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Development of Canva-Based E-Module on Biotechnology Subject for 10th Grade High School Students

Syifa Aliya Rahma*, Sulistiyawati
Biology Education Department, Faculty of Tarbiyah and Education, UIN Sunan Kalijaga
Jl. Marsda Adisucipto No 1 Yogyakarta 55281, Indonesia. Tel. +62-274-540971, Fax. +62-274-519739.

Corresponding author*
rsyifaaliya@gmail.com

Abstract: Biotechnology is complex and applicable material but is difficult for students to understand due to limitations in schools in the form of less attractive learning media. This study aims to determine the development, quality and response of students to e-modules based on Canva in class 10th SMA/MA biotechnology material. This research method is Research and Development (R&D) with the ADDIE model which is used up to the Development stage. The quality test involved 1 material expert, 1 media expert, 10 peer reviewers, and 1 biology teacher, with an assessment of 95.32% and a very good category. The student response test involved 35 students, with an assessment of 82.48% and the category strongly agreed. As a result, the Canva e-module for the tissue culture and vaccine sub-material in Biotechnology material in class 10th SMA/MA was successfully developed. This e-module has very good quality and student response, worthy of being used as a medium for learning biology in biotechnology material.

Keywords: E-modul, Canva, dan Bioteknologi.

Introduction

Biotechnology is one of the concepts in the Biology subject taught in High School that tests students critical thinking skills (Mardiyah et al., 2022). This topic is intriguing as it always presents the latest information, yet its complex Latin terminology, biotechnology principles, and limited Indonesian language references pose challenges for students to comprehend (Jumiarni et al., 2022). A preliminary study at SMA N 2 Banguntapan revealed that the summative assessment results for the Biotechnology material in the year 2023 yielded an average score of 60-68, whereas the Learning Objectives Achievement Criteria (LOAC) was set at ≥ 71. One of the contributing factors to the low learning outcomes is the scarcity of biotechnology learning media in schools.

Biotechnology education aims to enhance students knowledge, but a majority of teachers still employ lecture methods and reading assignments that lead to suboptimal learning outcomes (Laraswaty, 2017). Time constraints and limited teaching materials also contribute to students' inadequate comprehension of biotechnology (Fahdi et al., 2016). At SMA N 2 Banguntapan, observations reveal that teaching predominantly relies on lecture-style methods, question-and-answer sessions, presentations, and less diverse instructional models. Effective teaching quality necessitates the utilization of engaging, interactive, and involving teaching media for students, teachers, and relevant field experts (Kemdikbud, 2011). However, challenges arise due to limitations in learning resources and instructional materials employed, such as PowerPoint slides and school-issued textbooks.

Previous research indicates that the use of textbooks as instructional media in biotechnology subjects lacks significance and fails to cultivate students' life skills. Students encounter difficulties in reading and comprehending biology teaching materials (Syafruddin et al., 2016). Restrictive factors leading to student challenges encompass teachers' inadequate expertise in this field,

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insufficient teaching experience, as well as limited teaching resources and time (Tompe et al., 2017). Therefore, a systematic, clear, concise, and engaging instructional media is necessary to enhance students' learning interest (Amaringga et al., 2021).

An e-module is a form of self-paced learning material presented in an electronic, systematic format (Kemendikbud, 2017). Each learning activity within it can be linked with hyperlinks to enhance interactivity and students' learning experience (Mellisa & Imania, 2022). E-modules present content with the inclusion of images, videos, and article links. The advantage of e-modules lies in their portability and accessibility anytime, unlike printed modules. Learning through e-modules is a capable, viable, and intelligent choice as it aids in enhancing students' understanding of concepts and learning outcomes (Wilujeng et al., 2020).

Canva is an alternative application for creating e-modules or electronic modules (Elvionita, 2021). This application enables users to design various creative layouts easily online. Canva also features the capability to make e-modules more engaging by incorporating video links, especially in Biotechnology subjects. The Canva application is accessible through various versions, including desktop, web, iPhone, and Android, making it convenient to access e-modules across different electronic devices (Septiani et al., 2003).

