirical inquiry. Embedding STEAM into IRE revitalizes this

holistic model, enabling learners to examine Islamic values within modern, real-world contexts [6].

Furthermore, integrating STEAM in religious education aligns with Sustainable Development Goal 4, particularly target 4.7, which advocates for inclusive, value-based, and globally conscious learning. Through creative projects—such as educational posters on economic ethics or scrapbooks about Muslim scholars—students not only develop cognitive competencies but also internalize values like justice, empathy, and responsibility [9]. These outcomes highlight STEAM's potential to transform Islamic education into a platform for nurturing critical thinkers who are both spiritually grounded and prepared to contribute to a sustainable and ethical global society.

METHODOLOGY

This study employs a quasi-experimental approach using a pretest–posttest control group design to investigate the effect of the STEAM (Science, Technology, Engineering, Art, Mathematics) approach on enhancing students' cognitive abilities and academic achievement in Islamic Religious Education (IRE). This design was selected because it enables the researcher to objectively compare the effectiveness of the intervention (STEAM approach) on the experimental and control groups by measuring outcomes both before and after the treatment. The research framework is aligned with the Sustainable Development Goals (SDGs), particularly SDG 4 on Quality Education, which emphasizes inclusive, equitable, and transformative learning that promotes critical thinking and sustainable development competencies [10].

The research subjects consisted of eighth-grade students at SMP Negeri 13 Surakarta, divided into two groups: an experimental group that received IRE instruction using the STEAM approach, and a control group taught through conventional methods. The instructional content focused on the theme of muamalah, specifically topics related to riba (usury), jual beli (trade), and Islamic economic ethics. These themes were contextualized within SDGs perspectives, especially SDG 8 (Decent Work and Economic Growth) and SDG 16 (Peace, Justice and Strong Institutions), by encouraging ethical financial literacy, fairness in transactions, and responsible economic behavior. The STEAM approach applied in the experimental group was project-based, encouraging students to solve real-world problems collaboratively, creatively, and reflectively while integrating Islamic moral principles and SDGs-oriented global citizenship values [10].

The instruments used in this study included a cognitive ability test based on Bloom's Taxonomy at levels C3 (application), C4 (analysis), and C5 (evaluation), as well as an academic achievement test aligned with national IRE curriculum standards and SDGs competency indicators such as critical reasoning, ethical judgment, and problem-solving skills. Observation sheets were used to monitor student engagement, collaboration, and creativity—competencies emphasized in SDGs Target 4.7. Reflective journals and student perception questionnaires were administered to gather qualitative insights regarding students' awareness of ethical economic practices, sustainability values, and social responsibility as embedded within the SDGs framework.

RESULT AND DISCUSSION

Cognitive Ability Results – Cycle 1

To evaluate students' cognitive abilities following project-based learning using the STEAM approach in the Islamic Religious Education (IRE) subject, the researcher administered an instrument consisting of 15 multiple-choice questions covering cognitive indicators from C1 (knowledge) to C5 (evaluation). However, the primary focus of analysis in this cycle was directed toward higher-order thinking skills, specifically the indicators C3 (application), C4 (analysis), and C5 (evaluation) [11], [12], [13].

Based on the data presented in Table 1, it was found that the average student achievement for indicators C3 through C5 reached 92%. More specifically, the achievement for C3 (application) was 82%, C4 (analysis) reached 98%, and C5 (evaluation) was 97%. These high scores indicate that students were not only able to understand the material conceptually

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but also capable of applying it in real-life contexts and offering critical assessments of complex religious issues.

Table 1. Percentage of Students' Higher-Order Cognitive Mastery in Cycle 1

Cognitive Indicator	Scope of Competency	Number of Items	Mastery Rate (%)
C3 (Application)	Applying concepts within context	3 items	82%
C4 (Analysis)	Differentiating, deconstructing, and analyzing information	2 items	98%
C5 (Evaluation)	Evaluating and making decisions based on Islamic values	3 items	97%
Average C3–C5		**8 items**	**92%**

For the C3 (Application) indicator, questions were presented through illustrations of real-life events, such as trading practices and lending-borrowing scenarios. For instance, students were asked to evaluate the validity of a transaction based on a given illustration [14]. Another item required students to identify the correct statement regarding proper etiquette in financial dealings from five options, which was contextually linked to their experience with a crossword puzzle project [15].

