

Development of Contextual Integrated Electronic Temperature and Heat Modules Based on Qur'an Verses at MTsN 3 Tulungagung

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Abstract - This research contributes to the priorities of "Merdeka Belajar 2021", digitization of schools and learning media, and character education. This study used research and development (R&D) by Borg and Gall, modified by Sugiyono. In this method, there were ten research steps, which are then limited to seven steps. The seven steps are potential problems, data collection, product design, design validation, design revision, product testing, and product revision I. The instruments used came from the validation sheets of material and media experts, as well as electronic module readability questionnaires from MTsN 3 Tulungagung students. Data analysis used linkert scales 1-4. Validation results from media and material experts show valid criteria based on the attractiveness of the appearance and depth of the material, both in terms of contextual aspects and its integration with the Qur'an. Based on the test results, the electronic module is very interesting because it is presented interactively.

Keywords: *Electronic Module; Temperature and Heat; Contextual; Integrated of Qur'an*

INTRODUCTION

Education contributes significantly to the advancement of the nation. As a tangible manifestation of the government's efforts to promote national progress, the Ministry of Education and Culture (Kemendikbud) has initiated the "Merdeka Belajar" (Freedom to Learn) program (Kemendikbud, 2021). One aspect of this program is the digitalization of schools and learning mediums, which involves strengthening educational media models, teaching materials, and digital platforms (Kemendikbud, 2021). This program is in line with the situation in Indonesia, which has been affected by the COVID-19 pandemic, resulting in the implementation of online learning since March 2020 (Kemendikbud, 2020). In online learning, students are expected to learn independently through educational platforms.

An observation of online learning at MTsN 3 Tulungagung on May 8, 2021, revealed that the implementation of science

education was done by providing students with handouts and video materials. This method of delivering materials is interesting but still feels monotonous. The video materials are limited to the theoretical aspects covered in the school modules. Delivering materials through videos is believed to overcome students' boredom during the learning process (Hadi, 2017). Videos also contribute to the effectiveness of learning (Tutiasri, 2020). Choosing the right instructional videos has an impact on avoiding monotony in learning and achieving the learning objectives. Videos that connect technology with real-life contexts can help stimulate students' thinking patterns (Parawansa, 2022).

An IPA (Science) teacher at MTsN 3 Tulungagung explained that students have a limited understanding of physics concepts, and the teaching materials used do not integrate science with the Quran. Specifically, students struggle to differentiate between terms in the topic of

temperature and heat, such as specific heat, heat capacity, latent heat, and others. In this regard, Viratama (2020) also mentioned that students face difficulties in understanding temperature and heat due to the complexity of calculations and formulas involved. Physics is a discipline that relates to natural phenomena and everyday life (Yulkifli, Elmi Yanto, Rahmi Agustia, Ihsan, & Yohandri, 2020). Students naturally face difficulties if they are forced to understand formulas, calculations, and terms without relating them to real-world phenomena.

Based on the issues arising at MTsN 3 Tulungagung, several solutions can be implemented. Firstly, the monotonous nature of the teaching materials, including handouts and videos, can be addressed by combining them into an integrated unit known as an electronic module (Sari et al., 2019). An electronic module is a self-paced instructional material organized sequentially from the smallest learning unit to achieve specific learning objectives. It includes videos, audios, animations, and navigation elements that make students interact with the program as it is presented electronically (Satriawati, 2015). The use of electronic modules makes learning more interactive, engaging, and flexible, thereby enhancing the quality of education.

Secondly, the students' difficulty in applying physics concepts in real-life situations can be addressed by implementing a contextual approach to learning. Contextual learning is a concept that connects students' knowledge with its application in everyday life (Sagala, 2013). The learning process is carried out and experienced by students, where the teacher presents real-world problems in the classroom and encourages students to solve them (Satriawan et al., 2019). Students are also more motivated to learn through contextual learning (Ilmia et al., 2022).

Through contextual learning, students can construct their own knowledge, making the learning experience more meaningful.

