



INTEGRATING ISLAMIC VALUES AND LOCAL WISDOM INTO SCIENCE EDUCATION: Enhancing Character Development in Higher Education

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Abstract: Education plays a pivotal role in shaping intellectual and moral character, particularly in addressing the challenges of globalization and technological advancement. In Indonesia, integrating Islamic values and local wisdom into education is essential to nurturing students with strong character and cultural awareness. This study aims to analyze the integration of Islamic values and local wisdom in science courses at higher education institutions in Lombok, and their influence on character development among prospective educators. Using a quantitative approach, data were collected from 505 first-semester students through a Likert-scale questionnaire. Statistical analysis revealed high construct validity and reliability, with Composite Reliability values exceeding 0.7 and AVE values above 0.5. The findings indicate that the integration of Islamic values and local wisdom significantly influences character development, supported by strong model predictive power ($R^2 = 0.782$ for X3; $R^2 = 0.777$ for Y). The novelty of this research lies in its interdisciplinary framework that integrates Islamic norms and cultural heritage into science education, challenging traditional views of science as value-neutral. The study recommends systematically incorporating these values into science curricula and conducting longitudinal studies to assess their long-term impact on students' character formation and academic competencies.

Keywords: Islamic values, local wisdom, science education, character development, interdisciplinary integration

DOI: <http://dx.doi.org/10.20414/ujis.v29i1.1308>

Introduction

EDUCATION has a vital role in shaping human quality, not only from the intellectual side but also morals, ethics, and personality.¹ Amid the rapid development of globalization and technology, the challenges to the formation of learners' character are getting bigger.² Therefore, education is expected to provide a solid foundation for character development with integrity and virtue. In Indonesia, which has a majority Muslim population and is rich in local culture, integrating Islamic values and local wisdom is very relevant and urgent in the education process. These values have a fundamental role in shaping the character of students who are not only intellectually intelligent, but also have noble character.³

In the context of higher education, student character building through the integration of Islamic values and local wisdom is essential. However, such integration often encounters obstacles, especially in science courses such as Natural Sciences, which tend to be considered as a neutral and objective field of science, separated from moral and ethical values. Integrating Islamic values and local wisdom into science learning in the faculty still needs serious attention. Therefore, this research focuses on how integrating these values can be applied in science learning at the higher education in Lombok, Indonesia, to shape the character of

¹ Paweł Niszczota, Paul Conway, and Michał Biały, "Moral Decay in Investment," *Journal of Experimental Social Psychology* 115 (2024): 104664, <https://doi.org/10.1016/j.jesp.2024.104664>.

² Hasan Baharun, "Total Moral Quality: A New Approach for Character Education in Pesantren," *Ulumuna* 21, no. 1 (2017): 57–80, <https://doi.org/10.20414/ujis.v21i1.1167>.

³ Nashuddin, "Islamic Values and Sasak Local Wisdoms: The Pattern of Educational Character at Nw Selaparang Pesantren, Lombok," *Ulumuna* 24, no. 1 (2020): 155–82, <https://doi.org/10.20414/ujis.v24i1.392>. On related studies regarding the sufistic approach to Islamic education, see, for example, Eliana Siregar, Susilawati Susilawati, and Arrasyid Arrasyid, "Sufistic Approach in Islamic Education to Increase Social Concern and Peace," *MIQOT: Jurnal Ilmu-Ilmu Keislaman* 48, no. 1 (July 2024), <https://doi.org/10.30821/miqot.v48i1.1023>; Lailatussaadah Lailatussaadah, Asyraf Isyraqi Bin Jamil, and Fakhrul Adabi Bin Abdul Kadir, "Designing and Assessing an Islamic Entrepreneurship Education Model for Islamic Higher Education (IHE)," *Jurnal Ilmiah Islam Futura* 23, no. 1 (February 2023): 38–59, <https://doi.org/10.22373/jiif.v23i1.17556>.

students as holistic prospective educators.⁴ This is in line with the mission of Islamic education, which not only focuses on academic aspects but also moral and spiritual aspects. Higher education institutions have a great responsibility to produce prospective educators who are not only academically competent but also have noble personalities.⁵

Study programs in higher education, especially physics education, biology education, chemistry education, and elementary school teacher education, have an important responsibility in producing prospective educators who can integrate natural science with Islamic values. The main challenge in this integration lies in the general perception of science as a neutral and objective discipline, while the teachings of Islam⁶ and local wisdom⁷ bring subjective normative values. Therefore, the integration of science, religion, and local wisdom is an urgent need that must be understood and applied in the learning process, especially in science courses that have great potential in shaping the students' character.

At the beginning of the odd semester of the 2024/2025 academic year, new students in the four study programs are at an important phase in character building as prospective educators. The challenge in integrating Islamic values and local wisdom into science materials is not only related to the content of the lessons but also to the process of internalizing these values in students. This highlights that the difficulty lies not just in what is taught, but

⁴ Ade Alimah, "Contemplative and Transformative Learning for Character Development in Islamic Higher Education," *Ulumuna* 24, no. 1 (June 2020): 1–23, <https://doi.org/10.20414/ujis.v24i1.384>.

⁵ Republik Indonesia, "Peraturan Menteri Agama Republik Indonesia Nomor 5 Tahun 2020 Tentang Standar Penyelenggaraan Pendidikan Agama Pada Perguruan Tinggi," *Kemenag*, no. 79 (2020).

⁶ Setinawati et al., "The Framework of Religious Moderation: A Socio-Theological Study on the Role of Religion and Culture from Indonesia's Perspective," *Social Sciences and Humanities Open* 11, no. September 2024 (2025): 101271, <https://doi.org/10.1016/j.ssaho.2024.101271>.

⁷ Dewa Agung Gede Agung et al., "Local Wisdom as a Model of Interfaith Communication in Creating Religious Harmony in Indonesia," *Social Sciences and Humanities Open* 9, no. January (2024): 100827, <https://doi.org/10.1016/j.ssaho.2024.100827>.

also in how these values are absorbed and applied by the students. Islamic values such as honesty, justice, responsibility, and togetherness must become part of students' daily lives, including in the learning process and scientific practices⁸. Thus, science learning not only serves to improve academic competence but also builds students' moral and ethical foundation.