Under the C4 (Analysis) indicator, students were confronted with illustrations comparing various forms of *riba* (usury) and were required to analyze which type of *riba* was depicted [16]. One item tested students' precision in distinguishing Islamic trading principles by incorporating distractors, such as the word *"except"*, to assess their ability to identify key concepts and maintain cognitive focus [17].

Meanwhile, in the C5 (Evaluation) indicator, students were challenged to critically assess scenarios containing controversial issues, such as the use of bank interest and the moral wisdom behind financial transactions (*muamalah*). In these questions, students were expected to construct arguments grounded in Islamic values and draw on insights gained during their project-based learning experience [18].

Although the questions were formatted as multiple-choice, they were non-standard. Instead, the items were deliberately varied in construction, including complex statements, value-based selections, and prompts that encouraged divergent thinking and reasoned argumentation [19]. This demonstrates that the assessment instrument fulfilled the criteria for measuring procedural and metacognitive knowledge [20].

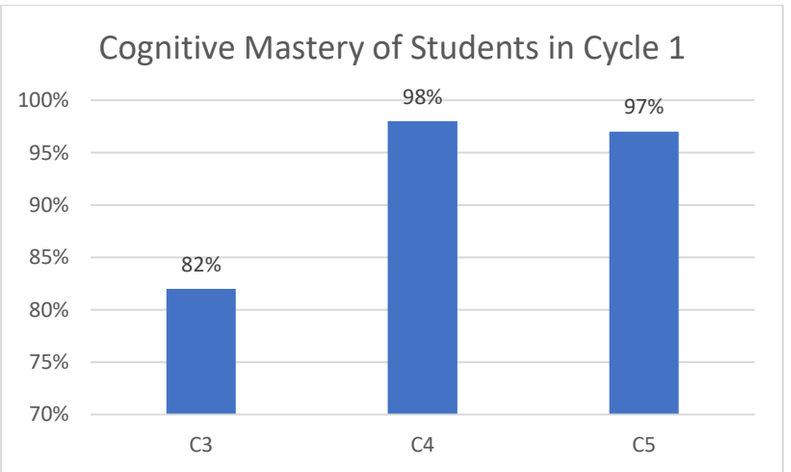

Figure 1. Percentage of Higher-Order Cognitive Mastery of Students in Cycle 1

The high achievement in indicators C3–C5, as shown in Figure 1 above, indicates that students have reached the concrete operational stage according to Jean Piaget's cognitive theory—namely, the ability to reason logically about real-world situations. This is reflected in the students' cognitive maturity as demonstrated through the completion of the crossword

puzzle project, group discussions, and critical evaluations of *Sharia* values within contemporary contexts.

This achievement also highlights the success of the STEAM approach in fostering divergent thinking skills—the ability to generate multiple solutions to a given problem. Therefore, the level of cognitive ability demonstrated by students in Cycle 1 not only signifies academic success but also validates the effectiveness of the STEAM approach as a means of revitalizing Islamic Religious Education, embedding both value-based learning and 21st-century skill development.

Cognitive Ability Results – Cycle 2

To assess the improvement in students' cognitive abilities following project-based learning using the STEAM approach in the second cycle, the researcher administered 15 multiple-choice questions representing cognitive indicators from C1 to C5. These questions were designed to measure both conceptual understanding and higher-order thinking skills. The primary focus of this analysis was on indicators C3 (application), C4 (analysis), and C5 (evaluation), as representations of critical and metacognitive thinking abilities.

