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Supporting Students' Scientific Literacy Skills Through an Experimental KIT Module Based On Al-Quran Studies

Ahmad Zohdi[1*], Azmar[2]

[1] Early Childhood Education, Faculty of Tarbiyah and teacher training, Universitas Islam Negeri Mataram, Indonesia.
[2] Physics Education, Faculty of Tarbiyah and teacher training, Universitas Islam Negeri Mataram, Indonesia.

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Corresponding Author:
Ahmad Zohdi
ahmadzohdi@uinmataram.ac.id

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Abstract: The transition from industry 4.0 to 5.0, the transformation of education into a worldwide challenge that emphasizes students' scientific literacy abilities in preparation for the future workforce. To promote scientific literacy, learning resources that support student abilities are required. In constructing an experimental physics KIT based on Al-Qur'an studies with the primary goal of enhancing students' scientific literacy, integrating students' spiritual values and scientific understanding is, thus, a central concern. The research design employed was the 4D Model (Definition, Design, Development, and Deployment), with a sample of Tadris Physics students enrolled in the fifth semester at UIN Mataram. Validity analysis, usability analysis, and effectiveness analysis are the techniques utilized for analysis. During the assessment, 83.33 percent of students demonstrated mastery of classical skills, classified as highly proficient. As a form of mastery learning, the test results indicate that developing experimental KIT modules based on Al-Qur'an studies is highly beneficial in supporting students' scientific literacy skills. In addition, the module development learning materials can promote the achievement of psychomotor, cognitive, and spiritual outcomes for students.

Keywords: Al-Qur'an Studies; Experimental KIT; Module Development; Science Literacy.

Introduction

As a global challenge, the transformation of education during the transition from Industry 4.0 to 5.0 concentrates on integrating and synchronizing learning materials, processes, and goals with the outside world (world of work) by enhancing literacy (Bahtiar & Azmar, 2022; Tan et al., 2020; Zhao et al., 2017). The concept of literacy encompasses a range of competencies and knowledge that are essential for individual proficiency. These competencies are integrated with students' factual context, enhancing reading skills, scientific understanding, cultural awareness, and numeracy (Dirjen Pendidikan Tinggi Kemendikbud, 2020; Kementerian Agama, 2022; Nuraini et al., 2023). Within the context of physics education, scientific literacy is a necessary component. This assertion entails possessing the requisite skills to proficiently explicate scientific phenomena, assess and devise scientific inquiries, and interpret scientific data and evidence, as outlined by the Program for International Student Assessment (PISA, 2018). Indonesia is positioned at the 62nd rank among 70 countries, indicating it is among the bottom ten countries regarding low literacy skills. The urgent need for scientific literacy in Indonesia is due to its direct correlation with developing a strong scientific attitude and mastering established skills among the next generation. This notion is equivalent to the findings or outcomes derived from Handayani et al.'s. (2022), Hidayah et al.'s (2020), and Ramansyah et al.'s (2021) research which suggest that expanding learners' expressive capacity within their abilities can be stimulated by disseminating scientific knowledge through the application of experimental encounters in a science discipline.

