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A Needs Analysis for Developing a STEM-R Module on Renewable Energy to Foster MTs Students' Creative Thinking

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Abstract

In the context of 21st-century education, students are required to master a range of skills, one of which is creative thinking. This study conducted a needs analysis to guide the development of STEM-R-based teaching modules on the topic of renewable energy. Using a descriptive qualitative approach, data were collected through document analysis (the Ministry of Religious Affairs' vision and mission, the curriculum, and textbooks) as well as semi-structured interviews with education stakeholders. The results reveal a significant gap: although the Ministry of Religious Affairs' vision emphasises holistic education and religious character, existing science teaching materials have not explicitly integrated Islamic values. The religious dimension (R) is entirely absent from the topic of renewable energy, even though stakeholders consistently emphasise the urgency of madrasah-specific teaching materials that contextualise science from an Islamic perspective. This study concludes that a STEM-R module on the topic of renewable energy is urgently needed. These findings indicate both the need for and potential direction of module development, which could serve as a basis for the design of future teaching materials to align with the Ministry of Religious Affairs' educational philosophy.

Keywords: STEM-R, Need Analysis, Module, Renewable Energy

INTRODUCTION

21st-century education demands that physics teaching focuses not only on mastering concepts, but also on developing students' creative thinking skills. Currently, the topic of renewable energy remains a major challenge in school teaching. Renewable energy is an important physics concept as it is directly linked to the global issues of climate change and the finite nature of fossil fuels (Szeberényi, 2022; Holechek et al., 2022). Unfortunately, research indicates that students often struggle to understand the concept of renewable energy due to a lack of engaging and contextual teaching materials (Nazhifah et al., 2023). These difficulties are not only conceptual, for instance, in calculating energy efficiency or understanding the working principles of solar panels and wind turbines, but also pedagogical, as the available materials have not yet integrated religious values relevant to the madrasah context (Sumarni et al., 2020). Consequently, students' creative thinking skills in physics, particularly regarding renewable energy, remain low and require an innovative STEM-R-based approach to enhance understanding whilst fostering religious character.

One approach that is considered effective for achieving and improving 21st century skills is the STEM (Science, Technology, Engineering, and Mathematics) approach. STEM is known to enhance learners' development in problem solving (Astuti, 2021), communication skills (Sury, et al., 2022), creative thinking (Nazhifah, et al., 2023), reflective and critical (Sarwi, et al., 2024), analytical and collaborative (Hidayah, et al., 2024). This approach is recognised as being able to prepare the younger generation to face global challenges and technological developments (Halawa, et al., 2024). On the other hand, the STEM approach emphasises project-based learning, positively impacting students with 21st century skills such as communication, collaboration, problem solving,

creativity, critical thinking, responsibility, environmental awareness, and information technology literacy (Baran, et al., 2021).

The integration of the STEM approach with the religious dimension into STEM-R is an important aspect of education in Madrasah Tsanawiyah. Religious values not only play a role in shaping students' character. STEM-R is an innovative way to improve students' understanding of scientific concepts in a religious context (Wiyatno, et al., 2024). The integration of STEM with religious values is also in line with Indonesia's national education goals, which emphasise the formation of student characters who are noble and have 21st century competencies (Kemdikbud RI, 2016). In addition, it is also in accordance with the Ministry of Religious Affairs' goal in education, which is to produce smart students with general education with religious characteristics (Kemenag RI, 2020). Therefore, education providers at various levels under the auspices of the Ministry of Religious Affairs must be able to integrate science and religion. Integrating STEM into Islamic education can be a catalyst for scientific revival in the Muslim world without compromising its religious identity (Aksan, et al., 2023). Studies show that incorporating religious perspectives into STEM can improve students' science literacy for learning and enhance their understanding of the relationship between science and spirituality (Sumarni, et al., 2020).