The results of observations and interviews with biology teachers at SMA N 2 Banguntapan indicate that students have an average score below the LOAC in the Biotechnology subject (60-68). Students struggle to independently comprehend biotechnology knowledge due to limited teaching methods involving lectures, question-and-answer sessions, presentations, and lack of diversity. The instructional media used, such as PowerPoint slides and textbooks, are considered unengaging, and there are no biotechnology e-modules provided by the teachers. Therefore, the researchers plan to develop a Canva-based e-module that focuses on information about the process of creating natural plant tissue culture media and eco-enzymes, with the aim of assisting students in understanding Biotechnology material. Based on the aforementioned context, the researchers are interested in conducting a study on the "**Development of Canva-Based E-Module on Biotechnology Subject for 10th Grade High School Students.**"

The objectives of this research are: 1) To determine the development of Canva-based e-modules on the topic of Biotechnology for 10th-grade high school students, 2) To assess the quality of Canva-based e-modules on the topic of Biotechnology for 10th-grade high school students, and 3) To evaluate student responses to the Canva-based e-modules on the topic of Biotechnology for 10th-grade high school students.

Research Methods

This study is a Research and Development (R&D) using the ADDIE development model, which has been adapted to become ADD, consisting of Analysis, Design, and Development (Oktavia, 2022). The research and development activities were carried out on June 15, 2023. The product testing was conducted at SMA N 2 Banguntapan in the 10th grade. This research and development project utilized the ADDIE model, which comprises 5 stages: analysis, design, development, implementation, and evaluation. However, in this study, only the development stage was conducted. The implementation and evaluation stages were not executed, as the research objective was limited to achieving a biotechnology e-module product deemed suitable based on assessment criteria by validators.

1. *Analysis*

In the analysis stage of the ADDIE model, the main activities involve six steps, including needs analysis, curriculum analysis, instructional analysis, and content analysis. The needs analysis aims to fulfill the students' needs in learning biology, specifically the sub-topic of Biotechnology. It is based on identified school issues to develop e-module learning media based on Canva. The curriculum analysis aligns with the independent curriculum of high schools, focusing on Learning Outcomes and Criteria of Learning Objective

Achievement. The instructional analysis covers aspects of knowledge, skills, and attitudes from the Learning Outcomes of the independent curriculum, with the goal of creating comprehensive understanding. Additionally, it details the content to align with learning objectives related to plant tissue culture technology, biology technology related to COVID-19 vaccines, and the demonstration of making biological technology products. Content analysis involves selecting relevant biotechnology material, both in definition and application, to serve as tools and independent learning resources.

2. Design

In the design stage of the ADDIE model, several steps are involved in developing the e-module, including determining the content based on the school's Teaching Module with a focus on biotechnology, especially the sub-topics of tissue culture and vaccines. Designing the e-module using Canva includes steps such as specifying the module size (21 x 29.7 cm - A4), selecting attractive colors, and designing the e-module, which includes a cover, introduction, instructional guide, learning outcomes and objectives, content sheets, evaluation, glossary, bibliography, bionarration, and back cover. The preparation of the product validity questionnaire is done using a Likert scale with a score range for validators such as subject matter experts, media experts, biology teachers, peer reviewers, and students. Scores include categories such as Very Good/Strongly Agree, Good/Agree, Enough/Undecided, Less/Disagree, and Strongly Less/Strongly Disagree to measure the overall validity of the product.

3. Development

The development stage of the ADDIE model, the steps to ensure the validity of the e-module involve drafting content and designing the layout using Microsoft Word 2019 and Canva for Education. Consultation is conducted with the thesis advisor, followed by revising the e-module based on the advisor's input. Validation is carried out by subject matter experts, media experts, and peer reviewers to obtain feedback and make improvements. Revisions are made according to the suggestions of the experts and peer reviewers. After the revisions, the e-module is validated by a biology teacher, and if necessary, additional revisions are made based on the teacher's feedback. Once the revision process is complete, the learning media can be tested with students to gather feedback on the feasibility of the e-module product. If there is input from students, the e-module is revised before being deemed ready for instructional use.

