PAPER NAME

Improving Energy-Saving Competencies: Needs Analysis and Training Program De sign for Islamic School

AUTHOR

Rohmatulloh Rohmatulloh

WORD COUNT

6605 Words

CHARACTER COUNT

39680 Characters

PAGE COUNT

11 Pages

FILE SIZE

663.0KB

SUBMISSION DATE

Jul 6, 2024 2:34 PM GMT+7

REPORT DATE

Jul 6, 2024 2:34 PM GMT+7

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Improving Energy-Saving Competencies: Needs Analysis and Training Program Design for Islamic School Teachers

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Abstract

The teachers' lack of competence in interpreting and applying the value of energy-saving ethics affects the process of instilling its value in students. In fact, there are many subjects in Indonesia's national and religious education curriculum that contain the value of energy-saving ethics. The purpose of this research is to design a training and competency development program for Islamic school (*madrasah*) teachers integrated with the boarding school system (*pesantren*). The design stages included needs analysis, textbook analysis for Islamic Religious Education, science, and language in grades 7-9, competency analysis, and curriculum and syllabus design. At each stage, we conducted interviews with school teachers, energy conservation instructors, curriculum development experts, and linguists. We also carry out benchmarking based on the curriculum and syllabus documents developed by training institutions. The research results led us to design a training program that emphasizes the ability to internalize religious ethical value messages related to energy-saving learning. The implementation uses a place-based education approach and a blended learning format that is highly flexible in terms of resource availability for teachers and schools. We discuss the implications of the research results, emphasizing efforts to establish partnerships with universities and human resource development institutions in the energy sector.

Keywords: Teacher, competency, needs analysis, training program, energy saving, Islamic school

1. INTRODUCTION

Energy-saving ethical values are part of the character values developed in the Indonesian national education curriculum [1]. The current trend in value education is done in various ways, namely value internalization. The internalization is not only in teaching explicitly contained in the curriculum but also in other educational practices systematically [2]. However, the challenge is making teachers competent in energy-saving education or energy literacy to integrate and internalize it in every subject. Teachers are required not only to carry out teaching or learning using the usual approach. More than that, teachers must be able to facilitate learning with intelligent approaches to create an active learning environment [3].

Training and development programs are a form of intervention to increase competence and fundamental change in the practice of delivering better and more effective instructional messages, and learners are actively involved in the process [4], [5], [6]. Continuous training for teachers will also contribute to awareness and changes in individual attitudes and values in the medium and long term in the community [7]. Therefore, this research aim to design a continuing education program or energy-saving training for Islamic school (madrasah) teachers integrated with the boarding school system (pesantren). The training program design uses the foundation of Islamic theology, which is the basis of Islamic education theory and practice in Islamic schools.

This program design has yet to be discussed in previous research work. Research on previous work on energy-saving training for teachers has generally provided a basis for designing curricula and syllabi and implementing a continuing professional education program or energy-saving training that suits the needs of the target participants, namely teachers. Unfortunately, no one has examined the design of an energy-saving training program for Islamic school teachers based on Islamic theological values. For example, an energy-saving training model uses a systems approach that begins with needs analysis and program or curriculum design [8]. Teacher professional development research has examined training designs using two methods of online and face-to-face learning: place-based and problem-based pedagogical framework approaches, as well as science outreach communication [9]. [10] also conducted a review of an energy literacy professional development program for science teachers. This program integrates experiential learning with field trips that focus on six different fossil and nonfossil energy sources.

The Inspire School Education by Non-formal Learning project has also implemented training to improve renewable energy and climate change literacy for teachers [11]. A previous study also identified the need for biomass energy literacy training to enhance teachers' self-efficacy (Han and Martin 2018). Other

research, although not in the context of energy literacy, has also contributed to informing the design of good training programs. For instance, studies have focused on training in media literacy for teachers [12], information literacy for clinical nurses [13], historical literacy [5], and geological disaster mitigation [14].

Based on our previous research findings, this program design is expected to fill the gap in Islamic school teachers' low energy-saving pedagogical and professional competencies. The low competence of some teachers in delivering energy literacy learning [15] is in line with the findings of previous [16], [17]. For teachers, competence or competent performance is essential to support their work. Competence includes hard and soft skills (Salman, Ganie, and Saleem 2020). Thus, teachers as facilitators can provide awareness that is not dogmatic so that students have an inclusive mind and realize their relationship as humans and their Creator [20]. Furthermore, this is the challenge of changing the role of educators in realizing holistic education focusing on the potential of learners in harmony, including intellectual, emotional, physical, social, aesthetic, and spiritual potential about environmental education and the interconnectedness of all living and non-living ecosystems on Earth [21]. In this context, the internalization of energy-saving values is based on holistic religious values in daily behavior as an effort to build harmony with the universe.

