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INTEGRATING IPAS AND ISLAMIC EDUCATION THROUGH A DIGITAL-SUPPORTED DEEP LEARNING MODEL: AN INTEGRATIVE REVIEW IN ELEMENTARY EDUCATION

Rita Nurasih[1*], Ismail[2]
[1,2] Institut Studi Islam Muhammadiyah Pacitan, Indonesia
*e-mail: ritanurasihnurasih@gmail.com

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ABSTRACT
This study examines the integration of IPAS (Ilmu Pengetahuan Alam dan Sosial) and Islamic Education through a digital-based deep learning model in a public elementary school. Using a qualitative field study design at SDN 04 Tegalombo, data were collected through classroom observations, semi-structured interviews with teachers, and analysis of lesson plans, student worksheets, and digital learning media. The data were analyzed thematically and validated through triangulation across multiple sources. The findings indicate that IPAS and Islamic Education can be structurally integrated within a digital-based deep learning framework, where inquiry stages problem orientation, exploration, collaboration, and reflection are directly connected with Islamic value internalization. This integration contributes to students' cognitive development, particularly in higher-order thinking skills such as analysis, evaluation, and problem-solving, as well as improved conceptual understanding of abstract IPAS topics. Affective outcomes are also evident, including increased motivation, responsibility (amanah), collaboration (ta'awun), moral awareness, and disciplined learning attitudes (adab). Digital tools, including interactive multimedia, simulations, and Google Classroom, function as pedagogical mediators that enhance visualization, engagement, and collaborative inquiry. Overall, the model supports holistic elementary education by balancing cognitive achievement, affective growth, and spiritual awareness.

INTRODUCTION

The integration of interdisciplinary learning in Indonesian elementary education has become increasingly urgent, particularly in the context of curriculum reform and the demand for 21st-century competencies. The implementation of the Merdeka Curriculum emphasizes holistic student development, integrating knowledge, skills, and character formation. However, despite these policy directions, classroom practices in many public elementary schools (Sekolah Dasar Negeri) still reflect a structural separation between general subjects and religious education. Ilmu Pengetahuan Alam dan Sosial (IPAS) is commonly oriented toward conceptual mastery and scientific reasoning, while Islamic Education tends to focus on doctrinal understanding and moral instruction. This dichotomy limits opportunities for students to connect scientific knowledge with ethical reflection and spiritual awareness in meaningful and contextual ways (Algozzine & Diliberto, 2004).

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Several studies have highlighted the importance of interdisciplinary learning in strengthening conceptual understanding and coherence. Fakhrurrozi, (2023) argue that fragmented subject implementation reduces opportunities for holistic competence development. Similarly, Ananda, (2024) demonstrate that thematic integration in elementary classrooms improves students' comprehension by linking concepts across disciplines. International literature further supports the view that interdisciplinary approaches foster deeper understanding and transferable skills (Nakakoji & Wilson, 2020; Shenbagavalli, 2025). However, while these studies emphasize cognitive integration, they often overlook the systematic incorporation of religious or moral values within academic subjects, particularly in public school settings where curricular boundaries remain rigid.

At the same time, the rapid expansion of digital technology in Indonesian schools has introduced new possibilities for instructional innovation. Government reports indicate that digital infrastructure and access to educational platforms have improved significantly in recent years, even though disparities persist between urban and rural regions (Nurbaiti et al., 2023). Research shows that digital learning media can enhance student engagement and cognitive achievement when effectively integrated into instructional design (Hidayat & Suryadi, 2023; Rahmawati et al., 2024). Trust & Whalen, (2021) emphasize that technology becomes transformative only when aligned with pedagogical objectives rather than used as a mere presentation tool. In practice, however, digital media in many elementary classrooms remain instrumental supporting content delivery but not necessarily facilitating inquiry, reflection, or value internalization.

Within this context, deep learning has gained attention as a pedagogical approach that promotes higher-order thinking, collaboration, problem-solving, and metacognitive reflection. McEachen & Kane, (2018) conceptualize deep learning as the integration of character, citizenship, collaboration, communication, creativity, and critical thinking. Similarly, Rosidah, (2024) underscores the role of inquiry-based and reflective learning strategies in fostering students' cognitive depth. Empirical studies in Indonesian elementary schools confirm that deep learning-oriented instruction improves higher-order thinking skills (Hamzah, 2022). Nevertheless, these studies predominantly focus on cognitive outcomes, rarely examining how deep learning can simultaneously cultivate affective and spiritual dimensions aligned with Islamic character education.

