



Managing Curriculum Reform: Integrating Science Literacy into Islamic Education and Character Instruction in SMAN 2 Palopo

Risna Sari¹, Firman², Dodi Ilham Mustaring³

¹Postgraduate Program, Universitas Islam Negeri Palopo, Indonesia

E-mail: 2305010028@uinpalopo.ac.id

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ABSTRACT

Curriculum reform becomes meaningful when broad policy expectations are translated into instructional resources that teachers and students can use in everyday learning. This study examines the integration of science literacy into Islamic Religious Education and Character Education at SMAN 2 Palopo through the development of a Grade XI learning module on fasting, piety, and health. The study employed a Research and Development design using the ADDIE stages of analysis, design, development, implementation, and evaluation, supported by qualitative and quantitative data. Needs were identified through observation and interviews with teachers and students. Product quality was assessed by material, media, and language experts; practicality was evaluated through teacher and student response questionnaires; and classroom effectiveness was examined through student learning outcomes during implementation with 20 Grade XI students. The findings show a strong need for contextual materials that connect Islamic teachings with scientific explanations and evidence-based reasoning. Expert validation reached 95% for content, 85% for language, and 70% for media, producing an overall validation mean of 83.33%. Teacher practicality reached 93.75%, while student practicality reached 80.25%. The class learning-outcome mean was 87.1, exceeding the school mastery threshold of 72 and falling within the study's very effective category. The developed module integrates religious values, health-related scientific phenomena, discussion, case analysis, reflection, and higher-order tasks. These findings indicate that curriculum reform in Islamic education can be operationalized through needs-based instructional design, expert quality assurance, and classroom-tested materials that align religious formation with scientific literacy.

Keywords: Curriculum Reform, Science Literacy, Islamic Religious Education, Character Education, Instructional Module.

INTRODUCTION

Curriculum reform is not completed when a new policy document is issued; it is realized when teachers can translate curricular intentions into coherent classroom

experiences. Contemporary education requires learning to respond to rapid scientific, technological, and social change while maintaining the values that shape learners' identities and conduct. In Islamic education, this requirement is particularly important because instruction is expected to develop religious understanding, moral character, and the capacity to interpret contemporary realities. The challenge is therefore not simply to add new content, but to manage the relationship between curriculum goals, instructional materials, teaching practices, and learner needs so that reform becomes visible at the level of everyday learning (Aripin et al., 2024; Ridwan & Maryati, 2024).

Islamic Religious Education and Character Education (Pendidikan Agama Islam dan Budi Pekerti) occupies a strategic position in Indonesian schools because it combines religious knowledge with the formation of values and conduct. Its learning outcomes include faith, worship, morality, and the application of Islamic principles in personal and social life. However, instructional practice may remain dominated by textual explanation and teacher-centered delivery, especially when teaching materials emphasize definitions, rules, and normative prescriptions without sufficient connection to students' contemporary experiences. Such conditions can reduce active participation and make religious content appear separate from the intellectual problems students encounter in other subjects and in daily life (Ammah, 2018; Permana & Fadriati, 2023).

Science literacy provides one pathway for addressing this separation. Scientific literacy is not limited to memorizing scientific facts; it involves using scientific knowledge to explain phenomena, evaluate questions and evidence, and make reasoned judgments in relevant contexts. The PISA science framework emphasizes the ability to explain phenomena scientifically, evaluate and design scientific inquiry, and interpret data and evidence scientifically (OECD, 2023). These competencies are educationally relevant beyond science classes because they cultivate habits of asking questions, examining evidence, and relating knowledge to real-world problems. Studies on science literacy also emphasize its role in critical thinking and the meaningful application of knowledge rather than the passive reception of information (Latif et al., 2022; Purnawati & Yakin, 2025).

