

Research Article

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Meaning-Based Learning: Integration of Islamic Values to Empower Students' Moral Sensitivity in Science Learning

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Abstract

Background/purpose. This research aims to integrate Islamic values into science teaching through meaning-based learning to enhance students' moral sensitivity.

Materials/methods. Design-based research by Borg and Gall was used to develop learning tools, involving 24 students for moral sensitivity questionnaire testing, 24 students for limited trials, and 40 students for large-scale trials. They were selected using purposive sampling. The learning tools were validated by experts, and moral sensitivity was measured using questionnaires. The findings indicate that the tools were validated based on expert assessments. The questionnaire met validity criteria with a reliability of 0.76.

Results. The effectiveness of meaning-based learning was evident from the large-scale trial, which showed that students involved in the teaching process experienced an increase in moral sensitivity ($p < 0.05$), with no students showing a decrease in moral sensitivity (negative ranks were 0). Student responses at the end of the learning process indicated that they enjoyed the classes, which were designed using meaning-based learning integrated with Islamic values.

Conclusion. The integration of Islamic values into science teaching, particularly in biology topics, contributed to strengthening students' moral sensitivity. The Islamic values tied to scientific concepts helped students realize that there is goodness inherent in scientific concepts from the perspective of the Quran & Prophetic Hadith. Students not only learned scientific concepts but also their deeper meanings, which ultimately enhanced their moral sensitivity. Future teaching can integrate Islamic values into other areas of science, so that students not only understand the material concepts but can also interpret them from the perspective of the Quran & Prophetic Hadith to empower their morality.

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1. Introduction

Science and religion operate from different epistemological perspectives but often address the same questions in different ways (McGrath, 2020). For example, science and the theory of evolution are often seen as contradictory, but Doko (2021) responded by explaining that the Quranic narrative and the theory of evolution can both be true from the perspective of "the multiple ancestors defense" and "double creation defense." From an educational standpoint, constructivism asserts that knowledge is not taught but rather constructed by learners themselves through active interaction with the learning environment, especially when learning is meaningful and connected to their real-life and social experiences (Fosnot & Perry, 2013). In the context of science education, linking scientific concepts to Islamic values gives them deeper meaning and contributes to the learner's development of a complex understanding that combines knowledge and emotion. Furthermore, meaning-based learning theory assumes that students learn more deeply when the content is linked to cultural, religious, or humanistic meanings, which contributes to strengthening moral sense and value-based identity (Pikoli et al., 2023).

Value-based education emphasizes that learning goes beyond cognitive skills to include the development of ethical values and behavior (Fauziah et al., 2024). Two key theories that support this view are Kohlberg's and Rest's models of moral development. Kohlberg (1981) outlined three stages of moral growth: the pre-conventional stage (ages 2–9), where children act based on reward or punishment; the conventional stage (ages 9–15), where social rules and acceptance guide behavior; and the post-conventional stage (16+), where moral decisions are based on universal principles like justice—though not everyone reaches this stage. Rest (1986) offered a complementary model with four components: recognizing moral issues (moral sensitivity), deciding what is right (moral judgment), choosing to prioritize moral values (moral motivation), and acting on those values (moral character). Together, these models provide a solid foundation for understanding how moral thinking and ethical behavior develop—relevant to the goals of this research.

In the Islamic context, the values derived from the Holy Quran and the Noble Prophetic Hadith serve as a moral and spiritual reference that can be employed in teaching science, to foster an integrated personality that combines reason and faith. From this, it can be understood that science and Islam should not be framed as oppositional, but rather can work together. Indeed, Allah Almighty has created human intellect to study and analyze what is in nature as lessons and guidance for life (Sappe, 2020). Studying nature and its phenomena is a scientific procedure (Fortunato et al., 2018). Religion, particularly Islam, mentions the phenomena occurring in the world in the Quran & Prophetic Hadith and does not hide them from human observation (Hakimi, 2024).

Science begins with curiosity (Damopolii et al., 2019), while religion begins with belief (Aini et al., 2020). Science and Islam can coexist, but unfortunately, little attention has been paid to the practical aspects of their relationship (Taşkın, 2014). This study is theoretically grounded in constructivism and meaning-based learning theory, with a focus on value education. Constructivism emphasizes that learners construct knowledge through their own experiences and cultural contexts. In the context of Islamic education, constructivism is enriched by spiritual and moral dimensions, where meaning is constructed not only cognitively but also morally and spiritually. Meaning-based learning theory further supports this by asserting that meaningful integration of values, especially those rooted in religious texts, enhances both understanding and moral development. Value education theory underpins the moral objectives of this study, emphasizing the integration of ethical and spiritual values into subject teaching. These frameworks collectively support the integration of Islamic values (derived from the Quran and Hadith) into science teaching to foster students' moral sensitivity and character development.

Taşkın (2014) further emphasized how constructivism, when aligned with Islamic perspectives, offers opportunities for science instructors to teach scientific concepts in ways that also build moral and spiritual understanding. Asiyah et al. (2024) stated that the addition of Islamic values into various disciplines, including science, is necessary. Islamic values derived from the Quran & Prophetic Hadith, when integrated into learning, can create students with good moral personalities (Fauziah et al., 2024). This study did not use verses from the Quran to support research findings, unlike other authors who have used specific Quranic verses to demonstrate the compatibility between science and Islam (Taşkın, 2014). In the research by Aini et al. (2020), a respondent noted that the curriculum in Indonesia should describe meaning, not just content, as this will help avoid conflicts between religion and science.

Amin et al. (2022) developed a scientific curriculum, particularly in biology, that integrates Islamic values. For example, in their research, students were taught the concept of the human digestive system through fasting and gratitude for the blessing of health bestowed by God Almighty. However, the study did not measure how the addition of Islamic values of the Quran & Prophetic Hadith could add meaning to scientific concepts in promoting moral awareness. Purwati et al. (2018) examined the impact of Islamic values integrating into science. Their research found that integrating Islamic values from the Quran & Prophetic Hadith affected learning outcomes. This was achieved by adding Islamic values into the learning materials presented by educators. Safkolam et al. (2023) only studied students' understanding of science in Muslim schools. These studies have not shown how students' moral sensitivity changes in science education with an Islamic value-based approach. Another study by Sutiana and Nugraha (2025) explained that science education must respect 'Tawhid' values, stimulate continuous knowledge-seeking, and pay attention to students' moral aspects. However, this study has not clearly explained changes in students' morals during learning.