The data collection instruments in this research include observation, documentation, interviews, and questionnaires. Observation is conducted directly and passively, focusing on the behavior of students as research subjects. Documentation data comes from photos and writings of students from SMA N 2 Banguntapan while filling out the questionnaire for the assessment of the biotechnology e-module product. Interviews with biology teachers are used to obtain information about learning resources and issues during the learning activities. The questionnaire used includes product quality assessments by 1 subject matter expert, 1 media expert, teachers, and 10 peer reviewers, as well as responses from 35 students to the developed product. The subject matter expert questionnaire consists of 12 statement components with a scoring range of 1-5. The media expert questionnaire consists of 22 statement components with a scoring range of 1-5. The peer reviewer and biology teacher questionnaires consist of 34 statement components with a scoring range of 1-5. Lastly, the student response questionnaire comprises 17 statement components with a scoring range of 1-5.

Quality testing questionnaires and response testing questionnaires are processed using the same technique. The scores used are on a Likert scale with a 5-point scale and the following categories:

Table 1. Assessment Score.

Category	Information	Score
Very Good or Strongly Agree	SB atau SS	5
Good or Agree	B atau S	4
Enough or Undecided	C atau R	3
Less or Disagree	K atau TS	2
Strongly Less or Strongly Disagree	SK atau STS	1

(Sugiyono, 2017)

The data analysis technique in this research involves both qualitative and quantitative data analysis. Qualitative data analysis includes describing the suggestions of experts such as subject matter experts, media experts, biology teachers, and peer reviewers. On the other hand, quantitative data analysis involves assessments from various parties, including media experts, subject matter experts, peer reviewers, biology teachers, and students. Furthermore, the data from this analysis include responses and evaluations of the developed product, obtained through testing using questionnaires and research instruments.

The assessment results from the questionnaires are then analyzed using the following formula:

$$Percentage\ of\ Respondents\ Answers = \frac{Total\ score\ obtained\ x\ 100\%}{Maximum\ total\ score}$$

Next, the obtained values are then interpreted into categories based on the following table:

Table 2. Rating Category.

Percentage	Category
81%-100%	Very Suitable
61%-80%	Suitable
41%-60%	Less Suitable
21%-40%	Not Suitable
0%-20%	Very Unsuitable

(Andriani, 2018)

The developed e-module can be considered suitable in theory if the feasibility rating is ≥ 61%.

Results and Discussion

1. Result

This Biotechnology E-module has a systematic structure starting from the introduction, preface, content, evaluation, and conclusion. The summary of the outline of this E-module is explained in the table below:

Table 3. Kerangka E-Modul.

No	Component	Description
1	Halaman Sampul	Contains title, user class, and author's identity
2	Kata Pengantar	Introductory sentence and author's expectations
3	Daftar Isi	Table of contents of the e-module along with page numbers
4	Petunjuk Penggunaan *E-Modul*	Contains instructions for using the e-module
5	Peta Konsep	Contains key points of the e-module content
6	Pendahuluan	Contains e-module's identity, learning objectives, and learning outcomes
7	Kegiatan Pembelajaran	Contains the e-module content
8	*Bionews*	Menu containing information to enhance knowledge and insights
9	Rangkuman	Contains a summary of the e-module content
10	Evaluasi	Contains practice exercises
11	Wawasan Produktivitas	Menu containing information to support content through practical implementation via videos and articles
12	Eskplorasi	Menu containing information to enhance knowledge and skills
13	Glosarium	Contains a list of words with their meanings explained
14	Daftar Pustaka	Contains a list of e-module sources
15	Bionarasi	Contains author's biography
16	Halaman Sampul Belakang	Contains the author's program of study identity

The biotechnology E-module was created with A4 paper size (21 cm x 29.7 cm) using the 'Canva for Education' application. The total number of pages in this biotechnology E-module is 54 pages.

Figure 1. Front and Back Cover Pages of the Biotechnology E-module.

Below is the data presentation from the validation of the e-module with 1 subject matter expert, 1 media expert, 10 peer reviewers, and 1 biology teacher, as well as the responses from 35 students.

Table 4. Data From Material Expert Quality Assessment Results.

No	Component	Category	Score
1	Language	Very Good	18
2	Material	Very Good	25
3	Evaluation	Very Good	15
Total Amount		58	
Maximum Score		60	
Percentage		96,67 %	
Category		Very Good	

Table 5. Data from Media Expert Quality Assessment Results.

