

Science Literacy Based on Religious Values in Shaping the Critical Thinking Framework of Generation Z

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Abstract: The development of the digital environment has given Generation Z broad access to information, including scientific information with varying levels of credibility. This situation requires scientific literacy and critical thinking skills to ensure that information can be understood, verified, and used responsibly. This study aims to analyze the concept of science literacy based on religious values, examine its contribution to the development of critical thinking, and formulate a critical thinking framework for Generation Z. The study employs a library research method, drawing on scholarly articles, books, and academic documents relevant to science literacy, OECD/PISA, critical thinking, religious values, and Generation Z. The data are analyzed using content analysis to identify, categorize, compare, and synthesize relevant ideas. The findings indicate that science literacy based on religious values can be formulated through the integration of scientific competencies with the Islamic values of **tabayyun** (verification) and **tafakkur** (reflective contemplation). The resulting conceptual framework comprises four components: scientific understanding, information verification, evidence evaluation, and reflection and decision-making. Science literacy provides the foundation of knowledge and evidence, critical thinking guides the processes of analysis and evaluation, while religious values provide an ethical and reflective orientation. This framework offers a conceptual foundation for strengthening critical thinking among Generation Z in navigating the complexities of digital information.

Keywords: Critical Thinking, Generation Z, Science Literacy, Religious Values,

INTRODUCTION

Generation Z has grown up in an environment closely connected to digital technology, with broad access to various sources of information (Ayub & Fuadi, 2024). This condition facilitates access to knowledge but also presents challenges due to the rapid circulation of information that is not always based on accurate or reliable evidence. Scientific information can be accessed through social media, search engines, video platforms, and other digital sources, each with varying

levels of credibility (Annafi & Musfialdy, 2026). This situation requires students to develop the ability to understand, evaluate, and use information appropriately. Consequently, education needs to foster the ability to process information critically.

These challenges become increasingly significant when students encounter information related to science. Issues concerning health, the environment, technology, and everyday life are often presented through digital information that combines scientific facts, opinions, interpretations, and claims unsupported by evidence. Students need the ability to understand phenomena, question information, examine evidence, and determine whether information is trustworthy. Science literacy is a relevant competency for addressing these conditions because it enables students to use scientific knowledge to understand problems and make decisions based on available information.

This study adopts the OECD/PISA framework as its primary conceptual foundation for science literacy. Within this framework, science literacy is understood as the ability to engage with science-related issues and use scientific knowledge to understand, explain, and make informed decisions (Fauziah, 2025). This framework positions science literacy as the capacity to engage with science-related issues, including explaining phenomena scientifically, evaluating and designing scientific inquiries, and interpreting data and evidence scientifically. Science literacy is not limited to mastering scientific concepts but also encompasses the ability to use knowledge and evidence to understand problems and make decisions (Purnawati & Yakin, 2025). This framework is relevant to the needs of Generation Z because the ability to evaluate information and evidence has become increasingly important in navigating a digital environment filled with diverse forms of scientific information.

These abilities are closely related to critical thinking. Students with science literacy need to understand information, analyze phenomena, evaluate evidence, consider different possibilities, and draw conclusions based on defensible reasoning (S. A. Handayani, 2025). This process indicates that science literacy can serve as one of the foundations for developing critical thinking patterns. For Generation Z, this ability is particularly important because they encounter large volumes of information at a rapid pace. Critical thinking is necessary to ensure that students are

not merely able to access information but can also determine its quality, relevance, and appropriate use.

From the perspective of Islamic education, the development of science literacy and critical thinking can be strengthened through religious values. Religious values are not positioned as substitutes for scientific processes but as a foundation for guiding how knowledge is acquired, evaluated, and used. The principle of *tabayyun* is relevant to the need to verify the accuracy of information before accepting or disseminating it, while *tafakkur* encourages individuals to use their reasoning abilities to understand phenomena and derive meaning from what they observe (Mudore, 2026). These two values converge with science literacy processes, particularly in examining information, considering evidence, analyzing phenomena, and reflecting on the outcomes of reasoning. Their integration can provide an ethical and reflective dimension to the development of critical thinking.