Teaching good manners and positive attitudes, including noble character, by adding special instructions to the curriculum does not fully solve the problem. This is why there is a need to integrate moral values into every subject, as teachers are no longer just knowledge transmitters but also moral guides, shaping character, behavior, attitudes, and leadership (Rokhman et al., 2014). Education and character building require habit formation. The habit of doing good, being honest, avoiding laziness, and feeling ashamed to let their environment become dirty. Character is not developed instantaneously; it requires conscientious and balanced training to attain its optimal shape and strength (Nusantari et al., 2020). Thus, education plays a crucial role in teaching morals to students. Chowdhury (2016) in his research explained that science education still lacks moral development for students, so learning must be facilitated with various pedagogies to foster moral values. Morality grows through students' involvement in the scientific process (Rudolph, 2020).

Based on the researchers' observations of students in science classes, immoral behavior was still found. These initial findings indicate that moral integration has not been well implemented in science teaching. Bad behavior in students must be addressed, as it will impact their future, particularly in terms of their moral development. Akca et al. (2017) found that students still had moderate moral sensitivity. The cause is that moral education has been neglected in science teaching (Rudolph, 2020). Moral sensitivity is an important issue in teaching because if not addressed properly, students will struggle to differentiate moral issues they encounter (Comrie, 2012). Students' bad behavior can be corrected by integrating Islamic values of the Quran & Prophetic Hadith into learning (Shah et al., 2020). The integration of Islamic values into learning contributes to improving students' morality (Khan et al., 2021).

There are many ways to teach moral values to students, such as using learning models and integrating Islamic values (Pahrudin et al., 2019), particularly in science education (Asiyah et al., 2024; Purwati et al., 2018; Tukiyo et al., 2022). According to Ibrahim and Sukartiningsih (2014), meaning-based learning is a teaching model through examples and role models that relate events, symptoms,

phenomena, or concepts that have the potential to be used as models in teaching. On the other hand, phenomena and symptoms are studied in science education (Hadzigeorgiou, 2021; Penuel et al., 2019). Meaning-based learning is a thinking framework that guides children in designing and implementing learning. Pikoli et al. (2023) have used meaning-based learning in science, such as chemistry, to teach students' moral sensitivity. In their research, they found that meaning-based learning can shape students' moral sensitivity. However, it has not been extensively studied in other fields of science, such as biology. In fact, there are natural events in biology teaching that can be linked to Islamic values to teach moral sensitivity to students.

Van Der Leij et al. (2021) in their research examined the morality of biology students. The article previously explained how evolution in biology is often contested. In their research, they used biological concepts related to evolution, particularly the balance of nature. For example, it was explained that when humans harm the environment, such as polluting the ocean, they must take responsibility to ensure that marine organisms do not suffer due to human actions. This situation demonstrates that moral teaching was conducted and successfully empowered students' morality. Regarding Islamic values, the Quran has clearly stated not to cause corruption on Earth (Surah Al-Baqarah 205), and Allah Almighty is near to those who do good and do not cause harm on Earth (Surah Al-A'raf 56). This also forms the basis of research on preserving the environment and organisms' lives (Intania & Meirani, 2023; Romziana et al., 2024), as well as human morality in maintaining ecological balance (Hidayah, 2024). Phenomena studied in science education can be interpreted to empower students' morality. Higher moral sensitivity in students leads to more positive beliefs about learning science, which is influenced by various teaching topics (Choi et al., 2015).

Clearly, moral development can be built by integrating Islamic values into learning. Islamic values hold meanings that can build students' morality. To fully appreciate Islamic values, meaning-based learning is a solution to interpreting Islamic values within scientific concepts. Thus, this research aims to empower students' moral sensitivity by integrating Islamic values into science teaching through the use of meaning-based learning.

2. Methodology

2.1. Research Design

Learning tools have been developed following the design-based research model of Borg and Gall, modified into seven stages: Preliminary Study, research planning, initial product development, limited trials, revisions, large-scale trials, and revisions. Design-based research is a systematic learning development process (Borg & Gall, 1983), which is related to Islam and morals (Abdillah et al., 2025), science and character (Arifin et al., 2025), and meaningful learning (Ting et al., 2025). In the Preliminary Study stage, the researchers conducted pre-observations to review the learning tools used by teachers, their teaching methods, and the form of learning implemented. This stage also included analyzing the teaching methods that empowered students' moral sensitivity. The next stage was analyzing Islamic values to be integrated into the learning process. The analysis of Islamic values was based on studies of the Quran & Prophetic Hadith. They were then matched with science were then matched with science material for middle school. During the research planning stage, the researchers developed learning tools such as lesson plans, student worksheets, observation sheets, and moral sensitivity questionnaires. The 2013 curriculum was used as the foundation for developing these tools. The lesson plans were designed based on meaning-based learning, with the steps adapted from Ibrahim and Sukartiningsih (2014): Phase 1: Orienting students to the problem or question; Phase 2: Designing the problem-solving process or answering the question; Phase 3: Guiding the investigation; Phase 4: Communicating results; Phase 5: Negotiation and confirmation; Phase 6: Interpretation; and Phase 7: Evaluation and Reflection.

In the initial product development stage, the learning tools were developed and validated by experts. The validation was carried out by a panel of three experts from the biology department. Therefore, the developed learning materials were reviewed for feedback from a team of experts. The feedback was used to revise the draft of the learning materials, which will then undergo further evaluation regarding their relevance and consistency (content and construct validity) using an assessment sheet. Additionally, an empirical test was conducted to determine the validity and reliability of the instruments measuring moral sensitivity.

Once the learning tools were validated by experts and the instruments had undergone empirical testing, they were implemented in the classroom. The first implementation was a limited trial, and the results were used to revise the learning tools. After revisions, the second implementation, known as the large-scale trial, took place. During both implementations, measurements were taken of the learning implementation, student activities, pre- and post-moral sensitivity, and student responses. The implementation used a one-group pretest-posttest design. The results from the large-scale trial were used to revise the learning tools to produce a final product that can be used by teachers in future classes.