Renewable energy is a relevant and important topic to teach to students, given the increasingly pressing issues of climate change and fossil energy scarcity (Szeberényi, 2022). Learning about renewable energy not only provides knowledge about science and technology, but also trains students to think creatively in finding solutions to global problems (Ulazia, et al., 2020). Teaching students about renewable energy is crucial in reducing dependence on fossil energy sources that may be replaced by 2050 (Holechek, et al., 2022). However, research shows that students often have difficulty in understanding science concepts, such as renewable energy, due to the lack of interesting and contextualised teaching materials (Nazhifah, et al., 2023). Developing STEM-R-based teaching module can be a solution to overcome this problem.

Several studies have examined the effectiveness of the STEM approach in improving students' creative thinking skills. Research shows that STEM-based learning significantly improves students' creative thinking skills (Lestari, et al., 2023). Another study showed the Islamic integrated PjBL-STEM learning model can improve students' creative thinking skills through projects (Nadhifah, et al., 2024). Previous research has also found that the use of STEM-Smart Physics E-Module digital media can improve students' conceptual understanding and Communication, Collaboration, Critical Thinking, and Creativity (4C) abilities (Asrizal, et al., 2024). However, there are still few studies that examine the development of STEM-R-based teaching module, especially on the topic of renewable energy, to improve the creative thinking skills of Madrasah Tsanawiyah students.

Needs analysis is an important first step in the development of teaching module. This analysis aims to identify gaps between current conditions and desired conditions, and formulate appropriate solutions. Several studies have conducted needs analyses for the development of STEM-based teaching materials. Research by Yulia, et al., (2020) identified the needs of students, teachers, and teaching materials in STEM-based science learning. Another study by Susilawati, et al,. (2023) showed that there is a need for STEM-based teaching materials in high school physics learning to support students' skills in problem solving and product design. Previous research was also conducted by Hizhar & Ramli (2020) which stated the importance of STEM-based needs analysis identified from student characteristics, teacher competencies, and student books. However, research on needs analysis for the development of religious STEM-based teaching module on the topic of renewable energy is still very limited.

This study aims to identify gaps in the curriculum and existing teaching materials. In addition, it is also to formulate recommendations in the development of religious STEM-based teaching module on the topic of renewable energy to improve the creative thinking skills of Madrasah Tsanawiyah students. By conducting a needs analysis, this research is expected to provide appropriate

recommendations for the development of teaching module that are effective and relevant to the educational context in Madrasah Tsanawiyah (MTs). The results of this study are expected to contribute to the development of curriculum and teaching materials that are more innovative and meaningful to students.

METHODS

This study employs a descriptive qualitative approach with a needs analysis design. The research was conducted in two MTs in South OKU Regency under the Ministry of Religious Affairs in South Sumatra Province. This context was selected based on the characteristics of madrasahs, which, by policy, integrate general and religious education. This serves as a preliminary step prior to the wider development of modules.

Data collection was carried out through document analysis and semi-structured interviews. The documents analysed comprised: (1) Ministry of Religious Affairs Regulation No. 18/2020 on the Ministry of Religious Affairs' Strategic Plan, (2) the 2013 Syllabus/Curriculum for Grade 9 Science (KMA No. 184/2019), and (3) two official Grade 9 Science textbooks for Semesters 1 and 2 published by the Ministry of Education and Culture's Curriculum Centre. The criteria for selecting documents were that they were still in force, actively used in MTs, and covered the topic of renewable energy. Interview participants were recruited using purposive sampling, comprising two stakeholders: the Head of the Madrasah and the Deputy Head of the MTs for Curriculum. Interviews lasted 20–30 minutes per participant, were recorded using a digital recorder following consent, and were transcribed verbatim.