Thirdly, MTsN 3 Tulungagung, which is characterized by its Islamic identity, has yet to integrate science teaching materials and the Quran. The integration of science and the Quran can be achieved by incorporating Qur'an verses related to science topics (Latifah & Ratnasari, 2016). Integrating the Quran into science materials raises students' awareness to increase their devotion to Allah. This integration aligns with the Character Education Strengthening Program in terms of religiosity, as stated in Presidential Regulation No. 87 of 2017 on Character Education Strengthening (Peraturan Presiden, 2017). Integrating science with Qur'an verses also makes learning more meaningful, enhances students' learning experiences, and broadens their knowledge domain (Pertiwi, 2016).

The research conducted by Silviyati (2018) on the development of an integrated physics module combining science and Islam showed that 82.5% found the media suitable, 78.3% found the content suitable, and 90% found it suitable for the integration of the Quran and science. Another study by Ekawati (2019) on conventional modules based on contextual integration with Islamic values demonstrated that they were considered interesting, valid, and improved learning outcomes. A research on contextual-based electronic modules conducted by Yulkifli et al. (2020) showed that the developed module had a validity rate of 89%, practicality for teachers of 97%, and practicality for students of 89.3%.

Based on several previous studies, it can be concluded that the development of modules demonstrated their suitability for use in learning. However, no previous research has been found on the development of contextual-based electronic modules

integrating Qur'an verses in the topic of temperature and heat. The objectives of this research include: 1) developing an electronic module on the topic of temperature and heat based on contextual integration with Qur'an verses, 2) determining the suitability of the contextual-based electronic module on temperature and heat integrated with Qur'an verses, and 3) assessing the readability of the contextual-based electronic module on temperature and heat integrated with Qur'an verses.

RESEARCH METHODS

The development of a contextual-based electronic module on temperature and heat integrated with Qur'an verses follows the research and development model proposed by Borg and Gall, which was modified by Sugiyono. However, due to time and cost constraints, the researcher limited the study to the seventh stage of the model. The research stages conducted are as follows: 1) Potential and Problems: Identified through classroom observations and interviews with teachers and students. 2) Data Collection: Analyzing the competency standards (KI-KD), formulating learning objectives, and gathering various reference sources for creating the contextual-based electronic module on temperature and heat integrated with Qur'an verses. 3) Product Design: Processing the collected data and organizing it into an electronic module. 4) Design Validation: Conducted by a science teacher, a media expert, and a subject matter expert to validate the design of the module. 5) Design Revision: Making revisions based on the comments and suggestions from the validators. 6) Product Trial: The electronic module on temperature and heat is tested with 15 eighth-grade students at MTsN 3 Tulungagung using a questionnaire to assess the readability of the electronic module. 7)

Product Revision I: Conducted if there are suggestions or comments from the students.

This research involves three variables: temperature and heat as the control variable, students' response to the readability of the electronic module as the dependent variable, and the electronic module as the independent variable.

The research instruments used are validation questionnaires and a questionnaire on the readability of the electronic module. Both qualitative and quantitative data are obtained from these instruments. Qualitative data are gathered from comments and suggestions provided by validators and students during the product trial. Quantitative data come from the average scores of the validation and feasibility tests of the module.

Data analysis in the first stage involves both qualitative and quantitative data. The quantitative data are obtained from the average scores of the validation questionnaire and the questionnaire on the readability of the electronic module. The Likert scale ranging from 1 to 4 is used. Data analysis is conducted using appropriate equations (Ekawati, 2019).

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} \tag{1}$$

description:

$$x_i = \frac{\text{total score}}{\text{maximal score}} \times 4$$

\bar{x} = final average score

x_i = score each respondent

n = total respondent

The design validation is conducted by subject matter experts and media experts. The subject matter expert validator consists of a specialist lecturer and an IPA (Science) teacher. The media expert validator consists of a specialist lecturer and an IPA teacher. The validators are given a validation questionnaire. The questionnaire is analyzed using equation (1), and the average scores

are obtained to determine the validation criteria.

