Vol 13 (2), 2024, 28-41 DOI: 10.23960/jppk.v13i1.29524
Jurnal Pendidikan dan Pembelajaran Kimia
e-ISSN: 2714-9595| p-ISSN 2302-1772
http://jurnal.fkip.unila.ac.id/index.php/JPK/index

Development of an E-Module Based on Integrated Scientific Literacy with Islamic Values in Chemical Equilibrium Material for SMA/MA

Septi Anggraeni, Setia Rahmawan

Chemistry Education, Faculty of Tarbiyah and Education, Sunan Kalijaga State Islamic University, Yogyakarta, Indonesia.

*Correspondinge-mail: septiaseptianggrae@gmail.com setia.rahmawan@uin-suka.ac.id

Received: March 21st, 2024 Accepted: July 5th, 2024 Online Published: August 28th, 2024

Abstract: Development of an E-Module Based on Integrated Scientific Literacy with Islamic Values in Chemical Equilibrium Material for SMA/MA. The development of an e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material is an important effort made to improve students' scientific literacy skills and increase students' awareness of spiritual aspects. This research aims to develop an e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material, as well as analyzing the quality and responses of students to the e-module developed. This research is development research using the ADDIE development model, consisting of 5 stages; Analyze, Design, Development, Implementation, and Evaluation which are limited to the development stage. The instruments used in this research were media expert validation sheets, material expert validation sheets, chemistry teacher assessment sheets and student responses to the e-module being developed. Validation was carried out by two expert lecturers, material experts and media experts. The result of quality of e-module by three chemistry teachers show the percentage 93.3% with very good category. The results of student response teset show percentage 96% with very positive category. Based on these findings, it can be conclude that e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material is very suitable for use in the learning process.

Keywords: E-Module, Chemical equilibrium, Scientific literacy, Integration of Islamic Values.

Abstrak: Pengembangan E-Modul Berbasis Literasi Keilmuan Terpadu dengan Nilai-Nilai Keislaman pada Materi Kesetimbangan Kimia untuk SMA/MA. *Pengembangan e-modul berbasis literasi keilmuan yang terintegrasi dengan nilai-nilai keislaman dalam materi kesetimbangan kimia merupakan upaya penting untuk meningkatkan kemampuan literasi keilmuan dan kesadaran peserta didik terhadap aspek spiritual. Penelitian ini bertujuan untuk mengembangkan e-modul berbasis literasi keilmuan yang terintegrasi dengan nilai-nilai keislaman dalam materi kesetimbangan kimia, serta menganalisis kualitas dan respon peserta didik terhadap e-modul yang dikembangkan. Penelitian ini merupakan penelitian pengembangan yang menggunakan model pengembangan ADDIE, terdiri dari 5 tahapan yaitu; Analyze, Design, Development, Implementation, dan Evaluation yang dibatasi sampai tahap development. Instrumen yang digunakan dalam penelitian ini berupa lembar validasi ahli media, lembar validasi ahli materi, lembar penilaian guru kimia dan respon peserta didik. Validasi dilakukan oleh dua dosen ahli yaitu ahli materi dan ahli media. Hasil penilaian kualitas yang dilakukan oleh 3 guru kimia diperoleh persentase sebesar 93,3% dengan kategori sangat baik. Kemudian hasil uji respon peserta didik terhadap e-modul yang dikembangkan diperoleh persentase 96% dengan kategori sangat positif. Hasil ini menunjukkan bahwa e-modul berbasis literasi sains*

terintegrasi nilai-nilai keislaman pada materi kesetimbangan kimia sangat layak digunakan dalam proses pembelajaran.

Kata kunci: *E-Modul, Kesetimbangan kimia, Literasi Keilmuan, Integrasi Nilai-Nilai Keislaman.*

▪ INTRODUCTION

Technological advances in the 21st Century are increasing. This is characterized by the many innovations that emerge from the simplest to the most complex (Nurjannati et al., 2017). The rapid development of science and technology affects almost all aspects of life, including education (Hidayati et al., 2018). This Century's learning relies on knowledge and emphasizes students' skills (Mardhiyah et al., 2021).

Education must emphasize students' mastery of life skills to be more responsive to changes and developments over time (Pratiwi et al., 2019). Students must be critical in connecting all knowledge with real life, mastering technology and information, and communicating and working with others (Hasibuan & Prastowo, 2019). One aspect of life skills intensively developed in the 21st Century is scientific literacy skills (Situmorang, 2016).

Scientific literacy is the ability to understand science (spoken and written) and apply scientific knowledge to solve problems to have a high attitude and sensitivity toward oneself and one's environment in making decisions based on scientific considerations (Toharudin et al., 2011). It is essential to develop scientific literacy skills so that students are ready to face problems in everyday life, master information technology, and improve the quality of education in Indonesia (Silaban et al., 2022).

