

## Development of an Islamic Integrated Biology E-Module on Class XI High School Excretory System Material to Empower Students' Critical Thinking Skills

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### ABSTRACT

This study aims to develop an Islamic integrated biology e-module on the excretory system material for grade XI high school to empower students' critical thinking skills. The product is developed using a 4-D development model (define, design, develop, and disseminate). The instrument used is a questionnaire. The research subjects comprised 30 class XI IPA students from MA Darul Ulum Semarang. Data collection was conducted through interviews, observations, documentation, and questionnaires. The data were analyzed using descriptive analysis and qualitative techniques. The study resulted in the development of valid e-module products, with validity criteria of 75% from material experts, 85% from Islamic integration experts, and 62.5% from media experts. Additionally, the results showed that practical e-modules were utilized with a practicality percentage of 77.94% based on responses from Biology Teachers and 86.66% from students.

**Keywords:** critical thinking, e-module, excretion system, Islamic integration.

## 1 INTRODUCTION

In the 21st century, students face challenges and must master specific skills. These skills, including critical thinking, problem-solving, communication, collaboration, innovation and creation, and information literacy, must be applied in learning activities (Yulianisa et al., 2018). Teachers play a significant role in directing and guiding their students to develop their potential and master these skills, including critical thinking.

Ardiyanti and Winarti (2013) stated that critical thinking skills must be cultivated across all school subjects, including biology. As a science, biology requires logical, analytical, critical, and combinative thinking (Campbell, 2010). Critical thinking involves reasoning and an orderly understanding of the relationship between ideas and facts. These essential skills can be enhanced by integrating Islamic values into the curriculum (Rahmawati, 2018). Integrating Islamic values complements scientific knowledge and bridges the gap between science and religious studies. Critical thinking enables students to master the cognitive realm, making learning meaningful and empowering their religious beliefs (Sulhan, 2011; Nuri et al., 2021). Students need to develop critical thinking skills to establish connections between science and spiritual beliefs, which is a crucial cognitive domain.

The empowerment of religious beliefs can be applied in learning, especially in sciences that require logical thinking, such as biology. This integration can elucidate the meanings of the

kauniyah verses (verses on natural knowledge) that are effective. Integrating biology education with Islamic principles demonstrates the unity of science, as evidenced by these kauniyah verses. This unity of science needs further development.

The paradigm of the unity of science was introduced and practiced by classical Muslim scholars such as Ibn Sina (980-1037 AD), Al-Kindi (801-870 AD), and Al-Farabi (874-950 AD). They studied Greek sciences, emphasizing contemplative logos, which are non-experimental but adapted and modified with scientific insights from revelation, and they emphasized empirical over natural facts (Rahman et.al., 2008). According to Islam, there is no distinction between religious sciences (Islam) and general sciences (science, technology, and social humanities); all knowledge comes from Allah SWT. The educational curriculum should be based on Islamic principles, serving as a benchmark and standard for assessing knowledge (Alim, 2014).

Based on observations conducted through interviews with biology teachers and grade XI students at MA Darul Ulum Semarang, the following data were obtained: 1) students' critical thinking skills are still underdeveloped; 2) there are no textbooks that integrate Islamic values; 3) 85.7% of students find the human excretory system a difficult topic; and 4) 57.1% of students prefer learning using e-modules over other media. E-modules, which are electronic-based and utilize information and communication technology, offer practical advantages such as smaller file sizes and accessibility through electronic devices. They are designed to engage students actively in the learning process, promoting independent learning anytime and anywhere (Fauziah and Jamaris, 2022).

Previous research by Damayanti et al. (2023) demonstrated that the learner worksheets they developed can improve students' science process skills. Baun et al. (2023) created flip charts on Rhizopoda material, which proved effective in the classroom learning process. Nurhasikin et.al., (2020) developed e-modules that improved students' mastery of the material, although their focus was on the structure and function of plant tissues. The development of e-modules on excretory system material at MA Darul Ulum Semarang has not been undertaken before, making this development crucial for enhancing students' critical thinking skills. This study aims to develop an Islamic-integrated biology e-module on the excretory system for grade XI high school students to empower their critical thinking skills.

