

Inquiry-Based Learning Model Grounded in Islamic and Muhammadiyah Values for Understanding Energy and Work

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Abstract

This study aims to analyze how the integration of Al-Islam and Kemuhammadiyahan (AIK) values within an inquiry-based learning model supports students' conceptual understanding of energy and work. The research employed a descriptive qualitative approach involving 32 eleventh-grade science students and one physics teacher at a Muhammadiyah senior high school in Tangerang Selatan, Indonesia. Data were collected through classroom observations, analysis of student worksheets (LKPD), and semi-structured interviews, and were analyzed using thematic analysis. The findings indicate that the implementation of inquiry stages integrated with AIK values such as tadabbur, amanah, ikhlas, and syukur is reflected in the ways students formulate questions, interpret experimental results, and reflect on the relationship between energy concepts and the order of natural phenomena. These qualitative findings suggest that students demonstrate a more structured conceptual understanding of energy transformation and mechanical work, along with reflective attitudes, careful reasoning, and moral responsibility during the scientific learning process. The contribution of this study lies in the formulation of an AIK-based inquiry learning model that operationalizes Islamic values pedagogically within each inquiry stage. This approach positions physics learning not only as a process of conceptual mastery but also as a means of developing holistic scientific literacy within the context of Muhammadiyah education.

Keywords: AIK values; energy; inquiry-based learning; islamic education; physics learning; work

Abstrak

Penelitian ini bertujuan untuk menganalisis bagaimana integrasi nilai-nilai Al-Islam dan Kemuhammadiyahan (AIK) dalam model pembelajaran berbasis inkuiri mendukung pemahaman konseptual siswa pada materi energi dan usaha. Penelitian menggunakan pendekatan kualitatif deskriptif dengan subjek 32 siswa kelas XI IPA dan satu guru fisika di SMA Muhammadiyah Tangerang Selatan. Data dikumpulkan melalui observasi proses pembelajaran, analisis lembar kerja peserta didik (LKPD), dan wawancara semi-terstruktur, kemudian dianalisis menggunakan analisis tematik. Hasil penelitian menunjukkan bahwa penerapan tahapan inkuiri yang diintegrasikan dengan nilai-nilai AIK seperti tadabbur, amanah, ikhlas, dan syukur tercermin dalam cara siswa mengajukan pertanyaan, menafsirkan hasil percobaan, serta merefleksikan hubungan antara konsep energi dan keteraturan fenomena alam. Temuan kualitatif ini mengindikasikan bahwa siswa tidak hanya menunjukkan pemahaman konseptual yang lebih terstruktur tentang transformasi energi dan usaha mekanik, tetapi juga menampilkan sikap reflektif, ketelitian, dan tanggung jawab dalam proses ilmiah. Kontribusi penelitian ini terletak pada perumusan model pembelajaran inkuiri berbasis AIK yang mengoperasionalkan nilai-nilai keislaman secara pedagogis dalam setiap tahapan inkuiri, sehingga pembelajaran fisika tidak hanya berorientasi pada penguasaan konsep, tetapi juga pada pembentukan literasi ilmiah yang holistik di lingkungan pendidikan Muhammadiyah.

Kata Kunci: nilai-nilai AIK; energi; pembelajaran berbasis inkuiri; pendidikan Islam; pembelajaran fisika; usaha

Article History: Submitted 13 November 2025; Revised 6 January 2026; Accepted 13 January 2026

How to Cite: Utama, R., & Perawironegoro, D. (2026). Inquiry-Based Learning Model Grounded in Islamic and Muhammadiyah Values for Understanding Energy and Work. *Al Asma : Journal of Islamic Education*, 8(1), 22-33. <https://doi.org/10.24252/asma.v8i1.62661>

