
IMPROVING ENERGY-SAVING COMPETENCIES: NEEDS ANALYSIS AND TRAINING

PROGRAM DESIGN FOR ISLAMIC SCHOOL TEACHERS

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Abstract

Teachers need to be more competent in understanding and implementing the value of energy-saving ethics, which 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 VII-IX, competency analysis, and curriculum and syllabus design. At each stage, we conducted interviews with Islamic Religious Education teachers, energy conservation instructor, 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, emphasize the use of local green energy issues and resources as learning resources, and establish partnerships with universities and human resource development institutions, as well as local teacher learning communities in the energy field.

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

Abstrak

Guru harus lebih kompeten dalam memahami dan menerapkan nilai etika hemat energi sehingga memberikan dampak pada proses penanaman nilai tersebut kepada peserta didik. Faktanya, banyak mata pelajaran dalam kurikulum pendidikan nasional dan agama di Indonesia yang mengandung nilai etika hemat energi. Tujuan penelitian ini adalah desain program pelatihan dan pengembangan kompetensi guru sekolah Islam atau madrasah yang terintegrasi dengan sistem pondok pesantren. Tahapan desain meliputi analisis kebutuhan, analisis buku teks pelajaran Pendidikan Agama Islam, sains, dan bahasa kelas VII-IX, analisis kompetensi, serta desain kurikulum dan silabus. Pada setiap tahap, wawancara dilakukan dengan guru sekolah, instruktur konservasi energi, ahli pengembangan kurikulum, dan ahli bahasa. Benchmarking dilakukan juga berdasarkan dokumen kurikulum dan silabus yang dikembangkan oleh lembaga pelatihan. Hasil penelitian mengarahkan kami untuk mendesain program pelatihan yang menekankan pada kemampuan internalisasi pesan nilai etika agama terkait pembelajaran hemat energi. Penerapannya menggunakan pendekatan place-based education dan format blended learning yang sangat fleksibel dalam hal ketersediaan sumber daya bagi guru dan sekolah. Kami membahas implikasi hasil penelitian, menekankan pada penggunaan isu dan sumber daya energi hijau lokal sebagai sumber belajar, dan menjalin kemitraan dengan perguruan tinggi dan lembaga pengembangan sumber daya manusia, serta komunitas belajar guru lokal di bidang energi.

Kata kunci: Guru; kompetensi; analisis kebutuhan; program pelatihan; hemat energi; sekolah Islam

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Introduction

Energy-saving ethical values are part of the character values developed in the Indonesian national education curriculum (MOECRT, 2024). 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 (Jordan et al., 2008). 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 (Manakul et al., 2023).

Training and development programs or continuing education 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 (Achimugu et al., 2023; Guerrero-Romera & Perez-Ortiz, 2022; Jordan et al., 2009). 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 (Dias et al., 2004). Therefore, the purpose of this research is 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 is based on Islamic theology, which is the foundation of Islamic education theory and practice in Islamic schools. Program design serves as a guide for training institutions and teacher learning communities in organizing teacher competency development that aligns with the needs of Indonesia, particularly in Islamic educational institutions (MORA, 2018). Developing professional development programs for teachers based on needs assessments can build teacher capacity to provide high-quality learning and improve student success (Ferrell & Tharpe, 2024).

We expect energy-saving education or energy literacy to serve as a program that supports national energy policy strategies and programs (Directorate of Energy Conservation, 2020), and the Sustainable Development Goals (SDGs) to promote a clean and affordable agenda (UNESCO, 2017). Energy literacy is crucial in environmental and sustainability education (Ramachandran et al., 2023). Environmental issues are also driving the campaign's national agenda to accelerate the energy transition in Indonesia to achieve the Net Zero Emission (NZE) target (IEA, 2022). Of course, the success of the energy transition campaign hinges on the public's high level of energy literacy and the practical design and implementation of education or training programs (Khuc et al., 2023). In addition, through education, the SDGs endeavor towards a future with inclusive equality, justice, and prosperity within environmental limits (Kioupi & Voulvoulis, 2019). The ESDGs emphasize a broader relationship than just the environment and ecology. Hence, the approach must be inclusive and innovative, using transformative methods (Wals, 2012). Transformative environmental education enables learners to appreciate nature, accept it wisely, question and transcend social norms and traditions, criticize global corporate greed, seek information, imagine ideal futures, solve problems, and act on ideas for solutions (Parker & Prabawa-Sear, 2020).