## **2 METHOD**

Researchers employed the Research and Development (R&D) model. The development model followed the 4-D model by Thiagarajan in 1974 (Kurniawan and Dewi, 2017). The research only reached the development stage due to limitations. The e-module development was conducted at Walisongo State Islamic University Semarang. Product trials involved 30 class XI IPA students from MA Darul Ulum. Data were obtained through validity test questionnaires and practicality tests. Validity tests involved lecturers, material experts, teaching material experts, and Islamic integration experts. Biology teachers and grade XI students from MA Darul Ulum conducted the practicality test. The data were analyzed using descriptive and qualitative analysis techniques.

## **3 HASIL DAN PEMBAHASAN**

### **3.1 Development Procedure**

### 1. Defining Stage (Define)

The Define stage is the stage of determining the criteria for learning, this stage begins by analyzing the objectives of the material to be developed in the learning device (Putra, 2015). The define stage includes 5 main stages including front end analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives.

### 2. Design Stage

The design stage consists of four stages: Constructing criterion-referenced tests, media selection, format selection, and initial design. The resulting product is an e-module for Biology integrated with Islam, focusing on the excretory system material for grade XI SMA, aimed at empowering students' critical thinking skills. Developing this e-module seeks to enable students to integrate science with Islam, creating a unified view of knowledge. Additionally, the e-modules are expected to enhance critical thinking skills. The format for preparing the e-modules is based on several relevant references. The complete systematic format of the e-module preparation includes the following:

#### a. E-Module Cover

The cover of the Islam-based biology e-module features the title, subject, grade or target audience, material, author's name, supporting images of the excretory system and Islamic elements, and the agency logo. The e-module cover that has been created is presented in Figure 1.

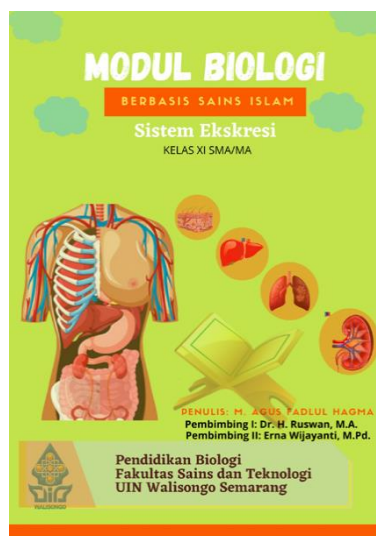


Figure 1. E-module Cover

#### b. Foreword

The foreword includes an expression of gratitude to Allah SWT and His prophet Muhammad SAW, an explanation of the benefits and objectives of developing the Islam-based e-module, an overview of the e-module content, gratitude to all contributors, and space for criticism and reader suggestions.

#### c. Table of Contents

The table provides the main instructions about the module's contents and page numbers. It includes the title page, preface, table of contents, Core Competencies & Basic Competencies, glossary, concept map, apperception, discussion, simple practicum, assessment, answer key, and bibliography.

d. **Introduction**

The introduction contains Core Competencies and Basic Competencies, Competency Achievement Indicators, and learning objectives.

e. **Glossary**

The glossary helps students understand complicated terms and allows them to find keywords quickly. The glossary is presented in Figure 2.

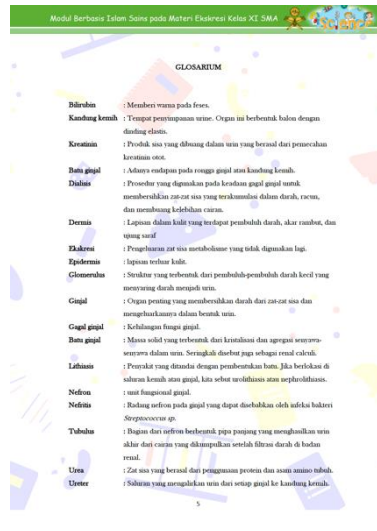


Figure 2. The Glossary

f. **Concept Map**

The concept map outlines the content of the excretory system material that will be discussed in the e-module.

g. **Learning Activity Section**

The learning activities section includes apperception, a general discussion of the excretory system, excretory organs and substances released, descriptions of the structure, function, and Islamic integration of each excretory organ, various excretory system diseases with pictures, causes, and symptoms, as well as a simple practicum on the excretory system. The sample of learning activity section is presented in Figure 3.