Previous studies have indicated connections among science literacy, religious values, and critical thinking in educational contexts. Gunawan and Zainuri (2021) highlighted the improvement of science literacy among Generation Z through interactive multimedia. Handayani (2025) demonstrated that integrating Islamic values into science learning can improve critical thinking. Meanwhile, Amrillah et al. (2026) examined the integration of scientific knowledge and religious values in Islamic schools, while Alega et al. (2025) showed that science learning based on Islamic values can support critical thinking skills. Nevertheless, these studies have primarily focused on media, instructional models, or teaching practices, with limited conceptual examination of the relationship between science literacy based on religious values and the development of a critical thinking framework for Generation Z. This study addresses that gap by synthesizing the literature to formulate a conceptual framework connecting science literacy, religious values, and critical thinking among Generation Z.

Based on this research gap, the present study examines science literacy based on religious values in shaping a critical thinking framework for Generation Z through a literature review. The analysis focuses on synthesizing literature concerning science literacy within the OECD/PISA framework, the relationship between science literacy and critical thinking, religious values relevant

to the acquisition and use of knowledge, and the characteristics of Generation Z in digital environments. This study does not seek to test the effectiveness of a particular instructional model; rather, it aims to formulate the conceptual relationships among science literacy, religious values, and critical thinking into a framework relevant to Generation Z. Accordingly, the research addresses three questions: (1) How can science literacy based on religious values be conceptualized from the perspective of Islamic education? (2) How can science literacy based on religious values contribute to the development of critical thinking among Generation Z? and (3) How can a critical thinking framework for Generation Z be formulated through the integration of science literacy and religious values?

Manuscripts are written neatly with the Microsoft Word program. A lot between 10-25 pages. Font used Times New Roman 12 pt, line spacing 1.5 (Sholeh, 2024). Verses or hadiths (written in Arabic) typed with traditional Arabic letters, size 12 pt. In the introduction, try to answer at least two questions: (1) why you believe that your research is so important to answer; how your research will contribute to the development of science (Sholeh et al., 2024).

METHOD

This study employs a library research method with a qualitative approach. Library research is used to examine and understand various ideas, concepts, and research findings relevant to science literacy based on religious values and the development of critical thinking among Generation Z. According to Zed, library research involves a series of activities related to collecting library materials, reading, taking notes, and processing research materials (Rahayu et al., 2024; Hariani & Jabbar, 2026). This method was selected because the study does not use field data but instead relies on written sources as its primary materials to obtain a comprehensive understanding of the subject under investigation.

The research data consist of scholarly journal articles, books, and academic documents relevant to science literacy, the OECD/PISA framework, critical thinking, religious values in education, and the characteristics of Generation Z. The literature was selected based on its relevance to the research focus, source credibility, and publication recency, while also considering

conceptual works that serve as foundational references. Literature searches were conducted through various academic databases and search engines using keywords related to science literacy, religious values, critical thinking, and Generation Z. The retrieved literature was then read, categorized by theme, and used to identify conceptual relationships.

Data were analyzed using content analysis, referring to Krippendorff's view of content analysis as a research technique for drawing replicable and justifiable inferences from data or texts within the context of their use (Fairuzawa & Deslia, 2026). The analysis involved several stages: determining the focus and units of analysis; identifying relevant information from each source; categorizing the findings into the themes of science literacy, religious values, critical thinking, and Generation Z; and comparing and synthesizing findings across the literature. The resulting synthesis was used to formulate the conceptual relationship between science literacy and religious values in developing a critical thinking framework relevant to the characteristics of Generation Z.