INTRODUCTION

Physics, as a discipline, serves not only as a means to understand the natural world but also as a reflection of the divine order embedded within creation. In Islamic education, learning science particularly physics is viewed as an act of *tadabbur*, a process of reflecting upon the signs of Allah (*ayat kauniyah*) manifested in nature (Amin et al., 2022). Within the Muhammadiyah perspective, education aims to cultivate both intellectual and spiritual intelligence, emphasizing that knowledge should lead to the betterment of humanity (*tajdid*) and the strengthening of faith (Azra, 2019; Majelis Diktilitbang PP Muhammadiyah, 2020). Thus, integrating Al-Islam and Kemuhammadiyahan (AIK) values into physics learning aligns with the philosophical foundation of holistic education that unites scientific inquiry with moral and spiritual formation (Megawati & Sulisworo, 2024). Physics, as a discipline, serves not only as a means of understanding the natural world but also as a way of interpreting order and regularity in natural phenomena. Within the context of Islamic education, learning physics is often viewed as a reflective process that encourages learners to contemplate the signs of God manifested in nature (*ayat kauniyah*), commonly described as *tadabbur* (Amin et al., 2022). From the Muhammadiyah perspective, education is expected to cultivate intellectual competence alongside moral and spiritual awareness, emphasizing that knowledge should contribute to human betterment (*tajdid*) and the strengthening of faith and ethical responsibility (Azra, 2019; Majelis Diktilitbang PP Muhammadiyah, 2020). Integrating Al-Islam and Kemuhammadiyahan (AIK) values into physics learning therefore aligns with a holistic educational vision that connects scientific inquiry with moral and spiritual formation (Megawati & Sulisworo, 2024).

However, contemporary physics education frequently emphasizes procedural mastery and problem-solving skills while giving limited attention to reflective and ethical dimensions of learning. Students may successfully apply mathematical formulas related to energy and work, yet struggle to interpret the broader meaning of physical laws in relation to balance, harmony, and sustainability in the universe (Kaltakci Gurel et al., 2015). This separation between cognitive achievement and affective understanding can result in fragmented learning experiences in which scientific knowledge is perceived as value-neutral and disconnected from faith-based perspectives (Ningsih et al., 2022). In response to this challenge, educators are increasingly encouraged to integrate ethical and religious values into science pedagogy to foster scientific reasoning rooted in moral awareness (Irwandi et al., 2022; Mustamin & Wahono, 2020).

Inquiry-oriented instruction has been widely recognized as an approach that actively engages students in observing phenomena, formulating questions, testing ideas through experimentation, and reflecting on evidence. Studies in physics education demonstrate that inquiry-based learning supports conceptual understanding by engaging

learners in processes analogous to those used by scientists, such as modeling, predicting, testing, and revising explanations (Pedaste et al., 2015; Sarioğlu & Gedik, 2020). Research also shows that inquiry learning improves students' conceptual durability and ability to transfer knowledge to new contexts, particularly in fundamental topics such as energy and work (Wartono et al., 2019; Samsudin et al., 2021). Moreover, inquiry-based instruction encourages metacognitive reflection, allowing students to focus on the reasoning underlying physical laws rather than solely on mathematical expressions (Furtak et al., 2012).

Parallel to this line of inquiry research, several studies have explored the integration of Islamic values in science education. Findings indicate that embedding religious or faith-based values within inquiry-oriented learning environments can enhance students' moral awareness, learning attitudes, and sense of responsibility (Irwandi et al., 2022; Hussien et al., 2021). Similarly, value-integrated science learning has been shown to promote students' ability to connect scientific concepts with broader ethical and spiritual meanings (Fahyuni et al., 2020; Ningsih et al., 2022). Nevertheless, such studies often emphasize general character development or value integration without explicitly explaining how Islamic or Muhammadiyah values are operationalized within each phase of the scientific inquiry process, particularly in relation to specific physics concepts such as energy and work (Barbour, 2000).