Research on integrating Islamic values into science or social studies provides additional insight but also reveals significant limitations. Widodo., (2025) show that embedding moral discussions in science lessons can strengthen students' ethical awareness. Surahman & Nayla, (2025) report positive responses to value-oriented contextual learning in elementary classrooms. However, these studies generally treat value integration as supplementary moral messaging rather than as part of a coherent instructional framework. The integration is often thematic or symbolic, lacking systematic alignment between learning objectives, inquiry processes, digital tools, and reflective activities. Consequently, the pedagogical mechanisms that meaningfully connect scientific inquiry in IPAS with Islamic ethical reasoning remain underexplored.

This condition highlights several pressing gaps. First, previous research tends to address interdisciplinary integration, digital innovation, or Islamic character education separately. Very few studies develop a structured model that intentionally combines IPAS and Islamic Education within a unified deep learning framework. Second, the majority of empirical research on deep learning in Indonesia prioritizes cognitive achievement, overlooking the simultaneous cultivation of affective dimensions such as moral reasoning, spiritual reflection, and ethical responsibility (Gustina & Iswantir, 2025; Nur'aini et al., 2025). Third, limited empirical attention has been given to public elementary school contexts, where institutional separation between subjects often reinforces pedagogical fragmentation.

The urgency of addressing these gaps becomes more evident when considering classroom realities. Preliminary observations at SDN 04 Tegalombo illustrate a common phenomenon in public

elementary schools. IPAS instruction emphasizes conceptual explanation, textbook-based exercises, and assessment of factual knowledge. Islamic Education, on the other hand, focuses on memorization of religious principles and normative moral instruction. Although digital tools such as presentation slides and online videos are occasionally used, their application lacks a structured deep learning design that engages students in inquiry, collaboration, and reflective value integration. This situation reflects a broader national challenge: aligning curriculum aspirations for holistic development with practical classroom implementation.

Compared to previous studies, this research responds directly to these challenges by critically examining the structural separation between IPAS and Islamic Education and by analyzing how a digital-based deep learning model can function as an integrative pedagogical bridge. Rather than merely advocating conceptual integration, this study investigates the alignment between learning objectives, instructional strategies, digital media utilization, and value internalization processes. In doing so, it shifts the discussion from descriptive claims about integration toward a systematic analysis of instructional design and pedagogical mechanisms.

Importantly, this research clarifies the meaning of "digital-based deep learning" as a pedagogical orientation rather than artificial intelligence technology. The model emphasizes inquiry-driven exploration of IPAS concepts, collaborative problem-solving activities, contextual case analysis, and structured reflection that connects scientific understanding with Islamic ethical values. Digital tools are positioned as facilitators of interaction, visualization, and reflective dialogue, ensuring that technology supports rather than replaces pedagogical intention. By situating this model within a public elementary school context, the study contributes empirical insight into how integration can be realistically implemented in state-school settings.

The novelty of this study lies in its analytical focus on identifying patterns and relationships that enable meaningful integration between scientific inquiry and Islamic values. At the cognitive level (aligned with Bloom's revised taxonomy level four analysis), the research examines how instructional components interact to support both scientific reasoning and ethical reflection. It does not simply measure outcomes but explores the structural mechanisms through which cognitive and affective domains can be interconnected within classroom practice. This dual emphasis distinguishes the study from prior research that isolates cognitive achievement or treats value education as an independent dimension.

Theoretically, the study contributes to interdisciplinary and Islamic education discourse by proposing a coherent framework for integrating IPAS and Islamic Education through a value-oriented deep learning model. Practically, it offers a contextually grounded strategy adaptable to Indonesian public elementary schools seeking to balance academic competence with character formation. By critically addressing the weaknesses of previous research, strengthening contextual relevance, and emphasizing pedagogical integration rather than technological novelty, this study responds to the urgent need for holistic and value-integrative education in contemporary elementary school settings.

METHODS

This study employed a qualitative field research design conducted at SDN 04 Tegalombo. The research was oriented toward understanding and analyzing instructional practices related to the integration of IPAS and Islamic Education through a digital-based deep learning model within a natural classroom setting. A qualitative approach was chosen because it allows researchers to explore meanings, interactions, and pedagogical processes in depth, particularly when the focus is on how learning strategies are implemented and experienced by teachers and students rather than on measuring causal relationships statistically (Creswell & Creswell, 2017; Firmansyah & Masrun, 2021). SDN 04 Tegalombo was selected purposively as the research site because it represents a public

elementary school implementing the Merdeka Curriculum, in which IPAS and Islamic Education are institutionally separated but potentially integrable through classroom practice. Preliminary mapping indicated that digital media had begun to be used in instruction, although not yet systematically aligned with deep learning principles or interdisciplinary integration. This context made the school a relevant setting for examining both existing instructional limitations and opportunities for pedagogical development (Irgil et al., 2021).