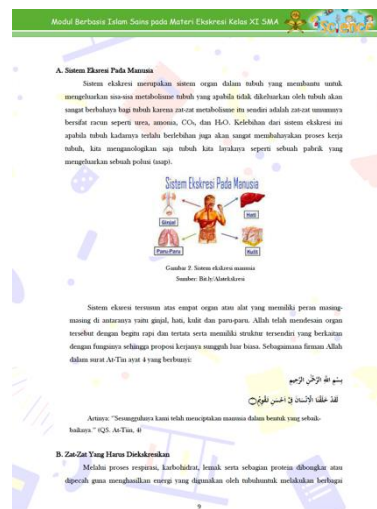


Figure 3. The sample of learning activity section

#### h. Problem Section and Answer Key

The problem section contains questions designed to assess students' understanding of the material through multiple-choice answers. The answers match the answer key provided in the e-module. The sample of the problem section is presented in Figure 4.

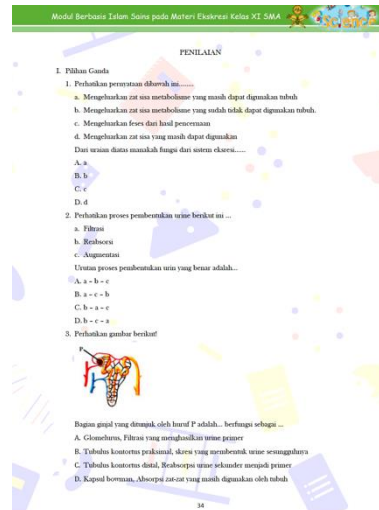


Figure 4. The sample of the problem section

#### i. Bibliography

The bibliography at the end of the e-module lists the references used by the author in compiling the e-module.

#### 3. Development Stage (Develop)

This stage is carried out to make products that have been determined. In the development stage, there are two processes: expert appraisal and developmental testing.

### 3.2 Quantitative Data

#### a. Material Expert Validation Results

Data from the results of material validation in the form of assessment scores on the material contained in the *e-module* by the instruments that have been prepared. In addition to using scores, researchers get suggestions and input for improvements to *the e-module* to make it more perfect. The material expert validator lecturer who provided the assessment was Mrs. Mirtaati Na'ima, S. Si., M. Sc. The data from the material expert validation results are listed in Table 1. below.

**Table 1** Material Expert Validation Results

No	Assessed Aspects	$\Sigma x$	$\Sigma xi$	%	Category
1	Material coverage	9	12	75	Valid
2	Accuracy of the material	13	16	81,25	Highly Valid
3	Activities that support the material	6	8	75	Valid
4	Material develops thinking skills	3	4	75	Valid
5	Language Use	4	8	50	Less Valid
6	Use of terms or signings	7	8	87,5	Highly Valid

7	Learning evaluation	6	8	75	Valid
Total		48	64	75	Valid

Based on data from the results of the assessment of *e-modules* by material experts in Table 1, it shows that the amount of validity of the material presented in the *e-module* gets a total overall score of 75% so that the Islamic integrated Biology *e-module* in the excretory system material of class XI SMA to empower students' critical thinking skills is categorized as Valid for further test use.