In contrast, the present study positions Al-Islam and Kemuhammadiyah (AIK) values not as supplementary elements but as pedagogical instruments that shape students' scientific reasoning, reflection, and interpretation of physical phenomena. By systematically embedding values such as *tadabbur*, *amanah*, *ikhlas*, and *syukur* into each stage of an inquiry-based learning model, this study examines how value-integrated inquiry supports students' conceptual construction of energy and work while fostering reflective and responsible learning behaviors. This positioning aligns with broader perspectives in moral and character education that emphasize the integration of ethical reflection within disciplinary learning (Lickona, 1991; Nucci et al., 2014).

Accordingly, this study aims to explore how the integration of AIK values within an inquiry-based learning model can enhance students' conceptual understanding of energy and work while nurturing moral and spiritual awareness. By aligning scientific inquiry with reflective values, the study contributes to the development of an AIK-grounded inquiry framework that supports holistic scientific literacy in physics education within Muhammadiyah schools, in line with contemporary science education perspectives that emphasize scientific practices and meaningful learning over rote memorization (Osborne, 2014; Hodson, 2011).

METHOD

Research Design

This research adopted a descriptive qualitative design, emphasizing the exploration of how Al-Islam and Kemuhammadiyah (AIK) values can be meaningfully integrated into the inquiry-based learning (IBL) model to improve students' conceptual understanding of energy and work. The qualitative design was chosen because it allows for rich and detailed interpretation of students' experiences, interactions, and reflections during the learning process (Creswell & Poth, 2018). The study did not aim to produce

statistical generalizations, but rather to uncover the ways in which students construct scientific meaning while internalizing spiritual and ethical principles.

The framework of inquiry used in this study was based on the five-phase IBL model introduced by Pedaste et al. (2015), which includes orientation, conceptualization, investigation, conclusion, and reflection. Each of these phases was recontextualized within the Muhammadiyah educational perspective, embedding specific AIK values such as *tadabbur* (reflection on nature as God's creation), *amanah* (responsibility in seeking truth), *ikhlas* (sincerity in learning), *tafakkur* (critical reflection), and *syukur* (gratitude for knowledge). Through this adaptation, the inquiry process was transformed into a spiritualized scientific cycle that preserves scientific rigor while cultivating moral and religious awareness. The design also emphasized collaborative learning and reflective dialogue, allowing students to relate the laws of energy and work to their lived experiences and beliefs as Muslim learners.

Participants

The research was conducted at a Muhammadiyah-affiliated senior high school in Tangerang Selatan, Banten, during the 2024–2025 academic year. Participants consisted of 32 eleventh-grade students (science stream) and one physics teacher experienced in inquiry-based and faith-oriented instruction. The school was selected purposively because it actively implements AIK-based curricula, making it an appropriate context for integrating spiritual values into scientific inquiry. All participants voluntarily participated and provided consent prior to data collection.

Instruments and Data Collection

To obtain comprehensive and credible data, this study employed multiple instruments that complemented one another in capturing students' cognitive, affective, and reflective learning processes. The use of varied instruments was intended to ensure triangulation, thereby strengthening the validity of the findings. Each instrument was carefully designed to align with both the scientific objectives of inquiry-based learning and the spiritual framework of Al-Islam and Kemuhammadiyahan (AIK). The data collection process focused on observing classroom interactions, documenting inquiry activities, and exploring students' reflections during the integration of AIK values in the study of energy and work.

Three primary instruments were employed in this research. First, the Observation Sheet was used to record how teachers facilitated inquiry learning and how students responded during each phase of the inquiry cycle integrated with AIK values. This instrument provided direct insights into classroom behaviors, questioning patterns, and the ways students demonstrated curiosity, responsibility, and sincerity in their learning activities.

Second, the Student Worksheet (LKPD) served as both a learning medium and a data source. It was developed around the topic of energy and work using a guided inquiry approach. Each worksheet contained conceptual prompts, procedural instructions, and reflective questions connecting physical concepts to spiritual insights such as reflecting on how energy conservation exemplifies balance and harmony in God's creation.