In addition to Islamic values, local wisdom that is rich in cultural values, ethics, and social norms can be used as guidelines in shaping student character. In West Nusa Tenggara (NTB), particularly in Lombok, various local wisdoms, including environmentally friendly farming procedures, sustainable natural resource management, and the use of natural resources to enhance the quality of life for students, are practiced.⁹ Customs that respect for nature can be used as a concrete example in science learning.¹⁰ The integration of local wisdom not only enriches students' insight into local culture but also instills respect for the environment and natural balance, as guided by Islamic values. Thus, science learning based on Islamic values and local wisdom can make a significant contribution to building holistic student character.

Based on existing research, although many studies highlight the integration of religious and cultural values in education, most focus on cognitive aspects or are limited to application in the context of religious or social education. For example, one study discusses how Islamic values influence spiritual and social well-

⁸ Mohd Nor Mamat, Siti Fatahiyah Mahamood, and Ismaniza Ismail, "Islamic Philosophy on Behaviour - Based Environmental Attitude," *Procedia - Social and Behavioral Sciences* 49 (2012): 85–92, <https://doi.org/10.1016/j.sbspro.2012.07.008>.

⁹ Jop Koopman, "Subawe, Traditional Knowledge, and Faith-Based Organisations Promoting Social Capital and Disaster Preparedness: A Lombok, Indonesia Case Study," *International Journal of Disaster Risk Reduction* 94, no. January (2023): 103837, <https://doi.org/10.1016/j.ijdrr.2023.103837>.

¹⁰ M. Taqiuddin et al., "O43 (Not Presented) Socio-Cultural Ties and Handling the Nutritional Needs of Herbivores: Feeding Practices of Cattle Farmers in Rural Lombok, Indonesia," *Animal - Science Proceedings* 14, no. 4 (2023): 573, <https://doi.org/10.1016/j.anscip.2023.04.044>.

being in the context of higher education, but does not discuss the application of these values in science learning in depth.¹¹

In addition, other studies have addressed the integration of religious values with science. However, these have been limited to the context of education in Indonesia and have not comprehensively discussed the implementation of Islamic values in science education at a broader level. Nevertheless, both studies highlight the importance of integrating religious values into education, but no research has specifically explored the direct influence of integrating Islamic values and local wisdom into science education in higher education, particularly in the context of character development among students that involves affective and psychomotor dimensions.¹²

Furthermore, other studies highlight the importance of curriculum integration in Islamic education. However, they are limited to Islamic boarding schools and universities, and do not directly address the integration of Islamic values in science learning in higher education. This gap indicates that although there is research on the integration of religious and cultural values in education, there is no research that holistically examines the integration of Islamic values and local wisdom in the context of science in higher education that focuses on character building among students.¹³

Thus, the existing gap is the lack of studies linking Islamic values and local wisdom in the context of science learning, particularly in higher education, with a more holistic approach, including affective and psychomotor dimensions. This study aims

¹¹ Hessa Al-Thani, "Religion and Spiritual Well-Being: A Qualitative Exploration of Perspectives of Higher Education Faculty in Qatar and Its Challenge to Western Well-Being Paradigms," *Frontiers in Psychology* 16, no. April (2025): 1–13, <https://doi.org/10.3389/fpsyg.2025.1549863>.

¹² Mintarsih Danumiharja et al., "Integrating Religious Character and Science Education at SMK KHAS Kempek: A Qualitative Study on Holistic Educational Approaches in Indonesia," *Jurnal Pendidikan Islam* 12, no. 1 (2023): 117–23, <https://doi.org/10.14421/jpi.2023.121.117-123>.

¹³ Ahmad Sirojuddin, Maskuri Maskuri, and Junaidi Ghoni, "Integration of Higher Education Curriculum With Islamic Boarding Schools From a Multicultural Islamic Education Perspective," *Nazhruna: Jurnal Pendidikan Islam* 8, no. 2 (2025): 265–81, <https://doi.org/10.31538/nzh.v8i2.163>.

to fill this gap by providing a deeper understanding of the integration of these values in science learning for student character development.

This research has distinctiveness and a significant contribution to the development of education science, especially in Islamic education. One of the novel aspects of this research lies in the interdisciplinary approach that integrates Islamic values and local wisdom in science learning. This research will also contribute to developing a higher education curriculum that is not only oriented to academic aspects but also to developing student character as prospective educators who have integrity, morality, and high cultural awareness. In addition, the results of this study are expected to provide new insights into learning methods and strategies that are more holistic in integrating religious values and local culture into the exact sciences, which have been considered not directly related to morals and ethics.

This study uses quantitative methods to measure the extent to which the integration of Islamic values and local wisdom affects students' character-building in science. The study population consisted of 1st-semester students at higher education institutions in Lombok, Indonesia. The sample was randomly selected using a purposive sampling technique, specifically targeting students who had taken the science content. The research instrument was a Likert scale-based questionnaire to measure students' understanding of Islamic values and local wisdom and their impact on character building. Data from the questionnaire were analyzed using descriptive statistics (mean, standard deviation) and inferential statistics (path analysis test) to see the relationship between integrating Islamic values and local wisdom with character building in science studies.

This research employs quantitative methods, distributing online questionnaires. The research was conducted on students in the odd semester of the 2024/2025 academic year. Figure 1 shows the distribution of 505 participants across various academic disciplines. Elementary Teacher Education has 297 participants (59%), Natural Science has 66 participants (13%), Biology has 77 participants (15%), Physics has 39 participants (15%), and

Chemistry has 26 participants (5%). This distribution highlights the highest interest in teacher education at the elementary level.

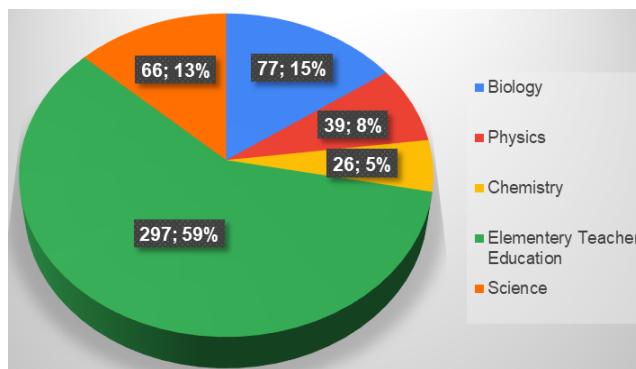


Figure 1. Student Respondents in Terms of Field of Study

Based on the gender distribution, there are 425 female respondents (84%) and 80 male respondents (16%), as shown in Figure 2.