The data were analysed using a content analysis approach for the documents (Krippendorff, 2018) and thematic analysis for the interview data (Braun & Clarke, 2006). The document analysis was carried out systematically, referring to a framework of operational criteria that had been established to identify the presence and depth of integration of STEM-R components, as well as the potential for creative thinking activities. Each document (Ministerial Regulation No. 18/2020, the 2013 Science Syllabus/Curriculum for class 9, and the Science Textbook) was examined using explicit guiding questions: (1) Science: clarity of concepts/physical phenomena related to renewable energy; (2) Technology: the use of tools, devices, or technological applications; (3) Engineering: explanations or activities related to the design/engineering process of systems; (4) Mathematics: the presence of calculations, formulas, graphs, or quantitative analysis; (5) Religion: explicit integration of Islamic values (Qur'anic verses/Hadith, environmental ethics, the responsibility of khalifah, or the contributions of Muslim scientists). The review was conducted in stages by recording findings, grouping patterns of gaps, and synthesising recommendations for module design.

The interview data were analysed using a thematic analysis procedure comprising: (1) familiarisation with the data through repeated reading of the verbatim transcripts; (2) identification of initial quotes and patterns relating to teaching material requirements; (3) identifying and naming themes based on the STEM-R framework; (4) reviewing themes to ensure internal and external coherence; (5) defining themes operationally; and (6) compiling a report of findings. Given that this research constitutes a preliminary needs analysis, the entire analysis process was conducted independently by the principal investigator. To ensure credibility and reliability, the researcher applied data quality assurance strategies in the form of: (1) triangulation of sources (comparing findings from policy documents, curricula, textbooks, and stakeholder perceptions); (2) iterative review by re-reading the data and analytical notes repeatedly to ensure consistency of interpretation; (3) alignment with the analytical framework established from the outset; and (4) procedural transparency (audit trail) through detailed documentation of every step of data reduction and categorisation. Findings are presented in a descriptive-contextual manner (thick description) so that the transferability of the analysis results can be assessed by readers or other researchers.

RESULTS AND DISCUSSION

Document Analysis (Ministry of Religious Affairs Vision and Mission, Curriculum and Teaching Materials)

Madrasah Tsanawiyah are schools under the auspices of the Ministry of Religious Affairs (Kemenag). The researcher analysed how the Ministry of Religious Affairs' vision, mission and objectives relate to the educational objectives of madrasahs. The document analysed was Minister of Religious Affairs Regulation No. 18 of 2020 concerning the Ministry of Religious Affairs' Strategic Plan for 2020–2024 (Kemenag RI, 2020). The analysis of the Ministry of Religious Affairs' vision, mission and strategic plan is not merely intended to verify policy alignment, but serves as a conceptual foundation for translating the macro principles of madrasah education into the operational dimensions of the STEM-R module design. The Ministry of Religious Affairs' vision of a society that is "religiously devout, intelligent, independent, and prosperous in both worldly and spiritual terms" implies that science learning in madrasahs must go beyond the transfer of knowledge towards the development of science literacy integrated with Islamic environmental ethics (the concepts of khalifah fil ardh and hifz al-bi'ah). The results of the analysis of the Ministry of Religious Affairs' vision, mission and objectives can be seen in Table 1.

Table 1. Analysis of the vision, mission and goals of the Kemenag

No	Aspects	Criteria	Findings	Description
1	Kemenag's Vision	Relevance to STEM-R	The vision is to support the formation of a smart and religiously observant society.	Relevant to STEM-R-based curriculum development.
2	Kemenag's Mission	Integration of religious values	Missions include improving the quality of religious and religious education.	Support the integration of religious values in science learning.
3	Kemenag's Goal	Implementation	Objectives include the development of holistic and characterised education.	In line with the STEM-R approach that is holistic and characterised.

The Ministry of Religious Affairs' vision, which emphasises the realisation of a society that is "religiously devout, intelligent, independent, and prosperous in both material and spiritual terms", and its mission to improve the quality of religious education and the competitiveness of graduates, are not merely aligned in a normative sense, but serve as the operational foundation for formulating concrete design principles for the STEM-R modules. Firstly, this vision is translated into the principle of integrating scientific ethos and environmental spirituality, whereby the teaching of renewable energy does not merely present the technical principles of solar or wind energy conversion, but frames them as a manifestation of moral responsibility (khalifah fil ardh) and worship in maintaining the balance of nature.

