



## **The Integration of the Nature of Science and Religion to Increase Students' Religious Beliefs in Acquiring Scientific Knowledge at the Elementary School**

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**Abstract:** Various efforts have been made to increase students' understanding and scientific skills in science learning; however, religion is often ignored. This study seeks to integrate science and religion concepts in increasing students' religious beliefs to acquire scientific knowledge. This study used mixed methods research. The samples of 100 students and four teachers from four elementary schools in Aceh province were chosen randomly. Data were collected from student questionnaires, teacher interviews, and observation of learning implementation. The research results found that there has been no integration of the concepts of science and religion by linking NOS (Nature of Science) aspects and religious beliefs in acquiring scientific knowledge in science learning in elementary schools. The previous integration was carried out by integrating the verses of the Qur'an into scientific concepts. The implementation of integrating the concepts of science and religion increased religious beliefs in acquiring scientific knowledge among elementary school students. Most students strongly agree with religious beliefs in acquiring knowledge. Students strongly agree that science is a way to get closer to God. In learning science, teachers should integrate NOS and religious beliefs in acquiring scientific knowledge through impressions of feelings, reasoning, and intuition toward God's creation. This research should contribute to understanding science and NOS concepts related to science and religion, how scientists work, social culture, moral values, and emotional and spiritual intelligence.

**Keywords:** integration, nature of science, religious beliefs

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### **Introduction**

Various attempts have been made in science learning to improve knowledge, scientific processes, and scientific attitudes in elementary school students, but religion is often neglected (Tursinawati et al., 2022b, 2022c). Some conflicts even occur in discussions between science and religion (Lessl, 2018; Southerland & Scharmann, 2013). These resulted in students refusing to discuss science and religion in classes (Bickmore et al., 2009). In another study, perceptions were discussed between Muslim and Jewish students (Aflalo, 2018), but they had not integrated NOS and religion into science learning.

Although some learning between science and religion has been integrated, such as Natural Theology and Theology of Nature (Barbour, 1966), problems were still found in implementing those two aspects. For example, in integrating with Natural Theology, teachers linked science and religion in the context of cosmological history, but students were not ready to discuss it (Bagdonas & Silva, 2015). Likewise, teachers faced difficulties integrating science concepts with the teachings of Holy Scriptures such as the Quran. One of the factors that causes difficulties in connecting religion and science is the

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influence of teachers' educational backgrounds (Hasanah & Zuhaida, 2018). It was found that the constraints in integrating science learning were influenced by several factors, such as teachers' limited understanding of the study of science in the Holy Quran and their different educational backgrounds.

Science learning aims in several countries to produce scientists with good religious and spiritual values. The aim is also one of the goals of the curriculum in Indonesia. As the Ministry of Education and Culture (2012) emphasized in science learning at elementary schools in Indonesia, students must practice their religious teachings and obtain knowledge by observing, asking, and being curious about themselves and God's creatures and the activities found around them.

However, it was found that teachers conducted science learning in the classroom did not explicitly involve students as scientists with spiritual values. During science learning, students have not been guided to have the qualities of scientists in examining nature as evidence of God's majesty. Therefore, teachers should teach NOS-based science learning with explicit reflective learning (Widodo et al., 2019) and develop NOS-based learning materials and learning models at elementary schools (Adi & Widodo, 2018).

Elementary school students were also found to have not been taught to use their intuition, spiritual attitudes (Kemendikbud, 2018), and scientific attitudes (Masithoh, 2018) in acquiring scientific knowledge. As scientists, students have not been involved in studying natural science through feelings of gratitude, admiration, and caring for nature as God's creation. This affected the shallowness of students' scientific knowledge, skills, and attitudes as religious scientists.

Furthermore, in science teaching, teachers often neglect students' knowledge and skills as ways to obtain scientific knowledge, as scientists did (Mar & Clim, 2022). Therefore, during the learning process, it is important to emphasize to the students to be a Muslim who understands how to think like scientists do, that is, by integrating scientific knowledge, scientific skills, and spirituality (Azhar, 2017).

Thus, science learning should reflect the integration of learning between scientific concepts and religious beliefs. One way is to integrate NOS and religious beliefs explicitly in science learning. As its name indicates, it is expected that NOS can be taught explicitly in science learning (Bang, 2013). Science learning (Mercado et al., 2015; Tursinawati et al., 2022b) teaches students the characteristics of NOS, such as what science is, how knowledge is acquired, what the results are, and how knowledge influences the socio-cultural context. Furthermore, the concept of NOS can be integrated with students' religious beliefs in acquiring scientific knowledge about the greatness of God in the creation of the universe (Qutub, 2011; Shihab, 2021b) by using the five senses given by God (Fakhri, 2010; Qutub, 2011; Tursinawati et al., 2020), and by applying scientific investigations to foster a sense of gratitude, awe, and affection so that they become acts of worship to God (Anwar & Elfiah, 2019; Golshani, 2000; Tursinawati et al., 2022b).