Third, the Interview Guide was employed to gather more in-depth data on students' conceptual understanding and spiritual reflections. Semi-structured interviews were conducted with selected students and the teacher after completing the learning sessions. The questions were designed to elicit how learners perceived the integration of AIK values and how these experiences influenced their understanding of energy, work, and their relationship with natural laws.

The entire data collection process took place over four inquiry sessions, each lasting approximately 90 minutes, covering the stages of orientation, conceptualization, investigation, conclusion, and reflection. Additional documentation, such as students' notes, photographs of experimental activities, and reflective journals, was also collected to enrich the qualitative data set and support triangulation.

Data Analysis Procedure

The data collected from classroom observations, student worksheets, and interviews were analyzed using thematic analysis procedures as described by Braun and Clarke (2021). This analytical approach was chosen because it allows researchers to identify, interpret, and report patterns of meaning across qualitative data in a systematic and flexible way. The process began with an intensive familiarization stage, in which all transcripts and field notes were repeatedly read to capture an overall understanding of the learning context. Subsequently, initial codes were generated to represent significant features of the data relevant to the research objectives. These codes were then organized and refined as broader themes began to emerge, reflecting both conceptual and spiritual dimensions of the learning process. The themes were reviewed to ensure coherence with the coded extracts, defined clearly to capture their essence, and finally synthesized into a comprehensive interpretation of the findings.

To enhance credibility and minimize researcher bias, two independent coders were involved in the analysis. Both researchers conducted parallel coding and later compared their results to reach a consensus on the thematic structure. The final codes were classified into two major domains. The first domain, Conceptual Themes, encompassed students' understanding of energy, work, and their interrelation in the context of inquiry-based learning. The second domain, Spiritual-Reflective Themes, represented the internalization of *tadabbur*, *amanah*, *ikhlas*, and *syukur* throughout the learning process, reflecting the influence of AIK values on students' moral and cognitive growth.

Furthermore, the reliability of the data was strengthened through methodological triangulation, which involved comparing and cross-validating evidence from different sources observations, worksheets, and interviews. This triangulation ensured the validity and consistency of interpretations, as recommended by Miles, Huberman, and Saldaña (2019). Through this analytic procedure, the study was able to capture not only the development of scientific understanding but also the evolution of students' reflective and spiritual awareness during inquiry-based learning.

Integration Framework of AIK Values in the Inquiry Cycle

To operationalize AIK integration, each phase of inquiry was aligned with an Islamic and Muhammadiyah value, as shown in Table 1.

Table 1. Integration of AIK Values within the Inquiry-Based Learning Framework for the Topic of Energy and Work

Inquiry Phase	Learning Activities	Embedded AIK Value	Expected Competency
Orientation	Observing energy transformation phenomena in daily life	Tadabbur (reflection on the signs of Allah in creation)	Curiosity and spiritual awareness
Conceptualization	Formulating questions and hypotheses on work-energy relationship	Amanah (responsibility in reasoning and learning)	Ethical and logical inquiry
Investigation	Conducting experiments on energy conservation	Ikhlas (sincerity and honesty in experimentation)	Discipline and accuracy
Conclusion	Analyzing data and deriving general principles	Tafakkur (critical reflection on divine order)	Deep conceptual understanding
Reflection	Discussing moral lessons and sustainable implications	Syukur (gratitude for knowledge and creation)	Stewardship and character building

Trustworthiness and Ethical Considerations

To ensure the quality and validity of this qualitative research, four criteria of trustworthiness—credibility, transferability, dependability, and confirmability—were carefully applied as proposed by Lincoln and Guba (1985). Credibility was maintained through prolonged engagement in the classroom setting and repeated verification of interpretations with participants. This process, known as member checking, allowed students and the teacher to confirm whether the researcher's interpretations accurately represented their experiences and perspectives during the inquiry activities. Peer debriefing was also conducted with fellow researchers to review analytical decisions and reduce potential bias.