Secondly, the mission to develop character-based and competitive education is implemented through the principle of contextual project-based learning, which requires students to design prototypes of environmentally friendly technologies using local resources, whilst internalising the values of collaboration, scientific integrity, and the contributions of Muslim scientists. Thirdly, the goal of holistic education is guided by the principle of multidimensional assessment, which not only measures mastery of energy physics concepts but also evaluates the creativity of solutions (fluency, flexibility, originality) as well as the reflection of religious values during the problem-solving process. Thus, this policy analysis explicitly bridges the Ministry of Religious Affairs' mandate with the content structure, pedagogical strategies, and assessment framework of the STEM-R module on the topic of renewable energy to be developed.

The Science curriculum for Madrasah Tsanawiyah is currently in a transitional phase between the 2013 Curriculum (K-13) and the Merdeka Curriculum. However, this study specifically focuses on an analysis of the 2013 Curriculum documents still being implemented in madrasahs, particularly regarding renewable

energy content for Year 9, as outlined in the Minister of Religious Affairs' Decree (KMA) No. 184 of 2019 (Kemenag RI, 2019). The Merdeka Curriculum is not analysed in this study because the topic of renewable energy within the context of the target madrasahs is still explicitly structured within the K-13 syllabus. Within the K-13 framework, the subjects of Science and Islamic Religious Education are taught separately. The Graduate Competency Standards (SKL) and Core Competencies (KI) for Science place greater emphasis on mastery of scientific concepts and technical applications, whilst religious values appear only implicitly and are not operationally integrated into the Science curriculum documents. The results of the content analysis of the K-13-based Year 9 Science syllabus, as presented in Table 2, demonstrate this gap empirically.

Table 2. Analysis of curriculum content (syllabus) of science class IX MTs

Topics	Science	Technology	Engineering	Mathematics	Religiu s
Human Reproductive System	There is: Discussion of reproductive organs, fertilisation process, and development.	There is: Reproductive-related technologies, such as ultrasound and baby	None	None	None
Human Excretory System	There is: Discussion of excretory organs (kidneys, skin, lungs, liver) and the process of removing waste substances.	None	None	None	None
Inheritance of Traits (Genetics)	There is: Discussion of genes, DNA, chromosomes, and patterns of trait inheritance.	There is: Genetic engineering technology and DNA testing.	There is: Genetic engineering for the improvement of organismal traits.	There is: Probability of inheritance of traits.	None
Biotechnology	There is: Discussion of biotechnology principles (fermentation, genetic engineering).	There is: Biotechnology applications in food (yoghurt, tempeh) and health (vaccines).	None	None	None
Static and Dynamic Electricity	**There is:** Discussion of electric charge, Ohm's law, and electrical circuits.	There is: Power generation technology and electronic devices.	There is: Design simple electrical circuits and electronic devices.	There is: Calculation of current, voltage, and resistance.	None
Magnetism	There is: Discussion of the properties of magnets, magnetic fields, and electromagnetic induction.	There is: Magnetic power generation (generator) technology.	There is: Design magnet-based devices, such as electric motors.	There is: Calculation of magnetic force and electromagneti c induction.	None
Eco-friendly Technology	There is: Discussion of renewable energy principles (solar, wind, water).	There is: Solar panel, wind turbine, and biogas technologies.	There is: Eco-friendly technology design.	There is: Renewable energy efficiency calculation.	None
Matter Particles	There is: Discussion of atoms, ions,	There is: Utilisation of	None	There is: Calculation of	None

Topics	Science	Technology	Engineering	Mathematics	Religius
	molecules, structure of simple substances with properties of materials used in life.	fibre, rubber, clay, glass, plastic and metal materials.		protons, electrons, atomic number.	
Land and Life	There is: Discussion of the role of soil, the formation process and the components that make up soil.	None	None	None	None

Based on Table 2, a content analysis of the grade 9 MTs science syllabus was conducted across nine learning topics using binary coding criteria: a STEM-R component was categorised as 'present' (1) if there was an explicit explanation in the text, images/diagrams, learning activities, or assessment instruments; and 'not present' (0) if no relevant indicators were found. No partial counts were made to maintain the consistency and objectivity of the coding.