Integrating NOS and religion in science learning in this study combined the aspects of NOS (Lederman et al., 2014; Tursinawati & Widodo, 2019; Williams & Rudge, 2019) and religious beliefs in acquiring scientific knowledge (Barbour, 1994; Golshani, 2000; Shihab, 2021b; Tursinawati et al., 2022a, 2022b). This learning links NOS and religion with the values of impression of feelings, reasoning, and intuition (Golshani, 2000). Impressions of feeling, reasoning, and intuition in science learning that connect aspects of NOS and religion are used to show the greatness of God in the creation of nature through scientific activities and attitudes as acts of worship to God. Therefore, the feeling of gratitude, awe, and affection for nature is expected to grow.

From the viewpoint of the Quran, there are several ways to understand nature: by impressions of feeling, reasoning, and intuition. Impressions of feeling in understanding nature are impressions the human senses receive through experiments and observations. Reasoning studies or investigates nature empirically and emphasizes intellectuality and logical reasoning. As for scientific intuition was acquired in a higher realm, such as revelation, by the prophets (Golshani, 2000).

In implementing science learning, the impressions of feeling can involve students in awe, respect, and gratitude to God for the beauty and natural order (Barbour, 1994). Furthermore, science learning can involve students in identifying the impressions of awe of God as the creator of nature through the activities of sciences in acquiring knowledge.

Reasoning in scientific methodology in the Alquran, called Al-Nazhr, can be interpreted as "seeing" using the eye and "paying attention", which can be carried out using the eye and other senses. As for Aql and Al-fikr, they can be interpreted to think and understand (Lubis, 2014). In learning

science, teachers can involve students by reasoning (observing, paying attention, understanding, thinking) in scientific investigation activities about the majesty of God in the creation of nature based on the work principles and attitudes of scientists in acquiring knowledge.

In the Quran, researching and studying something involves intuitive methods, namely spiritual experiences in the form of one mind and remembrance (dhikr) (Lubis, 2014). Scientists use intuition as the sixth sense (Shihab, 2021a). This aspect of intuition is related to the intuitive brain, which is related to spiritual intelligence and reasoning. Spiritual reasoning is the sensitivity behind the reality of what is happening. Spiritual reasoning is a spiritual experience that includes awe, gratitude, compassion, and the desire to get closer to God (Husein et al., 2019). In the intuition stage of science learning, the teacher can confirm and involve students by emphasizing that knowledge is acquired through activities and beliefs to prove God's majesty in the creation of nature through awe, gratitude, compassion, and the desire to get closer to God.

Previous literature studies showed very limited discussions regarding integrating science and religion in science learning. Compared to previous studies, this research provides new scientific teachings, namely, integrating NOS and religion explicitly. Integrating NOS and religion involves students becoming explicitly spiritual scientists in the classroom. Integrating NOS and religion involves students' understanding of how scientists work to obtain scientific knowledge in science learning. Furthermore, integrating NOS and religion can develop students' religious beliefs in acquiring scientific knowledge, science skills, intuition, and spiritual reasoning.

Thus, this research aimed to increase students' religious beliefs in obtaining scientific knowledge through integrating NOS and religion. This research analyzed the implementation of learning by teachers related to science learning that integrates the concepts of science and religion in elementary schools. Next, the researchers examined the application of learning that integrated NOS and religion in increasing religious beliefs and gaining scientific knowledge for elementary school students. Furthermore, this learning produced learning designs, learning planning designs and teaching modules integrating NOS and religion as references or guidelines for teachers in teaching science learning in elementary schools.

### **Methods**

Creswell (2015) explained that intervention mixed methods design is a design that studies a problem by conducting experiments or interventions and adding qualitative data to it. This study surveyed 100 fifth-grade students from four elementary schools in Aceh province, Indonesia, with an average age of 10-11 years old. The samples included 40 male and 60 female students. Additionally, the study included four experienced classroom teachers, each with five years of teaching experience in elementary schools and certified by the Indonesian Ministry of Education, who taught class V at each of the four schools. The samples for this study were chosen using a random sampling method.

The research instruments used were teacher interviews, observation, and questionnaires. Teacher interviews were used to collect data on the implementation of learning by elementary school teachers. Observation sheets were used to observe the application of science learning related to NOS and religion carried out by teachers in elementary schools and during learning interventions integrating NOS and religion. The student questionnaire collected data on increasing religious beliefs in acquiring scientific knowledge.

Interview and observation sheets were developed concerning the learning implementation components (Anwar & Elfiah, 2019; Golshani, 2000; Sumantri, 2015). The aspects studied were teacher strategies and student activities in implementing science learning that integrated NOS and religion related to religious beliefs, which have been carried out in science learning at elementary schools.

The questionnaire on students' religious beliefs in acquiring scientific knowledge was adapted from Tursinawati et al. (2022b, 2022c). The questionnaire consists of 30 questions. The aspects of religious belief in acquiring scientific knowledge consist of five aspects that can be observed in Table 1.