The participants in this study consisted of IPAS teachers, an Islamic Education teacher, and a fifth-grade class actively involved in digital-assisted learning activities. Participant selection followed purposive sampling principles, emphasizing relevance to the research focus rather than representativeness (Ahmad & Wilkins, 2025). Fifth grade was selected because IPAS content at this level requires higher conceptual understanding and provides broader opportunities for inquiry, analysis, and value integration. Students were involved as natural participants in the observed instructional processes, while teachers functioned as key informants in relation to instructional planning, implementation, and assessment. Data collection was conducted through classroom observations, semi-structured interviews, and document analysis to ensure methodological triangulation. Classroom observations were carried out using a non-participatory approach over four weeks during IPAS and Islamic Education lessons. The observations focused on instructional stages, teacher–student interactions, use of digital media, inquiry-based activities, collaborative learning, and moments where Islamic values were explicitly or implicitly internalized. Field notes were recorded systematically after each session to capture both descriptive classroom events and reflective analytical insights, as recommended in qualitative classroom research (Nassaji, 2020).

Semi-structured interviews were conducted with the participating teachers to explore their pedagogical perspectives, understanding of deep learning concepts, approaches to value integration, and challenges in digital instruction. The interview guide consisted of open-ended questions designed to allow flexibility while maintaining alignment with the research objectives. Each interview lasted approximately 45–60 minutes and was audio-recorded with participants' consent, then transcribed verbatim. This approach enabled deeper exploration of teachers' reasoning and instructional decision-making processes (Creswell & Creswell, 2017).

Document analysis was used to complement observational and interview data. Documents analyzed included lesson plans (Modul Ajar), digital teaching materials, student worksheets, and assessment instruments. The purpose of document analysis was to examine the alignment between intended learning objectives, instructional design, digital media use, and affective learning indicators. This step strengthened data credibility by allowing cross-verification between planned instruction and actual classroom implementation (Bowen, 2009). Data analysis followed a qualitative thematic analysis procedure based on the interactive model proposed by Miles, Huberman, and Saldaña, involving data condensation, data display, and conclusion drawing (Qomaruddin & Sa'diyah, 2024). During data condensation, observation notes, interview transcripts, and documents were coded inductively to identify recurring instructional patterns related to inquiry, interdisciplinary linkage, digital facilitation, collaborative learning, and value internalization. These initial codes were then organized into broader thematic categories reflecting cognitive development (such as analytical thinking, problem-solving, and conceptual understanding) and affective development (such as responsibility, cooperation, moral reflection, and spiritual awareness). Data display was conducted through thematic matrices that enabled systematic comparison across data sources and instructional contexts. This process facilitated identification of convergent and divergent patterns between IPAS and Islamic Education practices, particularly in terms of pedagogical alignment and digital media utilization. Conclusions were drawn iteratively and verified through continuous comparison of data sources to ensure analytical consistency and rigor. Informal member checking was conducted by discussing preliminary interpretations with participating teachers to confirm the accuracy and plausibility of the findings, thereby enhancing credibility (Pawar, 2020).

To ensure trustworthiness, this study applied qualitative criteria of credibility, dependability, confirmability, and transferability. Credibility was strengthened through prolonged engagement in the field and triangulation of observations, interviews, and documents. Dependability was supported by maintaining detailed documentation of research procedures and analytical decisions. Confirmability was addressed by clearly distinguishing empirical evidence from researcher interpretation, while transferability was enhanced through rich description of the research context and instructional setting (Pawar, 2020). By positioning this research explicitly as a qualitative field study conducted at SDN 04 Tegalombo, the methodological design is consistent with the nature of the findings presented. The study does not aim for statistical generalization but provides contextualized and analytically grounded insights into how a digital-based deep learning model can facilitate the integration of IPAS and Islamic Education in public elementary schools.

RESULTS AND DISCUSSION

Integration of IPAS and Islamic Education within a Deep Learning Framework

The findings indicate that integration is most effective when instruction is structured around authentic problems linking scientific concepts with ethical and religious values. Classroom observations at SDN 04 Tegalombo showed that when teachers introduced IPAS topics through contextual issues such as local environmental cleanliness or responsible resource use, students were more actively engaged in discussion and inquiry. The digital-based deep learning stages problem orientation, inquiry, collaboration, reflection, and value internalization were implemented sequentially, allowing students to explore scientific concepts while simultaneously reflecting on their ethical implications. During observed lessons, students were guided to analyze environmental problems and relate them to Islamic teachings about stewardship (khalifah).