Transferability was strengthened by providing rich, thick descriptions of the learning context, including the school environment, participants, instructional materials, and the specific integration of AIK values at each stage of inquiry. These detailed contextual descriptions enable readers and other educators to determine the extent to which the findings could be applicable to similar educational settings, particularly within Muhammadiyah schools or other faith-based science education environments.

Dependability was ensured by maintaining a consistent research process documented in reflective field notes and analytic memos. All procedures from data collection to thematic analysis were systematically recorded, allowing for an audit trail

that could be reviewed by external evaluators. This transparency ensures that the study's conclusions are not arbitrary but firmly grounded in the collected data.

Finally, confirmability was achieved by practicing reflexivity throughout the research. The researcher continuously examined personal assumptions and maintained a clear boundary between subjective beliefs and objective interpretations. Supporting data, including observation notes, interview transcripts, and student worksheets, were preserved for verification, ensuring that the results reflect participants' voices rather than the researcher's expectations.

Ethical considerations were addressed at every stage of the study. Permission was formally obtained from the administration of the Muhammadiyah school in Tangerang Selatan. Participation was voluntary, and informed consent was collected from both students and the teacher. Anonymity and confidentiality were strictly maintained by using pseudonyms and omitting identifiable information. The research adhered to Islamic ethical principles emphasizing honesty, respect, and sincerity (*ikhlas*) in conducting academic inquiry.

RESULTS AND DISCUSSION

Overview of Implementation

The implementation of the AIK-based Inquiry Learning Model was carried out over four sessions that followed the five stages of inquiry: orientation, conceptualization, investigation, conclusion, and reflection. Throughout these stages, both the teacher and students actively participated in integrating spiritual values into the scientific exploration of energy and work. Classroom observations revealed a noticeable shift in students' engagement patterns. During the orientation phase, students demonstrated curiosity when relating real-world phenomena such as the motion of vehicles, falling objects, or inclined planes to the concept of energy transformation. The teacher guided them to reflect on these observations as manifestations of divine balance in nature, linking physical phenomena with the Qur'anic notion of *tadabbur* or reflection upon the signs of Allah (Amin et al., 2022).

The inquiry environment encouraged students to move beyond rote memorization and engage in active questioning. In the conceptualization phase, students began formulating hypotheses about the relationships between work, force, and displacement. Their questions reflected both scientific reasoning and moral responsibility (*amanah*) in seeking truthful answers. For example, one student stated, "If energy cannot be created or destroyed, it must have come from Allah's design in nature," demonstrating the integration of theological reflection into conceptual thinking. This aligns with earlier findings by Irwandi et al. (2022), who noted that faith-oriented inquiry promotes moral awareness alongside cognitive understanding.

Students' Conceptual Understanding of Energy and Work

Analysis of the student worksheets and interviews showed significant improvement in students' ability to explain the principles of energy conservation and the relationship between work and energy transfer. Before the intervention, most students tended to describe energy as a tangible object or as something that "runs out" when used a common misconception identified in previous studies (Kaltakci Gurel et al., 2015). After

participating in the AIK-based inquiry sessions, students' explanations became more coherent and aligned with scientific reasoning. For instance, several students correctly described energy as a measurable quantity that changes form rather than disappears, and some explicitly related these transformations to the concept of sustainability as part of maintaining balance in creation.

Furthermore, the guided inquiry activities helped students develop metacognitive awareness of their reasoning. When analyzing the data from the inclined-plane experiment, students were able to link the numerical work-energy calculations to real-world implications such as human effort, resource efficiency, and environmental stewardship. This mirrors the findings of Samsudin et al. (2021), who emphasized that inquiry fosters deep conceptual connections between abstract theory and lived experience. The integration of AIK values amplified this effect by contextualizing physical principles within ethical and spiritual frameworks.