RESULT AND DISCUSSION

1. The Concept of Science Literacy Based on Religious Values

Science literacy within the OECD/PISA framework positions scientific competence as the ability to understand science-related problems, use knowledge appropriately, and evaluate information and evidence before making decisions. This framework encompasses the ability to explain phenomena scientifically, evaluate and design scientific inquiries, and interpret data and evidence scientifically. This perspective demonstrates that science literacy extends beyond the ability to recall concepts; it concerns how individuals use knowledge to understand phenomena, assess information, and respond based on evidence. In educational contexts, this competence is important because students encounter scientific issues in everyday life and within digital information environments.

Science literacy based on religious values can be understood as the development of scientific competence that incorporates religious values as an orientation for acquiring, evaluating, and using knowledge. Religious values are not positioned as substitutes for scientific procedures or as grounds for disregarding empirical evidence. Instead, they provide ethical and reflective guidance

to ensure that knowledge obtained through scientific processes is used responsibly. From an Islamic perspective, the process of acquiring knowledge can be associated with the values of tabayyun, which refers to examining and verifying the accuracy of information before accepting or disseminating it, and tafakkur, which refers to thinking and reflecting on various phenomena (Sholekah et al., 2026). These two values are relevant to the characteristics of science literacy, which requires the examination of information, consideration of evidence, and rational interpretation of phenomena.

Several studies have demonstrated that integrating Islamic values into science learning can strengthen the development of science literacy. Susanti et al. (2019) found that this approach was effective in improving students' science literacy. The integration of Islamic values into science materials provides a contextual framework that connects environmental issues with values relevant to students' lives. More recent findings were reported by Hardin et al. (2025) through the development of a booklet based on socio-scientific issues integrated with Islamic values. Their study demonstrated an improvement in science literacy following the use of the instructional material, particularly in the abilities to explain phenomena, interpret evidence, analyze information, and formulate scientific conclusions. These two studies illustrate that religious values can be integrated into activities that remain oriented toward scientific processes. The problems encountered by students can serve as opportunities to observe phenomena, gather information, evaluate evidence, formulate explanations, and connect knowledge with their beliefs and values (Tasrif, 2022).

This position is important because science literacy based on religious values is not intended merely to develop normative understanding but to build scientific competence accompanied by an awareness of the responsibilities involved in acquiring and using knowledge. Recent studies on the integration of science and religion also indicate that the separation between scientific knowledge and religious values can be reduced through learning approaches that connect the two contextually.

Based on this synthesis, science literacy based on religious values in this study is conceptualized through three interrelated elements. First, scientific competence, which refers to

the OECD/PISA framework and encompasses the ability to understand and explain phenomena, evaluate scientific inquiries, and interpret data and evidence. Second, information verification, which is reinforced by the value of tabayyun through the practice of examining sources, information, and the foundations of claims. Third, reflection and meaning-making, which are associated with tafakkur as an encouragement to use knowledge reflectively and responsibly. These three elements provide the conceptual foundation for examining the relationship between science literacy based on religious values and the development of critical thinking in the following section.

2. Science Literacy, Religious Values, and the Development of Critical Thinking

The relationship between science literacy and critical thinking can be understood through the cognitive processes they share. Science literacy requires individuals to understand scientific information, connect information with phenomena, evaluate evidence, and use the results of reasoning to make decisions. These processes are closely related to critical thinking, which encompasses the ability to analyze information, evaluate arguments or evidence, and draw conclusions based on defensible reasoning. From this perspective, science literacy provides the context and material for reasoning, while critical thinking guides the processing of information and evidence encountered throughout the process.

This relationship is supported by the study of Primasari et al. (2020), which found a positive correlation between science literacy and critical thinking skills among secondary school students. The study indicated that critical thinking skills were associated with science literacy and could serve as one of the factors supporting the development of students' science literacy. Similar findings were reported by Apriliana and Anggrella (2024) among elementary school students. Their results revealed a moderately strong positive correlation between science literacy and critical thinking, with a correlation coefficient of 0.617. These findings demonstrate that the ability to understand scientific knowledge, use scientific information, and solve problems is associated with students' capacity to analyze and evaluate information.