2. METHOD

This research uses a descriptive qualitative case study inquiry strategy [22]. From an interpretive perspective, this research explores how individual teachers experience and interact with their social world at a particular point in time and in a particular context [23]. The primary role is to deliver energy-saving learning messages. The research employed the generic training system cycle at the analysis and design stage [24], which encompasses activities such as needs and textbook analysis, competency analysis, and syllabus program design (Figure 1). Both stages are part of systems analysis, which only identifies problems based on competency needs and determines alternatives and solutions [25].

The needs data analysis or problem identification was prepared using data from our previous research based on interviews with the foundation's head. The principal and teachers totaled seven participants in an Islamic school located in Bandung Regency. We selected school A from the two previous research loci due to its easy access to information for follow-up on teacher competency development. In addition, the school has excellent accreditation. The study of school strategic planning documents and lesson plans yielded secondary data.

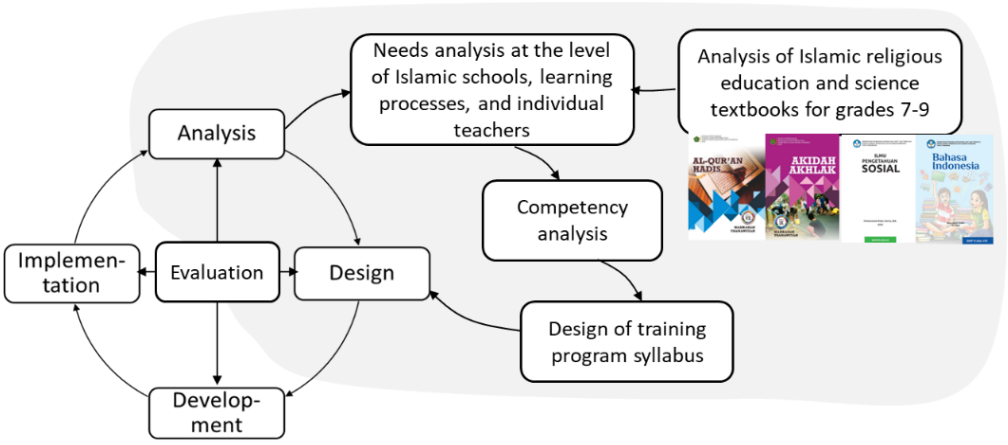

Figure 1. Research framework

Furthermore, we processed and analyzed the data using a performance diagnosis matrix to identify actual and desired performance, as well as the specification of performance improvement interventions [26], [27]. We used three aspects: mission, process design, and capacity, to assess the performance of the school organization and the learning process. We use these three aspects at the individual teacher performance level, along with two other aspects: motivation and expertise. In other words, the needs analysis has considered the subjective factors of teachers' professional development and life, school organization development, institutional environment factors, and field culture factors [28].

The addition of these two aspects, especially the skill aspect, is necessary to determine whether teachers need training or not. The other aspects at all levels do not require training as a single solution. Nevertheless, the information provides a comprehensive picture for designing training programs that meet the needs of the school organization, the learning process, and individual teachers.

We conducted a document study of secondary-level textbooks for grades VII–IX to support the results of the needs analysis, aiming to obtain a detailed description of the subject matter that aligns with the ethical value of energy saving, which we can then incorporate into the program design. The subjects include Islamic

Religious Education (Qur'an Hadith, Faith and character or *Aqidah akhlak*, Islamic law or Fiqh, History of Islamic Culture), Arabic (https://sikurma.kemenag.go.id, accessed on May 1, 2024), science (Natural Science, Social Science, Pancasila Education, Mathematics), and language (Indonesian and English) (https://buku.kemdikbud.go.id/, accessed on May 3, 2024). The qualitative data analysis at this stage, as well as the program design development stage, used thematic analysis, which was also supported by written content analysis from document and website sources that we used as secondary data [29], [30].