**Table 1.** Aspects of Religious Beliefs in Acquiring Knowledge

<b>Aspects of Religious Beliefs</b>	<b>Indicators</b>
Science as a way to know the greatness of God the Almighty's creations	Science is an instrument and basic human need to explore the secrets of nature and its processes as proof of the greatness of God's creation, the Most High Believing that someone who knows will be elevated in rank by God Almighty
The universe is a sign of the majesty of God's creation	Natural phenomena, natural events, their existence, beauty, and order are signs of the power of God the Almighty Appreciate the order and beauty of the universe through a caring attitude in maintaining the balance of nature as a deed of worship to God the Almighty
Human senses, reason, and conscience (intuition/revelation and inspiration) are valuable instruments for observing the creations of God the Almighty	Hearing, sight, and conscience are valuable instruments for acquiring knowledge as a way to thank God the Almighty Believing that God has given humans mind and conscience to study and conduct research so that they can master, control, and take advantage of nature with a sense of responsibility for the benefit of all mankind
Investigation is a process to show the signs of the greatness of God the Almighty	Believing that investigation (reading, seeing, paying attention, observing), in-depth analysis, and critical reasoning are intellectual processes to reach rational conclusions to show God's sign of greatness in the creation of the universe
Humans' role and positive attitude towards the universe as a deed of worship to God	Producing science and technology products and new theories that benefit humans and humanity are deeds of worship to God the Almighty Believing that humans, as caliphs on earth, have a role in cultivating the potential of the universe in a positive manner based on God's laws by taking into account the values and norms that are following human and humanitarian ideals

Qualitative data in interviews and observations were analyzed by applying data reduction, data presentation, and drawing conclusions or verification. The data were reduced by classifying or selecting data related to integrating NOS and religion at the elementary schools. The data were then analyzed by translating the classroom learning process recordings into text data with concrete details. The data gathered from the observation was given score levels where (3) was fully implemented, (2) was partially implemented, and (1) was not implemented. The data was classified into several study aspects at the presenting stage and described in depth. Furthermore, data verification was carried out by drawing conclusions, which were constructed in a narrative form that shows the relationship between each aspect of the study.

The data from the questionnaire was analyzed quantitatively using the Likert scale. The data was then tested for normality to test the distribution of normally distributed data using the One-Sample Kolmogorov Smirnov test in the Statistical Product and Service Solutions (SPSS) program. The data was then analyzed using the Independent Sample t-test through a paired sample test using SPSS to obtain results related to increasing students' religious beliefs in acquiring scientific knowledge by integrating NOS and religion in science learning in elementary schools.

## **Results and Discussion**

### **Results**

The results of this study describe the implementation of learning that teachers have carried out related to the integration of the concepts of science and religion. The integration was by connecting NOS and religious beliefs in acquiring scientific knowledge in science learning. It also describes the results of increasing religious belief in acquiring scientific knowledge in elementary schools by implementing science learning that integrates the concepts of science and religion.

**The Integration of the Concepts of Science and Religion in the Elementary Schools**

The results of observations and interviews with teachers in the implementation of the integration of science and religion concepts that teachers in elementary schools have carried out indicate that there has been no integration of science and religion concepts by linking NOS aspects and religious beliefs in acquiring scientific knowledge in science learning in elementary schools. Some elementary school teachers have integrated the concepts of science and religion in the context of integrating religious propositions with science material. However, the teachers have not yet integrated aspects of NOS and religious beliefs in acquiring scientific knowledge in science learning. This result indicated that elementary school students have not yet studied religious beliefs in acquiring scientific knowledge in science learning. So far, students have occasionally studied religious propositions related to science material.

**Table 3.** Integrating the Concept of Science (NOS) and Religion Implemented by Elementary School Teachers

Aspects of the Implementation of Science Concept Learning (NOS) and Religion Related to Religious Beliefs	Teachers			
	T1	T2	T3	T4
<b>1. Strategies applied by the teachers</b>				
a. Conveying goals, apperception and motivating learning related to religious beliefs in acquiring scientific knowledge	2	2	1	1
b. Delivering material related to religious beliefs in acquiring scientific knowledge	2	1	1	1
c. Explaining the concept of religious belief in acquiring scientific knowledge	1	1	1	1
d. Linking religious propositions with scientific concepts in acquiring religious beliefs	1	1	1	1
e. Facilitating students to do observations and analyzing data on how to acquire scientific knowledge based on religious beliefs in proving the greatness of God in the creation of nature	2	2	1	1
f. Facilitating students' questions and answers and discussing ways to gain scientific knowledge as a way to prove God's majesty in the creation of nature	2	1	1	1
g. Using additional learning teaching materials that support understanding and religious beliefs in acquiring scientific knowledge	2	1	1	1
h. Utilizing concrete media, multimedia as a support for science learning related to learning in increasing students' religious beliefs to acquire scientific knowledge	1	1	1	1
i. Teacher involves students to conclude, give feedback, and follow up learning related to science to get to know God's majesty in the creation of nature	2	2	1	1
j. The teacher provides an assessment related to religious beliefs in acquiring scientific knowledge	1	1	1	1
k. Conveying goals, apperception and delivering learning motivation related to religious beliefs in acquiring scientific knowledge	1	1	1	1
<b>2. Student activities in studying religious beliefs to acquire scientific knowledge in science learning</b>				
a. Preparing for learning	1	1	1	1
b. Studying material and passionate about relating science and the greatness of God in the creation of nature	2	1	1	1
c. Question and answer and discuss how to acquire scientific knowledge based on religious views	1	1	1	1
d. Observing scientific objects and relating them by acquiring scientific knowledge based on religious beliefs in proving the greatness of God in the creation of nature	2	2	1	1
e. Studying and analyzing observational assignments and relating the two assignments on how to acquire scientific knowledge of God's majesty in the creation of nature	1	1	1	1
f. Using additional teaching materials and learning media that support understanding and religious beliefs in acquiring scientific knowledge	1	1	1	1
g. Concluding, reflecting, and working on assessment questions related to the concept of religious belief in acquiring scientific knowledge	1	1	1	1