Together, these studies provide a basis for understanding science literacy as a context for developing critical thinking because scientific activities expose students to problems that require

evidence-based consideration. When individuals encounter a scientific claim, for example, the thinking process does not end with accepting the information. Instead, it continues with questions concerning the information source, the supporting evidence, the consistency of the data, and the strength of the reasoning presented. Such processes foster intellectual habits that discourage the immediate acceptance of information before it has been examined and evaluated. Within the context of this article, these processes represent the point of convergence between science literacy and critical thinking.

Religious values provide an additional dimension to this process through an ethical orientation toward acquiring and using knowledge. Tabayyun can be understood as an encouragement to verify information before accepting or disseminating it, while tafakkur provides a reflective orientation toward understanding phenomena and considering their meaning. Neither value replaces scientific testing; rather, both reinforce the attitudes necessary for critical thinking, particularly caution when encountering information, a willingness to examine the basis of a claim, and responsibility in using knowledge. This integration ensures that critical thinking extends beyond the accuracy of cognitive processes to include consideration of how knowledge is acquired and used.

The synthesis indicates that the development of critical thinking through science literacy based on religious values involves three processes: (1) analytical processes, through understanding phenomena and identifying information; (2) evaluative processes, through examining evidence, sources, and the strength of claims; and (3) ethical-reflective processes, through considering religious values when determining attitudes or making decisions. Science literacy provides an evidence-based foundation, critical thinking guides analysis and evaluation, and religious values provide an orientation for the use of knowledge. These three elements form the basis for strengthening critical thinking among Generation Z in navigating digital environments.

3. Challenges to Critical Thinking among Generation Z in Digital Environments

Generation Z has developed in an environment where digital technology and social media are integral to everyday activities. This condition provides broad access to information from various sources, including information on education, health, the environment, technology, and

social issues. Such accessibility creates opportunities for learning but also presents challenges when the information received varies in credibility. The rapid flow of information means that the ability to access information does not necessarily correspond to the ability to assess its accuracy and quality. Therefore, being a digital native must be distinguished from possessing critical information literacy skills.

This issue is reflected in research by Maryani and Wulandari on Generation Z's digital reading literacy in identifying hoax news. A study involving 74 respondents found that most respondents were aware of the existence of hoaxes and had developed habits of verifying information. However, these abilities were not fully accompanied by confidence in assessing source credibility. This finding indicates a gap between awareness of the importance of verification and the evaluative ability required to determine whether information can be trusted.

Similar findings appear in the study by Komara and Widjaya (2024) on Generation Z's information behavior on social media. Their study showed that Generation Z's familiarity with social media provides experience and competence in accessing information but simultaneously creates vulnerability to disinformation. Critical skills for selecting and evaluating information need to be strengthened through structured information literacy so that Generation Z can not only find information but also assess its validity before accepting or disseminating it.

These challenges become more complex when the information circulating concerns scientific issues. Information about health, environmental change, technology, food, and various aspects of everyday life may be presented on social media in brief and appealing formats, while its scientific evidence is not always apparent. Users may encounter scientific facts, personal opinions, interpretations, and even claims unsupported by evidence within the same information environment. Such circumstances require the ability to slow down the process of accepting information, examine sources, understand evidence, and compare claims with more reliable information. In this context, critical thinking is an essential competence for Generation Z because evaluating information requires judgment that goes beyond the technical ability to use digital devices.

Research on Generation Z's digital information literacy also indicates that technological competence does not automatically lead to the ability to evaluate information credibility. The challenges include information overload, the influence of social media algorithms, cognitive biases, limitations in verification, and vulnerability to misinformation. These conditions demonstrate that the primary need is not simply to increase the intensity of technology use but to develop epistemic competence—the ability to question, examine, and evaluate information responsibly.