Integrating science literacy into Islamic Religious Education does not require treating religious claims as scientific propositions. Rather, it can create structured opportunities for students to distinguish normative religious teachings from empirical explanations while exploring how both contribute to a more comprehensive understanding of human life. Research on the integration of religion and science in education has highlighted the potential of such approaches to reduce perceived disciplinary separation and to help learners connect religious meaning with observable phenomena (Murtadlo et al., 2023; Sari et al., 2025). In this study, the topic of fasting provides a particularly relevant context because it contains clear religious, moral, behavioral, and health dimensions that can be discussed without reducing one domain to the other.

The instructional context at SMAN 2 Palopo revealed a concrete need for such integration. Preliminary observations and interviews reported in the thesis showed that fasting was generally taught through its legal basis, requirements, and spiritual

purposes, while scientific explanations related to metabolism, physical health, mental balance, and evidence-based interpretation were not presented systematically. Teachers also indicated that existing materials did not sufficiently support science-literacy activities, while students expressed greater interest in discussion, real-life cases, illustrations, simple investigation, and contextual explanations. These conditions are consistent with the broader need for Islamic education to use learning strategies that encourage critical and reflective engagement rather than rely solely on conventional explanation (Parnawi, 2023).

The implementation of the Merdeka Curriculum further strengthens the need for contextual and student-centered materials. The curriculum gives teachers space to adapt instruction to learner characteristics and encourages learning activities that develop reasoning, independence, collaboration, and meaningful application. Nevertheless, curriculum flexibility can only produce instructional improvement when schools and teachers possess resources that convert general curricular expectations into structured learning sequences. From a curriculum-management perspective, this conversion process involves identifying needs, designing learning materials, assuring quality, testing usability, evaluating results, and revising products. The ADDIE model offers a systematic structure for managing these connected stages in instructional development (Sugiyono, 2019).

Previous development studies in Islamic education have produced materials based on sociocultural, literacy, multicultural, and character-oriented approaches. These studies demonstrate that Islamic Religious Education materials can be adapted to specific educational needs and values. Yet the available literature reviewed in the thesis shows limited attention to an empirically tested module that operationally integrates science-literacy indicators into the competency structure of Grade XI Islamic Religious Education and Character Education, particularly around fasting as both religious practice and health-related phenomenon. The gap is therefore not the absence of innovative materials in general, but the limited evidence on how science literacy can be systematically translated into Islamic education through a complete cycle of needs analysis, design, expert validation, classroom practicality, and effectiveness testing.

Accordingly, this study reframes the thesis development process as a form of curriculum reform management at the instructional-material level. It addresses five questions: (1) what instructional needs justify the integration of science literacy into Islamic Religious Education and Character Education at SMAN 2 Palopo; (2) how can those needs be translated into a structured Grade XI module; (3) to what extent is the developed module valid according to material, language, and media experts; (4) how practical is the module for teachers and students; and (5) what classroom learning outcomes are associated with its implementation? By answering these questions, the study seeks to explain how curriculum reform can move from policy expectations to a usable and empirically evaluated learning resource.

METHOD

This study employed Research and Development (R&D) using the ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation. The model was selected because the research aimed not only to describe an instructional problem but also to produce, revise, and evaluate a learning module that could be used in the classroom. The development process combined qualitative evidence from observations and interviews with quantitative evidence from expert validation, practicality questionnaires, and student learning outcomes. In this sense, the study used a mixed evidence base to inform successive product-development decisions rather than treating qualitative and quantitative components as separate studies (Sugiyono, 2019).

The research was conducted at SMAN 2 Palopo, South Sulawesi, Indonesia. The preliminary analysis involved Grade XI Islamic Religious Education and Character Education learning, with attention to the needs of teachers and students and the suitability of existing teaching materials. The research object was a science literacy-based instructional module for the topic of fasting, designed to connect Islamic values with relevant scientific explanations concerning health and human biological processes. The implementation stage involved 20 Grade XI students. Two Islamic Religious Education teachers participated in the practicality assessment, while product validation involved three experts representing content, language, and instructional media expertise.