Based on the data presented in Table 2, the average mastery level of students in responding to items aligned with indicators C3 to C5 reached 90%. This figure exceeds the minimum threshold for high-level mastery, which is defined as above 80%. More specifically, students' accuracy in answering questions for C3 (Application) was 89%, C4 (Analysis) was 88%, and C5 (Evaluation) reached 93%. These results reflect a strong level of proficiency in higher-order thinking, encompassing the application of concepts through to critical evaluation.

Table 2. Average Cognitive Ability of Students in Cycle 2

Cognitive Indicator	Number of Items	Sample Question Topics	Correct Answer Percentage
C3 (Application)	3 items	Implementation of online trading, principles of Islamic economics, identification of types of *riba*	89%
C4 (Analysis)	2 items	Legal analysis of online trading, rationale for the permissibility of credit in Islam	88%
C5 (Evaluation)	5 items	Proposing solutions to legal differences in credit, comparing scholarly perspectives	93%
Average C3–C5	**10 items**	**90%**	

For the C3 (Application) indicator, the assessment items were designed to require students to apply principles of Islamic economics to real-life situations. Three types of questions were presented: identifying online trading practices deemed permissible in Islam, recognizing the principles of *riba* (usury) in banking practices, and applying legal rulings within complex financial transaction scenarios. The results indicated that students were able to actively and accurately connect the concepts learned to real-world contexts, demonstrating a high level of application [21].

Regarding the C4 (Analysis) indicator, two questions were administered that tasked students with analyzing online trading cases from the perspective of Islamic law and evaluating the *Sharia*-based foundations of credit systems. These items included distractors designed to enhance students' attention to detail and analytical precision. Students demonstrated strong abilities in differentiating, clarifying, and drawing conclusions grounded in religious principles, reflecting significant achievement at the analytical level [22].

Meanwhile, in the C5 (Evaluation) indicator, students' cognitive performance reached its highest point. The five questions challenged them to assess the legality of leasing arrangements, weigh differing opinions on bank interest, and propose solutions to controversies in credit systems. The high percentage of correct responses—93%—illustrates students' reflective thinking skills. They were able to consider multiple

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perspectives and make decisions based on *Sharia* principles, indicating maturity in critical evaluation.

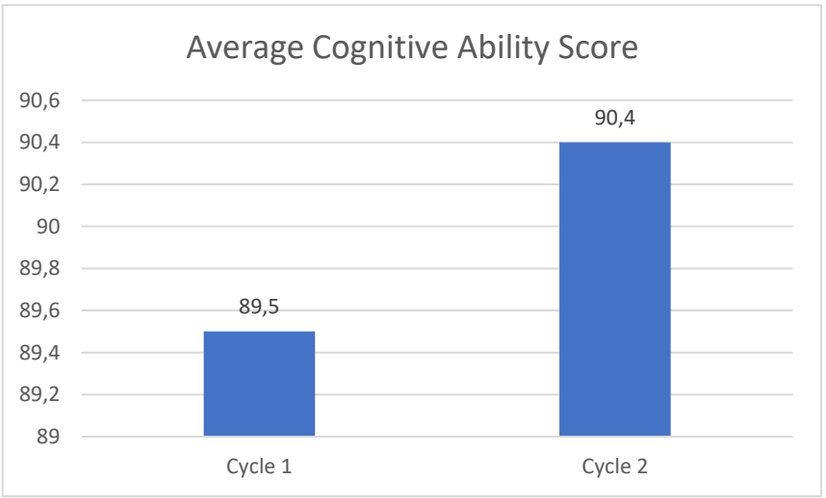

Figure 2. Comparative Graph of Cognitive Ability in Cycle 1 and Cycle 2

As shown in Figure 2 above, compared to Cycle 1, there was an improvement in both the quality of responses and the depth of students' thinking, even though the average percentage increase was not significantly large.