In Indonesia, the level of students' scientific literacy, as measured by PISA, is relatively low and is decreasing every year. Nearly 20 years after PISA was released, there has been no significant increase in scientific literacy among Indonesian students, and based on the results of a survey conducted by *the Program for International Student Assessment* (PISA), the scientific literacy of Indonesian students in 2018 obtained an average score of 396 from the overall average score of participating countries, namely 489 (OECD, 2018). Then, the results of the latest survey, namely in 2022, show that the scientific literacy scores of Indonesian students have decreased by 13 points compared to the previous year. Indonesia only received an average score of 383 out of the country's overall average of 477 (OECD, 2022). These results show that Indonesian students' current scientific literacy level is still below the overall country average.

Scientific literacy must be connected to science learning. One of the subjects in school that can improve students' scientific literacy skills is chemistry. Chemistry is a part of science that studies matter's properties, structure, composition, changes, and energy (Komisia et al., 2020). Chemistry learning focuses on understanding concepts, and students must apply scientific concepts to solve science-related problems in everyday life. A deep understanding of chemical concepts and their application in everyday life is possible if students have skills covering scientific literacy (Dewi & Rahayu, 2022).

The results of observations at one high school in Yogyakarta showed that most students needed help to relate the chemical material studied to problems in everyday life. This can be seen when students feel confused when faced with descriptions of questions related to phenomena in the surrounding environment. The teacher said that the cause of students' lack of understanding of the material being studied was that students needed more focus in learning. Some students need more motivation to follow the lesson and are

busy with their activities when learning takes place. Most students admitted that they were not interested in chemistry lessons. They consider chemistry lessons difficult, so they are reluctant to study them in depth. The methods used by teachers are discussions, lectures, and practicums. Teachers have also started linking learning with daily life and religious values. However, the learning resources used in the chemistry learning process in class are less varied. The media used in learning are still in the form of ordinary PPTs, worksheets, and textbooks, which still need to be integrated with Islamic values and utilize technology, so sometimes it makes students feel bored. Therefore, engaging interactive learning media is needed to increase students' enthusiasm for learning.

The ability to apply chemical materials in the living environment should be balanced with students' spiritual attitudes (Qurniati, 2021). This is to the core competency aspects of the 2013 curriculum, which are used as learning alternatives by the Indonesian government to achieve national goals. The four core competencies are spiritual attitudes, social attitudes, knowledge, and skills. These four must be implemented in every lesson, including science learning (Susilowati, 2017). Even if you understand it more deeply, the 2013 curriculum prioritizes spiritual attitudes. It is proven that in the 2013 curriculum, spiritual attitudes are ranked first in core competencies, followed by social attitudes in second place (Okmarisa & Darmana, 2016). Therefore, chemistry learning should not only emphasize developing knowledge and life skills but should also emphasize developing students' attitudes.

As time goes by, technological developments have influenced the types of learning media developed (Sugihartini & Yudiana, 2018). Technological advances have converted many print learning media to digital learning media (Ricu et al., 2020). One example is learning media in e-modules (electronic modules). E-module that will be developed needs to contain aspects of scientific literacy and also be integrated with Islamic values. There are not many studies that have developed e-modules based on literacy and integrated with Islamic values.

Electronic modules (e-modules) are digital modules developed from printed modules (Sugihartini & Jayanta, 2017). E-modules are equipped with images, animation, audio, and video, so they seem interesting (Herawati & Muhtadi, 2020). E-modules are considered more practical and efficient and can support all media components needed for learning (Agusti et al., 2021). E-modules can visualize a phenomenon that supports students in exploring and growing skills in problem-solving (Silaban et al., 2022). Thus, e-modules are suitable for increasing students' scientific literacy.

Based on research conducted by Silaban et al. (2022), a scientific literacy-oriented chemistry e-module on chemical equilibrium material is very suitable as additional teaching material for students. This is known from student responses, which show positive results where students feel interested in the e-module. Apart from that, Ronawati Silaban et al. (2022) have also proven that the e-module created makes it easier for students to understand the material because the lesson material is closer to everyday life so that students can apply the knowledge they have. It is easy to use the e-module because it can be accessed anywhere and anytime. Sarni Warningsih et al. (2019) through their research stated that e-modules that are integrated with Islamic values can increase students' faith and piety as well as gratitude towards Allah SWT.

▪ METHOD

This study is a type of research development. The development model used is the ADDIE model. The ADDIE development model is a model that can be used to develop media, teaching materials, learning models, and learning strategies (Nurmalasari et al., 2022). The ADDIE model is considered adequate for developing e-modules. The stages are systematic so that the product produced will be a valid product and ready to be used (Sugihartini & Yudiana, 2018). The ADDIE development model consists of 5 stages: analysis, design, development, implementation, and evaluation.

The subjects of this research consisted of material expert lecturers, media expert lecturers, three chemistry teachers, and 30 class XI SMA/MA students. The data analysis techniques used are qualitative descriptive analysis techniques and quantitative descriptive analysis techniques. Qualitative descriptive analysis techniques are used to analyze data in the form of notes, suggestions, and input in the product validation sheet. Quantitative descriptive analysis is carried out by analyzing quantitative data in numbers. Quantitative data was obtained from distributing product assessment sheets using a Likert scale and student response sheets using the Guttman scale, as in Table 1 and Table 2.