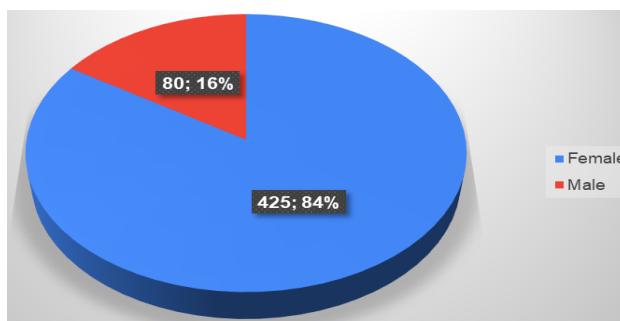


Figure 2. Student Respondents by Gender

There are four aspects and indicators measured related to the integration of Islamic values and local wisdom in character building in science-based courses for students, as presented in the following table.

Table 1. Aspects and Indicators of the Questionnaire

Aspects	Indicator	Statement Number
1. Integration of Islamic Values (X1)	Understanding and application of Islamic values in science learning and practice	1,2, 5, 6, 7

Aspects	Indicator	Statement Number
2. Integration of Local Wisdom (X2)	Understanding and application of local wisdom in science learning	3,4,8, 9
3. Character Building (Y)	The influence of the integration of Islamic values and local wisdom on student character	10, 11, 12
4. Relevance of Science Material (X3)	The suitability of science material with Islamic values and local wisdom	13, 14,15,16

The questionnaire filled out by students is in the form of a Likert scale with five answer options, namely 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree). The number of questionnaire statements filled in is 16 items, as presented in the following table.

Table 2. Questionnaire Statement Items

No.	Statement	1	2	3	4	5
1	I understand the importance of Islamic values taught in science learning.					
2	Lecturers often relate science material to Islamic teachings, making it easier for me to understand the scientific and religious context.					
3	Local wisdom can also provide a perspective in science studies.					
4	In science courses, I learn about the importance of protecting the environment through local wisdom in my community.					
5	The Islamic values that I learn in science courses help me understand my role as a caliph on earth.					
6	The integration of Islamic values in science learning makes the material more relevant and useful for daily life.					
7	Science teaching that incorporates Islamic values helps me become more responsible in protecting nature.					
8	Lecturers often provide examples of how local wisdom is applied in science studies.					
9	Local wisdom can be combined with science to provide a broader understanding of natural phenomena.					
10	The Islamic values and local wisdom taught in science learning have a positive impact on my character building.					
11	The integration of Islamic values in science learning makes me more concerned about social and environmental issues.					
12	Science teaching that is integrated with Islamic values and local wisdom helps me to form a wiser attitude.					
13	The science material I learn aligns with the Islamic values taught by the lecturer.					
14	The science material I learn is relevant to the local wisdom in my community.					

No.	Statement	1	2	3	4	5
15	I support science teaching that integrates Islamic values with science concepts.					
16	I support science teaching that incorporates local wisdom into the curriculum.					

Table 3 shows the descriptive statistics related to students' responses to the integration of Islamic values and local wisdom in character building in science studies. With 505 respondents, the average score obtained was 81.16, indicating that the majority of students responded positively to the integration. The wide range of scores, between 51.25 and 100, reflects some variation in student responses; however, higher scores generally indicate a strong acceptance of the integration of these values. This aligns with the finding that the majority of respondents consider the integration of Islamic values and local wisdom in science education important for character development.

The findings of this study emphasize the importance of integrating Islamic values and local wisdom into science learning as a means of character building. This aligns with the views of Muslim intellectuals at various Indonesian State Islamic Religious Universities (PTN-IAI) who are exploring ways to bridge the gap between science and religion. This integration is considered essential for fostering a holistic educational approach that respects both scientific inquiry and religious beliefs. Ultimately, it contributes to a more comprehensive understanding of the relationship between science and Islam, enriching students' perspectives on character development¹⁴.

In addition, the low standard deviation of 13.36 indicates that there is consistency in the students' responses, with most responses focusing on positive values. This reflects that the integration of these values is widely accepted, and there is no significant disagreement among students. This suggests that character integration in science, informed by Islamic values and

¹⁴ Miftahuddin, "Islamization of Science or Scientification of Islam? Bridging the Dichotomy of Science," *European Journal for Philosophy of Religion* 15, no. 1 (2023): 105–30, <https://doi.org/10.24204/ejpr.2023.4113>.

local wisdom, can be a practical approach to shape students' character without significant collective resistance.

Integrating character education into science through Islamic values and local wisdom can effectively shape students' character by connecting educational content with their cultural and religious backgrounds¹⁵. This approach minimizes resistance by aligning educational goals with students' existing values and experiences, fostering a more inclusive and relevant learning environment¹⁶. The integration of Islamic values and local wisdom into science education can be achieved through various methods, each contributing to the holistic development of students¹⁷.

Table 3. Descriptive Statistics of Student Responses related to the Integration of Islamic and Local Wisdom towards Character Building in Science Studies

	N	Minimum	Maximum	Mean	Std. Deviation
Responses	505	51.25	100.00	81.1584	13.3638
Valid N (listwise)	505				

However, although most students responded positively, the presence of several respondents with low scores (51.25) indicates that there is still a small group that may not fully accept or understand the importance of this integration. This slight variation could serve as a consideration for further development in teaching methods to ensure that all students, without exception, can appreciate and benefit from the integration of these values. Nevertheless, overall, the data indicate that the integration of Islamic values and local wisdom is well-received and has the

¹⁵ M. Abdul Fattah Santoso and Yayah Khisbiyah, "Islam-Based Peace Education: Values, Program, Reflection and Implication," *Indonesian Journal of Islam and Muslim Societies* 11, no. 1 (2021): 185–207, <https://doi.org/10.18326/IJIMS.V11I1.185-207>.