The coding results show that the Science (S) component appeared in all topics (9 out of 9), giving a percentage of 100%. The Technology (T) component was identified in 7 topics (Reproductive Systems, Inheritance of Traits, Biotechnology, Static & Dynamic Electricity, Magnetism, Environmentally Friendly Technology, and Particles of Matter), resulting in a percentage of 7/9 = 77.8%. The Engineering (E) component appeared in 4 topics involving design or system engineering activities, namely Inheritance of Traits (genetic engineering), Static & Dynamic Electricity (circuit design), Magnetism (generator/motor design), and Environmentally Friendly Technology (design of environmentally friendly technology), resulting in a percentage of 4/9 = 44.4%. The Mathematics (M) component also appeared in 4 topics involving explicit quantitative calculations (formulas, graphs, or numerical analysis), namely Inheritance of Traits (probability), Static & Dynamic Electricity (current-voltage-resistance calculations), Magnetism (magnetic force & induction), and Environmentally Friendly Technology (energy efficiency).

Although the 'Particles' topic includes references to atomic numbers, it is not categorised as a component of Mathematics because it is not accompanied by calculations or numerical applications that are meaningful in the context of learning. Based on this criterion, the percentage for Mathematics is 4/9 = 44.4%, the same as for Engineering. Meanwhile, the Religion (R) component does not appear in any of the 9 topics (0/9 = 0%), confirming the lack of integration of religious values in the analysed syllabus. These findings are visualised in Figure 1.

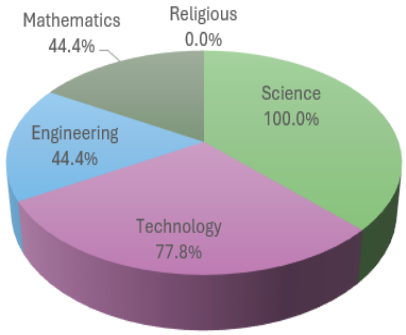

Figure 1. STEM-R content in the syllabus of science class IX MTs

The analysis of teaching materials focused on two official textbooks that serve as the primary reference for science education in grade IX at Madrasah Tsanawiyah, namely Natural Sciences Semester 1 and 2 of class IX, published by the Centre for Curriculum and Textbooks, the Research and Development Agency, Ministry of Education and Culture (Zubaidah, et al., 2018; Zubaidah, et al., 2018). The selection of these two documents was based on their status as standard government student textbooks adopted in the implementation of the 2013 Curriculum in the madrasahs, making them suitable as a baseline for identifying gaps in STEM-R integration. The analysis in this study is explicitly limited to the content of these two official government textbooks. The findings obtained are specific to the documents examined and are not intended to generalise the characteristics of commercial teaching materials or self-development modules in other educational institutions. The results of the content analysis of the two textbooks are presented in detail in Table 3.