Table 1 . Likert Scale

Category	**Score**
Very Good (SB)	4
Good (B)	3
Less (K)	2
Very Poor (SK)	1

Table 2. Guttman Scale

Category	**Score**
Yes	1
No	0

The score is then analyzed using the following calculation formula:

$$\% = \frac{\text{total score obtained}}{\text{maximum score}} \times 100\%$$

Next, the calculation results are interpreted according to Table 3 and Table 4.

Table 3 . E-Module Assessment Criteria

%	**Criteria**
$x \geq 81\%$	Very good
$61\% \leq x \leq 80\%$	Good
$41\% \leq x \leq 60\%$	Enough
$21\% \leq x \leq 40\%$	Not good
$0\% \leq x \leq 20\%$	Not good

Table 4 . Student Response Criteria

%	**Criteria**
$x \geq 81\%$	Very Positive
$61\% \leq x \leq 80\%$	Positive
$41\% \leq x \leq 60\%$	Enough
$21\% \leq x \leq 40\%$	Less Positive
$0\% \leq x \leq 20\%$	Negative

▪ RESULT AND DISCUSSION

This research produces a product in the form of an e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material. The e-module was developed using the ADDIE development model. The ADDIE development model has five stages: Analysis, Design, Development, Implementation, and Evaluation. However, this research only reached the development stage due to time constraints.

The analysis stage was carried out to determine the importance of developing an e-module based on scientific literacy integrated with Islamic values in this equilibrium material. The analysis carried out is needs analysis and curriculum analysis. The analysis stage was done by observing and interviewing chemistry teachers at SMA Muhammadiyah 3 Yogyakarta. Observations and interviews were conducted to determine the continuity of learning activities in the classroom, the condition of the teaching materials, and the curriculum used. Based on the results of observations at SMA Muhammadiyah 3 Yogyakarta, it was concluded that the majority of students were not able to relate the chemical material studied to problems in everyday life. This can be seen when students feel confused when faced with descriptions of questions related to phenomena in the surrounding environment. The teacher said that the cause of students' lack of understanding of the material being studied was because students lacked focus in learning. When learning takes place, some students do not have the motivation to follow the lesson and are busy with their own activities. Most students admitted that they were not interested in chemistry lessons. They consider chemistry lessons difficult so they are reluctant to study them in more depth. The methods used by teachers are discussions, lectures and practicums. Teachers have also started to link learning with daily life and also religious values. However, the learning resources used in the chemistry learning process in class appear less varied. The media used in learning are still in the form of PPTs, worksheets and ordinary textbooks so that sometimes it makes students feel bored. Teachers have not developed and used e-modules in chemistry learning. There have not been any textbooks or integrated modules with Islamic values that utilize technology. Teachers have not developed and used e-modules in chemistry learning. Therefore, it is necessary to develop interactive learning media that is not only based on scientific literacy and integrated Islamic values but is also interesting so that it can increase students' enthusiasm for learning, namely in the form of e-modules.

The second stage of this research is design. This stage focuses on finding solutions to learning problems identified at the analysis stage (Saputri & Syuhada, 2022). At this stage, researchers carry out three activities: selecting media that suits the objectives, determining the systematics of product preparation, and creating data collection instruments. The development of teaching materials must be based on an analysis of student needs (Widodo & Jasmadi, 2008). The product developed in this research is an e-modul. E-modul disigned using the *canva*. To make it more interesting, e-modul that has been developed is converted into a *flipbook* via *heyzine*. Alperi (2019), in his research, stated that the use of electronic modules could show a positive response to interest in learning and play a role in increasing students' learning independence. Wardiana (2004) stated that interest in the teaching and learning process is one factor that significantly influences learning achievement. Students with a high interest in learning will be more active and enthusiastic than less motivated students. The next step is creating the e-module framework. In creating the e-module framework, the researchers developed the concept of chemical equilibrium material using the core competencies and essential competencies of the 2013 curriculum. In this stage, the researcher also made the activity

sheets adapted to aspects of scientific literacy, created task lists, compiled practical sheets, and determined exciting and relevant images and videos. as support for learning. According to the Ministry of National Education (2008), the teaching materials developed must be by the applicable curriculum. Therefore, the material prepared is adapted to the core competencies and essential competencies of the 2013 curriculum. The material sources used in developing e-modules are from reliable sources, such as chemistry textbooks, journals, and articles. At this stage, the researcher also prepared validation instruments for material and media experts, assessment instruments for chemistry teachers, and student response questionnaires. The instruments used were material expert validation sheets, media expert validation sheets, chemistry teacher assessment sheets, and student response sheets.

The third stage is the development stage. At this stage, the first thing the researcher did was validate the instrument with expert lecturers. The results of instrument validation show that this instrument is declared valid with revision (VDR). Input from the instrument validator can be seen in Table 5.