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 (Sukendar & Setiawan, 2018). 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 (Eitel et al., 2015). (Bloom & Fuentes, 2019) 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 (Pipere et al., 2010). A previous study also identified the need for biomass energy literacy training to enhance teachers' self-efficacy (Han & 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 (Fadlillah et al., 2023), information literacy for clinical nurses (Wu et al., 2023), historical literacy (Guerrero-Romera & Perez-Ortiz, 2022), and geological disaster mitigation (Rusman & Rohman, 2017).

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 (Rohmatulloh et al., 2023) is in line with the findings of previous (Han & Martin, 2018; Stylos et al., 2023). 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 (Agbaria, 2024). 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 (Miseliunaite et al., 2022). 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.

Theologically, the Qur'an clearly states that natural damage has occurred, as mentioned in QS. Al-Rum [30]: 41. The Qur'an states that human actions have caused damage on land and in the sea. The term "*dzahar al-fasad fi al-barri wa al-bahr bima kasabat aydi al-nas*" indicates that damage occurs when something deviates from the order that it should be. Al-Thabari interprets the word "*al-barr*" as either a desert or a reference to the nomadic lifestyle of the Arab tribe during that period. Meanwhile, the word "*al-bahr*" refers to a city or village that is close to water resources, especially flowing water, or has a large volume, such as the sea and rivers (Al-Thabari, 2001).

Method

This research uses a descriptive qualitative case study inquiry strategy (Creswell, 2012). 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 (Merriam & Grenier, 2019). The primary role is to deliver energy-saving learning messages. The research employed the generic training system cycle at the analysis and design stage (Allen, 2006), 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 (Kaufman, 1972).

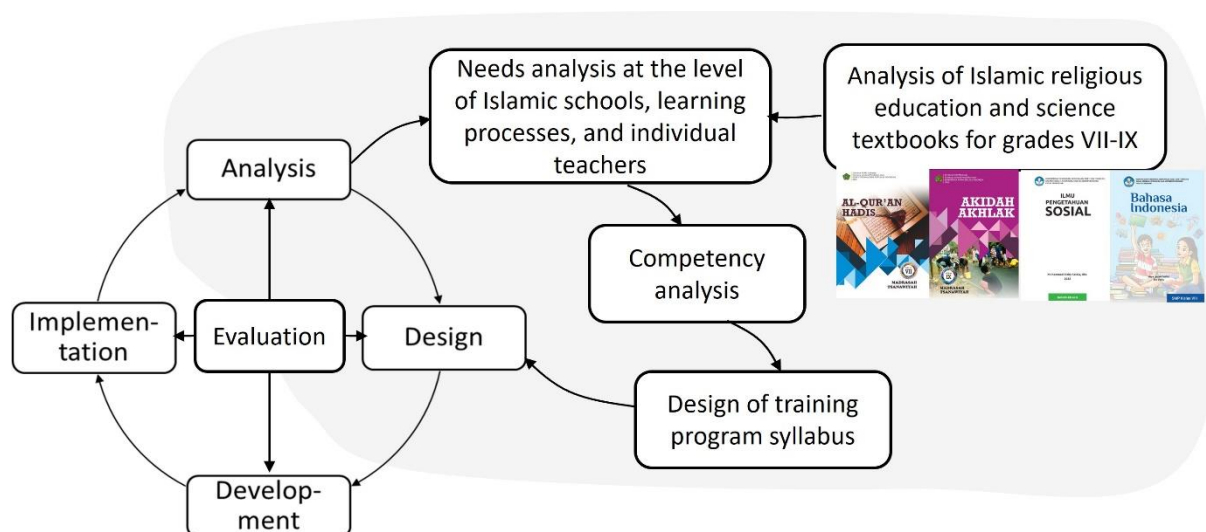


Figure 1. Research framework

Data collection

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 simple 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 (Rohmatulloh et al., 2023). We used interviews as the primary data collection method for the preparation of competency analysis and program design. 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, learning process, and individual teacher level of Islamic schools.

We obtained secondary data from 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).

In addition, we obtained secondary data from document studies, including the Strengthening Character Education book from the Ministry of Education and Culture (MOEC, 2017), the Energy Conservation Data and Information (Directorate of Energy Conservation, 2020), the competency analysis document from the learning strategy model training for educators by the Human Resources Development Center for Aparatus Bandung, and the energy conservation training syllabus from the 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 Module 1 (Introduction to Energy Literacy) and Module 4 (Positive Energy Habits), from which we obtained additional secondary data.