Table 3. Comparison of Cognitive Ability Between Cycle 1 and Cycle 2

Indicator	Cycle 1	Cycle 2	Description of Change
C3	82%	89%	Significant improvement – students became more practiced in real-world applications.
C4	98%	88%	Slight decrease – Cycle 2 questions were more complex and open-ended
C5	97%	93%	Remained high – evaluative understanding remained strong
Average	**92%**	**90%**	**Relatively stable, but with increased depth of thinking**

Although the average percentages for indicators C4 and C5 slightly declined in Table 3, the question types in Cycle 2 were more open-ended and reflective-argumentative, requiring logical analysis rather than mere recall or identification. This indicates that students have begun to engage in metacognitive thinking—understanding not only *"what to think"* but also *"how to think correctly."*

In the second cycle of learning, students were assigned a project to create educational posters using Canva, centered around the theme *"The Dangers of Riba and Trade in Islam in the Digital Era."* Through this project, students were challenged not only in terms of logical and critical thinking, but also in being creative and reflective. They demonstrated metacognitive abilities, including the ability to plan and design layouts, select supportive colors and images, and effectively craft educational messages.

During the creation process, students actively supported one another, exhibiting empathy and collaboration—aspects of social character development that are integral to the STEAM-based learning approach. The resulting posters were displayed in classrooms and throughout the school to provide moral education to the wider school community. This activity not only fostered students' social responsibility but also strengthened the relevance of religious education to real-life contexts.

With a correct response rate of 90% on C3–C5 indicators, it can be concluded that students demonstrated well-developed higher-order and metacognitive abilities. They were not only able to understand and apply the material, but also to reason and evaluate logically by Islamic values. The STEAM approach proved effective in shaping students who are critical, creative, and socially conscious.

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Cognitive Ability Results – Cycle 3

To assess students' cognitive achievement in the third cycle, the researcher administered 15 multiple-choice questions covering indicators from C1 to C5. These items were developed based on the material *"Contributions of Muslim Scholars during the Abbasid Caliphate."* The focus in this cycle was on integrating historical content, scientific thought, and Islamic civilizational values into a systematic and analytical thinking framework through a scrapbook-making project.

Table 4. Percentage of Students' Cognitive Ability in Cycle 3

Cognitive Indicator	Number of Items	Sample Question Topics	Correct Answer Percentage
C3 (Application)	5 items	Application of *Ilm al-Kalam*, key Islamic figures, school of thought implementation, and the content of Imam Ghazali's works	90%
C4 (Analysis)	2 items	Analysis of scientific development during the Abbasid era, the content of scientific narratives	100%
C5 (Evaluation)	2 items	Evaluation of the impact of knowledge transmission to Europe, analysis of factors behind Islamic success	98%
Average C3–C5	**9 items**	**96%**	

The test results indicate a significant improvement in students' cognitive performance on higher-order indicators (C3–C5). The average accuracy across these three indicators reached 96%, with detailed scores of 90% for C3 (Application), 100% for C4 (Analysis), and 98% for C5 (Evaluation). These results reflect that nearly all students were able to answer the questions corresponding to indicators C3 through C5 correctly. This indicates that higher-order thinking skills—ranging from concept application and in-depth analysis to critical evaluation—were optimally achieved by the students.

The C3 items were designed with varied formats, including matching exercises (e.g., associating schools of thought with specific regions) and analysis of the application of Muslim scholars' thought. Students demonstrated the ability to connect classical texts and scholarly contributions to contemporary contexts. For the C4 indicator, the two questions required students to analyze factors influencing scientific development during the Abbasid period and to interpret scientific narratives. All students answered these correctly, indicating strong logical reasoning and an ability to understand cause-and-effect relationships. The C5 items prompted students to evaluate the factors behind Islam's success in transmitting knowledge to the West and to provide critical reflections on the evolution of European civilization. Students displayed advanced evaluative abilities and intellectual maturity in drawing historical and cultural comparisons across civilizations.