The validation criteria used are as stated in Ekawati (2019). However, the specific equation (1) used to analyze the validation questionnaire is not provided in the given information.

Table 1. Criteria of Validation result

No.	Final average score (\bar{x})	Criteria
1.	$3,26 < \bar{x} \leq 4,00$	Valid
2.	$2,51 < \bar{x} \leq 3,25$	Valid Enough
3.	$1,76 < \bar{x} \leq 2,50$	Less Valid
5.	$1,00 < \bar{x} \leq 1,75$	Not valid

In the product testing phase, purposive sampling technique was employed, considering specific objectives (Sugiyono, 2016). A sample of 15 students from class VIII of MTsN 3 Tulungagung was selected. The selection was based on the consideration that students in class VIII have studied the topic of temperature and heat. The students were given a readability questionnaire for the electronic module. The readability questionnaire was analyzed using Equation (1), and scores were obtained to determine the readability criteria. The readability criteria used were based on (Ekawati, 2019).

Table 2. Readability criteria

No.	Final average score (\bar{x})	Criteria
1.	$3,26 < \bar{x} \leq 4,00$	Very Interesting
2.	$2,51 < \bar{x} \leq 3,26$	Interesting
3.	$1,76 < \bar{x} \leq 2,51$	Less Interesting
5.	$1,00 < \bar{x} \leq 1,76$	Not Interesting

RESULTS AND DISCUSSION

Development of Product

The development of electronic modules uses the compilation technique. The compilation technique involves the development of modules from various sources such as books available in the market, existing modules, articles, and scientific journals (Purwanto, 2007). The

output of the electronic modules is in the form of links in HTML format. The software used in the process of creating or developing electronic modules includes Canva, MS Word 2010, Flip PDF Corporate Edition, Google Drive, and web hosting drv.tw. The electronic modules are designed in A5 size using Microsoft Office Word. Canva software is used for creating the cover. Flip PDF Corporate Edition is used to convert PDF files into electronic modules. Web hosting drv.tw is used to publish the resulting electronic modules. The design of the electronic module product includes the introduction, main content, and conclusion. The explanation of each section is as follows.

The introduction section includes the cover, module usage instructions, preface, quotes, and table of contents. The electronic module is also equipped with a table of contents menu. Clicking on this menu will direct to the respective page. Below is the display of the introduction section of this electronic module.

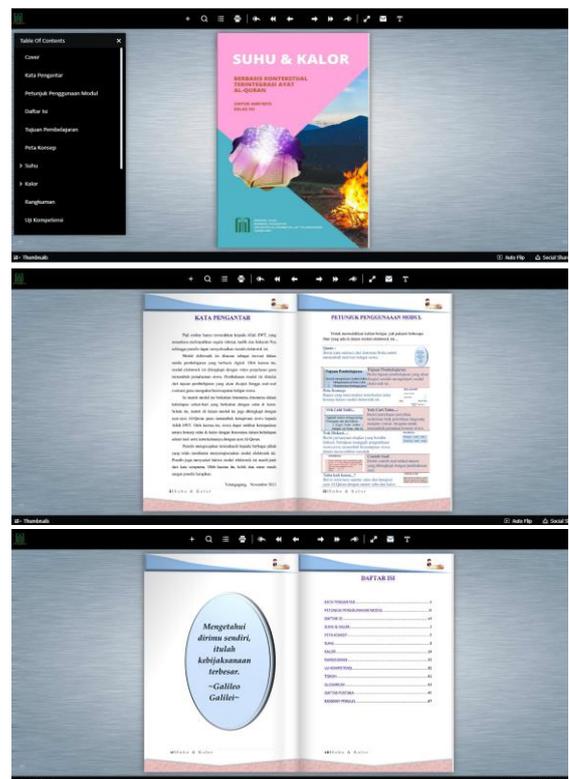


Figure 1. Front page appearance

In the main content section, there are learning objectives, concept maps, core materials, evaluation of learning outcomes, biographies of figures, and a glossary. The core materials are supplemented with the integration of Qur'an verses, images, animations, videos, and worksheets connected to the PhET Virtual Simulation. In the evaluation of learning outcomes, there are also links to problem-solving discussions.