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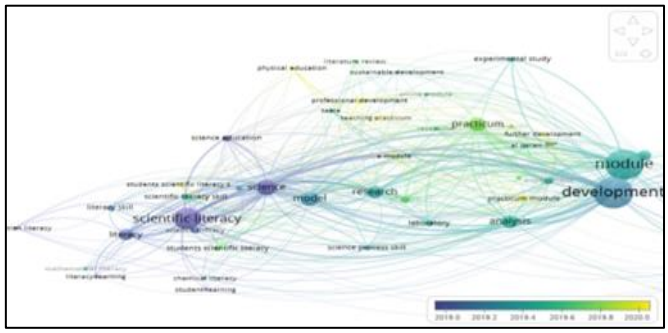
In response to this urgency, a curriculum reform movement was implemented at every educational institution and institution in Indonesia, including Tadris Physics at UIN Mataram, on 12 October 2022 via a faculty-led internal discussion forum for the Study Program. Students' scientific literacy skills were not optimal during learning, particularly during experimental activities (practicum). Suppose the integration of KI 1, "Integrating and practicing the teachings of their religion," and Core Competency 4, "on aspects of student science skills," is successful. In that case, students' scientific literacy skills should demonstrate significant improvement (Dirjen Pendidikan Tinggi Kemendikbud, 2020). The issues mentioned earlier align with Alfernando et al.'s (2020) and Savosin et al.'s (2021) that the integration of science and religion can facilitate students' comprehension of how science can offer new insights into their religious convictions and, conversely, how religious beliefs can provide alternative viewpoints in comprehending the science. The hindrance to developing scientific literacy skills among students is attributed to the constraints of modules deemed reliable, feasible, and efficacious sources of information (P. Hd. Sugiono, 2018). According to Citra et al. (2020) and Haryadi et al. (2019) to Haryadi, the KIT experiment is a set of physics experiments designed to enhance student skills by providing potential for skill development. The integration of Core Competency 1, which involves incorporating and applying religious teachings, has not been effectively implemented in conjunction with other achievement competencies, particularly in the psychomotor domain. This claim is evident in the execution of Experimental KIT skill activities, which encompass optical, mechanics, thermodynamic, and electric-magnetic kits (Ramadianti et al., 2020).

According to recent studies conducted by Krylova et al. (2021) and Yanfika et al. (2020), it is believed that incorporating the Al-Quran into the Experiment Kit can potentially enhance students' spiritual development. The previous assertion is consistent with Yusu's (2019) research, which posits that the divine revelation in the Qur'an was revealed 14 centuries before the discovery of the metaphysical concept in the 19th century, which coincided with the onset of the first industrial revolution. The Al-Quran provides a distinctive perspective on the phenomenon of science, which is elucidated through a three-phase framework. The first phase pertains to the past, as exemplified by the depiction of the creation of the universe in Surah Al-Anbiya verse 30. The second phase pertains to the present, as exemplified by the portrayal of natural development in various domains, including human, environmental, and universal phenomena in Surah Al-Hijr verses 19-20. The third phase progression of forthcoming events, including the destruction of the universe (apocalyptic event), are subjects of academic interest in Surah An-Naba verses 17-20, as cited by Khairunnisak et al. (2020) and Slater and Abdullah (2020). Skripkn et al. (2021) conducted a study that found that incorporating Al-Quran studies into the spiritual aspect yields a significantly favorable impact on the acquisition of scientific literacy. The Al-Quran's Islamic values can bolster students' spiritual development, thereby facilitating the cultivation of scientific literacy competencies encompassing contextual understanding, knowledge acquisition, competency development, and attitudinal orientation.

The variables have been comprehensively covered regarding their conceptual nature; however, no references to the development concept have been located. The present study employed a bibliometric analysis to delineate research positions in esteemed journals such as Scopus and Sinta, which are affiliated with Google Scholar, as well as other journal citations. (Shu et al., 2018; van Eck & Waltman, 2014). Figure 1 below displays the outcomes of the research mapping:



Picture 1. Mapping of bibliometric analysis research

The result of the bibliometric analysis showed that from 669 articles on developing Experimental KIT modules, the author only found two articles related to Quranic studies. Nevertheless, after reviewing both articles, the writers found no specific steps in the Quranic study in performing practicum or practical procedures. Additionally, they only comprise the paper without any valid requirement of the development method background in the practical module nor effective in its application. Based on the previous explanations, this study aims to support students' science literacy by developing a Qur'an studies-based experimental KIT module.

Method

The R&D Model (Research and Development) is the appropriate research framework for this study. This model is designed to facilitate the creation of a successful product by subjecting it to a rigorous testing process.

This approach to development utilizes the Four D Models framework, which encompasses the stages of defining, designing, developing, and disseminating (Nuraini et al., 2023; Ritu et al., 2021; S. Sugiono, 2020). The development process of products involves a three-stage approach to product testing, which includes evaluating the produced products' validity, practicality, and effectiveness (Azmar, 2022; Ula et al., 2023). The study design is as follows Figure 2.