2.2. Participants

Three experts were involved in this research. Experts are determined based on their expertise in the field of education and learning content. They were responsible for validating the developed learning tools. A total of 22 students participated in the empirical testing of the moral sensitivity questionnaire. Another 24 students were involved in the limited trial, and 40 students were involved in the large-scale trial, distributed across two classes with 20 students in each class. These students were in the seventh grade of a public junior high school at South Bolaang Mongondow. Participants in this research were determined using a purposive sampling technique. The 22 students involved in the empirical trial were eighth-grade students who had received material related to moral sensitivity in seventh grade. The 24 students in the limited trial and 40 students in the large-scale trial were determined using a purposive sampling technique on the basis that they were seventh-grade students, and the questions in the moral sensitivity questionnaire were related to the material they received in this grade. Table 1 presents student profiles by gender and age.

Table 1. Student profile

Trials	Gender	%	Age	%
Limited	Male	29.17	12	75
n = 22	Female	70.82	13	25
Large-scale	Male	35.00	12	75
n = 40	Female	65.00	13	25

2.3. Instrument and Data Collection

The instruments used included validity sheets, observation sheets for the learning implementation, moral sensitivity questionnaires, and student response questionnaires. The validation instrument was given to the experts to validate the developed learning tools, including the moral sensitivity questionnaire. The questionnaire was designed based on four levels: sensitive, egocentric, rational, and insensitive (Fraenkel, 1977; Pikoli et al., 2023). A total of seven questions were developed, expecting students' answers to reflect these four levels. Figure 1 shows an example of the moral sensitivity questionnaire (S= Sensitive, E= Egocentric, R= Rational, TS= Insensitive). The developed learning tools were validated, and the instrument for measuring moral sensitivity was empirically tested for validity and reliability (Table 1). In the limited trial, students were taught science

material using meaning-based learning, integrated with Islamic values from the Quran & Prophetic Hadith. In this trial, observations were made on the implementation of learning and student activities. Students' moral sensitivity was measured before and after learning. The results of the limited trial were used for revisions, and then the large-scale trial was conducted. The measurements in the large-scale trial were the same as those in the limited trial, but this time involved two classes of students. The results of the large-scale trial provided the data needed to determine the effectiveness of meaning-based learning, integrated with Islamic values, in enhancing students' moral sensitivity in science classes.

Objective	Question	Category			
		R	E	S	TS
Given an image of the interaction between a mango tree and an orchid flower, students are expected to derive the moral meaning/value from the interaction between two living beings where one benefits without harming the other, as a representation of moral values and attitudes.	Observe the following image.	A	B	C	D
	 Source: https://kependidikan.com/simbiosis-komensalisme/simbiosis-komensalisme-anggrek-500px/ The meaning of the relationship between the two living beings is A. A relationship where one party benefits, but the other does not suffer harm B. When we help others, they should also help us C. Giving without expecting anything in return is a manifestation of sincerity D. A mutually beneficial relationship between two living beings				

Figure 1. Examples of questions in the moral sensitivity questionnaire related to the scientific concept of commensalism and symbiosis

Table 2. Results of empirical validation and reliability tests

Item	Vailidity			Reliability	
	r _{count}	r _{table}	Category	r ₁₁	Decision
1	0.69	0.40	Valid	0.76	Reliable
2	0.62	0.40	Valid		
3	0.71	0.40	Valid		
4	0.62	0.40	Valid		
5	0.64	0.40	Valid		
6	0.65	0.40	Valid		
7	0.87	0.40	Valid		

Based on the data in Table 2, all the items in the questionnaire have r-values greater than the r-table values, meaning that the items are valid and suitable to be used as instruments in the study. The seven validated and reliable items can be used to measure students' moral sensitivity

2.4. Data Analysis

The feasibility analysis of learning tools utilizing meaning-based learning integrated with Islamic values is based on the calculation of scores from validators, practicality scores, and their effectiveness in enhancing students' moral sensitivity. The validity score is calculated as a percentage and compared with the validity standards (Akbar, 2013). Meanwhile, the improvement in moral sensitivity is calculated using the formula from Hake (1998) with three n-gain categories (high if n-gain > 0.7, moderate between 0.3–0.7, and low if <0.3). The Wilcoxon test was conducted to calculate the significance of the increase in students' moral sensitivity.

3. Results

Based on observations, the students were aged 13-14. Their social skills at school were relatively average, as measured by their participation in extracurricular activities, organizational involvement, and social care activities. In science classes, the students' learning materials did not yet contain moral messages that could train their moral sensitivity. Common negative behaviors among students at the school, such as fighting, bullying, skipping classes, and smoking, were considered serious offenses by the teachers. The most frequent misconduct recorded by the researchers was bullying, with 6–7 students engaging in it weekly. This was largely due to the insufficient teaching of good morals and manners within the learning environment, where there was no integration of moral values into the subjects taught by the teachers.

Based on this preliminary study, learning tools were designed. The learning materials developed were integrated with values from the Quran & Prophetic Hadith, specifically for science subjects. These materials were subsequently validated by experts (Table 3).

Table 3. The information regarding the learning tools' validity assessment

Learning Tools	%	Criteria
Lesson plans	94.90	V
Moral sensitivity questionnaire	99.17	V
Implementation learning observation sheet	100	V
Student worksheet	100	V