Data analysis

Qualitative data were analyzed using thematic and content analysis (Aguirre-Bielschowsky et al., 2018; Castañeda-garza & Valerio-ureña, 2022). We processed and presented the primary data from the interviews using thematic analysis, which involved manually reading, marking, and dividing the data into sections. Data analysis involves identifying needs or problems using a performance diagnosis matrix to distinguish between actual and desired performance, as well as specifying performance improvement interventions (Laird, 2003; Swanson, 2007). We used three aspects: mission, process design, and capacity, to assess the performance of the school organization and the learning process. These three aspects are used 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 (Fu et al., 2021). 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 necessitate 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.

Furthermore, qualitative data analysis is needed for the preparation of competency analysis and program design. Before determining the training program design themes, we categorized the data from the competency analysis and program design activities into several aspects, namely competency units, competency elements, performance criteria, curriculum standards, program structure, and syllabus. We conducted a content analysis of secondary data from textbooks, report documents, and website sources to enhance the competency analysis and program design. We read each chapter in the data sources, particularly the textbooks, to identify materials that integrate the value of energy-saving ethics. We used a matrix to summarize the identification results.

Program design validation

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 (Rusman & Rohman, 2017). We used inclusion criteria modified from (Wu et al., 2023) to select experts, namely specialists in the field of curriculum development, linguists, and training program managers. We contacted five experts and practitioners, but only two volunteered to contribute: a doctoral expert in curriculum development from the Human Resources Development Center for Oil and Gas Cepu, Central Java, and a doctoral expert in linguistic 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 SurveyHeart feedback platform (<https://surveyheart.com/form/664bfc59e40d932094ec5a0>, the access period is from May 21 to June 24, 2024), which provided insights quickly. We kept the instruments and final program design documents publicly accessible on the Open Science Framework (<https://osf.io/6b4x2/>).

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 ethical 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.

Needs analysis

Findings from the large-scale analysis show that the mission and system design of Islamic educational institutions are in line with Islamic education's goals, which stress the development of Islamic ethical values in a holistic manner. 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 energy saving. 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 VII-IX) 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.

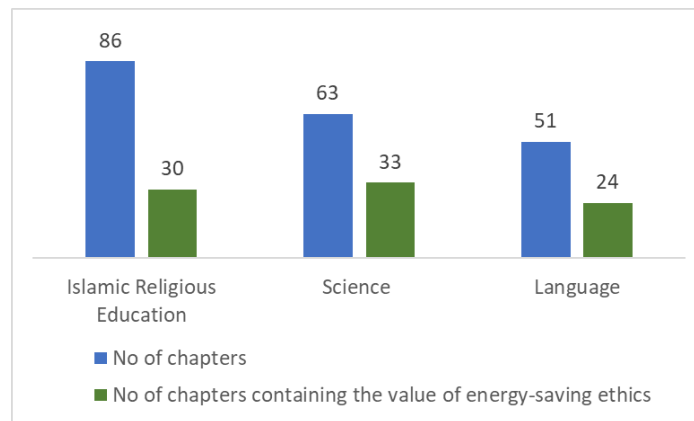


Figure 2. Lesson material containing the ethical values of energy saving

Islamic Religious Education lessons, which include 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.

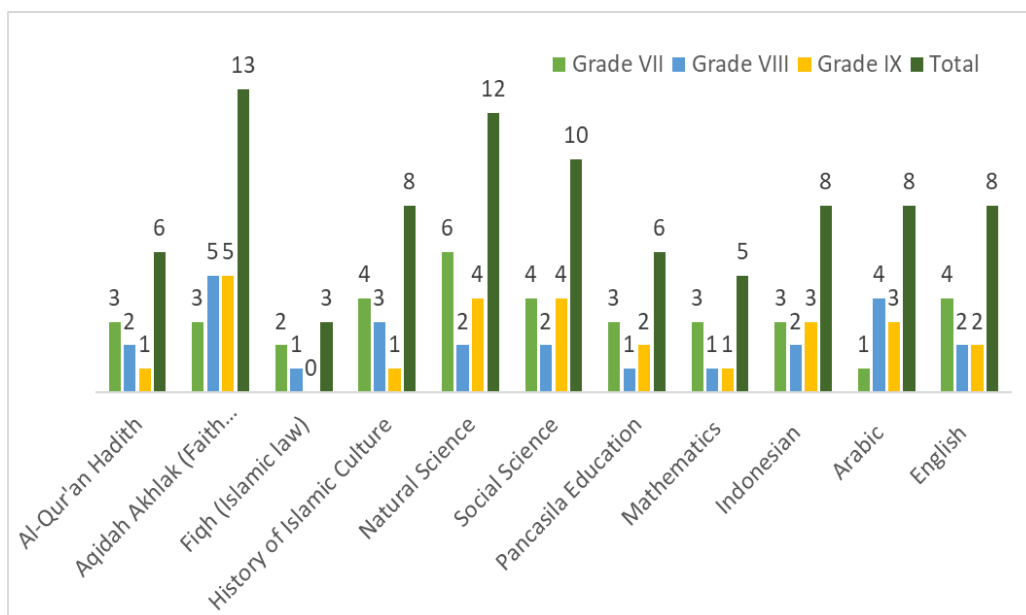


Figure 3. Lesson material containing ethical values of energy saving by subject and grade

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. Population, natural resource utilization, and environmental damage are all examined in Social Science. Finally, the Arabic language subject 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, greedy, excessive, or wasteful, as well as habits and examples of saving energy.