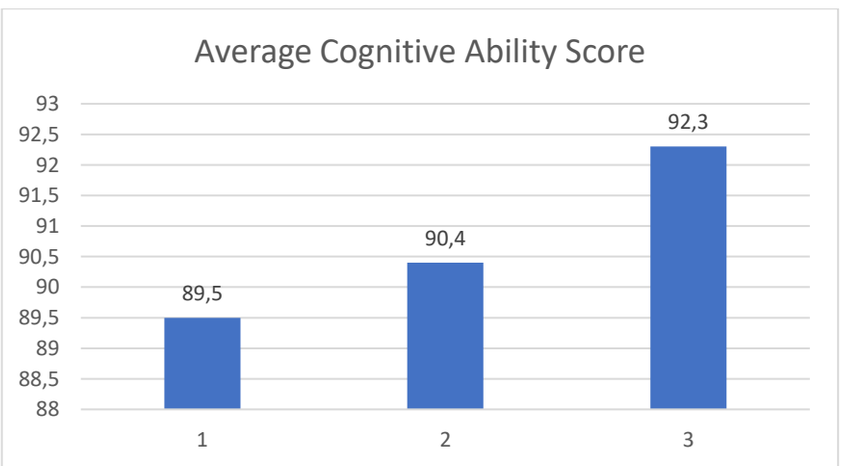

Figure 3. Graph of Students' Cognitive Development Across Cycles

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The high achievement observed in Cycle 3, as depicted in Figure 3, indicates that students have successfully developed both procedural and metacognitive knowledge comprehensively. Procedurally, they demonstrated the ability to apply the thoughts of prominent Islamic scholars within the context of historical learning by connecting theories and concepts to real-world situations.

Metacognitively, students showed the capacity to analyze historical relationships with civilizational progress and to evaluate Islamic values in the advancement of global knowledge. The questions presented in this cycle employed a complex and reflective multiple-choice format, including tasks such as identifying true or false statements, interpreting the meaning of historical narratives, and expressing personal viewpoints based on historical evidence.

Unlike previous cycles, which emphasized current contexts, Cycle 3 placed greater focus on analyzing past historical events as a basis for present-day reflection. As such, the question format leaned more toward narrative-analytical structures rather than contextual case studies.

Table 5. Comparison of Cognitive Ability from Cycle 1 to Cycle 3

Cycle	C3 (%)	C4 (%)	C5 (%)	Average C3–C5 (%)
Cycle 1	82%	98%	97%	92%
Cycle 2	89%	88%	93%	90%
Cycle 3	90%	100%	98%	96%

With an average achievement of 96% across indicators C3 to C5, as shown in Table 5, students are considered to have reached the formal operational stage as proposed by Jean Piaget. At this developmental stage—typically attained by learners aged 12 and above—students can think abstractly and logically, draw comparisons across historical periods and cultures, and generalize principles and concepts from historical content to global contexts.

The results in Cycle 3 also demonstrate that the STEAM-based instructional approach, which emphasizes the integration of history and Islamic literacy, has effectively fostered the development of higher-order thinking skills [23]. Students not only understood the material at a textual level but were also able to interpret, evaluate, and articulate personal reflections on the intellectual heritage of Islam critically and reflectively. Therefore, this approach has proven effective in supporting the achievement of Sustainable Development Goal (SDG) 4: Quality Education, particularly by cultivating transformative thinking and strengthening Islamic historical literacy in the 21st century.

Effectiveness Test of the STEAM Learning Approach

To examine the effectiveness of implementing the STEAM learning approach on students' academic achievement, a t-test analysis was conducted to compare the Pre-Test and Post-Test scores between the experimental class (which received STEAM-based instruction) and the control class (which continued using conventional teaching methods). The purpose of this test was to determine whether the STEAM approach had a statistically significant impact on student learning outcomes in the Islamic Religious Education subject.