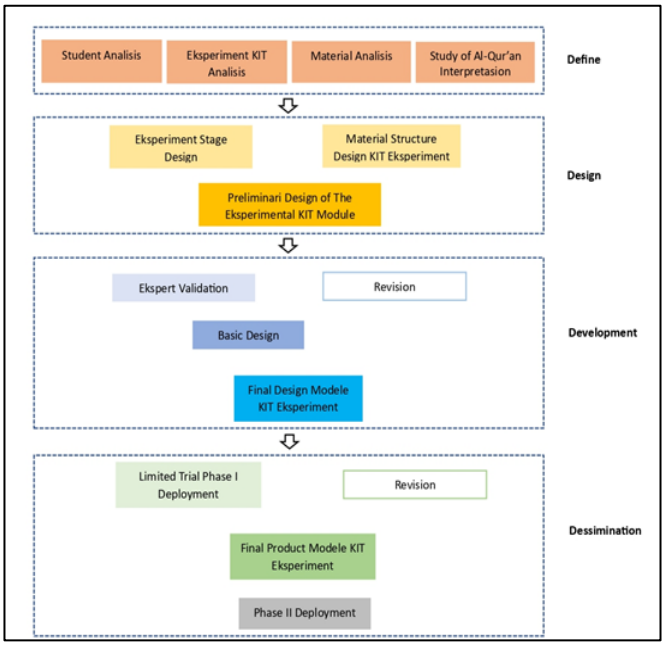


Figure 2. Design procedure for 4D model

The study recruited 24 students in their fifth semester of the Tadris Physics Study Program at UIN Mataram. The participants were categorized into four distinct groups. The research was conducted at the Integrated Science Laboratory of UIN Mataram, with the participation of students from the Tadris Physics Study Program.

This study procedure is translated into the subsequent four phases of development. In Stage 1, the implementation process encompasses four distinct categories of activities. These activities are described in detail in the following section. The present analysis, entitled "Student Analysis," seeks to delineate the fundamental attributes of students' proficiency concerning experimental KIT material, which is slated to be incorporated into Al-Qur'an studies in the laboratory. It will be achieved through a series of interviews conducted with instructors teaching basic physics courses. The second stage involves conducting an experimental analysis at KIT. This analysis aims to categorize the experimental physics KIT according to the type of practicum shown in the laboratory, based on KI.4. in the Curriculum of the Tadaris Physics Study Program. This curriculum emphasizes integrating (P4) skills in physics practicals in the living environment and industrial development (Dirjen Pendidikan Tinggi Kemendikbud, 2020). The analysis will be based on interviews conducted with lecturers who teach basic physics courses and will involve basic mapping of these results. The third aspect of the study pertains to Material Analysis, which aims to align the KIT material for physics experiments with the MBKM curriculum of the Physics Tadaris Study Program within the scope of KI.3. The objective is to enable students to analyze the fundamental concepts and principles of physics in the context of industrial and environmental advancements. It will be achieved by conducting a literature review of the scientific literacy competency base, which involves explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence (Kemendikbud, 2021). The fourth aspect of the study consists of Quranic verses analysis, intending to enhance the spiritual dimension of KI students. Specifically, this analysis seeks to facilitate the integration and practical application of religious teachings that students adhere to (Kementerian Agama, 2022). The previous statement is achieved through interviews with experts in Quranic exegesis and literature studies in the study program.

During Stage 2, the design phase, the implementation process involves the creation of procedural designs for experimental KIT activities. These activities are conducted in a laboratory setting, including mechanics, optics, thermodynamics, and magnetic electricity KITs. The structure of the practicum-type material was designed based on the analysis of the four experimental KITs and the physics material derived from the data obtained during the previous planning stage. This series of activities is through experimental KIT material design activities. The ultimate phase of this stage involves integrating the outcomes of the Al-Quran verse analysis with all the executed designs, encompassing the procedural and experimental KIT material designs, into a preliminary design activity for the experimental KIT module.