Table 3. Content analysis of grade IX science textbooks

Topic Material	Material Text	Picture / Diagram	Learning Activities	Assessment	STEM-R integration
Human Reproductive System	Explanation of reproductive organs and fertilisation process. Examples of reproductive system disorders.	Diagram of male and female reproductive organs. Picture of the fertilisation process.	Discussion on the importance of maintaining reproductive health. Project to make a poster about reproductive organs.	Written test on the function of reproductive organs. Poster project assessment.	Science: The biological process of reproduction. Religion: -
Human Excretory System	Explanation of excretory organs and their functions. Examples of excretory system diseases.	Diagram of the kidneys, skin, lungs and liver. Image of the process of urine formation.	Simple experiments on filtration (using materials such as sand and gravel). Discussion on dialysis technology.	Written test on the function of excretory organs. Experiment report.	Technology: Dialysis equipment. Religion: -
Inheritance of Traits (Genetics)	Explanation of genes, DNA and trait inheritance patterns. Examples of trait inheritance cases.	Chromosome and DNA diagram. Draw a Punnett diagram.	Punnett diagram activity. Discussion about genetic engineering.	Written test on patterns of inheritance of traits. Punnett diagram assessment.	Maths: Probability of inheritance of traits. Religion: -
Biotechnology	Explanation of biotechnology principles and applications. Examples of biotechnology products.	Image of the fermentation process. Diagram of genetic engineering.	Simple fermentation experiments (e.g. making yogurt). Discussion about vaccines.	Written test on biotechnology. Fermentation experiment report.	Technology: Biotechnology products. Religion: -
Static and Dynamic Electricity	Explanation of electric charge, Ohm's law, and electrical circuits. Examples of electrical applications.	Electrical circuit diagram. Draw a simple electrical appliance.	Experiment to make a simple electrical circuit. Discussion about power generation.	Written test on static and dynamic electricity. Experimental assessment of electrical circuits.	Maths: Calculation of current and voltage. Religion: -
Magnetism	Explanation of the properties of magnets, magnetic fields, and electromagnetic induction. Examples of applications of magnetism.	Magnetic field diagram. Pictures of generators and electric motors.	Experiment to make a simple magnet. Discussion about electric generators.	Written test on magnetism. Magnetism experiment report.	Engineering: Generator design. Religion: -
Eco-friendly Technology	Explanation of renewable energy and its applications. Examples of environmentally friendly technologies.	Images of solar panels, wind turbines and hydropower plants. Diagram of the biogas process.	Project on modelling environmentally friendly technology. Discussion on environmental impact.	Written test on renewable energy. Technology model project assessment.	Science: Principles of renewable energy. Religion: -

Based on the analysis of teaching materials, the religious element (R) in STEM-R does not appear. Religious values are often only mentioned in passing without an in-depth explanation of how science concepts are related to religious teachings. In addition, teaching materials do not provide concrete examples of how religious values can be

applied in everyday life related to the science topics studied. More specifically for renewable energy in environmentally friendly technology materials, the religious element only touches on the importance of protecting the environment without in-depth explanation. Religious elements can be displayed by linking Qur'anic verses about environmentally friendly technology or renewable energy. It can also be done by bringing up stories of Muslim scientists who inspire and show the contribution of Islam in science, which does not appear in the science textbooks in this madrasah. From the results of the analysis of teaching materials, it can be concluded that the existing teaching materials have not fully adopted the STEM approach and religious values.

The topics of static and dynamic electricity identified in the textbook analysis are of strategic relevance as a conceptual foundation for learning about renewable energy. Electrical principles such as charge, Ohm's law, circuit configurations, and electromagnetic induction form the direct technical basis of modern renewable energy technology. For example, solar panels convert photon energy into electric current (a principle of dynamic electricity), whilst wind turbines and hydroelectric power stations rely on electromagnetic induction in generators to produce electricity. In the context of developing the STEM-R module, this topic provides an optimal opportunity to design tasks that foster creative thinking. Students are not limited to conventional circuit calculations but can be challenged through design projects such as assembling a micro-power plant model, modifying series-parallel configurations to optimise efficiency, or designing a simple electrical system using recycled materials. These activities directly develop indicators of creative thinking: fluency (generating various technical solutions), flexibility (exploring mechanical, electrical, or hybrid approaches), originality (creating prototypes with unique configurations), and elaboration (developing functional details, safety, and efficiency).