Interviews served as the primary data collection method. The participants received a brief explanation of the preliminary findings of the needs analysis prior to the interview, which provided an overview of the performance gap at the organizational level of Islamic schools. We obtained secondary data from document studies, including the Strengthening Character Education book from the Ministry of Education and Culture [31], the Energy Conservation Data and Information [32], the competency analysis document from the learning strategy model training for educators by Human Resources Development Center for Aparatus Bandung, and the energy conservation training syllabus from Human Resources Development Center for Electricity New Renewable Energy and Energy Conservation Jakarta. The EL-Practice project (https://el-practice-hub.eu/, accessed on March 19, 2024) developed the energy literacy e-course modules 1 (introduction to energy literacy) and 4 (positive energy habits), from which we obtained additional secondary data.

The program design was validated using qualitative assessment instruments for final improvement, which involved assessing aspects of the curriculum components such as the syllabus, language, and general assessment, supplemented by qualitative notes [14]. We used inclusion criteria modified from [13] to select experts, namely specialists in the field of curriculum development and training program managers. We contacted five experts and practitioners, but only two volunteered to contribute: a doctoral expert in curriculum development from Human Resources Development Center for Oil and Gas Cepu, Central Java, and a doctoral expert in environmental studies from a state university in Surabaya. All participants in this study provided informed consent in verbal and written forms. Interviews were face-to-face and online with the SurveyMonkey feedback platform, which provided insights quickly. We kept the instruments and final program design documents publicly accessible on the Open Science Framework (https://osf.io/6b4x2/).

3. RESULTS AND DISCUSSION

Teachers play a crucial role in the energy education system, conveying energy-saving content messages across all subjects and teaching students the art of moral interaction to internalize the ethical value of energy-saving. To improve performance, energy-saving training programs are one strategy to increase teacher competence in facilitating active learning. Our research findings reveal that the results of needs analysis, particularly at the individual level, influence the design of training programs.

3.1. Needs analysis

Findings from the large-scale analysis show that the mission and system design of Islamic educational institutions are in line with the goals of Islamic education, which stress the development of Islamic moral values in a way that is holistic. So, in learning, there is no dichotomy between the subjects of Islamic Religious Education and science. Students will develop a new mindset through the cultivation of ethical values related to energy conservation. One of them is the ethical value of saving energy. However, there are several shortcomings in organizational capacity that hinder the implementation of energy-saving integrative learning programs. For instance, the provision of energy-efficient facilities, infrastructure, and educational materials, along with financial backing, is crucial. This problem has become an obstacle for educational institutions to implement integrative energy-saving learning programs, according to the desired expectations.

The learning process's objectives, system design, and capacity are aligned with Islamic schools' organizational levels. This means that the integrative learning process's effectiveness supports organizational performance. However, some teachers still think that energy-saving learning does not exist in Islamic schools. In fact, in terms of system design, energy-saving materials exist in several subject matters—for example, science subjects, Islamic Religious Education, and Scout activities. Despite the need for clear internalization in the learning stages, electronic textbooks are available to support this process.

Ultimately, the results of the needs analysis research, which focuses on individual teachers as key players in a successful learning process, reveal that numerous individuals still require alignment to achieve the process's objectives. The current condition still has gaps in several aspects, namely system design, capacity, and expertise. Meanwhile, the goal and motivation aspect involves fostering a positive attitude and behavior that demonstrates awareness and sets an example for others. Generally, educators are not well-versed in enhancing learning strategies that encourage students to internalize energy-saving ethical principles, and they require assistance in locating Islamic Religious Education and science materials that align with energy-saving ethics.

An analysis of secondary school textbooks for Islamic schools (grades 7-9) revealed a significant amount of learning material that incorporated the ethical value of energy saving. The ethical value of energy

saving is present in 33 out of 63 chapters (52%), representing the group of science subjects with the most internalized content. Furthermore, language is 24 out of 51 chapters (47%), and Islamic Religious Education is 30 out of 86 chapters (35%), as presented in Figure 2.