Description: T1: Teacher 1, T2: Teacher 2, T3: Teacher 3, T4: Teacher 4

The results of Table 3 show that most teachers and students rarely integrated religious beliefs in acquiring scientific knowledge in science learning. Some teachers have prepared lessons, started learning, linked religious propositions with science material, facilitated students to do observations, and used concrete media in science learning. However, teachers have not linked religious beliefs to acquiring scientific knowledge in science learning. All teachers have not yet explained, used teaching materials, concluded, reflected, and assessed learning related to religious beliefs in acquiring scientific knowledge.

Likewise, students' activities showed that most students have studied science material and done observations on science learning. However, students have not yet studied science and associated it with religious beliefs in acquiring scientific knowledge. All students have not been actively involved in preparing lessons, asking questions, discussing, doing assignments, using teaching materials, concluding, and working on questions about religious beliefs in acquiring scientific knowledge.

So far, teachers have integrated religious propositions with science material. However, teachers have never linked religious propositions about how to acquire scientific knowledge with NOS aspects in science learning. The teachers connected religious propositions according to scientific material learned. It was shown that T1 and T2 used religious arguments in teaching science material, but T3 and T4 did not. The interview results showed that two teachers had used religious arguments in science learning, but the other two had never used religious arguments. As T1 revealed that:

"I have used Alquran verses several times in teaching science. I chose verses from the Alquran related to scientific material. However, I have never been taught about how to learn science like scientists do, which is related to religion".

On the other hand, T2 revealed that:

"In implementing science learning, I have limited knowledge of the propositions or verses of the Quran regarding science material. This makes me rarely use Alquran verses in teaching science".

Furthermore, a few teachers linked religion and science at the apperception stage by explaining the universe God created with gratitude and using the sense of sight to observe. Moreover, T1 motivated the students by expressing the struggles scientists experience in creating technology. However, the teacher has not made a concrete connection to the role and activities of scientists in the research process to show the greatness of God in the creation of nature. Moreover, teachers used learning media such as concrete and multimedia media in science learning. However, teachers have not used teaching materials and learning media to show and prove God's majesty in the creation of nature.

As for students' activities, observation activities were still limited to observing experiments related to science concepts. Yet, students have not been involved in connecting the observational process with acquiring scientific knowledge based on religious beliefs. Students have not yet observed scientific objects by using their five senses, mind, and conscience as valuable instruments that God has given to carry out investigations. Moreover, students have not been involved in conducting observations by investigating and reasoning critically to show evidence of God's majesty in the creation of nature. Furthermore, students were not yet involved in playing an active and positive role in protecting nature as a charity of worship to God.

During the learning process, the teacher said that students participated actively in experiments and discussions related to science material. However, students have not linked religious beliefs to acquiring scientific knowledge in experimental activities. Students have not carried out investigations to prove God's greatness in the creation of nature. Likewise, students have not discussed or analyzed the results of science assignments using the senses, reason, and logical mind to show the greatness of God as the creator of nature. Furthermore, students did not involve the senses of awe, gratitude, and affection for nature as God's creation in the learning process.

The findings show that teachers have not yet linked religious beliefs to acquiring scientific knowledge in science learning. The data shows that the four teachers have not explained, concluded, reflected, and assessed learning related to religious beliefs in acquiring scientific knowledge. The four teachers have not yet explained the concept of religious belief in acquiring scientific knowledge.

Likewise, at the end of the lesson, the teachers have not yet involved students in concluding, reflecting, following up, and assessing religious beliefs in acquiring scientific knowledge.

The findings also show that the four teachers have not used teaching materials that integrate the concepts of science and religion in learning science. Based on the results of the interviews, it was revealed that they had not used teaching materials related to integrating religious beliefs in acquiring scientific knowledge. As T4 revealed that:

"I use the science textbooks provided by the school. Several other references were learned from the school library. But I have not found any books related to religion about science in science learning."