Dalam bab ini kalian akan mempelajari bagaimana seharusnya orang beriman menjalani kehidupan agar dapat menyeimbangkan kehidupan dunia dan akhirat, sehingga tidak menganut gaya hidup materialistik, hedonis, dan konsumtif.

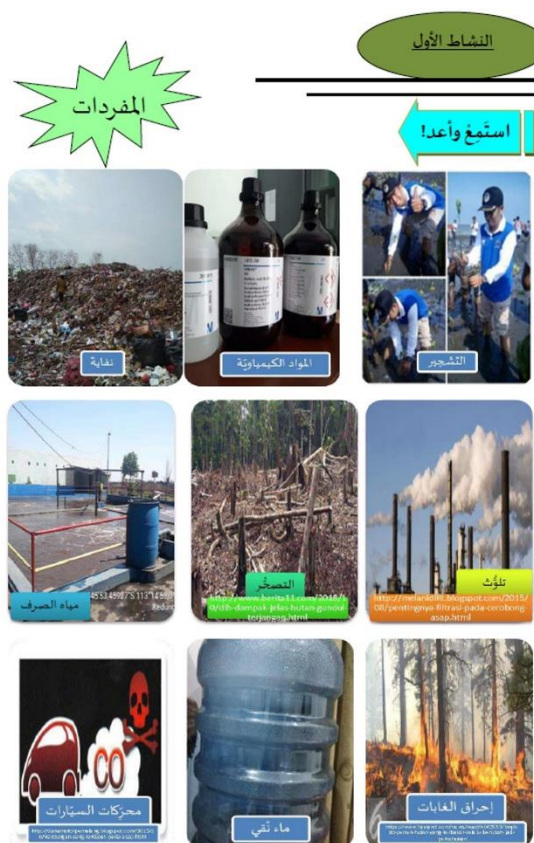


(a)

Pemanfaatan sumber daya alam secara terus menerus dapat membuat daya dukung lingkungan terhadap kehidupan menurun. Seiring berjalannya waktu, potensi sumber daya alam dapat mengalami perubahan yang berkaitan dengan masalah lingkungan.



(b)



(c)

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

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 Qur'an 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.

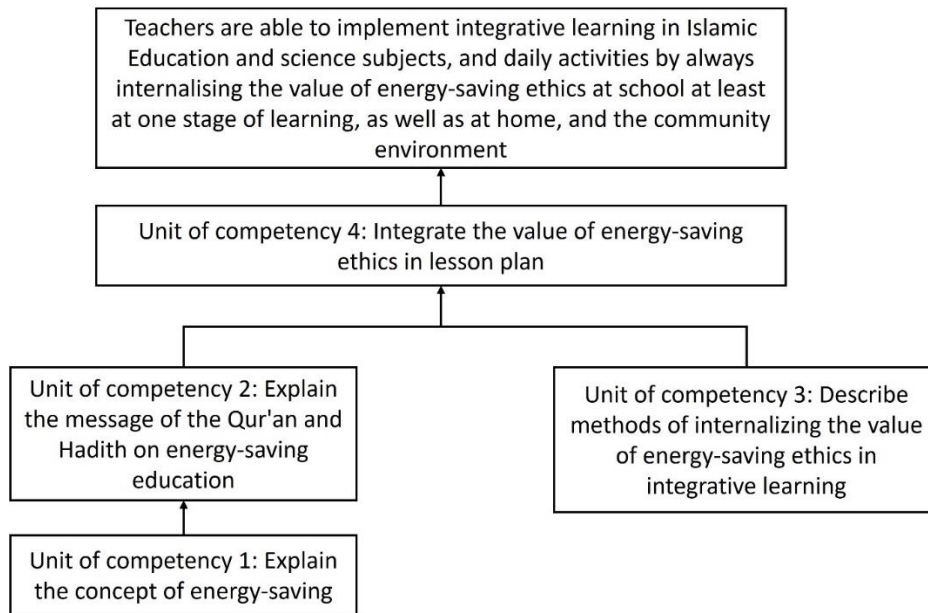


Figure 5. Competency analysis using a combination structure

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. Specifically, we need to rectify the biased training program objectives by applying the ABCD (audience, behavior, condition, and degree) formula and incorporating long-term or supplementary 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).