From a conceptual standpoint, these findings demonstrate that structured sequencing of inquiry and reflection constitutes the core mechanism enabling interdisciplinary integration. Empirically, the classroom data show observable engagement patterns and dialogical interaction between scientific reasoning and ethical discourse. Interpretatively, this suggests that integration is not merely thematic juxtaposition but operates as a pedagogical design principle in which epistemic and moral dimensions are intentionally interconnected. This distinction clarifies that the study does not only report improved engagement but identifies a conceptual instructional structure that systematically bridges IPAS and Islamic Education.

Interview data with teachers further reinforced this finding. One teacher stated that students "more easily understand IPAS concepts when they are connected to religious values they already know." Students also reported that learning felt "more meaningful" because they could see how science relates to daily life and religious practice. IPAS topics such as environmental conservation, social interaction, and natural resource management were contextualized through Islamic ethical principles, enabling students to construct conceptual understanding while engaging in structured moral reflection. This integration reduced subject fragmentation and fostered holistic comprehension.

Conceptually, these findings support the proposition that value integration becomes effective when embedded within inquiry-driven conceptual exploration rather than delivered as supplementary moral commentary. The novelty of the study lies in articulating this process as a coherent deep learning based integration model, rather than describing isolated classroom practices.

Cognitive Development Outcomes

The results reveal measurable support for higher-order thinking skills, particularly analysis, evaluation, and problem-solving. Classroom observations indicated that students participated in inquiry-based digital activities, including observing simulation videos, formulating hypotheses about

environmental changes, interpreting simple data sets, and presenting conclusions in collaborative groups. Compared to conventional lecture-based sessions previously observed, students asked more analytical questions and demonstrated stronger reasoning when explaining cause-and-effect relationships.

At the level of conceptual findings, these data indicate that inquiry-based digital tasks function as catalysts for analytical reasoning within IPAS content. Interpretatively, the integration of ethical reflection appears to deepen cognitive processing by situating scientific reasoning within meaningful contexts. Rather than treating value discourse as an external addition, the instructional model embeds it within analytical processes, thereby expanding the cognitive scope of learning.

Teacher interviews confirmed noticeable improvements in students' ability to articulate arguments and justify conclusions. One teacher explained that students "no longer simply memorize definitions but try to explain why a phenomenon occurs." Additionally, students demonstrated improved conceptual retention when IPAS learning was linked to religious values and real-life contexts. For instance, when discussing water conservation alongside Islamic teachings on avoiding waste (*israf*), students were able to recall both the scientific principles and the moral reasoning in follow-up discussions. This suggests that integrative deep learning enhances both cognitive processing depth and long-term understanding.

Conceptually, this finding supports the model's claim that cognitive and ethical reasoning can be co-constructed through aligned instructional design. The study therefore contributes not only evidence of improved higher-order thinking but also a theoretical explanation of how interdisciplinary value integration reinforces conceptual retention.

Affective Development and Value Internalization

The findings show increased learning motivation, responsibility, collaboration, and moral awareness among students. Observational data revealed higher levels of participation during group discussions and digital collaborative tasks. Students displayed greater accountability in completing assignments and showed respect during peer interactions. Reflective sessions at the end of lessons provided opportunities for students to articulate what values they learned alongside scientific concepts. As a conceptual finding, value internalization emerged most clearly when reflection was structured as part of the inquiry cycle. Interpretatively, this suggests that affective development is strengthened when students experience moral reasoning as a lived component of problem-solving rather than as abstract instruction. The integration model thus positions ethical reflection as a pedagogical stage equivalent in importance to inquiry and collaboration.

Interviews with teachers indicated that value internalization occurred more naturally when embedded within problem-solving activities rather than delivered through normative instruction alone. Teachers observed that students demonstrated behaviors reflecting honesty, cooperation (*ta'awun*), and responsibility (*amanah*) during collaborative tasks. Students themselves expressed that discussing Islamic values within IPAS lessons helped them "understand why they should care about the environment." These findings suggest that experiential and contextual learning facilitated authentic affective development rather than superficial value transmission. The novelty of this study is evident in conceptualizing affective and spiritual growth not as parallel outcomes but as structurally integrated within the same deep learning sequence that fosters cognitive development.

Role of Digital Technology in Supporting Deep Learning

Digital tools supported visualization of abstract concepts, simulation of natural phenomena, and collaborative inquiry processes. During classroom observations, interactive multimedia presentations and simple simulations helped students better understand abstract IPAS concepts, such

as environmental cycles and social systems. Students appeared more attentive and engaged when digital media were integrated into inquiry tasks compared to traditional textbook-based instruction.