#### b. Results of Islamic Integration Expert Validation

Data from the results of Islamic integration validation in the form of assessment scores on material integration with Islamic values contained in the *e-module* by the instruments that have been prepared. In addition to using the scores, researchers get suggestions and input for improvements to the e-module to make it perfect. The expert validator lecturer on Islamic integration who gave the assessment was Mrs. Dr. Miswari, M. Ag. The data from the validation of Islamic integration experts are listed in Table 2. next.

**Table 2.** Islamic Integration Expert Validation Results

No	Assessed Aspects	$\Sigma x$	$\Sigma xi$	%	Category
1	Ayatization of Islamic science	10	12	83,3	Highly Valid
2	Humanization of Islamic science	7	8	87,5	Highly Valid
Grand Total		17	20	85	Highly Valid

Based on data from the results of the assessment of *e-modules* by Islamic integration experts in Table 2. shows that the amount of validity of Islamic integration presented in the *e-module* gets a total overall score of 85% so that the *Islamic integrated Biology e-module* on the excretory system material of class XI SMA to empower students' critical thinking skills is categorized as very valid for further test use.

#### c. Media Expert Validation Results

Data from the results of media validation in the form of assessment scores on the media contained in the *e-module* in accordance with the instruments that have been prepared. In addition to using score, researchers also get suggestions and input for improvements to the e-module to make it perfect. The media expert validator lecturer who gave the assessment was Mrs. Nisa Rasyida, M. Pd. The data from the media expert validation results are listed in Table 3 below.

**Table 3.** Media Expert Validation Results

No	Assessed Aspects	$\Sigma x$	$\Sigma xi$	%	Category
1	Organization of general presentation	5	10	50	Less Valid
2	Presentation considers multiplicity and usefulness	5	10	50	Less Valid
3	General view	13	20	75	Valid
4	Completeness of <i>e-modules</i>	12	16	75	Valid
Total		35	56	62,5	Valid

Based on data from the results of the assessment of the *e-module* by media experts in Table 3 shows that the amount of media validity presented in the *e-module* gets a total overall score of 62.5% so that the Islamic integrated Biology *e-module* on the excretory system material of class XI SMA to empower students' critical thinking skills is categorized as valid for further test use. After getting the validation results from the validators, the e-module will be revised according to the input and suggestions from the validators. After revision, then the e-module was assessed for practicality by the Biology Teacher.

### 3.3 Qualitative Data

#### a. Material Expert Suggestions and Input

Based on the results of the validity assessment by material experts, the author received suggestions and input for improvements to the *e-module* developed in the form of three improvements: first, in the concept of augmentation, there are still errors to improve the idea, there are still typos and augmentation terms to be replaced with secretory terms, third, in question number 8 the correct answer key is B. sweating, The answer is from the question of the way the skin regulates body temperature. The results of expert advice and input The material is used to revise the e-module.

#### b. Islamic Integration Expert Validation Results

Based on the results of the validity assessment by Islamic integration experts, the author gets comments that the addition of basmalah writing is to be included in the Qur'anic verse. The results of Islamic Integration's expert advice and input are used as material for revising the e-module.

#### c. Media Expert Validation Results

Based on the results of the validity assessment by media experts, the author received suggestions and input for improvements to the *e-module* developed in the form of seven improvements; first, the font type is still rigid to be changed to a font form that is not rigid, the font size between subtitles and content is not suitable for adjustment. Second, the image skin caption still needs to be clarified, and a better image cannot replace the image resolution. Third, no simple practicum instructions prove the existence of an excretory system in the body to be added as a curve of *the excretory system e-module*. Fourth, on disorders and diseases of the excretory system to add pictures, causes, and symptoms. Fifth, multiple-choice questions have not been able to assess the ability to think; the types of questions are only in the form of C1 and C2, and Bloom's Taxonomy has not been able to obtain maximum results in its evaluation to be replaced by questions who has these characteristics, sixth, writing the answer key to make a separate page, seventh, there is still a distance of space that is too far to tidy up. The results of media experts' suggestions and inputs are used as material for revising the e-module.