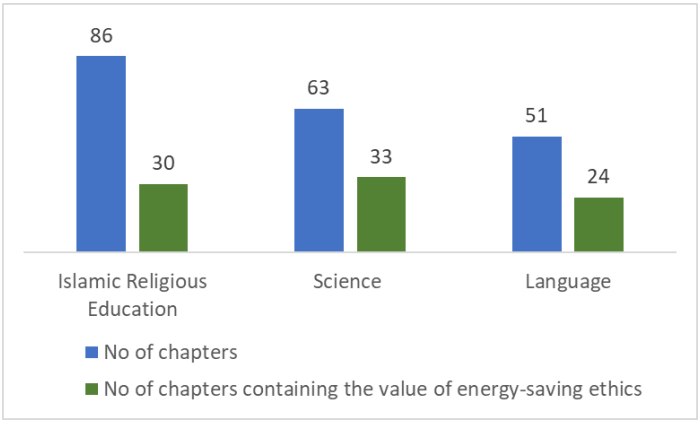

Figure 2. Lesson material containing the ethical values of energy saving

Islamic Religious Education lessons, which include Al-Qur'an Hadith, *Aqidah akhlak*, Fiqh, History of Islamic Culture, and Arabic, offer a wealth of content that can help students internalize the values of Islamic ethics. Figure 3 illustrates how each chapter in the subject distributes the material necessary for internalizing the Islamic ethical principle of energy conservation. The *Aqidah akhlak* subject has the most subject matter spread across 13 chapters, and History of Islamic Culture and Arabic have 8 each.

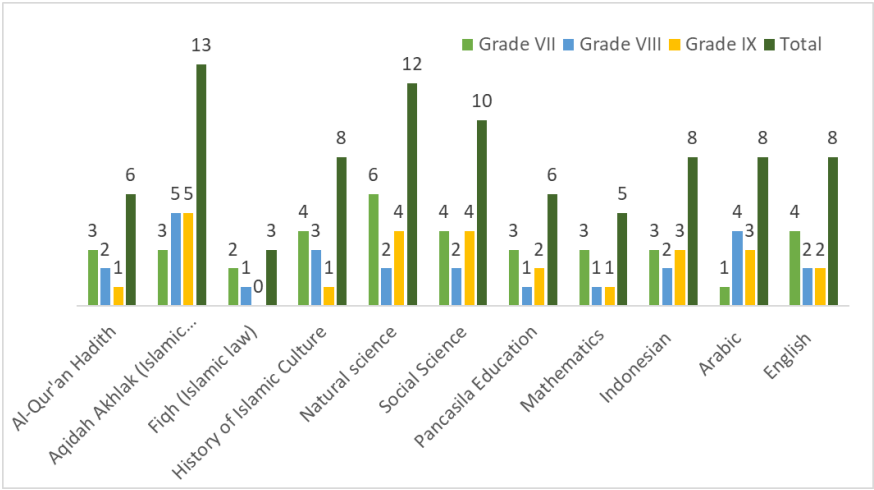

Figure 3. Lesson material containing ethical values of energy saving by subject and grade

As presented in Figure 4, the following are three examples of lesson material that can help internalize the ethical values of energy saving. The *Aqidah Akhlak* subject discusses the meaning and arguments behind the prohibition of materialistic, hedonistic, and consumerist lifestyles. The Islamic Cultural History subject examines the practical aspects of learning activities in schools. Finally, the Arabic language course focuses on environmental preservation. Various techniques, including pre-discourse, insight development, individual and group activities, reflection, observation, discussion, simulation, action plans, and exercises, facilitate the internalization of ethical values. Meanwhile, internalized ethical values encompass the cognitive aspects of energy sources, the relationship between energy and life, and the interaction between energy and the environment. Meanwhile, the affective and behavioral dimensions, namely donations and alms, materialistic, hedonic, consumptive, efficient or making the best use of time, simple, pure, maintaining the survival of the ecosystem, balance, dynamic, and innovative, as well as going beyond limits, prohibitions on being stingy or stingy, greedy, excessive, or wasteful, as well as habits and examples of saving energy.

Figure 4. Examples of subject matter containing the value of energy-saving ethics (a) *Aqidah akhlak*; (b) Social science; (c) Arabic language

3.2. Program Design

Competency analysis is the process of translating general competencies or behaviors identified in needs analysis into a logical and systematic list of basic competencies. We identified three themes from the general competency findings as input for formulating training program objectives across three domains. In the knowledge domain, teachers are expected to be able to explain the concept of energy saving and identify energy-saving materials referring to the texts of the Koran and Hadith. In the attitude and behavior domain, teachers are able to internalize the ethical values of energy-saving learning by applying learning methods and media that involve students.