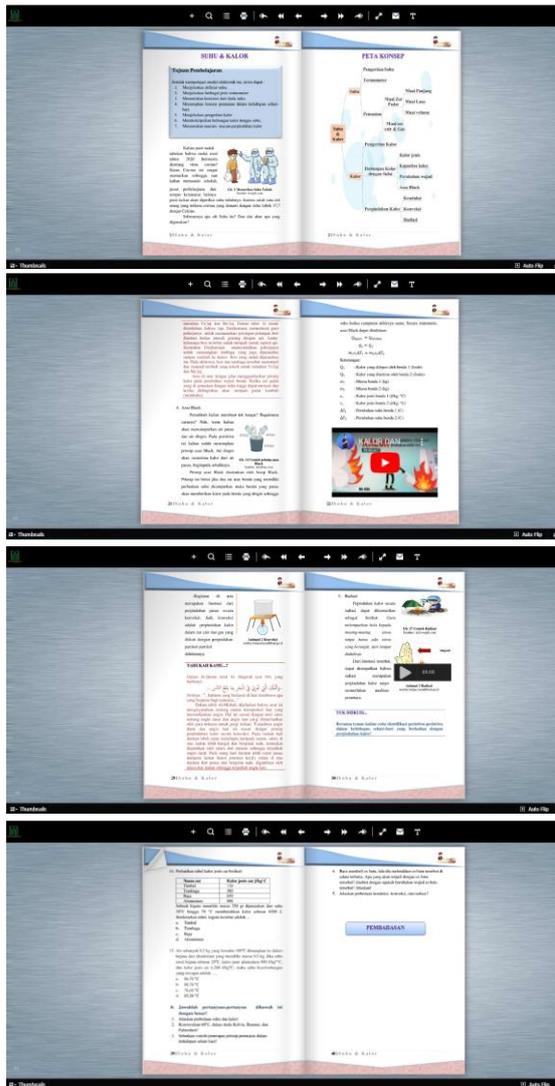


Figure 2. Main Section Appearance

In the closing section, there are references, a short quiz, author's biography, and back cover. The quiz consists of three parts: true or false questions, multiple-choice questions on theory, and multiple-choice questions on application.

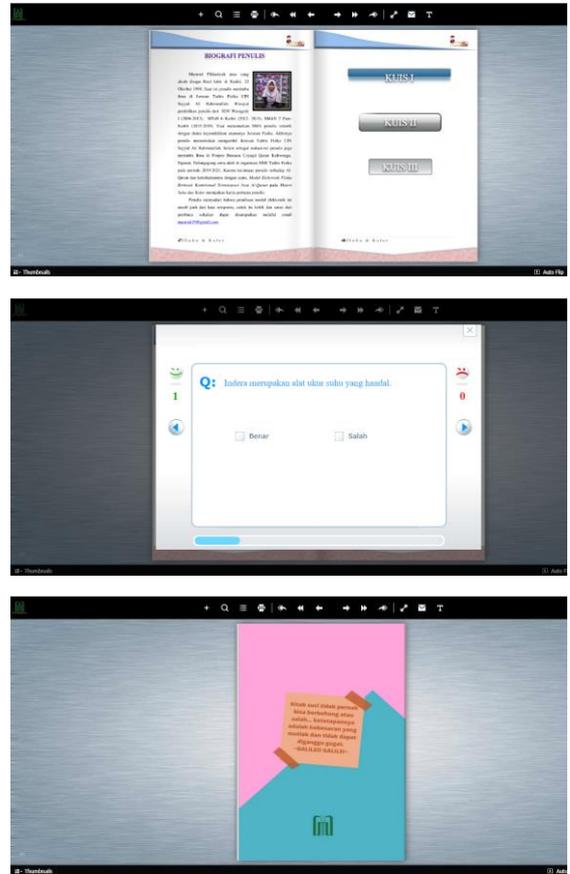


Figure 3. Closing

Validation Results

The validation results are useful for determining the feasibility of the developed product. The chosen validators include an expert in the subject matter, an expert in media, and a teacher who is knowledgeable in both subject matter and media. The validation results are analyzed to determine the level of feasibility of the developed product.