¹⁶ Joanna Hong Meng Tai et al., "Designing Assessment for Inclusion: An Exploration of Diverse Students' Assessment Experiences," *Assessment and Evaluation in Higher Education* 48, no. 3 (2023): 403–17, <https://doi.org/10.1080/02602938.2022.2082373>.

¹⁷ Alizaman D. Gamon and Mariam Saidona Tagoranao, "Fostering a Knowledge Culture for Peace, Development, and Integration: Muslim Education in the Philippines," *Studia Islamika* 29, no. 3 (2023): 485–517, <https://doi.org/10.36712/sdi.v29i3.20268>.

potential to enhance character education within the science curriculum.

The integration of Islamic values and local wisdom into science curricula is increasingly recognized as a promising approach to improving character education. This integration has been well-received and has the potential to enrich educational experiences by promoting the holistic development of students¹⁸. By instilling Islamic values and local wisdom, the education system can foster not only intellectual growth but also spiritual, emotional, and moral development¹⁹. This approach is in line with the broader educational goal of nurturing knowledgeable individuals who can contribute positively to society.

The findings in Figure 3 reveal that the majority of students, regardless of their field of study, show strong agreement on the importance of integrating Islamic values and local wisdom into science learning. Most fields, such as Biology, Physics, Chemistry, and other sciences, have consistently high scores around 80-90, indicating a broad consensus among students across different disciplines. This consistency reflects a shared understanding and acceptance of the integration, suggesting that students across various scientific domains recognize the value of incorporating Islamic values and local wisdom as part of their education.

However, the Elementary field, while still yielding positive results, shows a slightly wider range of responses. This suggests that, although there is general agreement on the importance of integration, there are some differences in opinion among students in this field. These variations could be influenced by factors such as the nature of the subject matter, the level of students' exposure to Islamic values and local wisdom, or the specific pedagogical approaches applied within elementary education.

Overall, the data indicate that, while students across fields agree on the significance of integrating Islamic values and local wisdom, the degree of consensus is slightly more varied in specific

¹⁸ Marlinda Irwanti et al., "The Study of Freedom of Expression in Islamic Teachings with an Emphasis on Nahj Al-Balagha," *HTS Teologiese Studies / Theological Studies* 79, no. 1 (2023): 1-7, <https://doi.org/10.4102/hts.v79i1.8368>.

¹⁹ Santoso and Khisbiyah, "Islam-Based Peace Education: Values, Program, Reflection and Implication."

fields. Nonetheless, these findings underscore the importance of this integration for character building in science education, while also highlighting areas where further exploration or tailored approaches may be needed to address field-specific nuances.

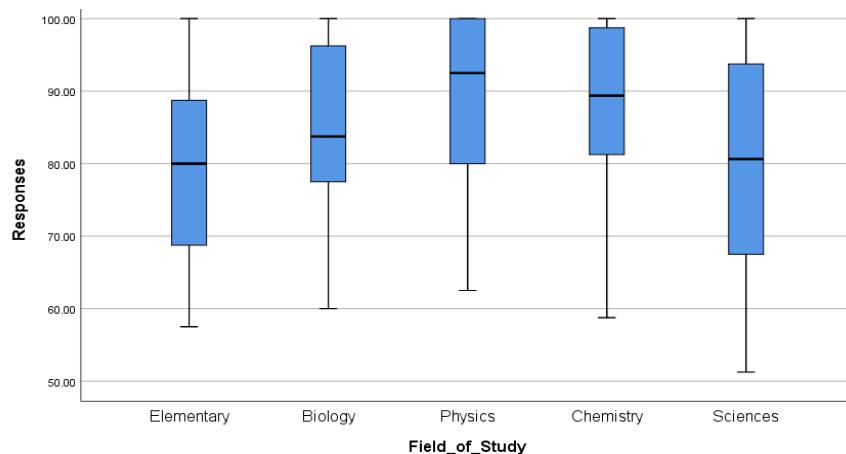


Figure 3. Average Student Response in terms of Field Study

The integration of Islamic values and local wisdom in elementary education, particularly in science, is a nuanced topic with varying degrees of consensus among students. This variation can be attributed to several factors, including the nature of the subject matter, students' exposure to these values, and the pedagogical approaches employed.²⁰ The research indicates that while there is a general agreement on the importance of this integration for character building, the degree of consensus varies across different educational fields. This suggests a need for tailored approaches to address specific nuances in elementary education.²¹

²⁰ Kevin Larkin and Thomas Lowrie, "Teaching Approaches for STEM Integration in Pre- and Primary School: A Systematic Qualitative Literature Review," *International Journal of Science and Mathematics Education* 21 (2023): 11–39, <https://doi.org/10.1007/s10763-023-10362-1>.

²¹ Edwin Koster and Henk W. de Regt, "Science and Values in Undergraduate Education," *Science and Education* 29, no. 1 (2020): 123–43, <https://doi.org/10.1007/s11191-019-00093-7>.

Figure 4 presents the average student responses categorized by gender. Both female and male students show similar response patterns, with average scores ranging from 80 to 90. The boxplots indicate a relatively narrow spread of responses for both genders, suggesting consistency in their views on the integration of Islamic and local wisdom in character building. Although both groups show high levels of agreement, male students tend to have a slightly wider range of responses compared to female students.

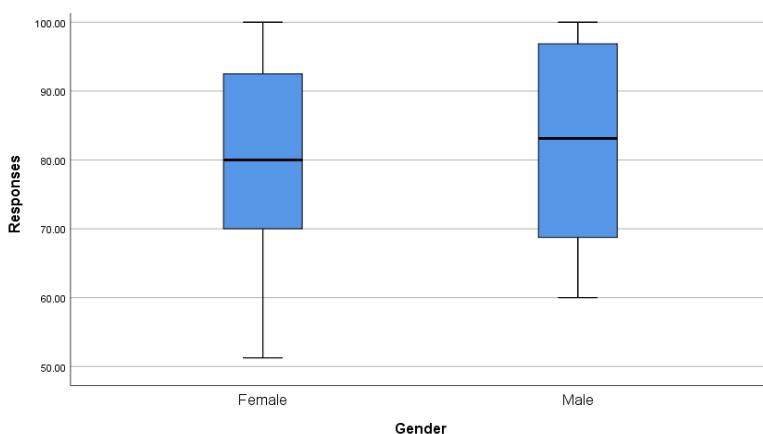


Figure 4. Average Student Response by Gender

These findings indicate that the integration of Islamic values and local wisdom in character building in science content is well received by students, both overall and by study program, as well as by gender. This suggests a promising opportunity to integrate the learning process and student character development.