At this point, science literacy based on religious values becomes relevant to shaping Generation Z's thinking patterns. Science literacy provides a foundation for understanding scientific information through explanations, evidence, data, and reasoning, while religious values offer guidance for approaching information carefully and responsibly (Umam, 2026). The value of *tabayyun* is relevant to the need to verify information before accepting or disseminating it, whereas *tafakkur* is associated with the habit of reflecting more deeply on information and phenomena. Their integration is important because digital challenges concern not merely the volume of information but also the ability to determine which information deserves to be trusted, how evidence should be used, and how knowledge can be accounted for responsibly.

Based on this review, the challenges to critical thinking among Generation Z can be formulated around three main issues: extensive exposure to information, limited ability to evaluate source credibility, and vulnerability to unverified information. These conditions reinforce the need for a framework that combines scientific competence, critical evaluation processes, and a value-based orientation. The following section formulates this framework through a synthesis of science literacy, religious values, and Generation Z's critical thinking needs.

4. A Critical Thinking Framework for Generation Z through Science Literacy Based on Religious Values

The findings of this review indicate that science literacy and critical thinking are interconnected through the ability to understand information, examine evidence, engage in reasoning, and make decisions. These abilities have become increasingly important for Generation Z because digital environments present large volumes of information with varying levels of

credibility. Science literacy provides the foundation for understanding phenomena and evaluating information based on scientific knowledge and evidence, while critical thinking processes information through analysis and evaluation.

The integration of religious values provides an ethical and reflective dimension to these processes. The value of tabayyun is relevant to the practice of examining the accuracy and credibility of information before accepting or disseminating it, while tafakkur encourages reflection on phenomena and the knowledge acquired. These two values do not replace scientific procedures but reinforce the attitudes necessary for using knowledge carefully and responsibly.

Based on the literature synthesis, a critical thinking framework for Generation Z through science literacy based on religious values can be formulated through the following four components.

Table 1. Conceptual Framework of Science Literacy Based on Religious Values in Developing Critical Thinking among Generation Z

Component	Science Literacy Foundation	Religious Value	Contribution to Critical Thinking
Scientific understanding	Explaining phenomena scientifically	Tafakkur	Understanding problems rationally
Information verification	Evaluating information and sources	Tabayyun	Examining information credibility
Evidence evaluation	Interpreting data and evidence	Tabayyun	Assessing the strength of a claim
Reflection and decision-making	Using knowledge to make decisions	Tafakkur	Formulating rational and responsible judgments

The framework demonstrates that science literacy based on religious values integrates scientific competence, critical thinking processes, and ethical orientation. Science literacy provides the foundation of knowledge and evidence, critical thinking guides analysis and evaluation, while religious values offer a foundation for verification, reflection, and responsible action. This framework constitutes the conceptual synthesis of the study and explains the development of critical thinking among Generation Z within the digital information environment.

CONCLUSION

This study shows that science literacy based on religious values can be understood as the development of scientific competencies accompanied by ethical and reflective orientations. The OECD/PISA framework provides a foundation for understanding phenomena scientifically, evaluating information and evidence, and using knowledge to make decisions. The values of *tabayyun* and *tafakkur* strengthen these processes by fostering the habits of verifying information, considering evidence, and reflecting on the responsible use of knowledge. The integration of science literacy, religious values, and critical thinking produces a conceptual framework relevant to the characteristics of Generation Z in digital environments.

The framework comprises four components: scientific understanding, information verification, evidence evaluation, and reflection and decision-making. Science literacy provides the foundation of knowledge and evidence, critical thinking guides the processes of analysis and evaluation, while religious values offer an ethical orientation for handling and using information. This synthesis positions science literacy based on religious values as a conceptual approach to strengthening Generation Z's ability to navigate diverse information that is not always verified.

This study remains conceptual in nature, as it is based on a literature review; therefore, the proposed framework has not yet been empirically tested. Future research could develop and test this framework through field studies across different educational levels and learning contexts by measuring science literacy, critical thinking skills, and the application of the values of *tabayyun* and *tafakkur*. Empirical testing is necessary to determine the extent to which the integration of

these three aspects contributes to the development of critical thinking among Generation Z when addressing scientific issues and digital information.

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