1. t-Test of Pre-Test Scores in the Experimental and Control Classes

   The t-test on the Pre-Test scores was conducted to assess whether there were any differences in initial ability levels between the experimental and control classes before the intervention was implemented. The data analysis results are presented in the following table:

Table 6. t-Test Results of Pre-Test Scores: Experimental vs. Control Class

Pre-Test	Experimental Class	Control Class
Mean Score	46.16	55.58
Sig. (2-tailed)	0,14	
$T_{calculated}$	-2.551	

T_{table} (α = 0,05)	1,681

Based on the analysis, the significance value was 0.14, which is greater than 0.05, indicating that the null hypothesis (H_0) is accepted while the alternative hypothesis (H_a) is rejected. This means that there was no significant difference between the Pre-Test scores of the experimental and control classes, and that students in both groups had equivalent baseline abilities. This finding suggests that the conventional teaching method used before the intervention did not significantly affect students' learning outcomes. This condition is crucial for establishing the validity of the study, as it confirms that any learning differences observed after the intervention can be attributed to the implementation of the STEAM-based instructional approach.

2. t-Test of Post-Test Scores in the Experimental and Control Classes

Following the implementation of the instructional intervention, a second t-test was conducted on the Post-Test scores of both classes to determine the effect of the STEAM approach. The results are presented in the following table:

Table 7. t-Test Results of Post-Test Scores: Experimental vs. Control Class

Post-Test	Experimental Class	Control Class
Mean Score	87.03	63.54
Sig. (2-tailed)	0,000	
$T_{calculated}$	8.383	
T_{table} (α = 0,05)	1,681	

Based on the results above, the significance value was 0.000, which is less than 0.05; thus, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This indicates that there is a statistically significant difference between the Post-Test scores of the experimental and control classes. Consequently, the STEAM learning approach has been proven to have a significant impact on students' academic achievement.

3. Comparison of Learning Mastery Between Experimental and Control Classes

To further examine the impact of STEAM on learning mastery, the following table presents a comparison of scores and mastery levels between the experimental and control classes:

Table 3. Comparison of Scores: Experimental Class vs. Control Class

Description	Pre-Test (Experimental Class)	Post-Test (Experimental Class)	Pre-Test (Control Class)	Post-Test (Control Class)
Highest Score	78	100	79	85
Lowest Score	33	66	26	45
Average Score	46.16	87.63	55.58	63.54
Number of Students Not Passing	19	0	22	17
Number of Students Passing	0	19	4	9
Mastery Percentage (%)	0%	100%	15.4%	35.6%

Based on the collected data, the STEAM learning approach has been proven to be more effective than conventional methods. The significant increase in scores and learning mastery in the experimental class demonstrates that STEAM not only enhances content comprehension but also encourages students to actively engage in critical, creative, and collaborative thinking. The t-test results confirmed that following the implementation of STEAM, there was a statistically significant improvement in students' academic achievement, whereas the control class showed only a marginal gain. Therefore, the

integration of STEAM-based instruction is strongly recommended for the development of modern and contextual Islamic Religious Education, and aligns directly with the goals of Sustainable Development Goal (SDG) 4: Quality Education.

Discussion

This study has demonstrated that the implementation of the STEAM approach (Science, Technology, Engineering, Art, and Mathematics) in Islamic Religious Education (IRE) is not only practically relevant but also theoretically and philosophically meaningful [24]. Across three cycles of action research and an effectiveness test, this approach has proven effective in enhancing students' cognitive abilities, particularly within the domain of higher-order thinking skills (C3–C5), and in cultivating reflective and responsible attitudes aligned with Islamic values [25].

One of the most important findings of this study is that the STEAM approach does not contradict Islamic principles [3]. On the contrary, it reinforces the substance of Islamic teachings through more contextual and applicable pedagogies. In Islam, knowledge is not merely empirical or quantitative; it is also ethical and transcendental [26]. Concepts such as *muamalah* (economic dealings), etiquette in lending and borrowing, and the contributions of Muslim scholars during the Abbasid period all carry profound moral and spiritual dimensions. Through the STEAM approach, students are not limited to memorizing laws—they are encouraged to analyze and evaluate the application of those laws in real-world contexts. This is consistent with the Islamic educational ideal of *tafaqquh fid-din*, which emphasizes deep understanding and application rather than rote memorization [27].