This result aligns with the findings that emphasize the importance of integrating Islamic values²² and local wisdom²³ in

²² A M Amin, "RQANI: A Learning Model That Integrates Science Concepts and Islamic Values in Biology Learning," *International Journal of Instruction* 15, no. 3 (2022): 695–718, <https://doi.org/10.29333/iji.2022.15338a>.

²³ I Triastari, "Developing Disaster Mitigation Education with Local Wisdom: Exemplified in Indonesia Schools," in *IOP Conference Series: Earth and Environmental Science*, vol. 884, no. 1, preprint, 2021, <https://doi.org/10.1088/1755-1315/884/1/012004>.

science learning²⁴ for student character development. They found that integrating Islamic values can increase students' awareness of moral and ethical values and strengthen their cultural identity²⁵. They found that such integration is important to prepare graduates who have a strong character and are aligned with Islamic values^{26,27} and local wisdom.²⁸

Furthermore, testing the value of Kaiser-Meyer-Olkin (KMO) and Bartlett's test aims to see the overall variable relationship without considering other variables. This test assumes that the MSA value must be > 0.5 and the significance value < 0.05 .

Table 5. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.914
Approx. Chi-Square	2974.881
Bartlett's Test of Sphericity	
df	10
Sig.	.000

The suitability of the data for factor analysis was evaluated using the Kaiser-Meyer-Olkin (KMO) measure of sample adequacy and Bartlett's test of sphericity. The KMO value of 0.914 indicated excellent sample adequacy and strong inter-item correlations, as

²⁴ R Susanto, "The Effect on the Integration of Local Wisdom in Physics Educational Applications: A Review," in *AIP Conference Proceedings*, vol. 2751, preprint, 2023, <https://doi.org/10.1063/5.0143441>.

²⁵ I Tsani, "EVALUATING THE INTEGRATION OF ISLAMIC VALUES IN PRIMARY EDUCATION: A LOGIC MODEL APPROACH," *Jurnal Pendidikan Islam* 10, no. 1 (2024): 87–100, <https://doi.org/10.15575/jpi.v10i1.34238>.

²⁶ I W Citrawan, "SPECIAL EDUCATION TEACHERS' ABILITY IN LITERACY AND NUMERACY ASSESSMENTS BASED ON LOCAL WISDOM," *Jurnal Ilmiah Ilmu Terapan Universitas Jambi* 8, no. 1 (2024): 145–57, <https://doi.org/10.22437/jiituj.v8i1.32608>.

²⁷ A Lutfauziah, "DOES ENVIRONMENTAL EDUCATION CURRICULUM AFFECT STUDENT'S ENVIRONMENTAL CULTURE IN ISLAMIC BOARDING SCHOOL?," *Revista de Gestao Social e Ambiental* 18, no. 5 (2024), <https://doi.org/10.24857/rgsa.v18n5-079>.

²⁸ N Ramadhana, "The Existence of Malaqbiq Tau Mandar Local Culture to Empower Students' Educational Character," *Cakrawala Pendidikan* 42, no. 3 (2023): 577–85, <https://doi.org/10.21831/cp.v42i3.56514>; A R Muhammad, "Integration of Character Education Based on Local Culture through Online Learning in Madras Ahaliyah," *Cypriot Journal of Educational Sciences* 16, no. 6 (2021): 3293–304, <https://doi.org/10.18844/cjes.v16i6.6559>.

values above 0.9 are generally considered to indicate highly suitable data for factor analysis.²⁹

Bartlett's sphericity test further confirmed the data's suitability for factor analysis, with statistically significant results ($\chi^2=2974.881$, $df= 10$, $p < 0.001$). This result rejected the null hypothesis regarding the identity matrix, indicating there was sufficient correlation between variables to proceed with factor analysis.

This study aims to understand how the integration of Islamic values and local wisdom in science education can enhance the character development of students. By utilizing the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity, the study demonstrates that the data collected are highly suitable for further analysis. This ensures that the findings of the research will provide valid and reliable insights into the impact of such integration in higher education.

The Anti-Image Matrix was analyzed to evaluate the suitability of each variable in the factor analysis.³⁰ The results of the analysis are presented in Table 6, which displays the anti-image covariance matrix and anti-image correlation matrix. The diagonal values in the anti-image correlation matrix represent the Measures of Sampling Adequacy (MSA) for each variable. All diagonal values are above the 0.5 threshold ($X1 = 0.885$, $X2 = 0.881$, $X3 = 0.856$, $Y = 0.879$), indicating that all variables are eligible for inclusion in factor analysis. This indicates that each variable has sufficient correlation with other variables to support the feasibility of the analysis. Non-diagonal values in the anti-image correlation matrix represent partial correlations between variables, where smaller values indicate that the variables are more independent after the influence of other variables is controlled for. This result further supports the suitability of the data for factor analysis.³¹

²⁹ Henry F Kaiser, "An Index of Factorial Simplicity," *Psychometrika* 39, no. 1 (1974): 31–36, <https://doi.org/10.1007/BF02291575>.

³⁰ J Hair et al., "Multivariate Data Analysis," in *Australia : Cengage*, 7 edition, preprint, 2014, 758.

³¹ Barbara G Tabachnick and Linda S Fidell, *Using Multivariate Statistics*, in *Contemporary Psychology: A Journal of Reviews* (New York, USA: Pearson Education, Inc., 2013), <https://doi.org/10.1037/022267>.

In the context of this research, the variables under investigation focus on the integration of Islamic values, local wisdom, and their relevance to science education, as well as their impact on character building in higher education. The high MSA values for all variables, including the integration of Islamic values (X1), local wisdom (X2), character building (Y), and the relevance of science material (X3), demonstrate that these aspects are sufficiently correlated to proceed with factor analysis. This confirms the adequacy of the data in exploring how the integration of these factors influences the development of student character within science education.