During the Analysis stage, data were collected through classroom observation and semi-structured interviews. Teacher questions addressed learning methods and media, innovation, instructional constraints, science integration, and the need for an interactive module. Student questions explored perceptions of Islamic Religious Education, learning difficulties, experience with learning media, prior exposure to science integration, preferred learning models, and the need for science literacy-based materials. Curriculum analysis examined the alignment of the proposed module with Grade XI learning outcomes and with the Merdeka Curriculum's emphasis on student-centered, contextual, critical, and independent learning.

The Design and Development stages translated the needs analysis into a module structure. The module included learning identity, learning outcomes, objectives, user guidance, concept presentation, contextual examples, science-literacy activities, reflective tasks, group discussion, case analysis, project-oriented assignments, and evaluation. The topic of fasting was linked to scientific phenomena such as bodily processes during fasting, metabolism, physical and mental health, and patterns of healthy living. The module was visually designed using Canva, while the content structure was developed to allow both guided and relatively independent learning. Science-literacy elements were incorporated through explanation of phenomena, interpretation of evidence, analytical questioning, and contextual decision making.

Expert validation was conducted before classroom implementation. The material expert assessed curricular relevance, content accuracy, completeness, currency, and the integration of Islamic values with science literacy. The language expert assessed sentence clarity, word choice, readability, consistency of language style, spelling, and

punctuation. The media expert assessed layout, visual design, consistency, interactivity, navigation, and readability. Each instrument used a four-point rating scale. Validation percentages were calculated by dividing the obtained score by the maximum possible score and multiplying by 100. In the study's criteria, 63-80% was categorized as valid and 81-100% as very valid. Expert comments were also used to revise the product before implementation.

Practicality was assessed from both teacher and student perspectives. Two Islamic Religious Education teachers evaluated ten aspects of the module, including material clarity, alignment with objectives and learner characteristics, visual attractiveness, usability, completeness, and instructional benefit. Student practicality data were collected from the implementation group of 20 learners using a ten-item response questionnaire that examined the need for additional materials, visual appeal, support for critical thinking, opportunity for analysis and problem solving, religious and scientific motivation, reading and inquiry habits, interest, conceptual clarity, satisfaction, and independent use. The same percentage formula was used, with 81-100% categorized as very practical in the study's rubric.

Effectiveness was evaluated through classroom learning outcomes after the module was implemented. The thesis describes the effectiveness design in relation to pretest and posttest planning, while the reported classroom outcome is a composite score incorporating attitude (30%), knowledge (50%), and skills (20%). The class mean was compared with the school's *Kriteria Ketercapaian Tujuan Pembelajaran* (KKTP) threshold of 72. Under the study's effectiveness rubric, percentages of 81-100 were categorized as very effective. Because the source document does not provide a complete pretest score distribution, this article interprets effectiveness primarily from the documented class outcome and the predefined mastery criterion rather than claiming a causal effect size.

Evaluation occurred throughout the ADDIE cycle. Formative evaluation was used to revise the draft following expert comments and user feedback, including improvement of the cover, consistency of font type and size, and clearer instructions for evaluation tasks. Summative evaluation focused on the overall validity, practicality, and classroom performance of the final module. The analysis therefore treated product quality as multidimensional: a module was considered educationally usable only when its content was defensible, its presentation was understandable, users could operate it in realistic learning conditions, and student outcomes met the study's predefined criteria.

RESULT AND DISCUSSION

Result

1. Instructional Needs for Science Literacy Integration

The needs analysis showed a consistent gap between the intended direction of contemporary Islamic Religious Education and the materials used in Grade XI learning. Existing instruction on fasting emphasized religious definitions, legal requirements, conditions, pillars, and spiritual purposes. These elements were important, but they were commonly presented as textual information rather than as a starting point for inquiry,

interpretation, and contextual application. Teachers reported that scientific dimensions of fasting, including bodily metabolism, physical health, mental balance, and the relation between behavior and well-being, were not integrated systematically into the learning materials.