Thus, the implementation of science learning that teachers have carried out so far indicated that they have not yet integrated the concepts of science and religion into science learning. Therefore, further research should be carried out by integrating science and religious concepts related to religious beliefs in acquiring explicit scientific knowledge.

### Increasing Religious Belief in Acquiring Scientific Knowledge in Elementary Schools

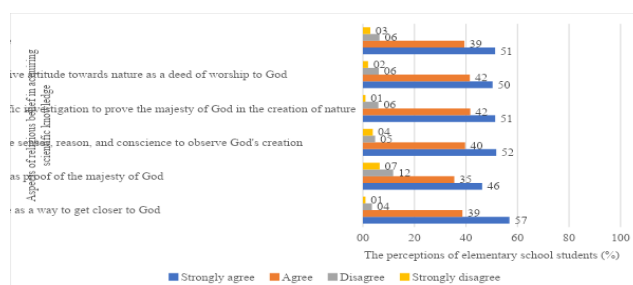
Integrating the concepts of science (NOS) and religion is done by loading the values of the impression of feeling, reasoning, and intuition related to science learning. Implementing science learning integrates the concept of NOS with religious beliefs in acquiring scientific knowledge explicitly. The learning activity involved students identifying the impression of awe of God in the creation of nature with scientific activities in acquiring scientific knowledge. It further involved students' reasoning by investigating or experimenting in showing the majesty of God in the creation of nature. Furthermore, students concluded the science acquired with the knowledge, activities, and scientific beliefs in proving the majesty of God in the creation of nature through a sense of awe, gratitude, compassion, and the desire to get closer to God.

After carrying out the learning process that integrated NOS and religion, it showed an increase in religious beliefs in acquiring scientific knowledge among students at elementary schools. This is shown to have a significance of  $t < 0.05$ , namely  $0.000 < 0.05$ . Therefore,  $H_0$  is rejected, and  $H_a$  is accepted. Likewise, the increase was shown in the mean of the posttest, 86.35, compared to the pretest, which was 79.49.

**Table 4.** Test of Different Levels of Religious Belief in Gaining Scientific Knowledge of Elementary School Students

Types of Data	Pre-test	Post-test
N	100	100
Mean	79.49	86.35
Std. Dev	8.151	7.241
Diff.test	Sig. Inter. (Ho)	0.000 Rejected

The results of students' views on religious beliefs in acquiring scientific knowledge show that most students strongly agree on the importance of religious beliefs in acquiring scientific knowledge in science learning. The data shows that 51.3% of students strongly agree, agrees 39.4%, disagrees 6.4%, and strongly disagree 2.9%.



**Figure 1.** Perceptions of Elementary School Students on Religious Beliefs in Acquiring Scientific Knowledge

The findings show that most students strongly agree about religious belief in acquiring scientific knowledge (Figure 1.). The findings indicate the highest percentage in each aspect is in the strongly agree statement. The highest is science or knowledge as a way to get closer to God (57%). Furthermore, most students strongly agree that the five senses, reason, and conscience are used to observe God's creation (52%). Students also strongly agreed that scientific investigation can prove God's majesty in the creation of nature (51%), a positive attitude towards nature as a deed of worship to God (50%), and nature as proof of God's majesty (46%).

**Table 4.** The Integration of the Concept of Science (NOS) and Religion Related to Religious Beliefs in Acquiring Knowledge in Elementary Schools

The Aspects of the Implementation of the Concept of Science (NOS) Learning and Religion related to religious beliefs	Teachers			
	T1	T2	T3	T4
<b>1. Strategies applied by the teachers</b>				
a. Preparing to learn (pre-instructional) in linking religion to science learning	3	3	3	3
b. Conveying goals, apperception and motivating learning related to religious beliefs in acquiring scientific knowledge	3	2	3	2
c. Delivering material related to religious beliefs in acquiring scientific knowledge	2	3	2	3
d. Explaining the concept of religious belief in acquiring scientific knowledge	2	3	3	3
e. Linking religious propositions with scientific concepts in acquiring religious beliefs	3	3	3	3
f. Facilitating students to do observations and analyze data on how to acquire scientific knowledge based on religious beliefs in proving the greatness of God in the creation of nature	3	2	2	3
g. Facilitating students' questions and answers and discussing ways to gain scientific knowledge as a way to prove God's majesty in the creation of nature	2	2	2	3
h. Using additional learning teaching materials that support understanding and religious beliefs in acquiring scientific knowledge	3	3	3	3
i. Utilizing concrete media, multimedia as a support for science learning related to learning in increasing students' religious beliefs to acquire scientific knowledge	3	2	2	2
j. Involving students to conclude, give feedback, and follow up learning related to science to get to know God's majesty in the creation of nature	3	2	1	2
k. Providing an assessment related to religious beliefs in acquiring scientific knowledge	2	2	2	2
<b>2. Student activities in studying religious beliefs to acquire scientific knowledge in science learning</b>				
a. Preparing for learning	3	3	3	3
b. Studying material and passionate about relating science and the greatness of God in the creation of nature	3	2	3	3
c. Question and answer and discuss how to acquire scientific knowledge based on religious views	2	2	2	2
d. Observing scientific objects and relating them by acquiring scientific knowledge based on religious beliefs in proving the greatness of God in the creation of nature	3	2	2	3
e. Studying and analyzing observational assignments and related the two assignments to how to acquire scientific knowledge of God's majesty in the creation of nature	2	3	2	3
f. Using additional teaching materials and learning media that support understanding and religious beliefs in acquiring scientific knowledge	3	3	3	3
g. Concluding, reflecting, and working on assessment questions related to the concept of religious belief in acquiring scientific knowledge	2	2	2	2