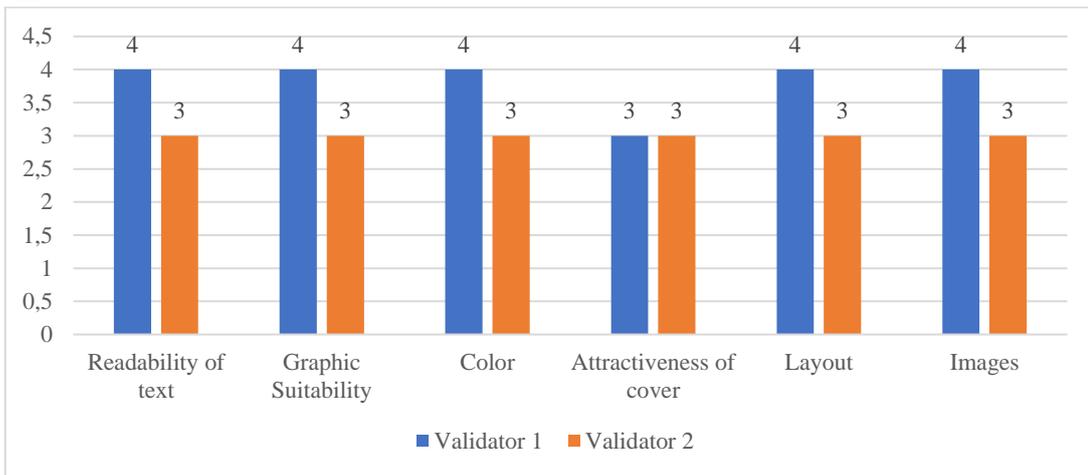


Figure 4. The result of Media validation

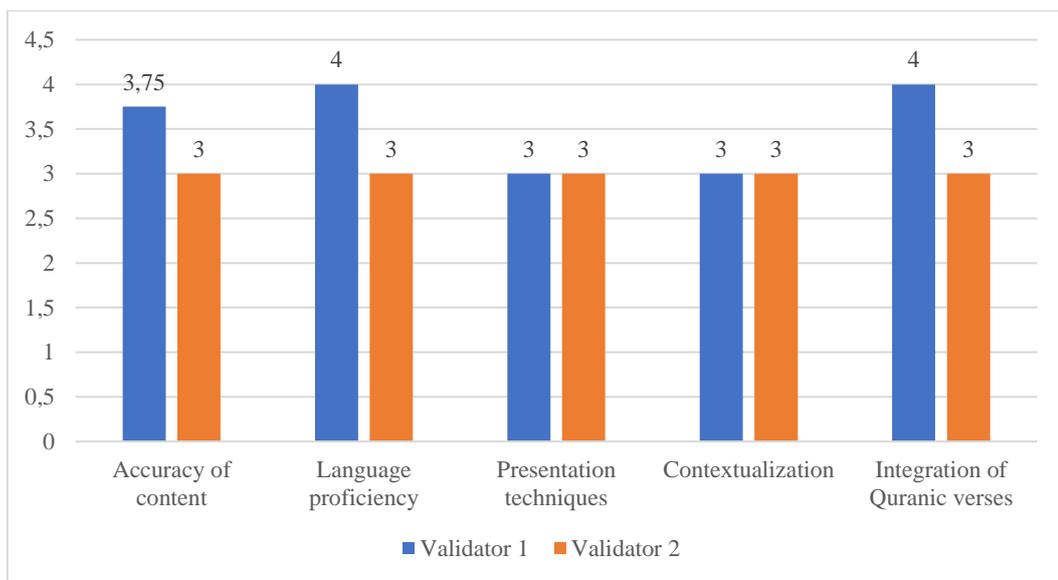


Figure 5. The results of content

The validation results obtained an average score of 3.35 from the media expert and 3.32 from the subject matter expert. Overall, the electronic module on temperature and heat has a valid criterion and can be used effectively. Based on the validation results, there were comments and suggestions for revisions that need to be made. These comments and suggestions serve as a reference for revising the electronic module on temperature and heat, which is contextual and integrated with Qur'an verses.