Table 5. Input Instrument Validator

No	Input	Information
1	SK was changed to KI	Has been revised
2	The depth of the material and the completeness of the material are just combined	Has been revised
3	The accuracy of the assessment item material is summarized	Has been revised
4	The feasibility of presenting supporting parts does not need to be assessed in too much detail	Has been revised
5	Media experts do not include the aspect of usefulness	Has been revised
6	The statement items may be grouped (related to the content of the module, scientific literacy, and the appearance of the module)	Has been revised
7	Positive and negative statements may be grouped as well.	Not revised

Based on Table 1, 6 points have been revised, and one still needs to be revised. In point 7, suggestions and input still need to be revised because the author's aim in randomizing positive and negative statements is so that students really pay attention to the statements presented and do not just answer randomly. In point 3, the deleted parts were the accuracy of pictures, diagrams, and illustrations and the accuracy of terms because they were listed in other assessment points. Then, in point 6, the author groups the points of the statement into four aspects: attractiveness, content appropriateness, linguistics, and usage.

After revising the instrument, the researcher compiled the e-module, which had been previously designed at the design stage. This e-module is arranged in flipbook form. The e-module cover consists of the title, author's name, target user, agency name,

curriculum used, and illustrations that describe the contents of the e-module. The design of an e-module cover is not just protective or decorative but contains elements of interpretation and expression of the module's contents (Wantoro et al., 2013). The images or illustrations used must be appropriate to make things easier or even attract students' interest in the material presented (Suprayekti et al., 2017).

Writing an e-module consists of three parts, namely the opening part, the central part, and the closing part. The opening section contains a foreword, a table of contents, instructions for using the e-module, essential competencies and learning indicators, and a concept map. The core section consists of sub-chapter titles, essential competencies, indicators, and the material content to be studied. The subchapters in the e-module consist of three subchapters: dynamic equilibrium, equilibrium constants, and shifts in the direction of equilibrium and the factors that influence them. The sub-chapter titles and learning objectives are stated in each sub-chapter cover.

The presentation of the material is based on the scientific literacy aspect, which consists of four aspects, namely science as the body of knowledge contained in "Let's Learn," science as a way to investigate stated in "Let's Try," science as a way to think contained in "Let's Reason." The interaction of science, technology, and society is contained in "Science in Life." In the aspect of science as a body of knowledge, e-modules are designed to display concepts, facts, and principles that require students to learn and remember the material. The concepts in the e-module are intended to support students' cognitive strengthening. Mastery of concepts indicates success in learning (Suranti et al., 2017).

Furthermore, regarding science as a way to investigate, the e-module is designed by presenting the experimental design that students will carry out. In this activity, students will learn to conduct experiments adapted to the studied material. Through practicum, students can practice skills and provide opportunities for students to apply and integrate the knowledge and skills they have in practice (Nisa, 2017). The third aspect of scientific literacy is science as a way of thinking. In this aspect, the e-module is designed to display questions on competency tests using materials, graphs, or tables that are appropriate to aspects of students' knowledge. Wati and Fatisa (2018) suggested that questions that require students to seek answers by analyzing evidence and evaluating and processing data can encourage students to develop intellectual discipline and critical thinking skills.

Furthermore, the last aspect of scientific literacy is the interaction aspect of science, technology, and society. In this aspect, the e-module is designed to present facts related to material related to daily life. According to Kosasih (2020), one of the criteria for a sound module is using material related to life facts and the surrounding environment. Presenting phenomena or facts that occur in everyday life will help students improve their critical thinking skills, have broad knowledge, and be able to take action on problems that occur in society (Warningsih et al., 2019). When students interact with the environment through the problems or phenomena presented, they are indirectly involved in developing their thinking skills and scientific literacy (Ardianto & Rubini, 2016).

The science in life section also presents the integration of Islamic values. The integration of Islamic values in the module contains universal moral values, meaning they apply to people of other religions. The e-module presented includes verses from the Koran relevant to the material discussed. The Islamic values instilled in the e-module include recommendations for a healthy lifestyle by the QS. 'Abasa verse 24 and QS. Al-A'raaf verse 31, the command to avoid things that can endanger the life of the QS. Al-Baqarah

verse 195 advises adopting a healthy lifestyle by the hadith of the Prophet about miswak, the law on destroying nature based on QS—al-A'raaf verse 56. Research by Jamilah et al. (2014) shows that integrating religious values into the learning curriculum provides positive results that contribute to producing good people who apply knowledge and skills according to religious values.

After that, there are several additional materials to support, such as chemistry figures, chemistry tips, and videos that are relevant to the material. The chemical figures listed are essential figures related to discovering chemical equilibrium concepts. Chem tips are a part of the e-module that contains essential notes that need to be underlined by students or readers. Presenting videos that are relevant to the material will help students understand the material (Rambe, 2022).

Furthermore, the closing section of the e-module consists of a glossary, answer key, bibliography, and author biography. The answer key in the e-module is provided as a Google Drive link. An answer key allows students to measure and evaluate their learning outcomes (Kosasih, 2020).