In Stage 3, the focus is on the preliminary development of the Al-Qur'an-based physics experiment KIT module, followed by the validation of both the experimental module and the testing instrument to assess the module's efficacy. The outcomes of expert validation and the limited discourse on the validator will be subjected to processing and analysis. Furthermore, the module components that require correction will be revised. The procedure mentioned above persists until the acquisition of a module for conducting physics experiments based on Al-Quran and a reliable assessment tool.

Phase 4 (Dissemination), At this stage, the dissemination of stage I carried out limited trials on valid products obtained from students through the Al-Quran-based physics experiment KIT practice in the integrated science laboratory at UIN Mataram. In addition, the dissemination of practicality measurement tools in the form of practitioner response questionnaires (i.e., laboratory assistants) and practical instruments is being considered. Specifically, the practical mechanism uses student worksheets (LKM) in the form of student scientific literacy competency tests. Upon completion of phase I, the outcomes will be subjected to processing and analysis, followed by a comprehensive review of the Al-Quran-based physics experiment KIT module to yield an efficacious end product.

Result and Discussion

The efficacy of a sequence of phases involved in creating experimental KIT modules centered on Al-Qur'an studies, with regards to enhancing students' scientific literacy skills, is contingent upon evaluating the modules' reliability, feasibility, and efficacy. The following describes the results obtained from this series of research activities:

Validity Analysis

Validity analysis of the experimental KIT module based on Al-Qur'an studies involves the submission of the module to two experts who will evaluate its validity and development (Putri & Abdullah, 2021). Regarding content feasibility, several indicators include the material's compatibility with KI and KD, its accuracy, its freshness, and its ability to arouse curiosity. Regarding the feasibility of the presentation, various indicators exist, including presentation methods and aids, as well as ideas' consistency and logical progression. In the aspect of language feasibility, there are several indicators. It includes straightforward, communicative, dialogic, and interactive, conformity with the development of students, conformity with language rules, and the use of terms, symbols, or icons. Regarding graphic feasibility, several indicators exist, like cover design and module design. Jusman et al. (2020) explained that the validity test was carried out using the Gregory technique as Equation (1):

$$Vc = [\frac{D}{A+B+C+D}] \quad (1)$$

The requirements for the Gregory test are if R ≥ 0.75 or ≥ 75%. Then the product is declared valid.

The description of the data processing results of the instrument items distribution is described in Table 1.

Table 1. Module validity analysis

		First Validator Assessment	
		Weak Relevance 1–2	Strong Relevance 3-4
Second Validator Assessment	Weak Relevance 1 – 2	0	0
	Strong Relevance 3 – 4	6	25

The study conducted an internal coefficient analysis on the data distribution and obtained a result of 0.80, which exceeds the relevance value of 0.70. Based on the findings, it can be inferred that the Al-Qur'an studies-based experimental KIT module has been deemed valid and is eligible to advance to the subsequent stage, which entails the implementation of the experimental KIT module.

Practicality Analysis

The practicality of the Al-Qur'an studies-based experimental KIT module was evaluated by obtaining feedback from two experienced lecturers. Demonstrating compliance with practical requirements indicates the module's viability for practical implementation by professionals, such as the lecturer in question. Through the practicality of the module, practitioners know the characteristics of the developed module in terms of its usability. The practical application of modules in educational activities is evident. The practicality assessment was conducted using a Likert scale scoring technique to analyze the questionnaire responses provided by the instructor. The module practicality indicators encompass various aspects such as material content, presentation techniques, language usage, illustrations, and physical modules (Nurdyansyah, 2018). The five testing criteria are a high practical score of 5, a practical score of 4, a somewhat practical score of 3, an impractical score of 2, and a highly impractical score of 1. Calculation of the percentage of the total score of respondents employs the following Equation (2):

$$P = \frac{\Sigma x}{\Sigma x_i} x\ 100\% \quad (2)$$

The requirements for determining practicality use the following criteria table (Nurdyansyah, 2018):

Table 2. Module practicality requirements

Percentage	Criteria
81 % ≤ X ≤ 100%	Very Practical
61% ≤ X ≤ 80 %	Practical
41% ≤ X ≤ 60 %	Quite Practical
21% ≤ X ≤ 40 %	Impractical
X < 20 %	Very Impractical

The research obtained data on the practicality of the Al-Qur'an studies-based experimental KIT module, as shown in Table 3.