Conceptually, digital technology functioned as an enabling medium rather than the core driver of integration. The findings indicate that its primary role was to facilitate exploration, visualization, and dialogue within the inquiry-reflection cycle. Interpretatively, this reinforces the argument that pedagogical alignment not technological novelty is the determining factor in successful interdisciplinary integration. However, interviews with teachers emphasized that technology effectiveness depended heavily on instructional design. Teachers noted that digital tools were most impactful when integrated into structured inquiry and reflective activities, rather than used merely for presentation purposes. When technology was aligned with learning objectives and value discussions, it enhanced both cognitive engagement and collaborative interaction. This finding indicates that pedagogical alignment, rather than technological sophistication alone, determines the success of digital-based deep learning.

Reliability and Analytical Validity of Findings

Reliability was strengthened through systematic thematic analysis and triangulation between literature synthesis and contextual observations at SDN 04 Tegalombo. Observational findings consistently aligned with patterns identified in the reviewed literature, particularly regarding interdisciplinary integration and deep learning processes. Data from interviews, classroom observations, and documentation analysis were compared to ensure consistency and minimize interpretive bias.

Furthermore, repeated observation sessions showed similar instructional patterns and student responses, increasing confidence in the stability of findings. Teachers' statements during interviews corroborated observational data, especially concerning improvements in student engagement and reasoning ability. The convergence between theoretical synthesis and empirical classroom evidence reinforces the analytical validity of the study and supports the robustness of the proposed integrative instructional model.

Importantly, beyond empirical confirmation, the reliability process also strengthens the study's contribution as a conceptual model. By consistently distinguishing observable classroom patterns (empirical findings) from interpretative explanation (theoretical implications), the research establishes a structured framework for integrating IPAS and Islamic Education within a deep learning orientation. This conceptual clarity constitutes the primary novelty of the study: the formulation of a coherent, pedagogically grounded model for Islamic education integration in public elementary school contexts.

DISCUSION

The results of this study demonstrate that the integration of IPAS and Islamic Education through a digital-based deep learning model at SDN 04 Tegalombo contributes significantly to students' cognitive and affective development. Field observations showed increased student engagement, analytical participation, and reflective dialogue when scientific topics were connected with Islamic values. Teacher interviews confirmed improvements in students' reasoning abilities and moral awareness. When analyzed in relation to previous theories and empirical studies, these findings both confirm and extend existing interdisciplinary and deep learning frameworks.

Integration of IPAS and Islamic Education within a Deep Learning Framework

Field findings indicate that integration is most effective when instruction is structured around authentic problems connecting scientific concepts with ethical and religious values. Classroom observations revealed that students demonstrated stronger conceptual connections when environmental topics were discussed alongside Islamic principles such as stewardship (*khalifah*). This practical implementation supports Beane's argument that interdisciplinary integration reduces subject fragmentation and enhances meaningful learning (Harvie, 2020). The empirical evidence shows that integration operates not only at curriculum level but within actual cognitive engagement processes.

Compared to Drake & Reid who primarily emphasize curriculum integration conceptually, this study demonstrates procedural integration through structured deep learning stages problem orientation, inquiry, collaboration, reflection, and value internalization (Drake & Reid, 2018). Field data show that these stages function as operational mechanisms translating interdisciplinary theory into classroom practice. Furthermore, consistent with Schmidt et al., digital tools strengthened engagement and conceptual coherence (Anand & Singh, 2025). However, this study advances prior research by analytically showing how value-based reflection becomes embedded within inquiry processes rather than treated as a separate instructional component.

Cognitive Development Outcomes

Classroom observations revealed that students actively engaged in hypothesis formulation, data interpretation, and analytical discussions during digital inquiry activities. These behaviors reflect higher-order cognitive processes aligned with Bloom's revised taxonomy, particularly at the levels of analysis (C4) and evaluation (C5). To ensure that claims of cognitive development were not merely descriptive, the study employed an observational rubric adapted from higher-order thinking indicators, including: (1) the ability to formulate causal hypotheses, (2) accuracy in interpreting simple data representations (tables, simulations, visual cycles), (3) capacity to justify conclusions with evidence, and (4) frequency of analytical questioning during discussion. Across repeated sessions, most students demonstrated progression from descriptive responses ("what happens") toward explanatory reasoning ("why it happens" and "what evidence supports it").

Document analysis of student worksheets further indicated improvement in structured reasoning. In early observations, responses tended to restate textbook definitions. In subsequent sessions within the deep learning sequence, student answers increasingly included causal explanations and reference to observed data from digital simulations. Teachers also reported noticeable differences in students' ability to articulate arguments orally, particularly in explaining environmental cause-and-effect relationships. These classroom-based indicators provide qualitative but systematic evidence of cognitive growth rather than relying solely on general impressions.