After the e-module has been prepared, the supervisor consults it for suggestions and input. The consultation results are followed up by improving parts of the e-module according to suggestions. After obtaining approval from the supervisor, the next stage is a validation of the e-module. Validation of the e-module aims to determine the validity of the e-module in terms of appropriateness of material, appropriateness of presentation, scientific literacy aspect, integration of Islamic values, graphic aspect, language appropriateness aspect, and usage aspect. Two validators carry out E-module validation, namely material experts and media experts.

Aspects assessed by material experts are aspects of the appropriateness of the content, aspects of the appropriateness of presentation, aspects of scientific literacy, and aspects of integration of Islamic values. The aspects assessed by media experts are graphics, language appropriateness, and usage. Each validator provides suggestions and input according to their respective fields. Based on the validation results by material experts, it can be concluded that the e-module is declared valid with revision (VDR). Meanwhile, for the media expert validation results, it can be concluded that the e-module is declared valid without revision (VTR). Based on these results, researchers only need to revise the material first. Input from material experts for product development can be seen in Table 6.

Table 6. Material Expert Input

No	Input	Information
1	An example of carbonate equilibrium needs to be added to some of the practice questions	Has been revised
2	The phase change of $H_2O_{(s)} \rightleftharpoons H_2O_{(l)}$ is not a chemical equilibrium because no new substances occur	Has been revised
3	Page 8, is coral the result of the reaction of Ca^+ ions and CO_2?	Has been revised
4	For concept maps, make sure that the columns in the column are nouns	Has been revised

No	Input	Information
5	Concept map → shift in what direction? (give information)	Has been revised
6	Write supervisor without the word "father."	Has been revised

Based on Table 2, 6 points of suggestions and input were revised, and 1 point was not revised. Point 1 still needs to be revised because the carbonate example is already on page 32. According to material experts, the e-module being developed still contains several misconceptions, such as in the example of the reversible chemical reaction H_2O (s) ⇌ H_2O (l). This reaction is not a chemical reaction because it does not produce new substances; what happens is only a phase change. Therefore, the author replaces it with another more appropriate example. Then, on page 8, the coral formation reaction does not come from calcium and CO_2 ions but from CaO and CO_2. Therefore, the author revised it by changing the word calcium ion to calcium oxide. The material expert also suggested that in the e-module identity section, the lecturer's name should be written without using the word "Father" so that the researcher can delete it. Apart from that, in the concept map, it is necessary to add an adverb regarding the shift in direction so that the researcher can add the word chemical equilibrium after it. Material experts also recommend adding sources to each video presented.

The revision carried out after validating the e-module is revision I. The revision that was carried out produced e-module I, which can be used for the following research stage: the e-module assessment stage.

The e-module assessment aims to determine the quality of the e-module being developed. Three chemistry teachers carried out the assessment. Aspects assessed by chemistry teachers consist of aspects of the appropriateness of the content, aspects of the appropriateness of presentation, aspects of scientific literacy, aspects of integration of Islamic values, aspects of graphics, aspects of the appropriateness of language, and aspects of usage. The results of the chemistry teacher assessment can be seen in Table 7.

Table 7. Chemistry Teacher Assessment Results

Aspect	%	Category
Content Eligibility	96.4	Very good
Feasibility of Presentation	100	Very good
Scientific Literacy	94.4	Very good
Integration of Islamic Values	91.7	Very good
Graphics	96.1	Very good
Language Eligibility	93.1	Very good
Use	91.7	Very good
Average	**93.3**	**Very good**

Based on the calculation results, the average percentage obtained from the chemistry teacher assessment was 93.3% in the excellent (SB) category. Therefore, the e-module developed is suitable for use in learning. Several factors, including the following, influence these results:

First, the e-module developed has fulfilled the content feasibility aspect components. The content's suitability greatly determines a textbook's quality (Ministry of National Education, 2008). The percentage of assessment results obtained for the content

feasibility aspect was 96.4% in the excellent (SB) category. These results show that the e-module is the core and basic competency in the 2013 curriculum. The material presented is also correct and can provide information related to the learning material. According to Kartowagiran and Nurhidayani (2015), the suitability of the content can be seen from the suitability of the material with SK, KI, and KD, as well as the accuracy of the material and supporting material. A good textbook will contain information and material that supports the learning process.

Second, the e-module developed has fulfilled the feasibility aspect of the presentation. The appropriateness of presentation can also determine the quality of a textbook (Ministry of National Education, 2008). The percentage of e-module assessment results obtained in the feasibility aspect of the presentation was 100% in the excellent (SB) category. These results show that the systematic presentation of the e-module being developed is coherent and perfect. According to Kartowagiran and Nurhidayani (2015), even though something has good value, it can only be attractive if packaged well, orderly, and conceptually coherent.

Third, the e-module developed meets the scientific literacy aspect. The percentage of assessment results obtained for the presentation aspect was 94.4%, with an excellent (SB) category. These results show that the presentation of the e-module material developed is by aspects of scientific literacy, namely science as a body of knowledge, science as a way to investigate, science as a way to think, and the interaction of science, technology, and society. According to Kosasih (2020), one of the criteria for a suitable module is using material related to life facts and the surrounding environment.