### 3.4 Product Trial Results

The results of the responses of biology teachers as practitioners are also used against e-modules and validated by the three experts. The biology teacher who responded to this research was Mrs. Bitu Afriyati Dewi S. Pd., who is a biology teacher at MA Darul Ulum Semarang. Data on practitioner responses are found in Table 4. next.

**Table 4.** Results of Validation of Practitioner Responses (Biology Teachers)

No	Assessed Aspects	$\Sigma x$	$\Sigma xi$	%	Category
1	Material coverage	6	8	75	Practical
2	Completeness of contents	14	16	87,5	Very Practical
3	Serving components	6	8	75	Practical
4	Layout	6	8	75	Practical
5	Language Use	12	16	75	Practical
6	Integration of Islamic Values	9	12	75	Practical
Grand Total		53	68	77,94	Very Practical

Based on data from the results of the assessment of e-modules by practicing teachers, there is Islam in Table 4. shows that the amount of media validity presented in the e-module gets a total overall score of 77.94% so that the Islamic integrated Biology e-module on the excretory system material of class XI SMA to empower students' critical thinking skills is categorized as very practical for further test use.

The wide-scale field test in this study consisted of 30 MA Darul Ulum students randomly drawn from class XI Science. Data collection in product trials was carried out directly in class XI Science, which contained questionnaires of student responses to e-modules developed by researchers. The results of the broad-scale student e-module readability test on the field test can be seen in Table 5. The results of students' responses to the Islamic e-module in Table 5 showed that the e-module got a total overall score of 86.66%, which means that the e-module is very practical to use.

**Table 5.** Student Response to *e-module*

No	Assessed Aspects	$\Sigma x$	$\Sigma xi$	%	Category
1	Material coverage	424	480	88,33	Very Practical
2	Serving	308	360	85,5	Very Practical
3	Language	301	360	83,61	Very Practical
4	Compatibility of e-module presentation with learning	406	480	84,58	Very Practical
5	Integration of Islamic Values	329	360	91,38	Very Practical
Grand Total		1.768	2040	86,66	Very Practical

The excretory system e-module developed consists of a fundamental analysis of excretory system material, divided into four excretory system organs: kidneys, skin, lungs, and liver. Each organ has a description of organ function and organ metabolism, and it is equipped with the integration of verses from the Qur'an with science. E-module is also added with a simple practicum and various diseases and their causes, which are symptoms and photos of excretory system abnormalities. Including practical sections and case studies in e-modules can help students develop decision-making patterns. For instance, in the context of biology, e-modules can present scenarios involving various excretory system diseases and their causes. Students must then analyze the information, identify key factors, and decide the best course of action (Sejati et al., 2021).



The development of e-module can empower critical thinking, contained in the simple practicum section, and various excretory system diseases and their causes and questions in the e-module, where all three focus on decision-making patterns. Interactive elements within e-modules, such as quizzes, discussion forums, and problem-solving activities, promote active learning. These features encourage students to engage with the material more effectively, fostering deeper understanding and better retention of complex concepts (Wahyuni et al., 2019).

Critical thinking involves reflective thinking, which means students must analyze information, evaluate its validity, and synthesize it to form conclusions. E-modules can facilitate this process by providing interactive content encouraging students to engage deeply with the material (Ennis, 2011). By incorporating real-world applications into e-modules, educators can make learning more relevant and engaging. For example, discussing various excretory system diseases and their causes helps students understand the practical implications of biological concepts. This real-world context enhances students' ability to think critically about how biological principles apply in everyday life (Sejati et al., 2021).

## 4 KESIMPULAN DAN SARAN

### 4.1 Kesimpulan

The development of e-modules is very valid for use as teaching materials. This can be seen based on the value of validation test results by material experts at 75%, Islamic integration experts at 85%, media experts at 62.5%, practicality tests by biology teachers at 77.94%, and practicality tests by students at 86.66%.

### 4.2 Saran

E-modules can be used as an alternative for teachers to use learning media in the classroom, and they can be used for independent learning by students. E-modules can be developed wider and carried out in several other faith-based high schools or MA schools.

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