Students expressed a corresponding need for learning experiences that were more connected to observable life. They indicated that discussion, projects, real-life cases, simple investigations, and scientific explanations would make Islamic Religious Education more interesting and easier to understand. Their responses suggested that the problem was not rejection of religious content, but the limited opportunity to connect it with questions they could examine through logic, evidence, and everyday experience. Teachers likewise supported the development of a module that could combine Islamic values, science-literacy activities, reflection, and higher-order questions.

Curriculum analysis reinforced these findings. The Merdeka Curriculum expects learning to support faith and character while also strengthening critical reasoning and learner independence. The fasting topic offered a direct opportunity to connect these dimensions because it contains spiritual discipline, self-control, ethical conduct, social empathy, and health-related phenomena. The needs analysis therefore identified science literacy not as an additional subject inserted into Islamic education, but as a learning approach that could make the existing topic more contextual and intellectually active.

Table 1
Summary of Needs Analysis and Curriculum Implications

Needs Dimension	Empirical Evidence	Curriculum Implication
Current learning materials	Fasting was mainly presented through normative and textual explanations of law, requirements, pillars, and spiritual meaning.	Materials needed stronger contextualization and inquiry-oriented activities.
Science integration	Health, metabolism, bodily processes, and evidence-based explanations were not presented systematically.	Scientific phenomena should be connected to the existing religious topic without replacing its normative meaning.
Student learning preferences	Students favored discussion, real-life cases, projects, illustrations, and explanations linked to daily experience.	The module should increase active participation and contextual reasoning.
Teacher needs	Teachers requested support for science-literacy activities, reflection, case analysis, and higher-order assessment.	The product should be teacher-usable, structured, and compatible with active learning.

Needs Dimension	Empirical Evidence	Curriculum Implication
Curriculum alignment	Merdeka Curriculum emphasizes faith, character, critical reasoning, independence, and contextual learning.	The module should translate these outcomes into a coherent Grade XI learning sequence.

2. Translating Curriculum Expectations into Module Design

The design stage converted the identified needs into a structured learning module for the topic of fasting as a practice that forms piety and supports health. The module began with clear learning outcomes and objectives, followed by user guidance, concept explanations, contextual scientific information, student activities, reflection, and evaluation. Its central design principle was epistemic integration: religious values were retained as the normative foundation of the topic, while scientific literacy was used to help students examine health-related phenomena, evidence, and real-life implications.

The learning sequence moved beyond reading and answering conventional questions. Students were invited to discuss the relation between fasting and bodily processes, analyze health-related cases, interpret information, reflect on self-control and healthy behavior, and complete simple tasks that connected religious practice with responsible decision making. Activities were designed for both individual and group work so that the module could support self-directed learning while still allowing teacher guidance.

Visual revision also became part of the design process. The original draft used a general cover, inconsistent font treatment, and incomplete evaluation instructions. Expert feedback led to a cover that more clearly represented the fasting theme, standardized typography, and clearer task directions. These changes show that curriculum translation required attention not only to conceptual content but also to the communicative quality of the material.

Table 2

Comparison of Conventional Material and the Developed Module

Aspect	Previous Material	Developed Module
Learning objectives	Emphasized basic conceptual understanding of fasting.	Integrated understanding of fasting with piety, healthy living, and science-literacy reasoning.
Content	Focused mainly on cognitive and normative aspects such as definition, law, requirements, and pillars.	Combined cognitive, affective, and skills dimensions with relevant health and biological explanations.
Science connection	Scientific concepts were limited or absent.	Connected fasting with health, metabolism, bodily balance, and evidence-based discussion.