Table 6. Anti-image Matrices

		X1	X2	X3	Y
Anti-image Covariance	X1	.238	-.058	-.078	-.065
	X2	-.058	.231	-.074	-.072
	X3	-.078	-.074	.199	-.070
	Y	-.065	-.072	-.070	.227
Anti-image Correlation	X1	.885 ^a	-.245	-.357	-.278
	X2	-.245	.881 ^a	-.344	-.313
	X3	-.357	-.344	.856 ^a	-.330
	Y	-.278	-.313	-.330	.879 ^a

a. Measures of Sampling Adequacy (MSA)

Table 7 presents the communality values for each variable, which were calculated using the Principal Component Analysis (PCA) extraction method. The "Initial" column represents the initial communalities, where all variables are assigned a value of 1.000, assuming each variable fully contributes to its variance. The "Extraction" column shows the communalities after extracting the principal components.

The communalities after extraction show the proportion of each variable's variance explained by the extracted components. All variables have high communality values: X1 = 0.862, X2 = 0.866, X3 = 0.888, and Y = 0.870. These values indicate that most of the variance of each variable has been captured by the retained components, supporting the appropriateness of the data for the PCA approach.

In this study, the variables under analysis include the integration of Islamic values (X1), integration of local wisdom (X2), the relevance of science material (X3), and their impact on student character development (Y). The high communality values for all variables indicate that the extracted components effectively explain a significant portion of the data's variance. This further validates the suitability of the data for PCA analysis and reinforces the understanding of how integrating Islamic values and local wisdom influences science education and the development of student character.

Table 7. Communalities

	Initial	Extraction
X1	1.000	.862
X2	1.000	.866
X3	1.000	.888
Y	1.000	.870

Extraction Method: Principal Component Analysis

Testing research data using the inner model aims to analyze the relationship between constructs, measure the significance value, and calculate the R-square value for the research model. This model will be evaluated using R-squared to test the dependent construct, as well as testing the significance of the parameter coefficients on the structural path (**Table 8**).

Table 8. R-Square

Variable	R Square	R Square Adjusted
X3	0.782	0.781
Y	0.777	0.776

The analysis results show high R-Square values for the dependent variables X3 (0.782) and X4 (0.777), which reflect the model's strong predictive ability. The R-squared value above 0.75 is considered substantial, indicating that most of the variance in the dependent variable can be explained by the independent constructs in the model. An adjusted R-Square value close to the R-Square also indicates that the model is stable and does not

experience overfitting, which means that the sample does not overly influence the analysis results³².

Within the scope of this study, these findings align with the theory that structural models with high R-square values demonstrate strong predictive capability. This suggests that the model is effective in explaining the relationships between latent constructs, such as the integration of Islamic values and local wisdom in science education, and their influence on character development. As such, the model is appropriate for further examination of the causal relationships between these variables within the context of higher education.

Table 9. F Square Values

	X1	X2	X3	Y
X1			0.340	0.097
X2			0.320	0.101
X3				1.114
Y				

Table 9 shows the F^2 values, which represent the effect size of the independent variables in predicting the dependent variable. F^2 values indicate the relative contribution of each predictor in explaining variance, with interpretations based on Cohen (1988): small (0.02), medium (0.15), and large (0.35). X1 had a significant effect on X3 (0.340) and a negligible effect on Y (0.097). X2 shows a medium effect on X3 (0.320) and a negligible effect on Y (0.101). Meanwhile, X3 has a significant effect on Y, with an F^2 value of 1.114. These results indicate the important role of X1, X2, X3, and Y in the model, with X3 making the most significant contribution to the target variable Y.

Figure 5 displays the results of path analysis using the Partial Least Squares (PLS) method, illustrating the relationship between the latent variables (X1, X2, X3, and Y) and their indicators. The path coefficients between latent variables indicate the strength of the direct relationship, with larger values indicating a stronger

³² Wynne. W. Chin, "The Partial Least Squares Approach to Structural Equation Modeling. Modern Methods for Business Research," *Statistical Strategies for Small Sample Research*, no. April (1998): 295-336.

relationship. The relationships of X1 to X3 (0.471) and X2 to X3 (0.457) show a significant direct effect, while X3 also has a significant direct effect on Y (0.342).

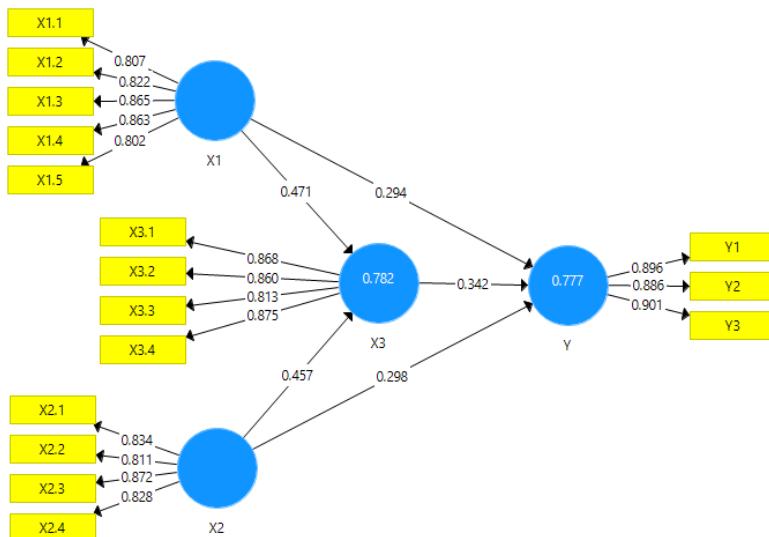


Figure 5. Results of Path Analysis with Smart PLS

The outer loadings values for each indicator (e.g., X1.1 = 0.807; X2.1 = 0.834) are above the standard threshold of 0.7, indicating the indicators strongly represent their respective latent variables. In addition, the R-squared values of 0.782 for X3 and 0.777 for Y indicate that most of the variance in the endogenous variables can be explained by the exogenous variables in this model.