The teacher's reflective journal also indicated that students became more confident in articulating their understanding during group discussions. They began to use the language of both science and faith naturally, such as expressing gratitude (*syukur*) for being able to observe Allah's laws in motion through their experiments. This suggests that conceptual learning, when combined with AIK reflection, fosters both intellectual and affective growth a form of holistic education consistent with Muhammadiyah's philosophy of *ilmu amaliah* (knowledge in action).

Integration of AIK Values and Reflective Outcomes

The thematic analysis revealed four dominant spiritual-reflective themes *tadabbur*, *amanah*, *ikhlas*, and *syukur* which emerged consistently across classroom observations and interview data. These values shaped the students' attitudes during the learning process and enhanced their moral engagement with scientific inquiry (Hodson, 2011).

The theme of *tadabbur* appeared strongly during the orientation and conceptualization phases, where students interpreted everyday energy phenomena as signs of divine order. This reflective stance transformed routine observation into an act of worship, reinforcing the Islamic view that exploring the natural world is part of understanding the Creator's wisdom (Azra, 2019). The value of *amanah* was evident in how students carefully conducted experiments and verified data with integrity. They expressed awareness that precision and honesty in science are forms of moral responsibility, aligning with the Qur'anic ethic of trustworthiness in handling knowledge.

The value of *ikhlas* emerged during data collection and analysis, particularly when students faced difficulties or errors in measurement. Instead of frustration, they displayed perseverance and sincerity, acknowledging that effort itself constitutes worship when performed with the right intention. Meanwhile, *syukur* became the culminating value in the reflection phase. Students expressed gratitude for the opportunity to learn about how energy operates in harmony with divine principles, seeing knowledge as both a blessing and a trust. These findings align with Hussien et al. (2021), who found that value-based inquiry promotes moral discipline and emotional maturity.

Integrating AIK values within the inquiry model also transformed the classroom atmosphere. Discussions shifted from a purely mechanical focus on formulas to a more humanistic dialogue about ethics, sustainability, and the moral responsibility of scientific

understanding. This integration produced a learning environment where scientific literacy and spiritual literacy developed concurrently. It supports the argument made by Mustamin & Wahono (2020) that faith-driven contextualization enhances the relevance of physics learning to students' personal and cultural identity.

Discussion Summary

The results collectively indicate that embedding AIK values into inquiry-based physics learning enhances both cognitive and spiritual dimensions of understanding. Students not only improved in explaining the laws of energy and work but also demonstrated reflective thinking grounded in Islamic values. This dual improvement confirms that religiously contextualized inquiry models provide a transformative framework for 21st-century science education in Muhammadiyah schools.

The study's outcomes reinforce the broader view that integrating AIK values is not merely moral decoration but epistemological enrichment, a way of harmonizing faith and reason, science and ethics. In line with the Muhammadiyah vision of education for liberation and enlightenment (*pendidikan pencerahan*), the AIK-based inquiry model can thus serve as a prototype for developing spiritually responsive science pedagogy in Indonesia.

Interview Findings

The interviews conducted with both students and the teacher revealed deeper insights into how AIK-based inquiry learning shaped the participants' experiences beyond cognitive understanding. Students reported that learning through inquiry allowed them to "see the laws of physics as part of God's order," indicating a conceptual and affective shift in how they perceived science. One student reflected, "Before, I thought energy was just numbers and formulas, but now I realize it's part of Allah's balance in nature." Such statements illustrate an epistemological awareness that learning physics can also be an act of faith.

Teachers' reflections echoed this sentiment. The participating teacher noted that integrating AIK values did not slow down scientific exploration but rather deepened students' motivation to learn. According to the teacher, students who previously hesitated to engage in experimentation became more responsible and honest when the activity was framed as a form of *amanah* (moral trust). This aligns with the findings of Megawati & Sulisworo (2024), who emphasized that faith-based contextualization of inquiry fosters intrinsic motivation and ethical awareness.

