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The effect of Islam and science integration implementing on science learning in Indonesia: a meta-analysis

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ABSTRACT

National education aims to produce dedicated, religious, moral individuals and cognitive intelligence. Applying students' Islamic values through integrating Islam and science in science learning is one of the strategies that can be used to achieve these goals. Integrating Islam and science in science learning can direct the formation of knowledge about science concepts and improve students' attitudes and spiritual skills. This study aims to analyze the effect of integrating Islam and science in science learning. This study explores the effect of integrating Islam and science in science learning with meta-analysis research by calculating effect size (ES). Research data were obtained from 38 studies from national and international journals. The results showed that integrating Islam and science in science learning has a significant impact, as seen from the ES of 0.658. It is explained that science learning integrating Islam and science can be an alternative learning method. Integrating Islam and science into science learning is an alternative educational method to achieve national education goals that can increase students' intellectual and spiritual values. The results of this study can be utilized as a reference in the learning process and the development of teaching materials in science learning in the future.

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1. INTRODUCTION

According to article 3 of the law of the Republic of Indonesia no. 20 of 2003 concerning the national education system, the goal of national education is to help students realize their full potential as human beings who are obedient and devoted to God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and functional members of society [1]. Education is crucial for creating top-notch human resources. Excellent human resources tend to be moral and behave well [2]. The educational process can help students build their moral character, but it also needs support from families and nearby schools [3], [4].

The significance of religious education [5], notably Islam [6], in helping pupils develop excellent morals and morality is undeniably essential. Islamic education aims to harmonize the Islamic sciences as the basis of faith, achieve serenity and pleasure, develop students' morality, and guide the mind and soul in a more beneficial way [7]. Islamic education also purifies the soul by empowering pupils with admirable principles and decent values to live better [8]. Students can develop good morals and moral character by instilling faith and devotion (religion) in education.

One of the sciences taught in schools is science learning. It is a way to help students grow in their knowledge, skills, attitudes, and sense of social responsibility, as well as to help them strengthen their faith in and admire God Almighty [9]. Science systematically studies one's self, the cosmos, and life. As a result, when combined, the study of religion and science will result in significant learning [10]. Science educates people on the details, activities, and occasions surrounding God's creation of life. Students will realize the extent of God's power after studying science.

The holy book of Muslims, the Quran, in addition to examining issues about religion, also examines science, especially science [11]. The Quran and Hadith provide a complete and comprehensive explanation of every facet of human life, including scientific pursuits and study. Many verses in the Quran explain scientific phenomena, making it a helpful reference or reference for science learning [12]. The Quran has over 750 verses that explain various natural phenomena in vivid detail. Science education can be utilized to validate Quranic verses and present scientific proof, as the Quran can function as *hudal* (guidance) lines. The Quran and Hadith can be studied and used in science classes to investigate Islamic concepts and help students develop the noble character and faithfulness to God Almighty that is demanded by the goals of national education [13].

Applying a normative framework integrating Islamic concepts from the Quran and Hadith into science instruction can help build national education goals [14]. Students must have a character to develop and attain the attitude indicated in national education goals [15]. According to some, the goal of teaching Islamic principles is to help students become more proficient while also fostering deeper spiritual insights and a logical understanding of Islam in the context of life, especially those verses pertaining to *kauniyah* (nature) [16]. Students are given a variety of natural knowledge skills to accomplish this.

Islamic-based learning can be pursued through actualizing Quranic values in the learning process [17]. Developing the spiritual dimension, which includes faith, holiness, and noble character, is essential. The goal of science Islamization is to make every significant discovery about science in the 20th century, the majority of which occurred in the West, so that it can be used to increase the faith of Muslims [18]. According to several previous studies [19], [20], that explains the science, technology, engineering, art, mathematics, and religious (STEAM.R) strategy of integrating Islam and science has greatly increased students' understanding of scientific ideas. Research using digital media in the form of mobile learning Apps (MLA) with integrating Islam and science can help students learn. Therefore, the Islamization of science is undoubtedly beneficial for science education in Indonesia, which aims to give students confidence about the majesty of God Almighty and the natural order of God's creation.