Figure 6 displays the results of the path analysis after the bootstrapping process, which is used to estimate the statistical significance of the relationships between latent variables. The path coefficients shown above, such as X1 to X3 (10.338), X2 to X3 (10.612), and X3 to Y (5.023), provide information on the strength of direct influence between latent variables. The values on the indicators of each latent variable (e.g., X1.1 = 30.017; X3.1 = 48.381) reflect the results of bootstrapping resampling, which indicates the stability of the estimated outer loadings. All values appear consistent with the assumption of strong contributions of the indicators to their respective latent variables.

Significant relationships can be interpreted from relatively large path coefficient values, such as the effect of X3 on Y (5.023), indicating that X3 has a significant direct influence on variable Y. Meanwhile, smaller values (e.g., X1 to Y = 4.288) indicate a weaker but still relevant influence in the context of the model.

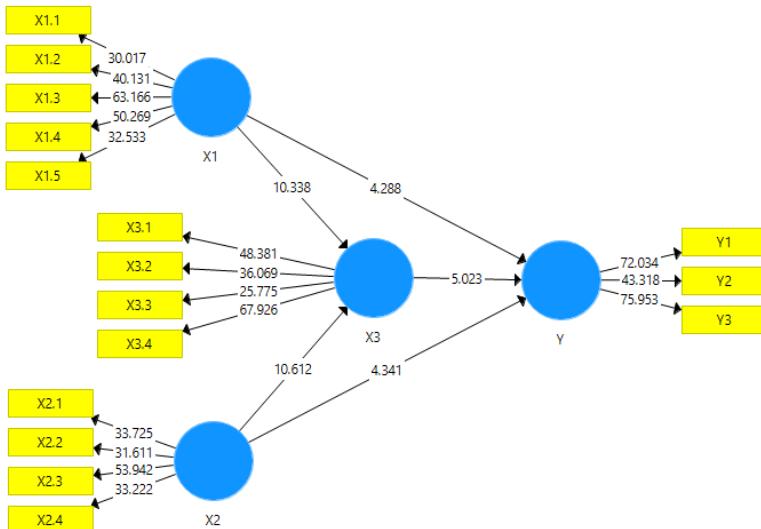


Figure 6. Path Coefficient after Bootstrapping

Table 10 reports the assessment of discriminant validity using the Fornell-Larcker criterion. Discriminant validity is met if the square root of the Average Variance Extracted (AVE) for each construct (diagonal values) is greater than its correlation with other constructs (non-diagonal values). The results show that all constructs meet this criterion: X1 (0.832), X2 (0.837), X3 (0.854), and Y (0.894) each have higher diagonal values than the correlations with other constructs. This confirms that each construct shares more variance with its indicators than with other constructs, indicating adequate discriminant validity of the model.

Table 10. Discriminant Validity

	X1	X2	X3	Y1
X1	0.832			
X2	0.816	0.837		
X3	0.844	0.842	0.854	
Y	0.826	0.826	0.841	0.894

Table 11 shows the outer loading values for each indicator, which reflect the strength of the relationship between the indicator and the respective latent construct. All outer loading values are above the recommended threshold of 0.7, indicating strong convergent validity. For X1, X2, X3, and Y, the indicators made significant contributions to their constructs (e.g., X1.1 = 0.807, X2.1 = 0.834, X3.1 = 0.868, Y1 = 0.896). These results confirm that the indicators adequately represent their respective latent constructs and support the validity of the measurement model.

Table 11. Outer Loading

	X1	X2	X3	Y1
X1.1	0.807			
X1.2	0.822			
X1.3	0.865			
X1.4	0.863			
X1.5	0.802			
X2.1		0.834		
X2.2		0.811		
X2.3		0.872		
X2.4		0.828		
X3.1			0.868	
X3.2			0.860	
X3.3			0.813	
X3.4			0.875	
Y1				0.896
Y2				0.886
Y3				0.901

Table 12 shows that all constructs meet the reliability and validity criteria. The Cronbach's Alpha, rho_A, and Composite Reliability (CR) values for X1, X2, X3, and Y are all above the 0.7 threshold, indicating high internal reliability. In addition, the Average Variance Extracted (AVE) values for all constructs exceed 0.5, indicating adequate convergent validity. These results confirm that the measurement model is reliable and valid.

Table 12. Reliability and validity test results

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
X1	0.889	0.892	0.919	0.693
X2	0.857	0.859	0.903	0.700
X3	0.876	0.878	0.915	0.730
Y1	0.875	0.875	0.923	0.800

Figure 7 shows the Composite Reliability values for latent variables X1, X2, X3, and Y. All Composite Reliability values are above the recommended threshold of 0.7, as shown in the blue horizontal line. This indicates that all constructs in the model have excellent internal reliability. Thus, the indicators on each latent variable consistently represent their respective constructs, supporting the validity and reliability of the measurement model.

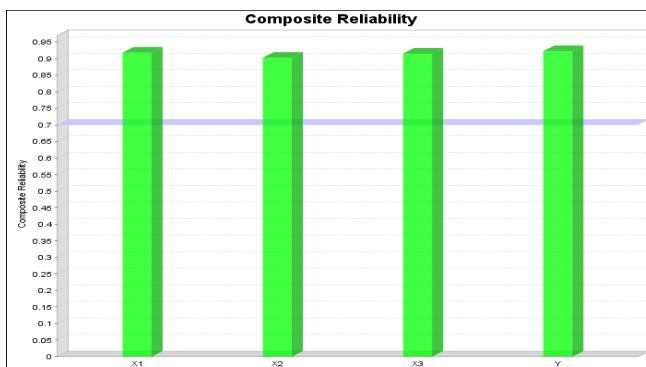


Figure 7. Composite Reliability for latent variables (X1, X2, X3, and Y) in the model

Table 13 shows that all relationships between latent variables in the model are statistically significant with T-statistics > 1.96 and P-values < 0.05 . X1 has a significant effect on X3 (0.471; $T = 10.338$), while X2 has a significant effect on Y (0.455 and 0.454; $T = 7.266$ and 7.259) and X3 (0.457; $T = 10.612$). In addition, X3 also significantly affects Y (0.342; $T = 5.023$). These results support that all relationships in the model have good predictive power and are relevant.