Discussion

Our main findings indicate that teachers still lack energy-saving competence, which hinders their ability to effectively convey energy-saving learning messages and moral interaction to students, particularly 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 (Han & Martin, 2018). 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 (Fu et al., 2021). 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— an environmental-cultured school. This *Adiwiyata* school has effectively established an environmentally conscious and energy-efficient learning environment (Nurwidodo et al., 2020). For example, internships are a method of developing personal, professional, and responsible citizen competencies (Sweitzer & King, 2009).

Training is a popular continuing education concept in adult education and occupational professions (Jarvis, 2004). According to learning outcomes, the emphasis on training is more task- and

job-specific (Blanchard & Thacker, 2013), 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 (Achimugu et al., 2023; Guerrero-Romera & Perez-Ortiz, 2022; Jordan et al., 2009; Musfah & Erviani, 2018).

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 (Laine & Tirri, 2023). 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 (Dias et al., 2004).

Our second key finding is that 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 VII-IX. Energy-related textbook content can provide learners with a rich interdisciplinary perspective (Castañeda-garza & Valerio-ureña, 2022). 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 (DeWaters & Powers, 2011).

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 (Sahin, 2018), 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 (Alomari et al., 2023). 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 (Jordan et al., 2008). 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 (Mustaqim, 2019).

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 (Eitel et al., 2015; Ferrell & Tharpe, 2024; Wals, 2012). 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 meaning, experience, and learning, which can go beyond the school walls (Yemini et al., 2023). Local energy issues and resources, which are widely available in the area, can enhance the learning experience. For example, in West Java, schools can use examples of hydropower energy of various types, namely pico, micro, mini, small, and full-scale capacities. According to Regional Energy General Plan of West Java Province 2018-2050 data, West Java has a hydropower potential of 2,861 MW and a fairly high utilization rate of 1,991 MW (69.6%) (Regional Government of West Java Province, 2019). West Java boasts hydroelectric power plants with capacities varying from 0.7 to 1,008 MW, specifically the Ubrug, Kracak, Plengan, Lamajan, Cikalong, Bengkok, Dago, Parakan, Saguling, Cirata, and Jatiluhur hydroelectric power plants (MEMR, 2018).

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 (Bloom & Fuentes, 2019). 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 (Cole et al., 2022).

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 (Lucas et al., 2018). 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 (Uribe-Banda et al., 2023).

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 (Lysenko et al., 2023). 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 (Brame, 2016). 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 (Paton et al., 2005).

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 (Pipere et al., 2010). Schools can also partner with higher education and vocational institutions, as well as teacher learning communities, to deliver training. Partnerships are a success factor for teachers in improving content knowledge and teaching practices (Ferrell & Tharpe, 2024).

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 (Grgić & Jutzi, 2024). 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 *Adiwiyata* program in Islamic educational institutions but also contribute to the development of national energy conservation policies and initiatives.

Conclusion

The low competence in understanding the concept of energy saving and internalizing its value in energy-saving learning has implications for the importance of developing a training program for Islamic school teachers. The program places emphasis not only on developing competence in understanding energy concepts but also on exploring the value of energy-saving ethics, which are based on religious ethical values, and methods to internalize these values in integrated learning across all subject areas. We successfully adapted the training program design from this research to the formal Islamic education institution, *madrasah*, which integrates with the *pesantren* system, ensuring no distinction between religious and science subjects. This program design model contributes to the development of Islamic education theory and energy conservation. On the other hand, previous studies primarily concentrated on understanding the concept of energy saving in a general sense without taking into account the ethical value of energy saving, which is rooted in religious ethical values, and the strategies for internalizing these values within integrated learning.

From a systems perspective, the next research agenda focuses on the implementation aspect of the program, exploring place-based education approaches in different Islamic school settings through local partnerships with various university and polytechnic educational institutions, training institutions, and teacher learning communities. Additionally, we should develop innovative learning media by leveraging the issues and potentials of local green energy resources, particularly for blended learning training, to ensure effective and efficient training programs that align with the diverse resources of schools and

teachers. Regarding the program's output and outcome logic, future research endeavors should concentrate on assessing the influence of teacher-led energy education on students' energy-saving awareness and the overall effectiveness of energy conservation and environmental initiatives.

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