Description: T1: Teacher 1, T2: Teacher 2, T3: Teacher 3, T4: Teacher 4

Table 4 shows that all teachers applied the integration of NOS and religion in science learning. Most teachers applied the integration of NOS and religion to NOS learning well through strategies and actively involved students in increasing religious beliefs in acquiring scientific knowledge in class. Most of the teachers have integrated NOS and religion in preparatory activities, opening lessons, linking



religious propositions, delivering material, and using teaching materials and learning media. Some other teachers applied the integration of NOS and religion in observation, question and answer, discussion, instructional media, and reflection and assessment related to religious beliefs in acquiring scientific knowledge, but this was not yet effective.

Most teachers have linked religious beliefs in the learning preparation process, such as preparing lesson plans, media, teaching modules, and teaching strategies. Likewise, in the learning process, the teacher included religious propositions related to science teaching materials, such as verses from the Alquran.

In integrating NOS and religion, the teacher conveyed the concept of religious belief in acquiring scientific knowledge. The teacher conveyed that science is a way to know the greatness of God. The teacher also conveyed that the universe is proof of God's majesty in the creation of nature. The teacher further said that the five senses, mind, and conscience are valuable instruments in acquiring knowledge. Likewise, the teacher conveyed that the investigation process is a process to show the majesty of God in the creation of nature. The teacher also said that humans have a role and are responsible for managing and protecting nature because they are caliphs on this earth. At the beginning and end of the activity, the teacher also conveyed admiration, gratitude, and compassion for nature as a deed of worship to God.

Some other teachers guided students in conducting observations by linking religious beliefs to acquiring scientific knowledge. The teacher emphasized that students used the five senses, such as the eye, to observe. Likewise, the teacher carried out questions, answers and discussions but not specifically related to aspects of religious beliefs in acquiring scientific knowledge.

Some teachers guided students in concluding, reflecting, and assessing learning activities related to religious beliefs in acquiring scientific knowledge. However, teachers have not involved students to summarize, reflect, and evaluate learning related to the investigation process and the positive role of humans towards God's creation.

Most students were actively involved in learning preparation activities, studying teaching materials, and using teaching modules about religious beliefs to acquire scientific knowledge. Some other students were actively involved in questions and answers, discussions, observations, or investigations, analyzing assignments, reflections, and assessments related to religious beliefs in acquiring scientific knowledge, but this was not optimal.

The observations show that some students were active in preparing for learning, such as preparing teaching modules, practicum materials and tools, and self-preparation in science learning. Most students also actively studied teaching materials by reading teaching modules and listening to teacher explanations related to religious beliefs in acquiring scientific knowledge. Observations showed that some students were active in debriefing, observing, and discussing. However, those activities have not effectively asked questions and discussed religious beliefs in acquiring scientific knowledge.

Some observation activities involved religious beliefs in acquiring scientific knowledge, such as linking the use of the five senses in conducting observations. However, students have not yet involved aspects of other religious beliefs in observational or experimental activities. Likewise, most students have analyzed assignments related to science teaching materials. A few students were actively involved in discussing their assignments related to aspects of religious beliefs, such as showing the greatness of God in the creation of nature and the use of the five senses. However, students have not discussed the investigation, which is a process to show the greatness of God in the creation of nature and humans' role and positive attitude in managing and protecting nature as a deed of worship to God.

Several implementations of integrating NOS and religion in science learning have not been done well in increasing religious beliefs in acquiring scientific knowledge. These activities include observation and investigation, question and answer, discussion, data analysis, reflection, and assessment in linking religious beliefs to acquiring scientific knowledge. Therefore, it is necessary to do some follow-up to produce an effective implementation of the integration of the nature of science (NOS) and religion. Teachers should apply impressions of feeling, reasoning, and intuition more effectively in science learning. Likewise, module development should include aspects of religious belief in acquiring more concrete scientific knowledge of scientific concepts.