The target participants for the training program are religious and science teachers, as well as educational staff. Competency analysis research findings refer to the structure of the procedural and cluster combination models, as illustrated in Figure 5. Four competency units are designed to achieve training objectives, enabling teachers to apply integrative learning in Islamic Religious Education, science subjects, and daily activities. By always internalizing ethical values, teachers can save energy in schools, at least at one stage of learning, as well as at home and in the community.

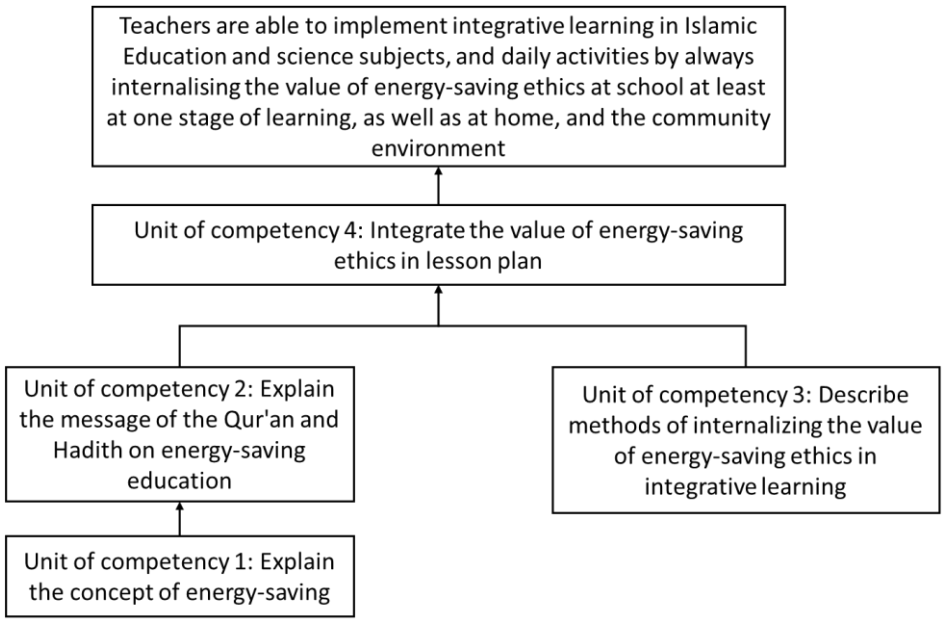

Figure 5. Competency analysis using a combination structure

According to the competency analysis results, the task structure description consists of 4 competency units, 13 competency elements, and 35 performance criteria. This competency analysis formulation is the basis for making a training program's syllabus or outline. The syllabus or outline covers four topics: the idea of saving energy; messages from the Qur'an and Hadith about energy literacy; internalizing the moral value of saving energy in integrative learning; and methods for internalizing the moral value of saving energy in integrative learning (Table 1). The first and second materials equip teachers with knowledge about the importance of energy in life, the relationship between energy and ecology, the types of fossil and green energy sources, the distinction between conservation and energy efficiency, how to save energy in buildings and equipment in schools and homes, and the theological message of energy education. The third and fourth materials instruct teachers on how to incorporate energy-saving values into integrative learning and practice incorporating them into learning plan documents through a microteaching approach.

We determined the duration of time required to implement the training program by conducting a time analysis for each component of the performance criteria. This resulted in a total of 22 lesson hours, which comprised 12 hours of theory lessons and 10 hours of practical sessions. We implemented the learning method with two options: online learning and traditional face-to-face, in-class learning. Participants in the training program primarily rely on these two options for the support of financial resources, facilities, infrastructure, and teacher readiness.

Table 1. Outlines the structure of training subjects

No	Training subjects	Lesson hours	
		Theory	Practice
1	Energy-saving concept	6	-
2	The Qur'an and Hadith contain messages about saving energy	2	-
3	Methods of internalizing energy-saving ethical values in integrative learning	3	-
4	Integrate energy-saving ethical values into learning plan documents.	1	10
	Total	12	10

Expert assessments have guided the improvement of the training program's design, resulting in a generally excellent assessment that could benefit from a few minor tweaks. Some suggestions for improvements to statements that are still lacking. namely, training program objectives are still biased, so it need to be corrected using the ABCD (audience, behavior, condition, and degree) formula and adding long-term goals or accompanying goals. Other changes that could be implemented include providing basic training to individuals who lack experience in using technology or electrical and electronic equipment for learning, providing more detailed evaluations for each performance indicator or success factor, balancing theory and practice with a greater emphasis on direct practice, ensuring that all participants have access to and use learning materials, providing information about national and global energy policies, providing follow-up plans after

training, and utilizing standard Indonesian spelling rules to enhance various aspects of the language. For language checking, we use the SIPEBI application (Indonesian spelling editing).