Fourth, the e-module developed has fulfilled the integration aspect of Islamic values. The percentage of assessment results obtained for the integration aspect of Islamic values was 91.7% in the excellent (SB) category. This result is the lowest result among other aspects. This happens because the coverage of integration material presented by the author still needs to be improved. In one sub-material, the author uses only one integration.

Fifth, the e-module developed meets graphic aspects. The percentage of assessment results obtained for the graphic aspect was 96.1% in the excellent (SB) category. These results show that the graphic components in the e-module, namely the appearance of the cover, font type, font size, layout, illustrations presented, and the overall design of the e-module content, are appropriate, clear, and easy to understand. This is to the Ministry of National Education's (2008) idea that the size and type of letters are appropriate to the characteristics of students, and the ratio of portions between titles, subtitles, and text content must be appropriate. Good textbooks are presented with balanced proportions.

Sixth, the e-module developed meets the language feasibility aspect. The percentage of assessment results obtained for the content feasibility aspect was 93.1% in the excellent (SB) category. These results show that the e-module uses good, correct, and easy-to-understand language. Prastowo (2011) stated that the sentences used in the module must be simple, straightforward, and effective so that students can easily understand the material. Apart from that, the use of language must also be appropriate to students' development level so that it is easy for students to understand (Kosasih, 2020).

Finally, the e-module developed also meets the usability aspect. The percentage of assessment results obtained for usage was 91.7% in the excellent (SB) category. These results show that the content in the e-module being developed is easy to access, and the operational buttons function well. Apart from that, the e-module instructions are also

accessible for readers to understand. These instructions are important because they guide students regarding textbook use procedures (Widodo & Jasmadi, 2008).

After the e-module goes through the validation and revision stages, the e-module is tested on students. The trial aims to determine students' responses to the e-module being developed. The e-module was tested on 30 students in class XI MIPA 4 at SMA Muhammadiyah 3 Yogyakarta. The results of distributing student response sheets can be seen in Table 8.

Table 8 . Student Response Results

Aspect	**%**	**Category**
Attractiveness	94.4	Very Positive
Content Eligibility	96.7	Very Positive
Language	95.6	Very Positive
Use	96.7	Very Positive
Average	**96**	**Very Positive**

From the distribution of response sheets, the average percentage of student responses was 96% in the positive category. The highest percentage was obtained in the feasibility aspect of content and usage aspect, namely 96.7%. These results show that the material presented in the e-module is easy to understand and can develop students' abilities to connect science concepts with life. This is because the descriptions, examples, and practice questions presented in the e-module are related to students' daily lives, and there are visualizations in the form of pictures and videos so that they are interesting for students. Apart from that, this e-module is also easy to use and has instructions for use that are easy to understand. Students can use A suitable module independently, either with or without teacher guidance in learning (Budiono & Susanto, 2006).

Next, the linguistic aspect gets an average percentage of 95.6%. These results show that the sentences and language used in the e-module are clear, simple, and easy to understand. Simple, effective, and straightforward sentences will make it easier for students to understand the e-module (Prastowo, 2011). According to Kartowagiran and Nurhidayani (2015), a suitable module is a book that uses language that is easy for the reader to understand.

Finally, the attractiveness aspect received an average percentage of 94.4%. This shows that the e-module being developed has an attractive appearance and can make students interested in studying the e-module. According to Kartowagiran and Nurhidayani (2015), using size, cover design, and attractive content design can increase interest in reading the textbook.

On the student response sheet, there are also several comments regarding the development of the e-module. Student comments were that students felt interested in studying the e-module being developed. This shows that students received the e-module developed well, so it is suitable for learning. These results align with Sarni Warningsih et al. (2019) research, which shows that scientific literacy-based learning modules integrated with Islamic values are suitable for use in learning. Apart from that, research conducted by Sri Astuti et al. (2021) also shows that e-modules based on scientific literacy are very suitable for use as teaching materials. The resulting electronic module is flexible and easy to use and can train students' independence.

This e-module development has advantages and disadvantages. The advantages of an e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material are: first, the e-module developed provides the final result in the

form of a link or web-based so that it can be operated using Android, IOS, computers, and laptops. The results of the e-module development can be accessed via the link: http://bit.ly/e-modul_kesetimbangankimia.

Second, the e-module developed can be accessed anywhere and at any time, allowing students to learn independently. Third, the material developed is based on aspects of scientific literacy to help students connect material concepts with phenomena that exist in everyday life. Fourth, the material developed is also integrated with Islamic values to improve students' spiritual attitudes and make them aware of God's power.

Apart from the advantages, the development of the e-module also has disadvantages. These shortcomings include: first, internet stability affects the smooth use of e-modules. Second, *Canva* does not support writing chemical reactions, making writing chemical reactions less neat.

▪ CONCLUSION

This research uses the ADDIE development model to develop an e-module based on scientific literacy integrated with Islamic values in chemical equilibrium material. Only three stages are carried out: analysis, design, and development. The research results show that the e-module based on scientific literacy integrated Islamic values in the chemical equilibrium material developed is suitable for use in learning based on the average teacher assessment score for the e-module of 93.3% with excellent criteria. The response results were obtained from 30 students in the class.