## **Discussion**

### **The Hindering Factors Influencing the Integration of NOS and Religion in Science Learning in Elementary Schools**

Several efforts have been made to integrate science and religion into science learning. However, obstacles were often found in science teaching. Findings from this research showed that teachers have difficulty integrating the verses of Alquran with scientific concepts. Furthermore, teachers experienced problems involving religious students actively discussing, conducting experiments, and analyzing the characteristics and ways scientists work in gaining scientific knowledge in the classroom. Teachers also experienced obstacles in obtaining learning resources about integrating science and religion. Teachers were also found to have not used media related to integrating NOS and religion.

One of the factors that caused teachers to experience problems in integrating religious and scientific propositions was different educational backgrounds. Science teachers often avoid religious propositions in teaching science. As Zuhaida et al. (2018) revealed, science education teachers face challenges in internalizing their spiritual and philosophical values in learning science. Likewise, teachers with religious educational backgrounds have limitations in integrating scientific findings with religious studies in science learning.

Teachers were found to have not yet involved students in learning how scientists work in gaining scientific knowledge based on their religious beliefs in the classroom. Students were involved in carrying out practical activities and exploring science concepts. However, teachers have not involved students in understanding the inquiry process by scientists to produce new theories, scientific laws, and new technology based on observations of God's creation. Likewise, students have not been involved in discussing the nature of science, the process of obtaining science, and what values or attitudes a scientist must have based on the student's religious beliefs. So far, science learning has tended to direct students to master scientific material but ignored the process of obtaining scientific knowledge. As Tan et al. (2017) stated, it is important to provide an overview for children and teenagers to understand how scientists work, their attitudes towards science, and their interest in science learning in schools oriented towards how scientists will work.

Teachers were found to use learning media such as concrete and multimedia media in science learning. However, teachers have not used teaching materials and learning media to show and prove God's majesty in the creation of nature. The results of previous studies showed the importance of considering the use of appropriate learning media in integrating science and religion because there was an increase in student learning outcomes by utilizing learning media (Fardiana, 2015) and developing students' characters (Ayu et al., 2019; Nugroho & Iman, 2018). The use of seamless mobile media in integrating Islamic values and science can increase knowledge, skills, spiritual potential, personality, and noble character, an attitude of gratitude to God as the creator of nature (Fahyuni et al., 2020).

Unfortunately, teaching materials that integrate NOS and religious beliefs in acquiring scientific knowledge were unavailable. Some of the available supports or textbooks were textbooks on the integration of scientific values in the Quran (Binti Rahman & Che Noh, 2021; Mukri et al., 2019) and textbooks that integrate science and technology related to religion (Nasir et al., 2019). One of them is developing teaching materials that integrate Islamic stories about the benefits of religious knowledge in the daily lives of elementary school students (Nuzulia, 2016). However, those studies have not developed teaching materials integrating NOS concepts and religious beliefs to acquire scientific knowledge. Therefore, it is important to have teaching material guidelines for teachers in integrating science and religion concepts in science learning.

Thus, the implementation of science learning that teachers have carried out so far indicated that they have not yet integrated the concepts of science and religion into science learning. Therefore, further research should be carried out by integrating science and religion concepts related to religious beliefs in acquiring explicit scientific knowledge.

### **Supporting Factors That Influence the Integration of NOS and Religion to Increase Religious Beliefs in Obtaining Scientific Knowledge**

Previous studies also indicated that students responded positively to religious beliefs in acquiring scientific knowledge. Most students believed science is a way of knowing God, proving God's majesty, and cultivating a positive attitude towards nature as God's creation with gratitude. The five senses,

reasoning, and conscience are valuable instruments that God has given to investigate nature as proof of God's majesty (Tursinawati et al., 2022c).

The increasing religious belief in acquiring scientific knowledge in science learning was influenced by learning strategies that explicitly and actively involved students and religion in science learning. Teachers implement learning that integrates NOS and religion explicitly in science learning. The observation results show that teachers used learning strategies that explicitly integrated NOS and religion in the preparation, implementation, assessment, and follow-up stages of science learning. The next strategy was that the teacher used teaching modules that integrated the concepts of science and religion in science learning to increase religious beliefs in acquiring scientific knowledge.

Another factor was that students actively learned about religious beliefs and NOS explicitly at each stage of learning. Students were actively involved in preparing lessons, studying material, asking questions, observing or investigating, discussing and analyzing assignments, using teaching modules, concluding, and working on questions related to religious beliefs in acquiring scientific knowledge in science learning.

Most teachers have linked religious beliefs in the learning preparation process, such as preparing lesson plans, media, teaching modules, and preparing teaching strategies. As Tursinawati et al. (2022c) stated in learning science, teachers should be able to internalize the divine value in science material.

In science learning, the teacher conveyed the goals of learning, conducted apperceptions, and motivated students by linking religious beliefs to acquiring scientific knowledge in class. Educational policies emphasize the integration of belief in God Almighty in education (Kemendikbud, 2018). Thus, teachers should motivate the students by encouraging them to study as a path to reach heaven, and their degree will be elevated by having a sincere intention to gain Allah's pleasure (Syahril, 2017).