3.2. Discussion

The needs analysis revealed that teachers still have a gap in energy-saving competence, so it has not had an impact on conveying energy-saving learning messages and moral interaction to students in a beneficial way in terms of the theoretical and practical dimensions of habituation and example. Needs analysis can enable detecting and identifying needs and deficiencies in teacher training, as well as finding new elements to improve the training process from the perspective of the teacher in charge (Guerrero-Romera & Perez-Ortiz, 2022).

For example, research reveals the problem of low self-efficacy in teaching biomass energy topics, emphasizing the need for teacher training on the topic [17]. Therefore, the competencies identified in this needs analysis serve as a proposed solution or intervention to bridge the gap, particularly in the area of teacher expertise. These findings have taken into account subjective factors such as professional development and teacher life, school organizational development, institutional environmental factors, and field cultural factors [28]. Naturally, training alone cannot solve the complex problem, necessitating the implementation of other integrated performance improvement programs like coaching, mentoring, and internships at the Adiwiyata pilot school. This Adiwiyata school has effectively established an environmentally conscious and energy-efficient learning environment [33]. For example, internships are a method of developing personal, professional, and responsible citizen competencies [34].

Training is a popular continuing education concept in adult education and occupational professions [35]. According to learning outcomes, the emphasis on training is more task- and job-specific [36], where the primary responsibility of teachers is to deliver learning messages. Teacher training and development, as a form of intervention, can improve skills and lead to real change in the practice of delivering better and more effective learning messages by actively involving students in the process [4], [5], [6].

Teachers recognize the significance of a growth-oriented mindset and practice in process-oriented learning. These two aspects also influence students' thinking patterns and their learning effectiveness [37]. Teachers are expected to play a crucial role in integrating technical knowledge of energy and scientific literacy with students, acting as mediators who can transform specific content into a space that fosters affective and behavioral understanding in students [7].

During the design of training programs, teachers acquire the necessary understanding to articulate the concept of energy saving, thereby broadening their understanding of energy efficiency and conservation. Islamic ethical values, which form the foundation of Islamic educational institutions' values and characteristics, connect the discussion of these two themes— Islamic ethical values and energy saving—to insights into global and local problems. The two themes aim to enhance learning in all subjects of Islamic Religious Education, science, and language. These subjects heavily incorporate energy-saving ethics, as revealed by an analysis of school textbooks in Indonesia for grades 7-9. Energy-related textbook content can provide learners with a rich interdisciplinary perspective [29]. Therefore, educators should possess the ability to think globally and act locally. Educators need to develop a global perspective, consider the impact of their decisions on energy use, understand the connection between global environmental and energy issues and their local impacts, and address environmental, social, economic, and political issues [38].

Teachers gain an understanding of energy-saving education within the framework of Islamic religious teachings. Islamic theology is a collection of God's messages, which is the foundation for the development of the Islamic education system and energy literacy. Islamic theology has become the foundation in interdisciplinary Islamic education studies [39], so bringing together religious views and secular science has become one of the most important and urgent issues for religion in education, which has brought increasingly intensive energy and ecology agenda. The findings of this study, which involve the role of religious values in the design of training programs, are in line with previous research, which has found that religiosity is one of the essential factors in encouraging energy literacy and energy conservation behavior [40]. Education based on religious values instills eternal truths, preparing individuals and society to live lives in accordance with universal laws, God's laws, or religious commandments. Education is a prerequisite for spiritual life in this world and the afterlife [2]. The holy book contains two relevant moral-ethical-Qur'anic principles, one of which is faith that fosters a positive relationship with nature and its contents. The second fundamental principle in nature management is to not damage, to be fair, and to use natural resources in a balanced manner [41].

Teachers who have the skills in Islamic education concepts and energy literacy can optimize their role as facilitators who provide non-dogmatic awareness so that students have inclusive thoughts and are aware of their relationship as humans and their Creator. Teachers can bring students into awe and wonder at the mysteries of life (Agbaria, 2024). In this context, the internalization of energy-saving values based on holistic religious values in daily behavior is an effort to build harmony with the universe. The practice of Islamic education, grounded in divine values and emphasizing ethics, sets it apart from secular education (Sahin 2018).