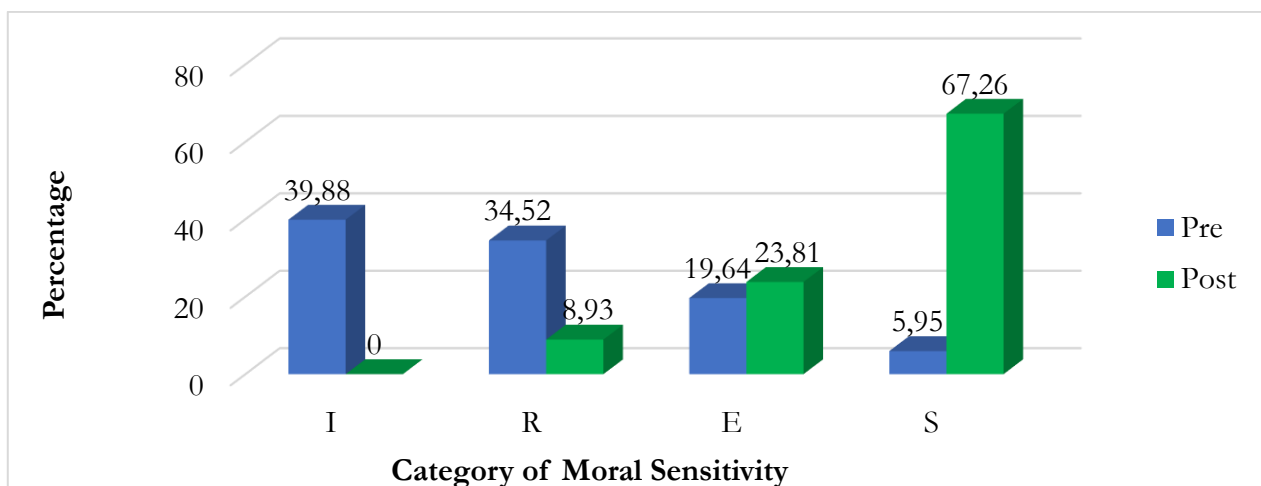
*V-Valid

The expert validation (Table 3) indicates that the learning tools meet the criteria for validity. The obtained validity percentage shows that the learning tools are ready for the next stage, which is limited testing. The Islamic-integrated science learning tools, validated by experts, are deemed suitable for testing (Suparjo et al., 2021). Table 4 presents the results of the limited and large-scale trials.

Table 4. Learning implementation and student activities

Limited Trial	Score
Pre-moral sensitivity	1.92
Post-moral sensitivity	3.58
N-gain	0.80
Learning Implementation	3.88
Student Response	3.68
Large-Scale Trial	
Pre-moral sensitivity	1.66
Post-moral sensitivity	3.67
N-gain	0.86
Learning Implementation	3.93
Student Response	3.75

Table 4 shows the students' achievements in terms of their moral sensitivity through the use of meaning-based learning integrated with Islamic values. In the limited study, students' moral sensitivity scores increased by 1.66, while in the large-scale study, the increase was 2.01. These findings are further supported by the high n-gain values obtained in both trials, indicating a high category of improvement. Observations of the learning activities showed that the implementation of meaning-based learning was carried out effectively. Both the limited and large-scale trials demonstrated high scores. The limited trial scored 3.88, and this increased to 3.96 in the large-scale trial, out of a maximum score of 4. Student responses at the end of the lessons indicated that they enjoyed the classes, which were structured using meaning-based learning integrated with Islamic values. They also gained insight into how Islamic values are embedded within the scientific concepts they studied.

**Figure 2.** Calculation of student achievement in each level of moral sensitivity in a limited trial

Based on Figure 2, at the beginning of the lessons, students' sensitivity was largely categorized as non-sensitive, as indicated by the highest percentage score of 39.88%. This finding suggests that many students had low moral sensitivity. Only around 5.95% of the students demonstrated moral sensitivity based on the seven questions provided. A different condition was observed after the students were taught using meaning-based learning integrated with Islamic values. No students were

found to be non-sensitive. A total of 67.26% of the students exhibited good moral sensitivity. However, the results from the limited trial did not yet indicate a fully optimal percentage.

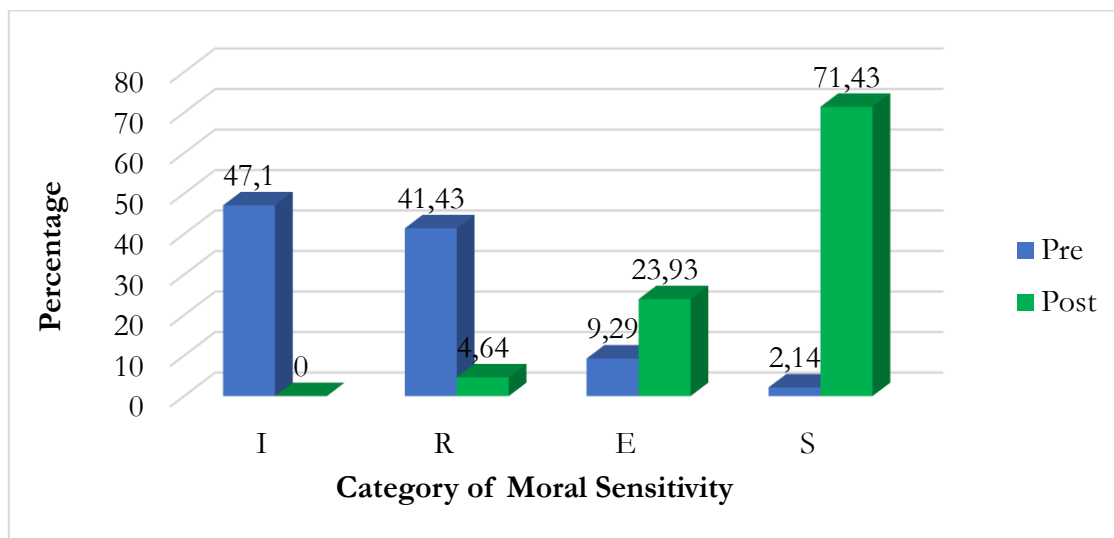


Figure 3. Calculation of student achievement in each level of moral sensitivity in a large-scale trial

In the large-scale trial (Figure 3), the percentage of students categorized as non-sensitive before the lessons was higher compared to the limited trial. In terms of moral sensitivity, the score was lower at 2.14, even lower than in the limited trial. However, after the lessons using meaning-based learning integrated with Islamic values, the findings showed that the non-sensitive level was at 0%, and 71.43% of the students had good moral sensitivity. This large-scale trial confirmed that more students had better moral sensitivity and fell into the "good" category. The effectiveness test of meaning-based learning on moral sensitivity is presented in Table 5. The normality test using Kolmogorov-Smirnov indicates that the pre- and post-moral sensitivity data are not normal (p value of pre is 0.001; post is 0.000). Thus, the calculation uses the Wilcoxon test.