Aspect	Previous Material	Developed Module
Student activity	Primarily reading and answering questions.	Included discussion, contextual analysis, reflection, case work, and simple project-oriented tasks.
Value integration	Islamic values were often presented separately from scientific contexts.	Islamic values and science-literacy activities were explicitly linked within the learning sequence.
Assessment	Focused on content recall.	Included structured evaluation and higher-order tasks related to interpretation and application.

3. Expert Validation and Product Quality Assurance

Expert validation demonstrated that the module met the study's minimum quality requirements across content, language, and media dimensions. The material expert awarded 95%, categorized as very valid. This result indicates strong alignment with Grade XI learning outcomes, appropriate depth and organization of the fasting material, and a convincing integration between Islamic Religious Education and science literacy. The language expert awarded 85%, also categorized as very valid, reflecting good readability, word choice, sentence construction, and conformity with language conventions.

The media expert awarded 70%, categorized as valid rather than very valid. This was the lowest validation score and identified presentation as the principal area requiring refinement. Comments focused on the relevance of the cover, consistency of fonts and sizes, and clarity of evaluation instructions. The research process used these comments formatively, revising the product before classroom use. The mean across the three validation domains was 83.33%, placing the overall module in the very valid category under the study's criteria.

The distribution of scores is important because it prevents product quality from being reduced to a single average. The high content score shows that the conceptual foundation of the module was strong, while the lower media score demonstrates that a substantively appropriate product can still require significant visual and navigational improvement. The validation stage therefore functioned as quality assurance rather than as a ceremonial approval process.

Table 3
Expert Validation Results

Validation Domain	Score	Percentage	Category	Main Quality Signal
Material/content	19/20	95%	Very valid	Strong curricular alignment, content accuracy, completeness, and integration of science literacy.

Validation Domain	Score	Percentage	Category	Main Quality Signal
Language	17/20	85%	Very valid	Good readability, terminology, sentence clarity, and language consistency.
Media	14/20	70%	Valid	Usable presentation, but visual consistency and task instructions required revision.
Overall mean	-	83.33%	Very valid	The module was eligible for classroom testing after revision.

4. Practicality and Classroom Implementation

The implementation stage showed that the module could be used in a real Grade XI classroom with limited operational difficulty. Twenty students used the module during learning with teacher guidance. Observation described generally positive participation: students read the material, discussed the relationship between Islamic teachings and scientific explanations, completed activities, and responded to contextual tasks. The module therefore functioned as a learning resource rather than merely as a supplementary text.

Teacher practicality reached 93.75%, a very practical rating. The two Islamic Religious Education teachers judged that the module clarified instructional steps, supported material delivery, matched Grade XI learning needs, and helped organize activities and evaluation. This high rating suggests that the module reduced rather than increased the teacher's organizational burden, which is important when new curriculum expectations are introduced through classroom materials.

Student practicality reached 80.25%. Although the thesis categorizes this result as very practical, the item-level distribution provides a more nuanced picture. The highest indicator reached 90%, while several items were in the 88.75% range; lower indicators were approximately 71-75%. Students generally reported that the module was understandable, interesting, and helpful for connecting concepts with scientific phenomena, while some aspects of motivation, presentation, or independent use still offered room for improvement. The overall pattern nevertheless showed sufficient acceptance for routine classroom use.

Table 4

Practicality Results from Teachers and Students

User Group	Participants	Practicality Result	Study Category	Interpretation
Teachers	2 Islamic Religious Education teachers	93.75%	Very practical	The module was easy to organize and supported delivery, activities, and evaluation.

User Group	Participants	Practicality Result	Study Category	Interpretation
Students	20 Grade XI students	80.25%	Very practical	The module was generally understandable, engaging, contextual, and usable in classroom learning.
Student item range	20 Grade XI students	Approximately 71.25%-90%	Practical to very practical	Some components were stronger than others, indicating specific opportunities for refinement.