▪ REFERENCES

Agusti, M., Ginting, S. M., & Solikhin, F. (2021). Pengembangan E-Modul Kimia Menggunakan Exe-Learning Berbasis Learning Cycle 5e Pada Materi Larutan Penyangga. *Jurnal Pendidikan dan Ilmu Kimia*, *5(2)*, 198–207.

Alperi, M. (2019). Peran Bahan Ajar Digital Sigil Dalam Mempersiapkan Kemandirian Belajar Peserta Didik. *Jurnal Teknodik*, *23*.

Ardianto, D., & Rubini, B. (2016). Literasi Sains Dan Aktivitas Siswa Pada Pembelajaran Ipa Terpadu Tipe Shared. *UNNES Science Education Journal*, *5(1)*.

Astuti, S., & Maulina, J. (2021). *Kelayakan Modul Elektronik Berbasis Literasi Sains Dengan Topik Pembuatan Edible Film Pulp Kakao Sebagai Kajian Koloid*. *10*(02), 8.

Budiono, E., & Susanto, H. (2006). Penyusunan Dan Penggunaan Modul Pembelajaran Berdasar Kurikulum Berbasis Kompetensi Sub Pokok Bahasan Analisa Kuantitatif Untuk Soal-Soal Dinamika Sederhana Pada Kelas X Semester I SMA. *Jurnal Pendidikan Fisika Indonesia*, *4*.

Depdiknas. (2008). *Panduan Pengembangan Bahan Ajar*. Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah.

Dewi , CA, & Rahayu , S. (2022). Importance Optimizing Chemical Literacy Through Learning Based Issues Socioscience in the 2nd Century. *Proceedings of the National Seminar National Science XII.*

Hasibuan, A. T., & Prastowo, A. (2019). Konsep Pendidikan Abad 21: Kepemimpinan Dan Pengembangan Sumber Daya Manusia SD/MI. *MAGISTRA: Media Pengembangan Ilmu Pendidikan Dasar dan Keislaman*, *10*(1). https://doi.org/10.31942/mgs.v10i1.2714

Herawati, N. S., & Muhtadi, A. (2020). Pengembangan Modul Elektronik (E-Modul) Interaktif Pada Mata Pelajaran Kimia Kelas XI IPA SMA. *Jurnal At-Tadbir*, *4*(1), 13.

Hidayati, N.-, Saputro, S., & Susilowati, E. (2018). The Effectiveness Of Chemical Module With Compendium Verses Quran In Pesantren-Based School. *Jurnal Kependidikan: Penelitian Inovasi Pembelajaran*, *2*(2), 320–332. https://doi.org/10.21831/jk.v2i2.17955

Jamilah J, A, A. N., Mr, D., Ho, A., & Nm, N. I. (2014). Integration of Islamic Input in Medical Curriculum – Universiti Sains Islam Malaysia (USIM) Experience. *IIUM Medical Journal Malaysia*, *13*(2). https://doi.org/10.31436/imjm.v13i2.483

Kartowagiran, B., & Nurhidayani. (2015). Pengembangan Instrumen Penilaian Kualitas Buku Kimia Pegangan Guru Dalam Implementasi Kurikulum 2013. *Jurnal Evaluasi Pendidikan*, *3*(1).

Kosasih, E. (2020). *Pengembangan Bahan Ajar*. Bumi Aksara.

Mardhiyah, R. H., Sekar Nurul Fajriyah Aldriani, Febyana Chitta, & Muhamad Rizal Zulfikar. (2021). Pentingnya Keterampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. *Lectura : Jurnal Pendidikan*, *12*(1), 29–40. https://doi.org/10.31849/lectura.v12i1.5813.

Nisa, U.M. (2017). Method Practice For Increase Understanding And Results Study Student Class V MI YPPI 1945 Tripe on Material Single Substance and Mixture. *Proceedings Biology Education Conference, pp. 14, 62–68*

Nurjannati, N., Rahmad, M., & Irianti, M. (2017). Development Of E-Module Based On Science Literacy In Electromagnetic Radiation Lesson. *Universitas Riau*.

Nurmalasari, L., Akhbar, M. T., & Syaflin, S. L. (2022). Pengembangan Media Kartu Hewan Dan Tumbuhan (TUHETU) Pada Pembelajaran IPA Kelas IV SD Negeri. *Jurnal Riset Pendidikan Dasar*, *05*, 1–8.

OECD. (2018). *PISA 2015 Draft Frameworks*. OECD Publishing.

OECD. (2022). PISA 2022 Result Factsheets. *OECD Publishing*.

Okmarisa, H., & Darmana, A. (2016). Implementasi Bahan Ajar Kimia Terintegrasi Nilai Spiritual Dengan Model Pembelajaran Problem Based Learning (PBL) Berorientasi Kolaboratif Untuk Meningkatkan Hasil Belajar Siswa. *Jurnal Pendidikan Kimia*, *8*(2), 6.