The benchmarking of teacher professional development training programs in other countries has led to the identification of these training approaches and formats. For instance, they employ place-based education

[9], [42], [43]. The educational philosophy encourages the exploration of local issues to connect students with broader environmental topics. The material incorporates research and practical results from postgraduate students, researchers, and practitioners.

Place-based education emphasizes the relationship between the learning process and the physical environment in which teachers and students are located. This approach combines learning, experience, and learning, which can go beyond the school walls [44]. Authentic, experience-based learning can contribute greatly to developing environmental literacy. This knowledge covers a wide range of topics, not just field visits. However, careful design of video and text resources, expert lectures, simulations, and reflective dialogue will expose learners to the complexity of the studied phenomena and provide a variety of opportunities for reflection [10]. Using reflective methods and providing reading materials based on energy literacy research can be a means of preparing teachers to face personal and professional difficulties when implementing them in the field. However, teachers, typically already burdened with high duties and responsibilities, must consider the time constraints when providing research reading materials [45].

Regarding the development of online training and learning media, it is a solution that needs to be prioritized because it has high flexibility in terms of time, which suits the activities of teachers with limited time and who manage many school administration activities. Online training allows students and teachers to collaborate and learn, as is the finding from global data on energy-saving education and training, especially renewable energy. Training and educational materials must be adapted and improved for online training and digitalization in general [46]. The proposed program design from this research, blended learning, aligns with previous research showing that teachers prefer blended learning over full online or face-to-face formats [47].

The development of online training media must also take into account various factors of training participants, namely socialization and psychological stress, motivation, communication, skills in using information and communication technologies (ICTs), and time management [48]. The communication of material through educational video media must adhere to principles and guidelines that optimize training participants' learning, such as minimizing cognitive load, promoting active learning, and fostering participant involvement [49]. Communication channels should offer a variety of options, as participants' preferred methods of learning vary. Participants can utilize various learning methods, including coaching, online discussions, study schedules and guides, text and computer learning materials, in-person meetings, assignments, and past experiences [50].

This research's limitation lies in the ongoing development of training materials and media, as well as their implementation. Therefore, further work could focus on the development, implementation, and evaluation stages. At the development stage, the quality of energy education teaching materials plays an important role in the overall success of training, especially if it helps teachers reduce the time needed for lesson preparation [11]. Schools can also partner with higher education institutions to deliver training. Partnerships are a success factor for teachers in improving content knowledge and teaching practices [42].

The post-training requires attention to ensure teachers can apply the acquired competencies to their integrative learning. Support for school culture is one important factor for successful implementation. As a result, schools can implement a school culture that allows for participatory decision-making with teachers, allowing them to design their energy-saving learning in an innovative way. Such a culture is preferable to a hierarchical culture where school heads and administrators centralize decisions. This hierarchical culture hurts the success of curriculum implementation, as in a study focusing on integrating media education and information technology in curriculum and learning [51].

In terms of future implications, human resource development institutions in Indonesia can use this training program design as a basis for developing training program standards and competency test materials. This will not only support the environmental-cultured school (Ahiwiyata) program in Islamic educational institutions but also contribute to the development of national energy conservation policies and initiatives.

4. CONCLUSION

Internalizing the value of energy-saving ethics in integrated Islamic schools requires the involvement of competent teachers. This is due to the fact that numerous materials in Islamic education, science, and language subjects at the primary school level in Indonesia incorporate content that aligns with the ethical principle of energy saving or energy conservation. Teachers, on the other hand, still face competency gaps when it comes to explaining and interpreting religious messages related to energy and the environment, as well as implementing methods of internalizing values in integrative learning. We can optimally implement a place-based learning approach by designing the training program to address competency needs. This approach contextualizes the training to the evolving global conditions as well as local issues and needs surrounding the school. The implementation of blended learning, with its efficient characteristics and flexible training time, is one option that allows teachers to participate, particularly those who are busy with teaching and school administration activities.

ACKNOWLEDGEMENTS

The researcher would like to thank the research participants, who came from various stakeholders involved in the energy literacy program in Islamic schools. They have all helped by providing data and connecting networks, expanding the relationship between researchers and various stakeholders.

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