5. Classroom Effectiveness and Learning Outcomes

The documented classroom outcome showed a mean score of 87.1 across the 20 students. The assessment combined attitude, knowledge, and skills with weights of 30%, 50%, and 20%, respectively. The school KKTP threshold was 72, meaning that the class mean exceeded the expected level of learning attainment. Under the study's effectiveness criteria, 87.1 was interpreted as very effective.

The result should be interpreted carefully. The thesis describes the use of pretest and posttest instruments in the effectiveness design, but the reported results table provides the final composite class scores rather than a complete pretest distribution or an inferential test of change. Therefore, the most defensible conclusion is that students achieved a high level of documented attainment after using the module and that the learning process met the study's predefined criterion. The evidence supports classroom effectiveness in terms of achieved outcomes, but it does not establish a causal effect size or long-term impact.

Qualitative observations complement this result. Students were more actively involved in discussing health-related phenomena, linking religious teachings to scientific explanations, and completing analytical tasks. This pattern suggests that the module's effectiveness was not limited to test completion; its design also created a more participatory learning process. Nevertheless, future research would need a stronger experimental or quasi-experimental design to determine how much of the observed outcome can be attributed specifically to the module.

Table 5
Summary of Classroom Effectiveness Evidence

Indicator	Documented Result	Criterion/Benchmark	Interpretation
Number of students	20	Implementation group	Small-scale classroom trial.
Assessment composition	Attitude 30%; knowledge 50%; skills 20%	Composite classroom assessment	Learning outcomes covered more than factual recall.

Indicator	Documented Result	Criterion/Benchmark	Interpretation
Class mean	87.1	School KKTP = 72	Mean achievement exceeded the school mastery threshold.
Study effectiveness category	87.1% of maximum scale	81-100 = very effective	The module met the study-defined effectiveness criterion.
Causal inference	Not tested with a reported inferential comparison	No effect-size benchmark available	Results support attainment after use, not a causal effect estimate.

DISCUSSION

1. Managing Curriculum Reform through Needs-Based Instructional Translation

The first contribution of the study lies in showing that curriculum reform can be managed at the level of instructional translation. Policy language about contextual learning, critical reasoning, character, and learner independence is broad by design; teachers still need concrete resources that organize these expectations into objectives, content, activities, and assessment. The needs analysis at SMAN 2 Palopo identified a mismatch between the curricular direction and the dominant form of existing materials. Rather than treating that mismatch as a deficiency of teachers or students, the development process treated it as a design problem that could be addressed through a structured product-development cycle.

This interpretation is consistent with arguments that Islamic education must respond to changing competence demands without losing its normative foundation (Aripin et al., 2024). It also aligns with integrative conceptions of Islamic Religious Education and Character Education that emphasize the relationship among knowledge, values, behavior, and lived context (Permana & Fadriati, 2023). The developed module translated this principle into a specific learning topic by retaining the religious meaning of fasting while adding opportunities for students to investigate health-related phenomena and reason about evidence.

The significance for educational administration and curriculum management is that reform depends on intermediate structures between policy and classroom practice. A curriculum document alone cannot determine how a particular concept will be explained, what evidence students will examine, or how teachers will sequence discussion and reflection. Needs-based instructional materials perform this mediating function. In the present study, the module became a practical mechanism for aligning school-level teaching with the broader direction of curriculum reform.

2. Science Literacy as an Integrative Pedagogical Framework

The second contribution concerns the role of science literacy in Islamic education. The study did not simply add scientific facts about fasting to a religious lesson. Its stronger design feature was the use of science-literacy processes to organize how

students engaged with the topic. Scientific literacy involves explaining phenomena, evaluating questions and investigation, and interpreting evidence in context (OECD, 2023). These competencies are compatible with religious education when they are used to examine empirical aspects of human experience while religious texts and values continue to provide the normative and ethical frame.