This finding confirms Wale & Bishaw, (2020) who reported that digital inquiry-based learning improves critical thinking skills. It is further supported by international evidence. Guided inquiry approaches produce significant gains in conceptual understanding and reasoning compared to traditional instruction (Utaminingsih, 2022). Similarly Gomez, (2025) that structured scaffolding in inquiry-based learning significantly enhances students' higher-order cognitive performance. Moreover, Shi., (2020) that digital learning environments improve cognitive engagement when aligned with active learning strategies. The field data in this study therefore empirically reinforce and contextualize these international findings within Indonesian elementary education.

However, this study extends constructivist theory by demonstrating that conceptual retention improved when IPAS content was connected to students' religious beliefs. Evidence of retention was observed through follow-up questioning sessions conducted several days after instruction, in which

students were able to accurately recall both scientific principles and their associated ethical reasoning (Alhabib, 2021). For example, when prompted about water conservation, students not only explained evaporation and water cycles but also articulated the concept of avoiding waste (*israf*) as a moral rationale. The dual recall of scientific explanation and ethical justification indicates strengthened cognitive schema integration.

Analytically, these findings suggest that ethical integration does not dilute cognitive rigor but may enhance schema consolidation and retrieval pathways. By specifying observable indicators hypothesis quality, evidence-based reasoning, analytical questioning frequency, and retention in delayed recall the study provides a clearer evaluative framework for understanding higher-order thinking development within an integrative deep learning model. Thus, the claim of cognitive improvement is grounded in structured classroom evidence and supported by international empirical research rather than general theoretical alignment alone.

Affective Development and Value Internalization

Observational data showed increased collaboration, responsibility, and moral awareness during group-based digital tasks. Students practiced cooperation (*ta'awun*) and accountability (*amanah*) in completing inquiry assignments. This finding supports Dean, (2020), who argue that character education is most effective when embedded in experiential learning contexts. The classroom evidence demonstrates that value internalization occurs through structured practice rather than through normative transmission alone.

Beyond observable behaviors, deeper analysis indicates that affective development in this study aligns with foundational principles of Islamic character education. The integration of IPAS inquiry with Islamic ethical reflection reflects the concept of *tauhid* (the unity of knowledge under divine orientation), where scientific understanding is not separated from spiritual consciousness. When students analyzed environmental problems and connected them to their role as *khalifah* (stewards of the earth), their motivation appeared grounded not only in task completion but also in spiritual responsibility. This suggests that affective engagement was strengthened by a transcendent moral framework rather than by external behavioral control.

From the perspective of *adab* (proper conduct rooted in moral discipline), students' collaborative behaviors respectful dialogue, shared responsibility, and honesty in reporting findings demonstrate the embodiment of ethical norms within academic activity. Islamic educational thought emphasizes that knowledge must lead to right action (*'ilm* accompanied by *amal*). In observed sessions, moral awareness was expressed not merely in verbal reflection but in disciplined participation and mutual accountability during inquiry tasks. This reflects a shift from declarative moral knowledge toward enacted moral practice.

Additionally, the findings respond to Durlak, (2022), who note that affective outcomes are often treated as secondary to cognitive achievement. In contrast, this study demonstrates that affective development can be systematically integrated within academic instruction through a spiritually grounded framework. When ethical reflection was embedded into scientific inquiry, students articulated not only environmental facts but also spiritual reasons for environmental care. This dual articulation indicates internalization at both cognitive and affective levels.

From a moral development perspective, the integration model facilitates movement from externally imposed norms toward internally regulated values. Rather than obeying rules because the teacher instructs them to do so, students expressed understanding of *why* environmental responsibility matters within their religious worldview. This reflects an internal motivational shift consistent with

Islamic spirituality (*ruhiyah*), where actions are oriented toward accountability before God as well as social responsibility.

Thus, the affective outcomes observed motivation, collaboration, moral awareness, and responsibility can be theoretically situated within the interconnected Islamic concepts of *tauhid* (unity of knowledge and faith), *adab* (ethical conduct in learning), and spirituality (inner moral consciousness). By embedding these dimensions within structured inquiry, the instructional model demonstrates that deep learning encompasses intellectual growth and spiritual-moral formation simultaneously. This analytical strengthening clarifies that value internalization in the study is not incidental but grounded in a coherent Islamic education framework.