It must be acknowledged that integrating Islam and science in science education takes much work. This study examines the impact of integrating science and Islam on science learning by determining the effect size (ES), which indicates whether learning with this integration differs from traditional learning. The necessity of integrating science and Islam into education must be illustrated using examples to highlight how important and urgent this process is. One of the key steps in addressing the pressing need to integrate Islam and science into education is to compare the circumstances in different places. Different parties will make decisions based on the conclusions of different research. As a result, this study aims to compare the effectiveness of traditional learning with learning that incorporates science and Islam in various Indonesian regions. The results of this meta-analysis study will likely provide an overview of how incorporating science and Islam into education enhances student learning outcomes and provide a basis for future research.

2. METHOD

This study is a meta-analysis that compiles the findings of related studies and draws a broad generalization. A study technique called a meta-analysis combines two or more previous research findings that may be statistically calculated [21]. This study focuses on how science and Islam can work together to improve science education. Therefore, all research comparing the outcomes of a learning process that uses or incorporates Islam and science makes up the data population in this article. The papers that are being reviewed were released in journals in the years 2016 through 2022. Articles are gathered using Google Scholar, a search engine linked to numerous journal portals and indexing services. This approach involves gathering data from as many relevant sources as possible to produce impartial data that appropriately represents real-world scenarios.

Based on articles published between 2016 and 2022, the following criteria must be met for an article to be included in this study: i) it must discuss the effects of integrating science and Islam in education; ii) it must be quantitatively analyzed; iii) it must describe data in the form of sample size, standard deviation, and average; and iv) it must be published in a journal that is indexed on Google Scholar. The articles that fell within the four inclusion criteria were also included in the list of exclusion criteria articles. The meta-analysis will not include articles not meeting the exclusion criteria.

In the end, we assembled 90 papers covering topics related to the major focus of the study. The mean of the research findings, the standard deviation of the data, and the number of samples were published in just 18 publications. The three factors can serve as a foundation for broad generalizations; these three facts are only partially written. The last page will be searched to obtain the raw data for the research findings, which may be utilized to calculate the mean, standard deviation, and sample count. The article will only be added to the sample set for analysis if these data are available. The 18 papers included a few that included several study results. Meta-analysis techniques will thus be used to evaluate 38 research findings.

The random effect model is utilized in this study to generalize the research findings to the population rather than just using them to conclude the data. This study compares learning with Islamic integration to traditional learning using a contrast group meta-analysis to see if there are any differences. Since the data have a variation interval (the range between the highest and lowest values), the data must be normalized. After that, the data must be harmonized. Standardization of the estimated sample mean and ES (d) is described in (1):

$$d = \frac{x_1 - x_2}{s_{within}}, S_{within} = \sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{(n_1-1)(n_2-1)}} \quad (1)$$

The standard error d (SEd) is calculated using the (2):

$$SE_d = \sqrt{V_d}, with\ V_d = \frac{n_1+n_2}{n_1 n_2} + \frac{d^2}{2(n_1+n_2)} \quad (2)$$

Hedges [22] pointed out that the resulting d is slightly biased. Hedges are converted into g with df and SE_g to minimize the bias.

$$g = J \times d, with\ J = 1 - \frac{3}{4df-1} \quad (3)$$

$$df = degree\ of\ freedom\ (n_1 + n_2 - 2) \quad (4)$$

$$SE_g = \sqrt{V_g}, with\ V_g = J \times V_d \quad (5)$$

The JASP software was then used to conduct the analysis process. Inputted data include g as the ES and SEg to create a plot with interval values and standard errors for each study's findings. The ES criteria value [23] is displayed in Table 1. Additionally, JASP aids in the calculation of publication bias and heterogeneity (funnel plot). It is possible to conclude the impact of learning to combine Islam and science during the learning process.