Furthermore, the topic of Environmentally Friendly Technology (Renewable Energy) serves as the strongest foundation for the development of the proposed module. To implement the STEM-R approach, the module can be designed around a concrete project such as 'Design and Construction of a Mini-Scale Hybrid Solar-Wind Power Plant Model for the Irrigation Needs of the Madrasah Garden'. In this activity, the integration of STEM-R is explicitly manifested: (S) students learn about energy transformation and the principles of renewable resource conversion; (T) utilising components such as mini solar panels, DC motors, and multimeters; (E) through the process of design, prototype assembly, testing, and data-driven iteration; (M) calculating output power, conversion efficiency, and technical feasibility analysis. The religious dimension (R) is integrated through reflection on the concept of khalifah fil ardh and the prohibition of israf (wastefulness), whereby students associate the utilisation of clean energy as an expression of gratitude and moral responsibility in maintaining the balance of nature (hifz al-bi'ah). This project directly stimulates indicators of creative thinking, particularly originality (creating hybrid designs that are adaptive to local conditions), elaboration (drawing up technical blueprints and testing protocols), and flexibility (adapting solutions to material constraints). This concrete example demonstrates that the STEM-R module not only teaches the concepts of renewable energy in theory, but also transforms them into a contextual learning experience that fosters technical creativity whilst instilling Islamic values.

Interview

Interviews were conducted with stakeholders, specifically the Madrasah Principal and the Vice Principal for Curriculum, revealing that teaching materials specifically designed for madrasahs are greatly needed. This is due to the uniqueness of madrasahs that integrate religious (Islamic) values with science. Currently, the teaching materials used in madrasas are still general in nature and do not touch on spiritual and religious aspects, so students do not get strengthened Islamic values in science learning. Both interviewees agreed that teaching materials in madrasa must be different from those used in public schools. The teaching materials must be able to integrate science with religious values, so that learning does not only focus on academic aspects but

also on the formation of student character based on Islamic teachings.

The results of the interviews also show that the science teaching materials currently circulating do not fulfil the needs of madrasah. The main unmet need is the integration between science and religious values. Many of the available science teaching books are still general in nature and do not present examples or explanations that link science with verses of the Qur'an or hadith. In addition, these teaching materials are often not adapted to the local context, such as the geographical, social and cultural conditions of the local community, making learning less relevant and less interesting for madrasah students.

Based on the interview results, the findings can be summarised into three key themes that form the rationale for the development of the module. Firstly, the need for the explicit integration of Islamic values. Informants emphasised that current science teaching materials remain general in nature and do not yet link scientific phenomena to verses from the Qur'an, hadith, or Islamic ethical values. Religious integration should not merely be treated as a separate add-on, but must be woven into the learning narrative to reinforce the distinctive identity of the madrasah. Second, the need for contextualised renewable energy content. Stakeholders desire teaching materials that do not merely present theory, but link concepts of solar, wind, or biogas energy to local environmental conditions and sustainability issues, thereby making learning more relevant and motivating for students. Third, the need for activities that stimulate creative thinking. Curriculum managers and teachers highlighted that current learning remains largely procedural and rote-learning oriented. Project-based activities are required that provide space for students to design technical solutions, experiment independently, and generate original ideas regarding the utilisation of clean energy. These three themes consistently point to the urgency of developing pedagogically designed STEM-R-based teaching modules to bridge curriculum gaps, integrate science with religious values, and provide real-world contexts and stimulation for critical thinking skills.

CONCLUSION

This study identifies a gap between the vision, mission and objectives of the Ministry of Religious Affairs and the current science curriculum and teaching materials, particularly with regard to the integration of religious values into the learning content. Document analysis and interviews indicate that the religious dimension (R) has not been explicitly accommodated in either the syllabus or textbooks; consequently, specialised madrasah teaching materials are required to contextualise scientific concepts from an Islamic perspective. Based on these findings, the development of STEM-R-based teaching modules on the topic of renewable energy is recommended as a priority for the next phase. These modules need to be designed through structured project-based activities, validated by experts in physics and religious education, and empirically tested to ensure pedagogical suitability. With a systematic development procedure, the resulting module is expected not only to enrich conceptual understanding and strengthen students' religious character, but also to be purposefully designed as a learning framework aimed at fostering creative thinking skills in line with the demands of 21st-century competencies.

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