Moreover, STEAM revives the spirit of classical Islamic epistemology, which embraces a holistic integration of knowledge and action, reason and spirituality [28]. This was evident in the student-led projects, such as crossword puzzles on *muamalah*, digital posters on the dangers of *riba* created using Canva, and scrapbooks detailing the contributions of Muslim scientists. These activities underscore that learning religion is not a dogmatic process, but rather a creative, reflective, and solution-oriented engagement with contemporary issues [29].

Student performance on C3–C5 questions increased significantly across cycles [30]. In the third cycle, students reached 100% accuracy in C4 (analysis) and 98% in C5 (evaluation), showing that STEAM effectively fosters higher-order thinking skills (HOTS). This is crucial, given that conventional education systems often overemphasize information recall and procedure repetition, rather than deep understanding, real-world application, and critical evaluation [31], [32].

Critically, this also highlights the need to reconstruct religious learning beyond one-way lectures and rote recitation [33]. Islamic education must become a space for dialogue, exploration, and meaning-making. STEAM provides that space, especially when students interpret Islamic economic practices, evaluate jurisprudential views, and develop informed stances on issues like modern banking interest and *riba*.

More broadly, this study affirms that the STEAM approach contributes directly to the achievement of Sustainable Development Goal (SDG) 4.7: ensuring that all learners acquire the knowledge and skills necessary to support sustainable development, appreciate cultural diversity, and promote peace [34], [35]. Project-based learning activities such as poster and scrapbook creation not only develop technical skills but also instill character values: social responsibility, economic justice awareness, and empathy toward contemporary issues [36]. When students post educational messages around the school or present their projects to peers, they are practicing the Islamic principle of *tabligh* (communicating goodness) in a form that resonates with their generation [37]. STEAM, in this sense, becomes not only a pedagogical method, but a transformative movement—bridging values and realities. It offers a model of Islamic education that is normative, contextual, progressive, and globally oriented [38].

Theoretically, this study also challenges the classical dichotomy between religious and secular knowledge. In Islamic intellectual history, scholars like Al-Kindi, Al-Farabi, and Ibn Sina embodied the integration of monotheism (*tauhid*), logic, and experimentation. In

that same spirit, STEAM may serve as a meeting point between Islamic education and the demands of the modern world, nurturing not only cognitive competence but also spiritual and social awareness.

Practically, this approach can be replicated across various educational levels and subjects, not only in religion classes but also in social studies, language, and science. This is vital for building a curriculum rooted in values, yet responsive to the complexity of the modern world. However, the success of this approach depends heavily on the readiness of teachers and institutions. Teachers must act not merely as transmitters of knowledge but as facilitators of inquiry and creativity. Likewise, the necessary infrastructure for project- and technology-based learning must be adequately provided. This study, therefore, also opens a policy discussion on the need for teacher training in designing STEAM learning grounded in Islamic values. By combining ethical values, creativity, and scientific reasoning, the STEAM approach stands out as one of the most promising strategies for revitalizing Islamic Religious Education. It shapes learners who are not only academically competent but also spiritually and socially mature. This study proves that when Islamic values are integrated with innovative approaches, education becomes more than a transmission of knowledge—it becomes a transformation of civilization [39].

This study provides strong empirical and pedagogical evidence that integrating the STEAM approach into Islamic Religious Education (IRE) significantly advances transformative learning aligned with the SDGs framework. The quantitative findings demonstrate substantial improvements in higher-order thinking skills (HOTS), particularly in indicators C3–C5, with mastery levels increasing from 92% in Cycle 1 to 96% in Cycle 3. The post-test comparison further confirms the effectiveness of the intervention, as the experimental class achieved a mean score of 87.03 compared to 63.54 in the control class, with a statistically significant difference ($p < 0.05$). These results indicate that interdisciplinary, project-based instruction enhances not only conceptual understanding but also analytical and evaluative reasoning [39].