Prastowo, A. (2011). *Panduan Kreatif Membuat Bahan Ajar Inovatif*. Diva Press.

Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019). Pembelajaran IPA Abad 21 dengan Literasi Sains Siswa. *Jurnal Materi dan Pembelajaran Fisika (JMPF)*, *9*, 9.

Qurniati, D. (2021). Pengembangan Bahan Ajar Kimia Kontekstual Terintegrasi Keislaman. *Chemistry Education Practice*, *4*(2), 186–193. https://doi.org/10.29303/cep.v4i2.2535

Rambe, K. (2022). Pengembangan Modul Elektronik (E-Modul) Berbasis Smartphone tentang Materi Sistem Ekskresi pada Manusia untuk Peserta Didik Kelas XI SMA. *Biodidaktika: Jurnal Biologi dan Pembelajarannya*, *17*(2).

Sidiq, R., & Najuah. (2020). Pengembangan E-Modul Interaktif Berbasis Android pada Mata Kuliah Strategi Belajar Mengajar. *Jurnal Pendidikan Sejarah*, *9*(1), 1–14. https://doi.org/10.21009/JPS.091.01

Saputri, S. D., & Syuhada, F. A. (2022). Pengembangan E-Modul Terintegrasi Pendidikan Karakter Berbasis Sets Pada Materi Sistem Koloid. *Jurnal Zarah*, *10*(2), 101–113. https://doi.org/10.31629/zarah.v10i2.4477

Silaban, R., Elvia, R., & Febrian Solikhin. (2022). Pengembangan E-Modul Kimia Berorientasi Literasi Sains Pada Materi Kesetimbangan Kimia Di SMA Negeri 3 Bengkulu Tengah. *ALOTROP*, *6*(2), 180–189. https://doi.org/10.33369/alo.v6i2.25515

Situmorang, R. P. (2016). Integrasi Literasi Sains Peserta Didik Dalam Pembelajaran Sains. *Satya Widya*, *32*(1), 49. https://doi.org/10.24246/j.sw.2016.v32.i1.p49-56

Sugihartini, N., & Jayanta, N. L. (2017). Pengembangan E-Modul Mata Kuliah Strategi Pembelajaran. *Jurnal Pendidikan Teknologi dan Kejuruan*, *14*(2). https://doi.org/10.23887/jptk-undiksha.v14i2.11830

Sugihartini, N., & Yudiana, K. (2018). Addie Sebagai Model Pengembangan Media Instruksional Edukatif (MIE) Mata Kuliah Kurikulum Dan Pengajaran. *Jurnal Pendidikan Teknologi dan Kejuruan*, *15*(2). https://doi.org/10.23887/jptk-undiksha.v15i2.14892

Suprayekti, S., Suparto, S., Sukawati, R., & Septiani, M. (2017). Teknik Penulisan Modul Keterampilan Belajar Untuk Mahasiswa. *Perspektif Ilmu Pendidikan*, *28*(1), 65. https://doi.org/10.21009/PIP.281.8

Suranti, N. M. Y., Gunawan, G., & Sahidu, H. (2017). Pengaruh Model Project Based Learning Berbantuan Media Virtual Terhadap Penguasaan Konsep Peserta didik pada Materi Alat-alat Optik. *Jurnal Pendidikan Fisika dan Teknologi*, *2*(2), 73–79. https://doi.org/10.29303/jpft.v2i2.292

Susilowati, S. (2017). Pengembangan Bahan Ajar IPA Terintegrasi Nilai Islam untuk Meningkatkan Sikap dan Prestasi Belajar IPA Siswa. *Jurnal Inovasi Pendidikan IPA*, *3*(1), 78. https://doi.org/10.21831/jipi.v3i1.13677

Toharudin, U., Hendrawati, S., & Rustaman, A. (2011). *Membangun Literasi Sains Peserta Didik*. Humaniora.

Wantoro, A. M., Zpalanzani, A., & Sachari, A. (2013). Napak Tilas Tata Rupa Dan Cetak Sampul Novel Di Indonesia (1931-2010). *VISUALITA*, *5*(1). https://doi.org/10.33375/vslt.v5i1.1105

Wardiana, U. (2004). *Psikologi Umum*. PT. Bina Ilmu.

Warningsih, S., Santoso, H., & Lepiyanto, A. (2019). Pengembangan Modul Berbasis Literasi Sains Dengan Terintegrasi Nilai-Nilai Islam Pada Materi Keanekaragaman Hayati SMA Kelas X. *UNESA Jurnal of Chemical Education*, 7.

Wati, L., & Fatisa, Y. (2018). Desain Bahan Ajar Berupa Handout Berbasis Inkuiri Terbimbing Pada Pembelajaran Kimia Materi Hidrokarbon. *Konfigurasi : Jurnal Pendidikan Kimia dan Terapan*, *1*(2), 219. https://doi.org/10.24014/konfigurasi.v1i2.4536

Widodo, C., & Jasmadi. (2008). *Panduan Menyusun Bahan Ajar*. PT Elex Media Komputindo.