Table 5. Moral sensitivity calculation results using the Wilcoxon test

	N	Mean Ranks	Z	p
- Ranks	0	0.00	-5.546	0.000
+ Ranks	40	20.50		
Ties	0			

Table 5 shows that students' moral sensitivity differed significantly before and after using meaning-based learning integrated with Islamic values ($p = 0.000 < 0.05$). The findings indicate that no students experienced a decline in moral sensitivity, as shown by the fact that the number of negative ranks was 0. All students involved in the lessons using meaning-based learning integrated with Islamic values showed an increase in moral sensitivity, as indicated by the 40 positive ranks. No students were found to experience either a decline or no change in moral sensitivity, as shown by the 0 entries in the Ties column.

4. Discussion

Our research reveals that the lessons using meaning-based learning integrated with Islamic values showed an increase in moral sensitivity. This means that science education at Junior High Schools became more effective in improving moral sensitivity when meaning-based learning was combined with Islamic values. This progress is consistent with Kohlberg's (1981) theory, which explains the development of moral thinking through stages starting from a focus on self-interest and

reaching higher principles such as justice. The research results also support Rest's (1986) model, which links moral behavior to four interconnected processes: perception, judgment, motivation, and moral implementation. This educational model appears to have practically activated these processes, contributing to the development of students' moral sense within a scientific-values context.

Our research also supports the findings of Firdausi et al. (2019), who used meaning-based learning to teach students moral sensitivity in science topics such as genetic substances. Their research showed that meaning-based learning was effective in strengthening students' moral sensitivity. Meaning-based learning, integrated with Islamic values, is a solution to improving students' moral sensitivity. Students not only learn scientific concepts but also enhance their moral sensitivity. Our research findings also align with those reported by Jalili et al. (2020) which revealed that students who were not taught spiritual values showed no significant difference in their moral sensitivity.

In our research, an example of a scientific concept taught during the lessons was commensalism and symbiosis. This is a type of interaction between two organisms of different species in which one takes advantage while the other is neither helped nor harmed (Mathis & Bronstein, 2020). An example of commensal symbiosis is the relationship between an orchid plant and a mango tree (see examples of questions in Figure 1). The orchid benefits by gaining a place to live, while the mango tree neither gains nor loses anything from the presence of the orchid. Meanwhile, the interpretation of the concept based on Islamic values was done as follows:

From the explanation of commensalism and symbiosis, we can derive a life lesson by emphasizing the concept of charity. Charity does not decrease wealth but rather increases blessings, as sincere charity will be rewarded by Allah Almighty without diminishing the giver's wealth. Prophet Muhammad (peace be upon him) said (Ilmu Islam, 2024):

“Charity does not decrease wealth” (HR. Muslim)

The meaning of the hadith above, as explained by Yahya bin Sharaf An-Nawawi, ‘rahimahullah’, has two interpretations:

1. The wealth will be blessed, and various harmful effects will be removed from it. The loss of wealth will be compensated by its blessings.
2. Although the wealth appears to decrease, that loss will be compensated by rewards from Allah Almighty and will continue to increase manifold.

Thus, when we give without expecting anything in return from others and do so sincerely, Allah will grant us blessings in life and continuously increase our provision with no limits in His sight. This is similar to the mango tree that provides a home for the orchid to live and flourish, displaying its beauty. Teaching with the integration of Islamic values in science concepts has a positive impact on the development of students' moral sensitivity. Testing after learning shows a significant increase, where all students experienced an improvement in their moral sensitivity scores.

In teaching science using meaning-based learning, students are taught scientific concepts. These concepts are then given meaning through the integration of Islamic values of the Quran & Prophetic Hadith. Initially, before teaching, measurements showed that students were “not sensitive” compared to after being involved in science teaching using meaning-based learning integrated with Islamic values. Figure 4 illustrates how students responded to the question in Figure 1 (the science concept of commensalism symbiosis).

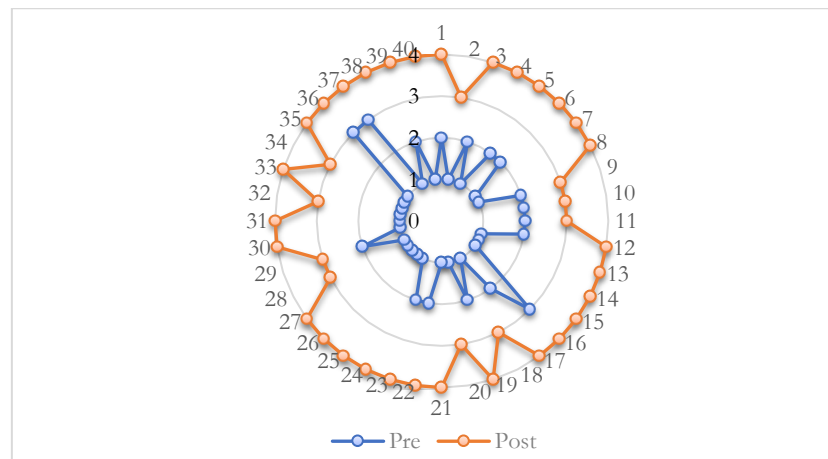


Figure 4. Development of students' moral sensitivity before and after teaching related to the science concept of commensalism symbiosis

Figure 4 illustrates the change in students toward having good moral sensitivity. At the beginning of the lesson, they only reached the "egocentric" level, where they show some awareness of moral values in phenomena or concepts, but are still limited to personal benefits. Bocian et al. (2020) explain that individuals adopt standards of right and wrong to guide their moral behavior, preventing immoral actions, where moral judgment is focused on avoiding unethical actions while still considering themselves moral. Measurements of teaching using meaning-based learning indicate that students' character is dominated by "moral sensitivity." Science topics often contain moral lessons related to Islamic values. This research proves that students who were initially insensitive developed moral sensitivity when they understood science not just from its material concepts but also how scientific phenomena teach them to do good, ultimately fostering good moral sensitivity. Giving meaning to science concepts based on Islamic values effectively builds students' moral sensitivity.