This distinction is important because integration can become conceptually weak when scientific information is used only as decoration or when religious claims are presented as if they were laboratory conclusions. The module instead created a division of intellectual labor: Islamic teachings explained the spiritual and moral meaning of fasting, while scientific reasoning helped students examine physiological and health-related phenomena. Research on religion-science integration similarly argues for educational approaches that connect domains without assuming that they are identical (Murtadlo et al., 2023; Sari et al., 2025).

The approach also corresponds with research emphasizing that science literacy supports critical thinking, the evaluation of information, and the application of knowledge in everyday life (Latif et al., 2022; Purnawati & Yakin, 2025). These competencies are especially relevant in a digital information environment where students encounter health claims, religious messages, and scientific assertions from sources of varying quality. By connecting fasting with evidence-based discussion, the module gave students an opportunity to practice intellectual responsibility while remaining within an Islamic education context.

The result therefore expands the meaning of literacy in Islamic education. Literacy is not limited to reading religious texts correctly or knowing scientific terms. It also involves the capacity to interpret, question, connect, and apply knowledge responsibly. This makes science literacy a pedagogical framework for deepening, rather than displacing, the reflective character of religious learning.

3. Expert Validation and Practicality as Conditions for Sustainable Implementation

The validation and practicality results demonstrate that curriculum innovation requires both conceptual quality and operational usability. The content score of 95% confirms that the module's strongest dimension was its curricular and substantive construction. The language score of 85% indicates that the conceptual integration was communicated at an appropriate level for Grade XI. By contrast, the media score of 70% shows that presentation quality remained the most vulnerable component. This pattern is instructive: a pedagogically promising product can fail in use if learners cannot navigate it easily or if visual inconsistencies reduce clarity.

R&D methodology treats expert judgment as an iterative mechanism for identifying such weaknesses before broader implementation (Sugiyono, 2019; Muthoharoh et al., 2025). The revisions to the cover, typography, and task instructions illustrate how expert review can improve the communicative interface between curriculum content and users. The process also reflects the principle that a learning module should be self-instructional, coherent, adaptable, and user friendly (Daryanto, 2013).

The practicality evidence is equally important. Teacher practicality of 93.75% suggests that the module fit existing instructional work rather than demanding a separate parallel system. Student practicality of 80.25% indicates broad acceptance, although the lower item scores warn against assuming uniform enthusiasm across all features. In curriculum implementation, this distinction matters because sustainable adoption depends on whether a resource is sufficiently convenient and meaningful for repeated use. A material that is theoretically excellent but difficult to operate is unlikely to become part of routine teaching.

From a management perspective, validation and practicality can be viewed as two forms of implementation risk control. Expert validation reduces the risk of conceptual or technical error, while user testing reduces the risk that a product will be rejected or used inconsistently. The combination of both processes helps transform curriculum innovation from an individual creative product into a more accountable instructional resource.

4. Constructivist Learning and the Interpretation of Effectiveness

The class mean of 87.1 provides evidence that students achieved the study's expected learning standard after implementation. The module's design can be interpreted through a constructivist perspective because students were asked to connect prior religious knowledge with new scientific information, discuss contextual problems, interpret phenomena, and reflect on their own practice. Constructivist learning emphasizes that knowledge is actively built through interaction, experience, and cognitive reorganization rather than simply transferred from teacher to learner (Piaget, 1969). Studies in Islamic education have likewise reported that constructivist approaches can strengthen participation and critical engagement (Muhibbin & Hidayatullah, 2020; Latifah et al., 2024).

The learning tasks also correspond with Bloom's view that educational outcomes extend beyond recall toward understanding, application, and analysis (Bloom, 1956). By combining conceptual explanations with case analysis, reflection, and evidence-oriented questions, the module created opportunities for higher-level cognitive activity. The assessment design further recognized attitude and skills in addition to knowledge, which is appropriate for Islamic Religious Education and Character Education because learning outcomes in this field cannot be reduced to factual memory.