The media expert suggested adding Online Worksheets linked to the Virtual PHET Laboratory. On the other hand, the subject matter expert provided comments and

suggestions to improve writing errors, add relevant images to make the module more contextual, and include content on heat transfer formulas. However, the addition of heat transfer formulas was not implemented by the researcher because the depth of the heat transfer material only covers the introduction to the concept and does not include the thermal characteristics of materials (Ministry of Education and Culture Regulation, 2018).

Product Trial Results

After the revision, the electronic module was tested on 15 students from Class VIII of MTsN 3 Tulungagung. The purpose

of this trial was to assess the readability of the electronic module by students. The trial results are as shown in Figure 5.

The product testing results obtained an average score of 3.47, indicating that the

electronic module is very easy to use. Students commented that the electronic module is highly engaging, easy to understand, and learn from.

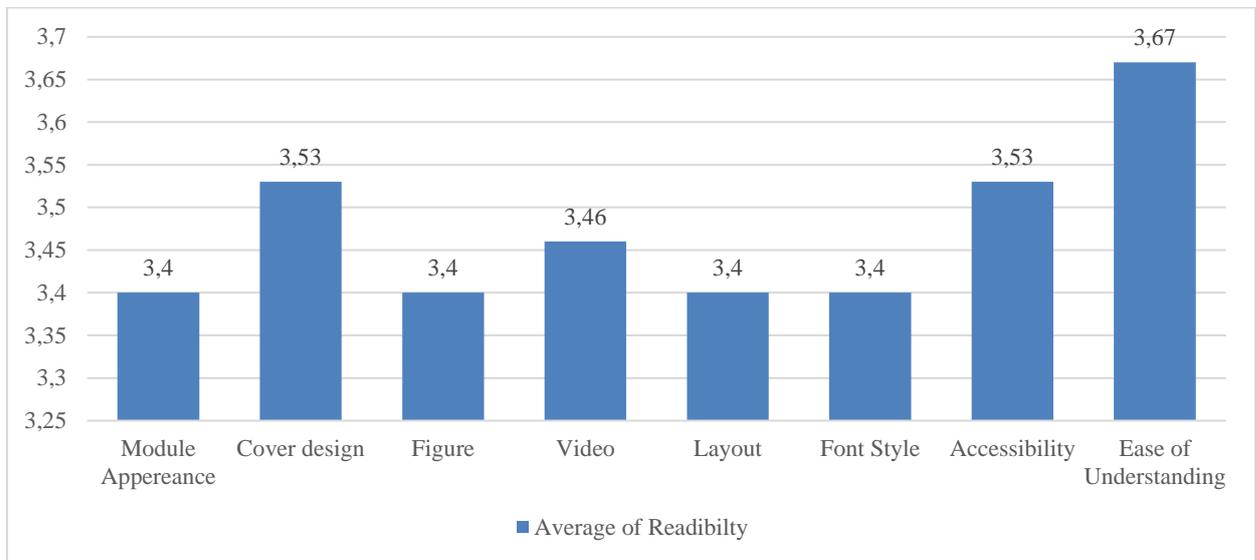


Figure 1. The result of e-module testing

Discussion

This research and development were conducted based on the research steps according to Borg and Gall, modified by Sugiyono, which involved seven stages. The seven stages include problem potential, data collection, product design, design validation, design revision, product testing, and product revision I (Sugiyono, 2016). These limitations were imposed due to time constraints, production costs, and the electronic module's content, which only covered one learning objective. Similarly, a study by Silviyati (2018) limited their research and development to the fifth stage, which is design revision.