Our research also shows that students' character at the "rational" level decreased. At this level, students view phenomena or concepts as rational facts, where the good is understood through scientific reasoning. According to Kohlberg's (1976) stages of moral development, this aligns with the conventional level, particularly the law-and-order orientation, where morality is viewed in terms of adherence to established rules and rational systems. Students at this stage often prioritize maintaining social order and reason-based ethics over a deeper understanding of empathy. Individuals at this stage are less sensitive to the moral meaning behind the phenomena or concepts they experience. For example, if students choose answer A (See question in Figure 1), the benefit is only based on the scientific fact that the relationship between two individuals remains ethical as long as neither is harmed. Cohen and Morse (2014) explained that as long as one individual does not negatively affect another, morality is preserved. Moralizing rationality is positively associated with trust in science, where individuals view traits oriented toward rationality as moral exemplars, while traits oriented toward irrationality are seen as immoral (Ståhl et al., 2016).

In our research, using meaning-based learning fostered moral sensitivity in students. The mango tree provides a place for the orchid to live, and the orchid does not harm the tree. Islamic values, such as the hadith from Muslim about charity not reducing wealth, when linked to the questionnaire answers, illustrate that giving without expecting anything in return is a manifestation of sincerity. The Quran also explains that Allah sees everything people do (including sincerity in actions) and increases their reward (Rashid, 2021). Science concepts not only teach understanding of phenomena related to good and bad but, when linked to Islamic values, also help shape students' moral sensitivity. This is supported by measurement results after teaching, where 71.43% of students showed moral sensitivity in the effectiveness test (see Figure 3). Moral sensitivity is used to gauge how well students

grasp the moral values embedded in the science concepts being taught. This reflects the first component in Rest (1986) four-component model of moral behavior, namely moral sensitivity, which involves the awareness of how one's actions affect others. Without this awareness, moral judgment, motivation, and character formation are unlikely to follow.

Moral sensitivity can naturally change but can also be intentionally influenced through educational processes. Narvaez (2006) emphasizes that moral sensitivity can be cultivated through deliberate educational practices that enhance moral perception, empathy, and ethical attention. His integrative ethical education model supports the idea that structured classroom experiences can significantly shape students' moral capacities. For students already at the sensitive stage, activities are needed to maintain and further develop their moral sensitivity, moving them to the next psychological stage. For students still in the egocentric stage, the focus should be on providing guidance to help them interpret each concept or phenomenon as part of habit-forming practice. Teachers must continually offer moral value interpretation exercises for every learning activity so that students begin to easily recognize moral values in the subject matter they encounter in learning activities (Sudiyono et al., 2017). The positive student response to the application of meaning-based learning integrated with Islamic values proves that this teaching method can be used in the future.

5. Conclusion

The integration of Islamic values in teaching science concepts, based on the Quran & Prophetic Hadith, provides an alternative learning approach that can improve students' moral sensitivity. This study has shown that students who were initially insensitive became morally sensitive through the use of meaning-based learning integrated with Islamic values. Islamic values shifted students' thinking from rational science to moral sensitivity. Meaning-based learning helps students interpret science through the perspective of the Quran & Prophetic Hadith. This research demonstrates that the change in students' sensitivity during science lessons using meaning-based learning integrated with Islamic values is significant. Students can learn science concepts while also deriving deeper meanings, ultimately enhancing their moral sensitivity.

Despite the positive results of the research, several limitations should be considered, as follows: The research was limited to students aged 12–13 years in a specific school, which limits the generalizability of the results to different age groups or educational settings. It also relied on immediate post-intervention measurement tools, without long-term follow-up to measure the continued influence of Islamic values on student behavior.

In light of the aforementioned limitations, some recommendations are proposed for consideration in future studies. These include conducting similar studies at different educational levels and in diverse regions to measure the model's effectiveness more broadly, and testing the integration of Islamic values into non-science disciplines, such as mathematics or language, to measure its comprehensive educational impact. Qualitative data collection is also needed in the future to strengthen the quantitative data obtained.

Declarations

Author Contributions. M.L.: Literature review, conceptualization, data collection, original manuscript preparation, and manuscript editing. A.G.: Data collection, Literature review, and data analysis. J.A: Data curation, data collection, and original manuscript preparation. R.M.A: Review editing, writing, and final approval. A.A.A: Review editing, writing, and final approval, N.I.R.F.N: Literature review, original manuscript preparation, and statistical analysis. I.D: original manuscript preparation, data curation, Literature review, manuscript editing, and statistical analysis.

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References

- Abdillah, H. T., Firdaus, E., Syafe'i, M., Budiyan, N., & Tantowi, Y. A. (2025). Religious Character-Based Inclusive Education in General Course for Difabel Students at University. *Jurnal Pendidikan Islam*, 11(1), 189–203. <https://doi.org/10.15575/jpi.v11i1.44011>
- Aini, R. Q., Rachmatullah, A., Harliadi, M. D., & Ha, M. (2020). Indonesian Pre-service Biology Teachers' and Biology Education Professors' Views on Evolution. *Science & Education*, 29(3), 713–741. <https://doi.org/10.1007/s11191-020-00127-5>
- Akbar, S. (2013). *Instrumen Perangkat Pembelajaran*. PT Remaja Rosdakarya.
- Akca, N. K., Simsek, N., Arslan, D. E., Senturk, S., & Akca, D. (2017). Moral Sensitivity among Senior Nursing Students in Turkey. *International Journal of Caring Sciences*, 10(2), 1031–1039. https://www.internationaljournalofcaringsciences.org/docs/43_arслан_original_10_2.pdf
- Amin, A. Muh., Ahmad, S. H., Zulkarnaim, Z., & Adiansyah, R. (2022). RQANI: A Learning Model that Integrates Science Concepts and Islamic Values in Biology Learning. *International Journal of Instruction*, 15(3), 695–718. <https://doi.org/10.29333/iji.2022.15338a>
- Arifin, A. N., Hastuti, U. S., Saptasari, M., & Susilo, H. (2025). Development of the PINISI Learning Model Based on a Sociocultural Approach and Its Impact on Students' Character Values in Biology Learning. *Asia-Pacific Science Education*, 11(1), 164–202. <https://doi.org/10.1163/23641177-bja10096>
- Asiyah, A., Febrini, D., Topano, A., Mustamin, A. A., & Hakim, M. A. R. (2024). Measuring the Impact of Islamic Values-Based Scientific Literacy on Scientific Competency of Madrasah Teachers. *International Journal of Learning, Teaching and Educational Research*, 23(4), 476–496. <https://doi.org/10.26803/ijlter.23.4.25>
- Bocian, K., Baryla, W., & Wojciszke, B. (2020). Egocentrism shapes moral judgements. *Social and Personality Psychology Compass*, 14(12), 1–14. <https://doi.org/10.1111/spc3.12572>
- Borg, W. R., & Gall, M. D. (1983). *Educational Research: An Introduction* (Fourth). Longman.
- Choi, Y., Kim, I., & Im, S. (2015). The Relationships between Moral Sensitivity and Preference for Science, Belief about Learning Science of Middle School Students. *Journal of The Korean Association For Science Education*, 35(1), 65–72. <https://doi.org/10.14697/JKASE.2015.35.1.0065>
- Chowdhury, M. (2016). Emphasizing Morals, Values, Ethics, And Character Education In Science Education And Science Teaching. *MOJES: Malaysian Online Journal of Educational Sciences*, 4(2), 1–16. <https://mojes.um.edu.my/index.php/MOJES/article/view/12645>
- Cohen, T. R., & Morse, L. (2014). Moral character: What it is and what it does. *Research in Organizational Behavior*, 34, 43–61. <https://doi.org/10.1016/j.riob.2014.08.003>