Table 3. Module practicality analysis

Indicator	Respondent		Total Score	Max. Score	Average	Pst.	Criteria
	I	II					
Content	4	4	8	8	4	100%	Very Practical
	3	4	7	8	3.5	88%	Very Practical
	4	4	8	8	4	100%	Very Practical
	4	4	8	8	4	100%	Very Practical
Serving Method	3	3	6	8	3	75%	Practical
	4	4	8	8	4	100%	Very Practical
	4	4	8	8	4	100%	Very Practical
	3	4	7	8	3.5	88%	Very Practical
Language	3	4	7	8	3.5	88%	Very Practical
	4	3	7	8	3.5	88%	Very Practical
	3	4	7	8	3.5	88%	Very Practical
	3	3	6	8	3	75%	Practical
Illustration	4	3	7	8	3.5	88%	Very Practical
	3	3	6	8	3	75%	Practical
	4	4	8	8	4	100%	Very Practical
Completeness	4	4	8	8	4	100%	Very Practical
	4	4	4	8	4	100%	Very Practical
	4	4	3	8	3.5	88%	Very Practical
Physical	4	3	7	8	3.5	88%	Very Practical
	3	3	6	8	3	75%	Practical
	4	4	8	8	4	100%	Very Practical

The data from Table 3 is then used to determine the average percentage. The mean rate is 63.84%. This number conforms to practical standards. According to the evaluation of two practicing lecturers, the developed module satisfies the practical requirements for usage in the learning process.

Effectiveness Analysis

The effectiveness of the experimental KIT module based on Al-Qur'an studies was evaluated based on students' scientific literacy skills using expert-validated scientific literacy instruments. The module's efficacy level will provide information regarding the module's usefulness in the learning process. The module's effectiveness is determined by analyzing students' scientific literacy abilities. The scope of scientific literacy indicators for students includes the competency-based content of skills for explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence (PISA, 2018). Calculation of the total score percentage of students' scientific literacy skills uses Equation (3) (Nurdyansyah, 2018):

$$P = \frac{\Sigma S}{\Sigma N} x100\% \quad (3)$$

The requirements for determining the effectiveness of the Al-Qur'an studies-based experimental KIT module use the following table of criteria (Azmar, 2022).

Table 4. Module effectiveness requirements

Percentage (100%)	Criteria
81-100	Very Effective
61-80	Effective
41-60	Quite Effective
21-40	Ineffective
0-20	Very Ineffective

The following displays the results of students' scientific literacy skills, which are described in Table 5.

Table 5. Module effectiveness analysis

Interval	Middle Value	Frequency	Percentage	Criteria	Skill
11-16	13.5	2	8.33%	Very Ineffective	Not Skilled
17-22	19.5	2	8.33%	Ineffective	Not Skilled
23-28	25.5	7	29.16%	Quite Effective	Skilled
29-34	31.5	8	33.34%	Effective	Skilled
35-40	37.5	5	20.84%	Very Effective	Skilled
Jumlah	24	24	100%		Skilled

Using the information in Table 4, the percentage of students with classic scientific literacy skills is calculated to be 83.33 percent, which is a very effective criterion. So, according to the theory proposed by J. van den Akker (Yusuf, 2019), the module has been operationally effective in promoting scientific literacy among students, as anticipated.

The distribution of the data is translated into a frequency distribution graph assisted by Microsoft Excel 2016 to present students' scientific literacy skills in the following Figure 3.