Table 1. Criteria ES

ES	Criteria
0.1	Low
0.3	Medium
0.5	High

3. RESULTS AND DISCUSSION

3.1. Results

This study examines 38 research outcomes from eighteen publications. Numerous investigations have yielded a multitude of research findings. The chosen works investigate how science and Islam are integrated into science education. Science and Islam can be integrated into this study in several ways, including ideas, tactics, and instructional techniques. The experimental group and the control group were compared in the study's findings. The researcher determines the impact size value and standard error using sample size data, mean, and standard deviation, as shown in Table 2.

The data in this study must adhere to the premise of heterogeneity since it uses a random effect model. One way to detect heterogeneity is to use the q value. A heterogeneity test using the data from Table 2 will demonstrate the model's applicability to the data. Table 3 displays the findings of the heterogeneity test.

Table 2. Recap of the study's findings, ES, and standard error

Study code	Study	Integrated learning of Islamic and science			Control (conventional)			ES	Standard error ES
		n	SD	M	n	SD	M		
Study 1	[24]	32	57.00	24.01	32	40.00	22.06	0.73	0.257
Study 2	[25]	43	79.20	4.17	43	73.21	2.99	1.64	0.249
Study 3	[26]	120	70.17	7.02	120	66.89	4.26	0.56	0.131
Study 4	[26]	120	85.29	11.13	120	68.30	12.23	1.45	0.145
Study 5	[27]	22	79.36	13.54	21	69.95	12.27	0.71	0.312
Study 6	[28]	30	0.73	0.10	30	0.62	0.11	1.02	0.273
Study 7	[29]	60	85.05	5.65	60	78.72	6.25	1.06	0.194
Study 8	[30]	55	32.38	3.38	54	26.59	2.93	1.82	0.227
Study 9	[31]	28	33.29	3.28	28	26.86	2.71	2.11	0.333
Study 10	[32]	27	84.00	6.44	27	76.71	5.87	1.17	0.293
Study 11	[33]	32	77.14	4.88	28	68.94	5.88	1.51	0.292
Study 12	[33]	32	84.07	5.09	28	77.41	4.10	1.41	0.288
Study 13	[34]	19	90.56	5.15	19	82.81	8.15	1.11	0.346
Study 14	[35]	23	78.46	3.33	19	75.89	6.38	0.51	0.312
Study 15	[36]	80	29.22	4.06	80	21.57	3.59	1.99	0.193
Study 16	[37]	35	78.10	9.20	33	76.40	8.80	0.19	0.242
Study 17	[37]	35	77.97	5.9	33	70.59	5.47	1.28	0.265
Study 18	[38]	62	43.80	6.90	62	43.60	5.70	0.03	0.179
Study 19	[38]	62	54.90	3.10	62	54.50	4.40	0.10	0.179
Study 20	[38]	62	35.20	4.70	62	35.20	4.90	0.00	0.179
Study 21	[38]	62	49.60	3.90	62	49.30	3.70	0.08	0.179
Study 22	[38]	62	35.50	2.20	62	35.70	1.80	-0.10	0.179
Study 23	[39]	37	3.88	0.54	44	3.80	0.50	0.15	0.222
Study 24	[39]	37	3.74	0.61	44	3.53	0.47	0.38	0.224
Study 25	[39]	37	4.28	1.58	44	3.85	0.53	0.38	0.224
Study 26	[39]	37	4.13	0.41	44	3.98	0.57	0.29	0.223
Study 27	[39]	37	3.59	0.52	44	3.53	0.56	0.11	0.222
Study 28	[39]	37	4.08	0.49	44	4.01	0.62	0.12	0.222
Study 29	[39]	37	4.05	0.36	44	3.88	0.53	0.38	0.224
Study 30	[39]	37	4.15	0.50	44	4.05	0.49	0.20	0.223
Study 31	[39]	37	4.21	0.45	44	4.12	0.56	0.17	0.222
Study 32	[39]	37	4.22	0.49	44	4.02	0.67	0.34	0.224
Study 33	[39]	37	4.31	0.51	44	4.27	0.49	0.07	0.222
Study 34	[39]	37	3.36	0.51	44	3.24	0.68	0.20	0.223
Study 35	[39]	37	4.18	0.52	44	4.06	0.50	0.24	0.223
Study 36	[39]	37	4.10	0.55	44	4.14	0.64	-0.06	0.222
Study 37	[40]	30	83.87	8.18	30	64.53	14.70	1.60	0.296
Study 38	[41]	35	83.40	11.23	35	75.77	10.80	0.68	0.245