- Comrie, R. W. (2012). An analysis of undergraduate and graduate student nurses' moral sensitivity. *Nursing Ethics*, 19(1), 116–127. <https://doi.org/10.1177/0969733011411399>
- Damopolii, I., Nunaki, J. H., Nusantara, E., & Kandowangko, N. Y. (2019). Integrating local resources into inquiry-based teaching materials to training students' science process skills. *AIP Conference Proceedings*, 2120, 060003. <https://doi.org/10.1063/1.5115703>
- Doko, E. (2021). Islam and Evolution: A Defense. *Kader*, 19(3), 899–913. <https://doi.org/10.18317/kaderdergi.1011590>
- Fauziah, R. S. P., Purnomo, A.M., Firdaus, U., Nanyanto, A. B. D., Roestamy, M., Rusli, R. K., Apriliani, A., & Lathifah, Z. K. (2024). Promoting Islamic Value for Green Skill Development in Islamic Vocational High School. *Jurnal Pendidikan Islam*. 10 (1), 53–64 <http://doi.org/10.15575/jpi.v10i1.35383>
- Firdausi, F., Ibrahim, M., & Rahayu, Y. S. (2019). Development of Science Learning Based on Pemaknaan Learning Model to Train Moral Sensitivity of Senior High School Students in Genetic Substance. *International Journal of Scientific and Research Publications (IJSRP)*, 9(11), p9527. <https://doi.org/10.29322/IJSRP.9.11.2019.p9527>
- Fortunato, S., Bergstrom, C. T., Börner, K., Evans, J. A., Helbing, D., Milojević, S., Petersen, A. M., Radicchi, F., Sinatra, R., Uzzi, B., Vespignani, A., Waltman, L., Wang, D., & Barabási, A. L. (2018). Science of science. *Science*, 359(6379), eaao0185. <https://doi.org/10.1126/science.aao0185>
- Fosnot, C. Perry, R. (2013). *Constructivism: theory, perspectives, and practice* (2nd ed.). Teachers College Press.
- Fraenkel, J. R. 1977. *How to Teach About Values: An Analytic Approach*. Prentice-Hall Inc
- Hadzigeorgiou, Y. (2021). Students' Reactions to Natural and Physical Phenomena: Documenting Wonder and Engagement with Science Content Knowledge. *Interdisciplinary Journal of Environmental and Science Education*, 18(1), e2261. <https://doi.org/10.21601/ijese/11340>
- Hake, R. R. (1998). Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses. *American Journal of Physics*, 66(1), 64–74. <https://doi.org/10.1119/1.18809>
- Hakimi, M. (2024). According to Islamic Shari'ah, three Natural Phenomena in Climate Change. *Nangarhar University International Journal of Biosciences*, 3(2), 435–438. <https://doi.org/10.70436/nuijb.v3i02.258>
- Hidayah, N. Q. (2024). Penanaman Etika Lingkungan sebagai Penerapan Jiwa Biologis pada Tiap Individu serta Korelasinya dengan Surat Al-A'raf ayat 56. *Es-Syajar: Journal of Islam, Science and Technology Integration*, 2(1), 167–177. <https://doi.org/10.18860/es.v2i1.18139>
- Ibrahim, M., & Sukartiningsih, W. (2014). *Model pembelajaran inovatif melalui pemaknaan*. Unipress. Ilmu Islam. (2024.). *Kumpulan Hadits: Hadits Muslim Nomor 4689*. <https://ilmuislam.id/hadits/28530/hadits-muslim-nomor-4689>
- Intania, N., & Meirani, R. K. (2023). Reharmonizing Islam And Science of Creating a Scientific Civilization Based on Religious Values: Case Study of Indonesian Fundamentals Pancasila. *Proceedings of International Conference on Research in Education and Science*, 614–624.
- Jalili, F., Saeidnejad, Z., & Aghajani, M. (2020). Effects of spirituality training on the moral sensitivity of nursing students: A clinical randomized controlled trial. *Clinical Ethics*, 15(1), 1–10. <https://doi.org/10.1177/1477750919898346>