From an SDGs perspective, the study directly contributes to SDG 4 (Quality Education), especially Target 4.7, which emphasizes education for sustainable development, global citizenship, and ethical awareness. Through STEAM-based projects—such as digital posters on riba, contextual muamalah case analyses, and historical scrapbooks on Abbasid scholars—students engaged in applied ethical reasoning and social reflection. These activities foster competencies relevant to SDGs 8 (Decent Work and Economic Growth) by strengthening financial ethics literacy, SDGs 9 (Industry, Innovation and Infrastructure) through digital creativity, and SDGs 16 (Peace, Justice and Strong Institutions) by cultivating justice-oriented moral evaluation rooted in Islamic principles [40].

The 100% analytical mastery (C4) in Cycle 3 demonstrates that students developed structured reasoning and causal analysis, essential competencies for sustainable decision-making. Meanwhile, the 98% evaluative achievement (C5) reflects students' capacity to assess complex socio-economic issues such as bank interest and Islamic economic systems within broader ethical frameworks. These outcomes align with SDGs indicators promoting critical thinking, inclusive participation, and responsible citizenship. Moreover, the STEAM integration model reduces the traditional dichotomy between religious and scientific knowledge, echoing holistic Islamic epistemology while supporting SDGs integration in curriculum innovation. The combination of technological tools (e.g., Canva), collaborative inquiry, and value-based discussion creates a learning ecosystem that supports lifelong learning principles embedded in SDGs policy discourse [40].

Importantly, the mastery increase from 0% to 100% learning completion in the experimental class signifies not only academic progress but also systemic instructional transformation. This suggests that embedding SDGs-oriented competencies within faith-based education can modernize religious instruction without compromising theological integrity. Therefore, this research substantiates that STEAM-based Islamic education is a viable pathway toward achieving SDGs goals, strengthening SDGs literacy, promoting SDGs values, and operationalizing SDGs principles in classroom practice [41].

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CONCLUSION

The implementation of the STEAM learning approach (Science, Technology, Engineering, Art, and Mathematics) in Islamic Religious Education (IRE) has been proven to significantly enhance students' cognitive abilities, particularly in higher-order thinking skills (C3–C5), while also promoting optimal academic achievement. Throughout three instructional cycles, students demonstrated consistent development in applicative, analytical, and evaluative thinking through project-based activities such as Islamic-themed crossword puzzles, digital posters, and scrapbooks. Statistical tests of effectiveness further support these findings, revealing significant differences between the experimental and control groups in terms of learning mastery and average scores. The STEAM approach not only has to be compatible with Islamic values, but also has to strengthen the spiritual, moral, and social dimensions of *muamalah* education. The integration of Islamic values and scientific approaches within this model enables students to engage in reflective, contextual, and creative learning. Moreover, this approach contributes directly to the realization of the Sustainable Development Goals (SDGs), particularly SDG 4, by fostering quality, inclusive education that is grounded in cultural values and tolerance. Based on these findings, it is recommended that the STEAM learning model be more broadly adopted across both religious and non-religious education curricula. Teachers should be provided with training in interdisciplinary, values-based instructional design, and schools should be equipped with the necessary infrastructure to support project-based learning. Further research is also encouraged to explore the long-term impact of this approach on students' character formation, social awareness, and global literacy.

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Author Contribution

Annas Fajar Rohmani led the conceptual design, coordinated the research implementation, and drafted the manuscript. Wachidi contributed to methodological design and data analysis. Waston strengthened the theoretical framework and SDGs integration. Abdunrorma Samaalee provided comparative educational perspectives and critical revisions. Camila Garcia assisted in academic editing, language refinement, and final proofreading. All authors contributed substantially to discussion development, approved the final manuscript, and agreed to be accountable for the integrity and accuracy of the work.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this article entitled Revitalizing Islamic Education Through STEAM to Achieve the SDGs: A Pathway to Higher-Order Thinking and Academic Excellence. This research was conducted independently without commercial funding or financial sponsorship that could influence the study design, data interpretation, or conclusions. All authors affirm adherence to ethical research standards, academic integrity principles, and transparency throughout the entire research and publication process.

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