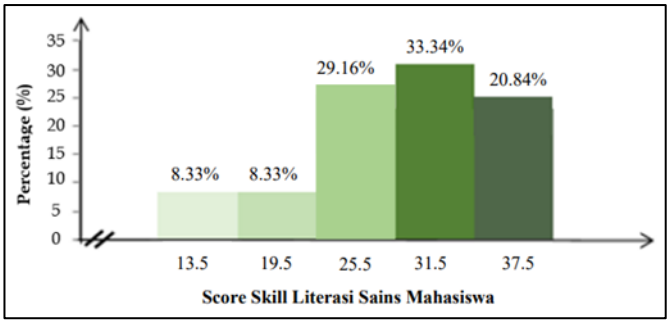


Figure 3. Percentage of students' scientific literacy skills

Validity of the experimental KIT module based on Al-Qur'an studies

Validity is one of the module development requirements. The developed module cannot proceed to the trial phase until it has undergone expert validation. Expert validation is conducted by submitting the module design to two experts in their respective disciplines to provide an evaluation of the module design based on several criteria. Adapted from National Education Standards Agency guidelines, the aspects evaluated include content feasibility, presentation feasibility, language appropriateness, and graphic feasibility (Putri & Abdullah, 2021).

The content feasibility aspect consists of evaluating the module's developed content. The study focuses on the following validity indicators: (1) the material's compatibility with Core Competency and Basic competencies, (2) the material's precision, (3) its currency, and (4) its ability to stimulate curiosity. According to the explanation of expert validation in the results section of the research on the Al-Qur'an studies-based experimental KIT module by two experts on 31 items and based on the validity results, there were indicators of material accuracy in material suitability items. It demonstrates that the developed module design has a superior assessment of the material's compatibility with advancements in physics.

The presentation feasibility component involves an evaluation of the presentation quality of the proposed module design based on several indicators, such as 1) presentation technique, 2) presentation support, and 3) coherence and thought flow coherence. According to the expert's evaluation, the presenting feasibility of the module design is deemed feasible. In terms of presentation, the modules have been designed and delivered according to the BSNP's module development and presentation guidelines. Regarding presentation support, the module provides examples of commonplace occurrences relevant to the subject matter being taught.

The language feasibility component evaluates the module's language usage quality. Several indicators assess the module's language feasibility, including straightforwardness, communicativeness, dialogue and interactivity, compliance with student development, adherence to language standards, and use of the term symbol or icon. The validator's evaluation demonstrates that this module design offers advantages in stimulating critical thinking and incorporates writing with consistent use of icons or symbols and interactive language.

The graphic feasibility component comprises an evaluation of the appearance or graphic design of the module design in the current investigation. The graphical feasibility assessment includes the following indicators: 1) module cover design; 2) module design. It indicates that the module cover design is exceptional.

The most impressive of the four assessment parts are the language feasibility and presentation aspects, each with four evaluation items that receive a score of 4. Those that require significant adjustments in terms of module cover design are those that have yet to be completed. However, the average total score of the two experts' evaluation of the developed module design is 3.58, which is still inside the strong relevance group.

The evaluation ratings of the two experts were then subjected to a Gregori test. The acquired data yield a coefficient of internal consistency of 0.80. The module's requirements are deemed valid, with an internal consistency coefficient of 0.70 or higher. So, based on expert opinion, the generated module design is accurate and suitable for field testing to assess its practicability and efficacy. Magdalena et al. (2020) disclosed that selecting or determining the appropriate learning module to assist students in achieving competency is one of the most significant challenges teachers encounter in learning activities. It is because module content is simply summarized in the curriculum or syllabus. The different opinions were stated by Isik (2016), Işik (2018), and Li et al. (2021) based on research findings that led to the development of an assessment process for comprehensive literacy instructional materials. This protocol addresses multiple issues, including language clarity, structure, relevancy, and the potential of the information to improve student literacy. The study's findings suggest that this procedure can provide

meaningful input to literacy instructional material designers and policymakers to enhance the quality of literacy instructional resources. From the three kinds of literature, it is evident that paying close attention to the authenticity of the module's content is crucial for supporting the success of the learning process and students' scientific literacy.