Table 13. Results of the relationship analysis between latent variables

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
X1 -> X3	0.471	0.475	0.046	10.338	0.000
X2 -> Y	0.455	0.454	0.063	7.266	0.000
X2 -> X3	0.457	0.454	0.043	10.612	0.000
X2 -> Y	0.454	0.457	0.06	7.259	0.000
X3 -> Y	0.342	0.339	0.068	5.023	0.000

This research uniquely integrates Islamic values and local wisdom into character-building analysis through a data-driven scientific approach. Using a Partial Least Squares (PLS)-based path analysis model, this study shows how this integrative approach is theoretically relevant and provides empirical evidence of its effectiveness. This research offers a new contribution to the development of character education based on Islamic values and local wisdom in the context of science learning.

The findings of this study underscore the theoretical significance and empirical efficacy of integrating Islamic values and local wisdom into science education as a means of enhancing character development. By demonstrating the positive impact of these integrative elements, this research adds a novel perspective to the ongoing discourse in character education. Specifically, the study highlights how the infusion of cultural and religious principles within academic content not only enriches students' understanding of science but also shapes their moral and ethical dispositions.

Previous studies have suggested that character education³³, when anchored in cultural values and religious teachings, fosters more profound and lasting personal development in students³⁴. This research aligns with such findings by providing empirical evidence that the integration of Islamic values and local wisdom significantly influences students' character development in the

³³ Tom Lickona, Carbonero Way, and Catherine Lewis, "Eleven Principles of Effective Character Education," *Character Education Partnership* 2, no. 1 (2002): 100.

³⁴ Mintarsih Danumiharja et al., "Integrating Religious Character and Science Education at SMK KHAS Kempek: A Qualitative Study on Holistic Educational Approaches in Indonesia."

context of science learning³⁵. Moreover, it contributes to the growing body of literature advocating for the inclusion of culturally relevant content in educational curricula to foster holistic development.³⁶

Furthermore, the study's results confirm that when science education incorporates principles that resonate with students' cultural backgrounds and belief systems, it promotes a deeper connection to the subject matter and enhances students' overall ethical development.³⁷ This finding is consistent with contemporary educational theories that emphasize the importance of culturally responsive pedagogy, which seeks to validate and affirm students' identities while promoting critical thinking and moral reasoning.³⁸ As such, this research offers valuable insights for educators, curriculum developers, and policymakers, suggesting that a curriculum that integrates Islamic values and local wisdom is not only pedagogically sound but also essential for fostering well-rounded, ethical individuals in the context of modern education.

However, this study has limitations. First, the limited number of latent variables may limit deeper exploration of the relationships between variables. A solution to this problem is to add new variables, such as moderating or mediating variables, to look at more complex relationships. Second, the research sample focused on one Islamic higher education institution, which may

³⁵ Ifina Trimuliana, Hapidin, and Asep Supena, "Ethno Pedagogy-Based Project Learning Model to Increase Religious Behaviour and Collaboration Skills of Early Childhood," *Journal of Neonatal Surgery* 14, no. 4 (2025): 133–42, <https://doi.org/10.52783/jns.v14.1758>.

³⁶ Salami Mahmud et al., "Building Students' Character Based on Maqāṣid al-Shari'ah: Perspectives of Parents, Teachers, and Community Members in Banda Aceh," *Samarah* 7, no. 3 (2023): 1803–26, <https://doi.org/10.22373/sjhk.v7i3.17708>.

³⁷ Idit Adler and Christopher Karam, "Djaji Mahshey, Moghrabeye, and Labaneh: Making Science Relevant," *Journal of Research in Science Teaching* 61, no. 1 (2024): 103–36, <https://doi.org/10.1002/tea.21866>.

³⁸ Helen Adam and Matthew Byrne, "'I'm Not from a Country, I'm from Australia.' Costumes, Scarves, and Fruit on Their Heads: The Urgent Need for Culturally Responsive Pedagogy When Sharing Diverse Books with Children," *Australian Educational Researcher* 51, no. 4 (2024): 1121–40, <https://doi.org/10.1007/s13384-023-00631-x>.

limit the generalizability of the findings to a broader population. Therefore, further research needs to be conducted with a more diverse sample, including other institutions both within and outside the context of Islamic higher education.

Based on the research results, the integration of Islamic values and local wisdom can be implemented more systematically in the science education curriculum to strengthen student character building. Educational institutions are advised to develop learning modules based on Islamic values^{39,40} and local wisdom integrated with science materials.⁴¹ Further research can also focus on longitudinal testing to measure the long-term impact of this approach on student character development and academic competence. Thus, this integration can have a broader and more sustainable impact on the development of national character based on local values and Islamic values.

Conclusion

This study found that the integration of Islamic values and local wisdom in science content learning is positively accepted by students, with the structural model showing excellent validity and reliability, as indicated by Composite Reliability values (>0.7), AVE (>0.5), and significant relationships between latent variables ($P < 0.05$). The findings reveal that the integration of these values has a substantial influence on student character building, with X3 (integration of Islamic values and local wisdom) making the most significant contribution to variable Y (character building). This study offers a new approach that links character education based on Islamic values and local culture with science learning, making a significant contribution to the development of an integrative

³⁹ Muhammad Ahmad Ibrahim AlJahsh, "Science and Islamic Ethics: Navigating Artificial Womb Technology through Quranic Principles," *Heliyon* 10, no. 17 (2024): e36793, <https://doi.org/10.1016/j.heliyon.2024.e36793>.

⁴⁰ Sheheryar Banuri, Lucia Milena, and Imtiaz Ul, "International Review of Financial Analysis The Power of Religion: Islamic Investing in the Lab ☆," *International Review of Financial Analysis* 96, no. PB (2024): 103690, <https://doi.org/10.1016/j.irfa.2024.103690>.

⁴¹ I. Made Geria et al., "Built Environment from the Ancient Bali: The Balinese Heritage for Sustainable Water Management," *Heliyon* 9, no. 11 (2023): e21248, <https://doi.org/10.1016/j.heliyon.2023.e21248>.

curriculum in Islamic higher education. As a recommendation, educational institutions should systematically integrate these values into the curriculum to enhance their impact on character building. Additionally, encouraging further research to evaluate the long-term effects on students' academic competence and social contribution would be beneficial.

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