Another emerging theme was sincerity (*ikhlas*) in learning. Several students mentioned that when their experiments failed or measurements deviated, they viewed those moments as opportunities for reflection and perseverance rather than as failure. This mindset transformation shows that inquiry grounded in AIK values nurtures emotional resilience and moral character, consistent with Muhammadiyah's educational philosophy that emphasizes balanced development of *iman*, *ilmu*, and *amal*.

Instructional Implications

The findings of this study carry several pedagogical implications for physics educators, particularly within Muhammadiyah and other faith-based institutions. First,

embedding AIK values into inquiry learning demonstrates that science instruction can cultivate not only intellectual competence but also moral and spiritual maturity. By framing observation and experimentation as acts of *tadabbur* and *amanah*, teachers can help students perceive scientific inquiry as a meaningful and ethical pursuit rather than merely a technical exercise.

Second, the integration model encourages student-centered learning environments that foster curiosity, accountability, and integrity. Teachers are encouraged to adopt inquiry questions that naturally invite reflection, such as “What does this phenomenon teach us about the balance and order in creation?” This approach helps bridge cognitive and affective learning domains, thereby reducing the dichotomy between science and religion in the classroom.

Third, this model suggests that assessment in AIK-based science learning should go beyond factual recall and problem-solving accuracy. Evaluations should also consider students’ reflective responses, ethical behaviors during experimentation, and their ability to connect physical principles with moral reasoning. These aspects represent measurable indicators of holistic literacy as a combination of scientific, moral, and spiritual competencies.

Finally, the AIK-integrated inquiry model can serve as a prototype for curriculum innovation in Muhammadiyah schools, supporting the organization’s mission to develop “scientifically advanced yet spiritually grounded” graduates (*unggul dalam IPTEK dan IMTAQ*). In this regard, teachers play a central role not only as facilitators of knowledge but also as moral exemplars who embody the AIK principles in classroom practice.

Synthesis

Synthesizing the findings, this study confirms that integrating Al-Islam and Kemuhammadiyah values within inquiry-based physics learning creates a transformative learning environment where scientific exploration and spiritual reflection coexist harmoniously. Students’ understanding of energy and work evolved from a fragmented, procedural concept into a comprehensive, value-laden understanding that aligns with the Islamic worldview of balance and stewardship.

From a theoretical standpoint, the results support constructivist learning principles while extending them into the moral domain. Inquiry-based learning encourages cognitive construction through evidence and reasoning (Pedaste et al., 2015), whereas the addition of AIK values enriches this process by grounding it in ethical intentionality. This synthesis demonstrates that faith and reason are not opposing forces but complementary dimensions of human inquiry as a principle long upheld in Muhammadiyah’s educational philosophy (Majelis Diktilitbang PP Muhammadiyah, 2020).

In essence, the AIK-based inquiry model can be viewed as a pedagogical bridge between modern science education and Islamic moral education. It enables students to internalize the scientific method as a form of worship (*ibadah ilmiah*), reflecting gratitude (*syukur*) and responsibility (*amanah*) in understanding the natural order. The model thus embodies the Muhammadiyah vision of education for enlightenment and liberation, producing learners who are intellectually critical, spiritually grounded, and ethically responsible citizens.

CONCLUSION

This study concludes that integrating Al-Islam and Kemuhammadiyah (AIK) values into an inquiry-based learning (IBL) model supports students' conceptual understanding of energy and work while fostering reflective attitudes and moral responsibility in the learning process. The findings show that embedding values such as *tadabbur*, *amanah*, *ikhlas*, and *syukur* within each inquiry stage helps students construct scientific understanding that is both meaningful and ethically grounded.

Based on these findings, it is recommended that physics teachers in Muhammadiyah schools consider adopting AIK-based inquiry learning as an alternative pedagogical approach to integrate conceptual learning with value-based reflection. Future studies may further examine this model across different physics topics or educational levels to explore its broader applicability.

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