The practicality of the experimental KIT module based on Al-Qur'an studies

Modules previously validated are then field-tested to assess their applicability and efficacy. The practicality of a module's design is an essential element. The practicality of a module is measured by the extent to which it is utilized in the learning process. Understanding the module's usability can be a reference for future development. The practicability of the created module is determined through field trials using a practitioner questionnaire. In this instance, practitioners are topic lecturers.

The questionnaire presented to practicing lecturers focuses on numerous elements, including the material's content, way of presentation, language, illustrations, and the module's completeness. According to the practitioner response questionnaire, as previously indicated, the module received 63.84 percent based on the results of the responses from the two practitioners. This result falls under the practical module category. Hence this module can proceed to the packaging phase.

The widespread consensus of practitioners is that this module is very applicable and meets the Tadris Physics Study Program requirements at UIN Mataram. Practitioners have stated that the module supports students' reading skills because it integrates scientific studies and students' spiritual aspects, such as Quranic study. This assertion is consistent with what Agustin et al. (2022), Kusuma et al. (2022), and Utami et al. (2023) indicated that the development of Al-Quran-based learning modules and approaches is very practical in improving students' literacy skills. This strategy can boost college students' motivation, reading skills, and understanding. Therefore, the construction of experimental modules based on the Al-Quran can contribute significantly to improving student literacy. To ensure the practicality of the module, however, the developer must test and assess it completely using acceptable research methodologies.

The effectiveness of the experimental KIT module based on Al-Qur'an studies

The module's efficiency in promoting optimal scientific literacy is an essential feature of the developed module. This study examined the module's efficiency by analyzing the students' abilities as measured by the scientific literacy skills test instrument.

According to the module effectiveness test findings, twenty out of twenty-four students met the proficiency requirements. Consequently, 83.33 percent of all test-takers possess classical abilities.

In particular, the data indicates that students' scientific literacy skills fulfill the criteria for classification as excellent. This indication suggests that the experimental KIT module based on Al-Qur'an studies has promoted optimal scientific literacy. Thus, it can be argued that the designed module has satisfied the effective requirements, as indicated by the 83.33 percent completion rate of learning outcomes. This result aligns with Fahmi et al.'s (2021), Kusuma et al.'s (2022), and Suharsiwi et al.'s (2022) research that Al-Quran-based learning modules have the potential to improve scientific literacy and student skills. This module can also improve students' pronunciation skills and educational character values.

The three rounds of analysis conducted throughout the construction of the Al-Qur'an Study-Based Experimental KIT Module boost students' scientific literacy skills, particularly in the psychomotor area. This result is consistent with Fahm et al.'s (2021) assertion that research linking science and religion discusses how to teach, create modules, and students' abilities to connect science and religion. Other aspects are also explained by El Fandy (2020), Muslih (2018), Nihayati (2017), Sastria (2014), and Yusuf (2019) that The Quran existed before the development of science. Therefore, belief is a significant aspect that influences students' conceptual learning. So that they cannot be separated, physical science and religion must be integrated based on monotheism. It goes on to clarify that a mature spiritual self can be the primary foundation for directing students' valid, practical, and successful talents.

Conclusion

Education requires a high literacy level, particularly in the real world or at work. To enhance students' abilities, sufficient learning resources and literacy are needed. Emotional intelligence and spiritual intelligence are necessary for the intellectual development of students. In forming a physics experiment KIT, the integrity of knowledge with spiritual values is paramount. Consequently, this study aimed to assess students' scientific literacy using an experimental module kit based on the Qur'an studies. The research design employed was the 4D Model (Definition, Design, Development, and Deployment), with a sample of Tadris Physics students enrolled in the fifth semester at UIN Mataram. Validity analysis, usability analysis, and effectiveness analysis are the techniques used for analysis. During testing, it was determined that 83.33 percent of students possessed a

mastery of classical skills, which qualifies them as highly skilled. The test results show that developing Al-Qur'an studies-based experimental KIT modules effectively supports students' scientific literacy skills.

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Conceptualization, methodology, software, validation, formal analysis, investigation, resources, supervision, project administration : Ahmad Zohdi;, data curation, writing—original draft preparation, writing—review and editing, visualization : Azmar . All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest

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