Role of Digital Technology in Supporting Deep Learning

Field observations confirmed that digital tools enhanced visualization of abstract IPAS concepts and increased student engagement. In the observed classrooms, teachers utilized interactive PowerPoint presentations, short simulation videos (e.g., environmental cycle animations accessed via YouTube Edu), and simple web-based quizzes through platforms such as Google Forms and Quizizz to guide inquiry stages. In several sessions, WhatsApp groups were also used to distribute reflective questions and facilitate follow-up discussion outside classroom hours. These tools supported students in observing environmental processes, interpreting visual data, and collaborating in small-group analysis. Technology-enhanced learning environments promote deeper understanding and learner autonomy when integrated with active learning strategies (Duterte, 2024). Students responded positively to simulations and multimedia presentations that facilitated conceptual exploration, particularly when visualizing abstract processes such as water cycles, ecosystem balance, and social interaction patterns.

More specifically, interactive multimedia allowed students to pause, replay, and analyze environmental phenomena step by step, which strengthened causal reasoning during hypothesis formulation. Quizizz-based formative assessments provided immediate feedback, enabling students to evaluate their own understanding before group reflection. In addition, teachers occasionally integrated short Islamic educational videos illustrating concepts such as *khalifah* (environmental stewardship) and amanah (responsibility), linking scientific discussion with ethical reflection. These concrete classroom practices demonstrate how digital tools functioned not merely as presentation media but as structured supports within inquiry and reflection cycles.

However, teacher interviews revealed that technology effectiveness depended heavily on instructional design and facilitation. Teachers noted that when PowerPoint slides were used only for delivering information, student engagement did not significantly differ from textbook-based instruction. In contrast, when multimedia resources were embedded within inquiry prompts such as asking students to predict environmental consequences before watching a simulation discussion quality improved substantially. This finding refines Redecker's, perspective by demonstrating that digital competence alone is insufficient to ensure deep learning outcomes; pedagogical orchestration remains central (Amzat, 2022).

Within the Indonesian elementary school context, where infrastructure and digital literacy levels vary, the study indicates that accessible and low-bandwidth tools (e.g., Google Classroom, WhatsApp, YouTube Edu, and locally developed Islamic learning videos) can effectively support deep learning when systematically integrated. The technology used in SDN 04 Tegalombo was relatively simple and widely available, suggesting that sophisticated platforms are not a prerequisite for meaningful innovation. Instead, alignment between digital media, inquiry stages (problem orientation, exploration, collaboration), and reflective value discussion determines effectiveness.

Analytically, the present study positions digital tools as mediating instruments within a pedagogically grounded framework. Technology becomes effective only when it supports structured inquiry, collaborative interaction, and value-based reflection. Thus, in the context of Indonesian public elementary schools, digital technology is not an independent solution but a pedagogical enabler that strengthens the integration of IPAS content and Islamic ethical education within a deep learning model.

Reliability and Analytical Validity of Findings

The reliability of the findings is strengthened through triangulation between literature synthesis, classroom observations, and teacher interviews. Patterns observed in field data consistently aligned with established interdisciplinary and deep learning research trends, supporting Darling-Hammond, (2020) regarding the effectiveness of student-centered and integrative approaches. Moreover, the analytical consistency across multiple data sources enhances theoretical validity. The study does not contradict previous research but refines and contextualizes it within Indonesian public elementary school settings. By demonstrating how digital-based deep learning bridges scientific knowledge and Islamic values, this research extends existing theories with contextual specificity and integrative depth.

The field findings suggest that integrative digital-based deep learning reduces subject fragmentation and curriculum overload, supporting interdisciplinary efficiency. Teachers reported that combining IPAS and Islamic Education within a unified framework streamlined lesson planning while enhancing student engagement. Compared to studies focusing solely on digital learning (Alenezi, 2023) or value education independently (Lickona, 2022), this research demonstrates the feasibility of combining both dimensions. The analysis indicates that cognitive rigor and character education can be developed simultaneously through structured deep learning processes. The novelty lies in empirically validating this integrative model within a public elementary school context, thereby contributing both theoretical refinement and practical applicability. From the discussion and findings above, they can be presented in the following table:

Table 1: Results and Discussion of the Integration of IPAS and Islamic Education through a Digital-Supported Deep Learning Model

No	Components	Result	Discussion
1	Integration of IPAS and Islamic Education within a Deep Learning Framework	IPAS and Islamic Education are structurally integrated through a digital-based deep learning model in which scientific inquiry stages (problem orientation, exploration, collaboration, reflection) are interconnected with Islamic value internalization.	Integration moves beyond thematic combination toward epistemic alignment between scientific reasoning and Islamic worldview (tauhid). Ethical reflection is embedded within inquiry, reducing subject fragmentation and fostering holistic development that unites intellectual competence and moral consciousness.
2	Cognitive Development Outcomes	Students demonstrate improvement in higher-order thinking skills (analysis, evaluation, problem-solving) and conceptual understanding of abstract IPAS topics.	Digitally supported inquiry learning strengthens knowledge construction and conceptual depth. Visualization tools and structured questioning promote analytical reasoning, while reflective dialogue connects empirical findings with ethical meaning.