- Khan, H. M., Khan, W., Farooq, S., Aleem, A., Mann, A., & Akhtar, S. (2021). The Role of Islamic Education in Moral Character Building of Pakistani Youth: An Analytic Study. *Multicultural Education*, 7(9), 174–181. <https://doi.org/10.5281/zenodo.5500731>
- Kohlberg, L. (1976). Moral Stages and Moralization: The Cognitive-Development Approach. In T. Lickona (Ed.), *Moral Development and Behavior: Theory and Research and Social Issues* (pp. 31–53). New York, NY: Holt, Rinehart, and Winston
- Kohlberg, L. (1981). *The philosophy of moral development: Moral stages and the idea of justice*. Harper & Row.
- Mathis, K. A., & Bronstein, J. L. (2020). Our Current Understanding of Commensalism. *Annual Review of Ecology, Evolution, and Systematics*, 51(1), 167–189. <https://doi.org/10.1146/annurev-ecolsys-011720-040844>
- McGrath, A. E. (2020). *Science & religion: A new introduction*. John Wiley & Sons.
- Narvaez, D. (2006). Integrative Ethical Education. In M. Killen & J. G. Smetana (Eds.), *Handbook of Moral Development* (1st Edition). Psychology Press. <https://doi.org/10.4324/9781410615336>
- Nusantari, E., Utina, R., Katili, A. S., Tamu, Y., & Damopolii, I. (2020). Effectiveness of Environmentally-Based Science Learning towards Environmentally-Friendly Character of Students in Coastal Area. *International Journal of Instruction*, 13(3), 233–246. <https://doi.org/10.29333/iji.2020.13316a>
- Pahrudin, A., Syafril, S., Zahro, R., Handoko, A., Yaumas, N. E., & Iksan, Z. H. (2019). Development of Islamic Value-based Picture in Biology Learning with the ISI-ARE Model. *Tadris: Jurnal Keguruan Dan Ilmu Tarbiyah*, 4(2), 237–246. <https://doi.org/10.24042/tadris.v4i2.4668>
- Penuel, W. R., Turner, M. L., Jacobs, J. K., Van Horne, K., & Sumner, T. (2019). Developing tasks to assess phenomenon-based science learning: Challenges and lessons learned from building proximal transfer tasks. *Science Education*, 103(6), 1367–1395. <https://doi.org/10.1002/sce.21544>
- Pikoli, M., Gonibala, A., Kilo, A. L., Lukum, A., & Abdullah, R. (2023). The effectiveness of chemical bond learning tools based on meaning learning model for training students' moral sensitivity. *AIP Conference Proceedings*, 2614, 030033. <https://doi.org/10.1063/5.0126070>
- Purwati, N., Zubaidah, S., Corebima, A. D., & Mahanal, S. (2018). Increasing Islamic Junior High School Students Learning Outcomes through Integration of Science Learning and Islamic Values. *International Journal of Instruction*, 11(4), 841–854. <https://doi.org/10.12973/iji.2018.11453a>
- Rashid, B. (2021). Charity Ethics in Islam with Special Reference to Sincerity and Ostentation. *Turkish Online Journal of Qualitative Inquiry*, 12(9), 5946–5960.
- Rest, J. R. (1986). *Moral development: Advances in research and theory*. Praeger
- Rokhman, F., Hum, M., Syaifudin, A., & Yuliati. (2014). Character Education for Golden Generation 2045 (National Character Building for Indonesian Golden Years). *Procedia - Social and Behavioral Sciences*, 141, 1161–1165. <https://doi.org/10.1016/j.sbspro.2014.05.197>
- Romziana, L., Nabila, I. N., & Salomon, N. (2024). The Phenomenon of Fast Fashion on Environmental Pollution from The Perspective of Al-Qur'an. *Al-Insyiroh: Jurnal Studi Keislaman*, 10(1), 134–153. <https://doi.org/10.35309/alinsyiroh.v10i1.250>
- Rudolph, J. L. (2020). The lost moral purpose of science education. *Science Education*, 104(5), 895–906. <https://doi.org/10.1002/sce.21590>

- Safkolam, R., Nuangchalerm, P., Zaky El Islami, R. A., & Saleah, P. (2023). Students' Understanding of Nature of Science in Islamic Private School. *Jurnal Pendidikan Islam*, 9(1), 1–14. <https://doi.org/10.15575/jpi.v0i0.21308>
- Sappe, S. (2020). Differences in Knowledge Science in Islamic Education Philosophy Perspective. *International Journal of Asian Education*, 1(1), 1–8. <https://doi.org/10.46966/ijae.v1i1.22>
- Shah, S. A., Khan, S., & Muhaimin, A. (2020). Character Education according to Quran and Hadith: A description of Provision of Character Education in Secondary Schools. *Journal of Islamic and Religious Studies*, 5(1), 99–114. <https://doi.org/10.36476/JIRS.5:1.06.2020.18>
- Ståhl, T., Zaal, M. P., & Skitka, L. J. (2016). Moralized Rationality: Relying on Logic and Evidence in the Formation and Evaluation of Belief Can Be Seen as a Moral Issue. *PLOS ONE*, 11(11), e0166332. <https://doi.org/10.1371/journal.pone.0166332>
- Sudiyono, A. H., Widodo, W., & Susantini, E. (2017). Pengembangan Perangkat Pembelajaran Model Pemaknaan pada Materi Gelombang dan Bunyi untuk Melatihkan Sensitivitas Moral peserta didik SMP. *JPPS (Jurnal Penelitian Pendidikan Sains)*, 5(1), 811. <https://doi.org/10.26740/jpps.v5n1.p811-821>
- Suparjo, S., Hanif, M., & Senja, D. I. (2021). Developing Islamic science-based integrated teaching materials for Islamic religious education in Islamic high schools. *Pegem Journal of Education and Instruction*, 11(4), 282–289. <https://doi.org/10.47750/pegegog.11.04.27>
- Sutiana, D., & Nugraha, M. S. (2025). Integration of Islamic Values and Science in Islamic Primary Schools: A Philosophy of Science Approach. *Journal of Elementary Education Research and Practice*, 1(1), 21–34. <https://doi.org/10.70376/bv7bqx53>
- Taşkın, Ö. (2014). An exploratory examination of Islamic values in science education: Islamization of science teaching and learning via constructivism. *Cultural Studies of Science Education*, 9(4), 855–875. <https://doi.org/10.1007/s11422-013-9553-0>
- Ting, Z., Chookhampaeng, C., & Chano, J. (2025). Developing an early childhood Pre-Service Teacher Instructional Model Based on Meaningful Learning Theory to Improve Lesson Design Ability. *Educational Process: International Journal*, 17, e2025335. <https://doi.org/10.22521/edupij.2025.17.335>
- Tukiyo, T., Haryono, P., Arifin, S., Kartiko, A., & Shofiana, F. R. (2022). Improving Multiliteracy Ability in the Integration of Islamic and Science Learning. *AL-ISHLAH: Jurnal Pendidikan*, 14(4), 6025–6038. <https://doi.org/10.35445/alishlah.v14i4.2433>
- Van Der Leij, T., Avraamidou, L., Wals, A., & Goedhart, M. (2021). Biology Students' Morality When Engaged With Moral Dilemmas in the Human-Nature Context. *Frontiers in Education*, 6, 729685. <https://doi.org/10.3389/feduc.2021.729685>

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