Table 3. Heterogeneity test results (fixed and random effects)

Tests	Q	df	p
Omnibus of model coefficients	39.961	1	<0.001
Residual heterogeneity	305.556	37	<0.001

Note: *p*-values are approximate; the model was estimated using the restricted ML method

The outcomes found 38 varied ES across the examined studies (Q=305.556; p 0.001). Therefore, the random impact model is more suited to determining the average impact size of the 38 research that were analyzed. The analysis suggests examining moderator factors influencing how Islam and science are taught in schools. Table 4 and Figure 1 display the findings of each study's mean effect and ES analysis.

The research results utilizing the random effect model indicate that learning science and integrating Islam and science are strongly positively correlated (z=6.321; p=0.001; 95% CI=[0.454; 0.862]). Science integration and Islam have a major impact on scientific learning (r=0.658). The forest plot shows that the investigated ES ranges from -0.10 to 2.11.

Table 4. Results of mean effect analysis 38 studies (coefficients)

	Estimate	Standard error	z	p	95% confidence interval	
					Lower	Upper
Intercept	0.658	0.104	6.321	<0.001	0.454	0.862

Note: Wald test

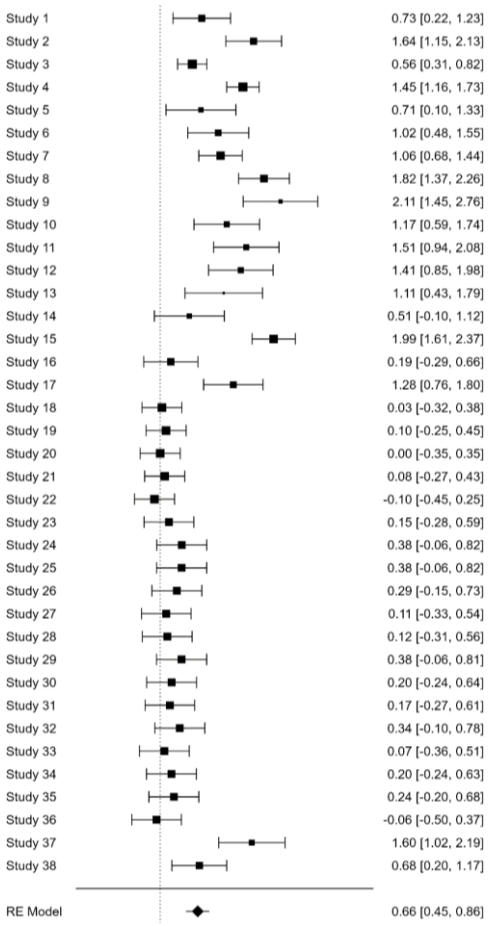

Figure 1. Forest plot

In order to identify publication bias, this meta-analysis used the Trim and Fill method on failed safe-N data. Previous research suggests that the Trim and Fill strategy employs a cutting-edge method to remove irrelevant studies from the funnel plot's positive side [42]. The corrected ES is then recalculated, resulting in a reduced confidence interval and a decrease in the effect's variance. Researchers can, therefore, detect a shift in impact size when they take unpublished trials into account during the analysis. Using the fail-safe N data, publication bias can also be identified. According to Rosenthal, the meta-analysis study does not show publication bias if the file-safe N number is more than 5K+10, which is significant [43]. Figure 2 and Table 5 illustrate the Trim and Fill outcomes and fail-safe N data using JASP software.