3	Affective Development and Value Internalization	Students show enhanced motivation, responsibility (amanah), collaboration (ta'awun), moral awareness, and disciplined learning attitudes (adab).	Affective growth is linked to Islamic character education principles, including tauhid (awareness of divine accountability), adab (proper conduct in learning), and spirituality (intentionality and moral reflection). Values are internalized experientially through collaborative inquiry, reflection sessions, and guided discussion rather than through normative transmission.
4	Role of Digital Technology in Supporting Deep Learning	Digital tools such as interactive multimedia presentations, simulations, and Learning Management Systems (e.g., Google Classroom) enhance visualization, engagement, and collaborative inquiry in elementary classrooms.	Technology functions as a pedagogical mediator, not an independent solution. Its effectiveness depends on alignment with inquiry stages and reflective value discussions. When integrated with Islamic-oriented reflection and teacher facilitation, digital media supports both conceptual understanding and character formation within the Indonesian elementary school context.
5	Reliability and Analytical Validity of Findings	Findings are consistent across classroom observation, teacher interviews, student worksheets, and literature synthesis.	Thematic analysis and triangulation strengthen analytical validity. The convergence of empirical data and theoretical perspectives on deep learning and Islamic character education supports the robustness of the conclusions.
6	Educational Benefits and Practical Implications	The model supports holistic elementary education by balancing cognitive achievement, affective development, and spiritual awareness.	The framework offers practical guidance for teachers and schools in implementing integrative, value-based, and digitally supported instruction. It provides a scalable foundation for strengthening interdisciplinary and Islamic-oriented learning in public elementary education.

The table demonstrates that the integration of IPAS and Islamic Education through a digital-based deep learning model effectively addresses both cognitive and affective aspects of elementary students. Each component from interdisciplinary integration to digital technology utilization plays a critical role in creating a holistic learning environment. Cognitive outcomes are strengthened through inquiry-based and problem-oriented learning activities, while affective outcomes, including motivation, responsibility, collaboration, and moral awareness, are intentionally developed through reflective and value-oriented tasks. The findings highlight that meaningful learning occurs when academic content is linked with ethical and religious values, providing students with opportunities to internalize knowledge in a socially and spiritually relevant context.

Moreover, the analysis emphasizes the role of digital technology and teacher facilitation as enablers rather than substitutes for pedagogy, ensuring that learning is interactive, collaborative, and reflective. Reliability and analytical validity are reinforced through systematic literature synthesis and contextual classroom observations, confirming that the model is both theoretically grounded and practically applicable. The practical implications are significant: this framework offers a clear roadmap for teachers, schools, and policymakers to implement integrated, digital, and value-based learning that simultaneously fosters cognitive achievement, character development, and holistic student growth.

CONCLUSION

This study demonstrates that the integration of IPAS and Islamic Education through a digital-based deep learning model provides a coherent framework for fostering both cognitive development and Islamic character formation in Indonesian public elementary schools. The findings confirm that when inquiry stages problem orientation, exploration, collaboration, reflection, and value internalization are systematically aligned, interdisciplinary learning shifts from superficial thematic combination to structural integration. Scientific reasoning and Islamic ethical reflection operate as mutually reinforcing dimensions within a unified pedagogical design. The novelty of this research lies in formulating and empirically validating a conceptual instructional model that bridges IPAS and Islamic Education within a deep learning orientation. Unlike previous studies that treat digital learning, interdisciplinary integration, or value education separately, this study demonstrates how these elements can be operationalized within a single structured framework. Ethical reflection is positioned as an embedded stage within inquiry rather than as supplementary moral instruction, while digital technology functions as a pedagogical mediator that supports exploration, collaboration, and reflective dialogue instead of serving as an independent innovation driver.

Nevertheless, several methodological limitations should be acknowledged. The study was conducted in a single public elementary school context, which limits broader generalization across diverse Indonesian settings. Cognitive and affective outcomes were primarily derived from qualitative observation, worksheet analysis, and interviews rather than standardized quantitative measurement, and the observation period was limited to specific instructional cycles. Future research should employ quantitative or mixed-method approaches with longitudinal designs to measure sustained cognitive and moral development, as well as comparative studies across multiple schools to strengthen external validity. Further refinement of the model may explore integration with other subject areas, expansion of digital platforms, and experimental testing against conventional approaches to establish stronger causal evidence. Overall, this research contributes a theoretically grounded and practically applicable model for holistic, value-integrative learning in Indonesian elementary education.

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