In the overall validation conducted by content experts, an average score of 3.32 was obtained. This indicates that the content of the electronic module is suitable for use. The validity was based on the accuracy of the content, which scored 3.38, meeting the valid criteria. The presented content is

appropriate for junior high school level. The content expert validator suggested adding formulas for heat transfer, but this suggestion was not implemented by the researcher due to the consideration that according to the Minister of Education and Culture Regulation No. 37 of 2018, the depth of the heat transfer material for junior high school level only covers the introduction to heat transfer concepts. This introduction includes definitions and the application of heat transfer in daily life. As for the language aspect, it scored 3.5, indicating that it adheres to the rules of the Indonesian language. The presentation technique scored an average of 3, which is considered valid in conveying information about the module's content. The contextual aspect scored 3, indicating that it partially fulfills the seven contextual components. These components include constructivism, inquiry, questioning, learning community, modeling, reflection, and authentic assessment (Ekawati, 2019).

Following the validator's suggestion, additional images were included to support students in interpreting physics concepts in everyday life. As mentioned by Sagala (2013), contextual learning connects students' knowledge with its application in daily life. The integration of Qur'an verses scored 3.5, indicating its validity. This shows that the verses used in the content are relevant to the topic of temperature and heat.

In the media expert validation, a score of 3.35 was obtained, indicating that the electronic module is suitable for use in terms of its appearance. The media expert validator suggested adding an online worksheet linked to the Virtual PHET Laboratory. The Virtual PHET Laboratory is software that helps students visualize concepts, making learning more understandable and contextual (Nadaifa et al., 2015). For example, the influence of temperature changes on matter can be better understood with the help of PHET simulations. This is because PHET simulations demonstrate the differences in the density of solid, liquid, and gas particles. Additionally, the presence of these simulations makes the electronic module more interactive. The media validation assessed the suitability of the module's appearance or clarity of presentation. The validation results indicate that the developed electronic module is suitable for use in learning.

The product testing results obtained a score of 3.47, indicating that the electronic module is easy to use and highly engaging. The attractiveness of the electronic module is attributed to the inclusion of images, animated videos, and quizzes, making the module more interactive. This is consistent with the study by Satriawati (2015), which showed that the use of electronic modules increases student interactivity and enriches the learning experience.

A research study on context-based electronic modules conducted by Yulkifli et al. (2020) showed that their developed module met a validity criterion of 89%, was practical for teachers at 97%, and practical for students at 89.3%. Another study using electronic media by Abbas (2020) on "Development of Computer-Based Diagnostic Tests on Temperature and Heat Misconceptions" obtained good results, with an average validation score of 3.76 and an average score of 3.73 in limited testing. Nurdiana (2017) conducted research on the development of Android-based electronic modules, which obtained a validation score of 3.75 with a valid criterion, and the usage test showed an interesting criterion with a score of 3.25. However, these three studies did not integrate Qur'an verses. In contrast, in this research, both the content and media validations resulted in valid criteria with scores of 3.32 and 3.35, respectively. In the usage test of the electronic module, a score of 3.47 was obtained, indicating a highly engaging criterion. This usage test result is higher than that of Nurdiana (2017). The electronic module was made interactive and contextual, and a connection between Qur'an verses and the content was established. Another study by Silviyati (2018) on the development of physics modules integrating science and Islam showed that 82.5% were suitable for media, 78.3% were suitable for content, and 90% were suitable for the integration of Quran and science. However, Silviyati's research focused on the development of conventional or printed modules.

CONCLUSION

This research has produced a context-based electronic module on temperature and heat, integrated with Qur'an verses, for junior high school level. The average validation score obtained from content

experts was 3.32, and the validation score from media experts was 3.35, indicating that the module is suitable for use in teaching and learning. The product testing results received a score of 3.47, indicating that the module is easy to use and highly engaging. Therefore, the conclusion drawn from this research is that the context-based electronic module on temperature and heat, integrated with Qur'an verses, can be used by students as a self-learning resource.

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