At the same time, the evidence does not justify a strong causal claim. The source reports a high final class mean and identifies the module as very effective, but it does not provide the complete comparative statistics needed to estimate learning gain attributable to the intervention. This limitation should be treated as a methodological boundary rather than ignored. The study establishes feasibility, high attainment, and positive user response in a small-scale setting. A future quasi-experimental study with pretest-posttest data, a comparison group, and direct measures of science-literacy competencies would provide stronger evidence of impact.

This cautious interpretation strengthens the article's relevance for educational leadership. Decisions to scale an instructional innovation should distinguish between evidence that a product can work in one setting and evidence that it will produce the

same effects across settings. The present module has passed an important first level of evidence - validity, practicality, and satisfactory classroom attainment - but broader implementation should be accompanied by further evaluation.

5. Implications for School-Level Curriculum Leadership

Although the study did not directly investigate the behavior of principals or curriculum leaders, its findings generate clear implications for school-level curriculum management. First, schools need mechanisms for identifying gaps between curriculum expectations and available teaching resources. The needs analysis in this study exposed a specific gap that would have remained hidden if implementation were assessed only through lesson completion. Curriculum leadership therefore requires attention to the quality of materials that mediate between policy and teaching.

Second, schools can support cross-disciplinary collaboration when a topic legitimately spans more than one knowledge domain. The fasting module required accurate religious content and responsible treatment of health-related scientific concepts. Future implementation could benefit from collaboration between Islamic Religious Education teachers and science teachers so that students encounter disciplinary connections without sacrificing conceptual accuracy. This recommendation follows the thesis's broader call for schools to provide adequate learning facilities and support innovative materials aligned with learner characteristics and the Merdeka Curriculum.

Third, innovation should be accompanied by quality assurance and professional learning. The media validation score of 70% demonstrates that teachers who develop materials may need support in visual communication, instructional design, and user testing in addition to subject knowledge. School management can facilitate peer review, small-scale trials, and revision before new materials are adopted more widely. Such processes make curriculum reform cumulative and organizational rather than dependent on isolated individual effort.

Finally, the study suggests that curriculum reform in values-based subjects can remain faithful to disciplinary identity while becoming more responsive to contemporary competence demands. Integrating science literacy did not require changing the religious objectives of fasting instruction; it changed how students were invited to understand, question, and apply the material. This is a useful principle for curriculum leadership: meaningful reform often depends less on adding content than on redesigning the relationships among objectives, evidence, activities, and assessment.

CONCLUSION

This study demonstrates that the integration of science literacy into Islamic Religious Education and Character Education at SMAN 2 Palopo can be managed through a systematic instructional-development process. The needs analysis identified a gap between predominantly normative-textual fasting materials and the Merdeka Curriculum's expectation for contextual, critical, and student-centered learning. The ADDIE process translated that gap into a Grade XI module that connected Islamic values with health-related scientific phenomena through discussion, case analysis,

reflection, project-oriented tasks, and structured assessment. Expert validation produced 95% for material, 85% for language, and 70% for media, with an overall mean of 83.33%. Practicality reached 93.75% among teachers and 80.25% among students. The implementation group of 20 students achieved a class mean of 87.1, exceeding the school KKTP threshold of 72 and meeting the study's very effective criterion. These findings indicate that curriculum reform becomes operational when policy goals are converted into validated and user-tested instructional resources rather than remaining at the level of formal curriculum statements.

The study is limited by its single-school setting, small implementation group, focus on one Islamic Religious Education topic, and the absence of a fully reported comparative pretest-posttest analysis. The media validation score also indicates that visual and navigational refinement should continue. Future research should test the module across multiple schools, use stronger comparative designs, measure science-literacy competencies directly, and examine longer-term effects on critical reasoning, religious attitudes, and healthy behavior. For practice, Islamic Religious Education teachers can use the module as an alternative resource for fasting instruction, while schools should support collaborative material development, instructional-design capacity, and systematic review so that curriculum innovation remains accurate, practical, and sustainable.

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