During the learning process, the teacher included religious propositions related to science teaching materials, such as verses from the Qur'an. However, religious propositions were still not the main reference in integrating science and religion because of the different educational backgrounds of teachers, so teachers faced difficulties in understanding the descriptions of the Qur'anic propositions and related them to science teaching materials. The results of the study by Hasanah and Zuhaida (2018) suggested that in providing religious material, teachers should mention the verses and connect the verses with natural phenomena.

In integrating NOS and religion, the teacher conveyed the concept of religious belief in acquiring scientific knowledge. The teacher conveyed that science is a way to know the greatness of God. The teacher also conveyed that the universe is proof of God's majesty in the creation of nature. The teacher further said that the five senses, mind, and conscience are valuable instruments in acquiring knowledge. The teacher further conveyed that the investigation is a process to show the majesty of God in the creation of nature. The teacher also said that humans have a role and are responsible for managing and protecting nature because they are caliphs on this earth. At the beginning and end of the activity, the teacher delivered admiration, gratitude, and compassion for nature as a deed of worship to God.

Science material can be explained with Islamic values (As-Shodiq, 2020) in the form of wisdom, meaning, and nature of scientific material from an Islamic point of view (Darmana, 2016). In addition, teachers can integrate Islamic values into material, learning processes, and evaluation in learning science (As-Shodiq, 2020). Experts found that Islamic scientists in teaching science are believed to be able to increase NOS (Safkolam et al., 2021).

Some teachers guided students in concluding, reflecting, and assessing learning activities related to religious beliefs in acquiring scientific knowledge. However, teachers have not involved students to summarize, reflect, and evaluate learning related to the investigation process and the positive role of humans towards God's creation. It is important to carry out assessments in learning (Nurhadi et al., 2014; Setiawati et al., 2018) by incorporating Islamic values into assessments in learning (As-Shodiq, 2020). Furthermore, students can self-evaluate their lessons from religion to develop a critical view of the world (Stolberg & Teece, 2010).

Another factor that increases religious belief in acquiring scientific knowledge is that students are actively involved in learning science. Most students were actively involved in learning preparation activities, studying teaching materials, and using teaching modules about religious beliefs to acquire scientific knowledge. Some other students were actively involved in questions and answers, discussions,

observations or investigations, analyzing assignments, reflections, and assessments related to religious beliefs in acquiring scientific knowledge, but this was not optimal.

Based on the results of observations it shows that some students were active in preparing for learning, such as preparing teaching modules, practicum materials and tools, and self-preparation in science learning. Most students also actively studied teaching materials by reading teaching modules and listening to teacher explanations related to religious beliefs in acquiring scientific knowledge.

Observations showed that some students were active in debriefing and discussion. However, those activities have not effectively asked questions and discussed religious beliefs in acquiring scientific knowledge. Students were also active in observing. As Dharmawan et al. (2023) emphasized, teachers should actively involve students in integrating Islamic science by increasing students' religious attitudes through collaboration in groups, discussions, assignments, questions, and answers in learning.

Some observation activities involved religious beliefs in acquiring scientific knowledge, such as linking the use of the five senses in conducting observations. However, students have not yet involved aspects of religious beliefs in observational or experimental activities. Most students have analyzed assignments related to science teaching materials. A few students were actively involved in discussing their assignments related to aspects of religious beliefs, such as showing the greatness of God in the creation of nature and the use of the five senses. However, students have not discussed the investigation, which is a process to show the greatness of God in the creation of nature and humans' role and positive attitude in managing and protecting nature as a deed of worship to God. Muspiroh (2016) recommended that students be active in determining facts or events, objects of scientific study, and observing natural phenomena with a scientific rational approach. The aim is to strengthen students' faith and piety to Allah

### **Conclusion**

So far, there has been no integration of the concepts of science and religion by linking NOS aspects and religious beliefs in acquiring scientific knowledge in science learning in elementary schools. The integration has been carried out by integrating verses of the Qur'an into scientific concepts. Integrating the concepts of science and religion was carried out explicitly in implementing learning strategies, involving students actively, using teaching materials, and assessments related to religious beliefs in acquiring scientific knowledge. After the integration of the concepts of science and religion was explicitly applied, it showed an increase in religious beliefs in acquiring scientific knowledge among elementary school students. Most students strongly agree with religious beliefs in acquiring knowledge. Most of the students strongly agree that science is a way to get closer to God, the five senses of reason and conscience are valuable instruments in observing God's creation, the process of scientific investigation is to prove God's majesty, a positive attitude towards nature as a deed of worship, and nature as evidence of God's majesty.

This research has implications for encouraging students to become scientists who have better religious beliefs. It can also develop students' sociocultural science values in social life, moral/character values, and students' religious intelligence.

Integrating the concepts of science and religion can be carried out further in the developing plans, teaching models, teaching materials, and assessment instruments that link NOS and religious beliefs in acquiring scientific knowledge. Furthermore, this research can be used by considering general and specific methodologies in linking NOS and religious beliefs in acquiring scientific knowledge..

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