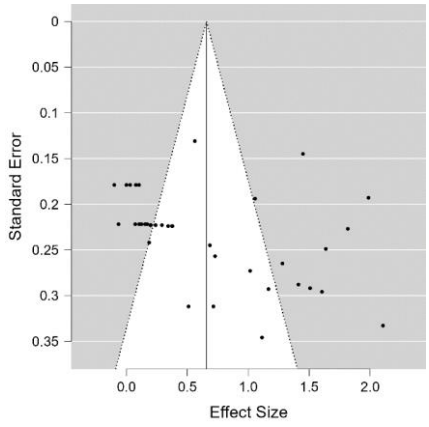

Figure 2. Funnel plot

Table 5. File-safe data N (file drawer analysis)

	Fail-safe N	Target significance	Observed significance
Rosenthal	4147.000	0.050	<0.001

Results from examining the funnel plot using the Trim and Fill approach matched the illustration in Figure 1. At each chosen sample data interval, the original forest and funnel plot images are identical using the Trim and Fill method. This comparison demonstrates the meta-analysis's lack of bias. Learning that successfully integrates science and Islam enhances learning outcomes compared to traditional learning. The fail-safe N data analysis results indicate that K=38; hence, 5K+10=5(38)+10=210. The calculated file-safe N value was 4,147, with p<0.001 and .05 as the significant aim. Because there is a fail-safe N number greater than 5K+10, the publication bias in the meta-analysis study is not an issue.

3.2. Discussion

Implementing Islam and science integration in science learning in Indonesia significantly influences students' education and understanding of science and Islamic values [44]. Integrating Islam and science allows students to understand better how science and real-world knowledge can relate to Islamic values [45]. This helps in strengthening their understanding of Islamic religious and ethical teachings. This integration can help students better understand Allah's (God) creation and the universe's workings [46]. They can understand that science is a tool used to unravel the mysteries of the universe created by Allah.

The integration of Islam and Science can encourage students to develop scientific attitudes [47], such as curiosity [48], critical thinking [49], [50], and careful observation [51]. This is because Islam encourages the development of deep knowledge and understanding of the universe [52]. This integration can also help students to develop more holistic problem-solving skills [53]. They learn to connect scientific knowledge with Islamic moral and ethical values to make better decisions in daily life [54]. Integrating Islam and Science allows students to develop a balanced character between their lives' material and spiritual aspects [55]. They learn that science can improve the quality of life, but it must be aligned with Islamic principles.

This integration can also open the door to deeper discussions about different cultures and understanding of science worldwide [56], [57]. It can help students to understand global diversity and appreciate the contributions of various cultures to science [58]. However, it is essential to note that integrating Islam and Science in science learning in Indonesia must be done carefully and following the existing curriculum framework [59]. Teachers must understand these two fields and how to effectively integrate them into learning to achieve the desired educational goals [60].

The effectiveness of integrating Islam and science in science education might enhance students' comprehension of scientific ideas while taking Islamic principles and values into account. This can be accomplished using suitable learning models [61], techniques, and media. The RQANI approach has been used in research to enhance learning outcomes and encourage student replies [62]. Additionally, studies show that creating picture media based on Islamic principles is thriving as a substitute for traditional teaching methods in the classroom [63].

Based on the explanation, learning incorporating Islamic principles and scientific principles is ideally suited as an alternate method of instruction to help students develop their religious character into a cohesive whole. Additionally, learning science becomes more entertaining, fun, and meaningful. Accordingly, only those who accept and use science and technology can comprehend the numerous natural facts and events (compared to *kauniyah*). As a result, science content acquires a great deal of holistic values.

4. CONCLUSION

Based on a completed meta-analysis, the use of Islam and science integration in scientific learning has an ES value of .658 with a high category. Islam and science must be integrated into the classroom in order to meet the goals of national education. This will help students develop better attitudes and spiritual values. As a result, it is hoped that future studies will continue to advance innovations in the teaching of Islam that are integrated into the curriculum to help students develop their attitudes and spirituality.

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