No	Component	Category	Score
1	Screen design appearance	Very Good	24
2	Ease of operation	Very Good	9
3	Format	Very Good	10
4	Sound	Very Good	5
5	Video	Very Good	5
6	Display quality	Very Good	14
7	Software engineering	Very Good	9
8	Interface	Very Good	19
9	Navigation effectiveness	Very Good	10
Total Amount		105	
Maximum Score		110	
Percentage		97,14 %	
Category		Very Good	

Table 6. Data from Peer Reviewer Quality Assessment Results.

No	Component	Category	Score
1	Language	Very Good	179
2	Material	Very Good	231
3	Evaluation	Very Good	139
4	Screen design appearance	Very Good	214
5	Ease of operation	Very Good	89
6	Format	Very Good	87
7	Sound	Very Good	45
8	Video	Very Good	47
9	Display quality	Very Good	131
10	Software engineering	Very Good	94
11	Interface	Very Good	174
12	Navigation effectiveness	Very Good	93
Total Amount		1523	
Maximum Score		1700	
Percentage		90,12 %	
Category		Very Good	

Table 7. Data from Biology Teacher Quality Assessment Results.

No	Component	Category	Score
1	Language	Very Good	19
2	Material	Very Good	24
3	Evaluation	Very Good	15
4	Screen design appearance	Very Good	23
5	Ease of operation	Very Good	10
6	Format	Very Good	10
7	Sound	Very Good	5
8	Video	Very Good	5
9	Display quality	Very Good	15
10	Software engineering	Very Good	9
11	Interface	Very Good	19
12	Navigation effectiveness	Very Good	10
Total Amount		164	
Maximum Score		170	
Percentage		97,34 %	
Category		Very Good	

Based on tables 3, 4, 5, and 6, it can be observed that the results of the percentage assessment categories for the quality evaluation of the e-module by subject matter experts and media experts for each component are already in the category of excellent for use. In table 5, there is an assessment of quality by peer reviewers for each component, and the evaluation aspects are categorized as excellent for use. In table 6, the quality assessment results by the biology teacher for the e-module are already categorized as excellent for use. From the evaluations of the two

experts, peer reviewers, and the biology teacher, it can be concluded that the Canva-based e-module on Biotechnology topics can be used as a student learning medium.

Similar results were also obtained from student responses, which showed that the response percentage scored an average of 82.48% with the category of strongly agree. This means that the e-module is highly suitable for use as a student learning medium.

Table 8. Student Response Data.

No	Komponen	Kategori	Skor
1	Material	Very Good	286
2	Benefits	Very Good	717
3	Language	Very Good	147
4	Display Quality	Very Good	291
5	Video	Very Good	146
6	Format	Very Good	145
7	Ease of Operation	Very Good	436
8	Screen Design Appearance	Very Good	140
9	Suitability	Very Good	146
Total Amount		2454	
Maximum Score		2975	
Percentage		82,48 %	
Category		Very Good	

2. Discussion

The quality data of the e-module is obtained from the validation results of subject matter experts, media experts, peer reviewers, and biology teachers. Meanwhile, the suitability data of the e-module is acquired from student response outcomes. The collected data comprises quantitative and qualitative data. Quantitative data consists of assessment sheets of the e-module, used to assess the quality and suitability of the e-module. On the other hand, qualitative data consists of suggestions used to improve the e-module.

The subject matter expert provides an assessment consisting of 3 aspects with 12 assessment indicators. Based on validation by the subject matter expert, a total score of 58 is obtained out of a maximum score of 60, resulting in a score of 96.67% with the category of excellent. This indicates that the content within the instructional media aligns with the content outlined by the National Education Department (2006), where the material's substance is accumulated based on core competency standards and basic competencies present in the curriculum (Mellisa & Imania, 2022).

The media expert provides an assessment consisting of 9 aspects with 12 assessment indicators. Based on validation by the media expert, a total score of 105 is obtained out of a maximum score of 110, resulting in a score of 97.14% with the category of excellent. With this category, it aligns with the statement(Rusman et al., 2013) that the presentation in an instructional media should clarify, simplify, and expedite the delivery of messages or instructional materials to students. This ensures that the core of the learning material can be conveyed in its entirety. After analyzing the assessment results from the media expert, the researcher revises the e-module based on the suggestions provided by the media expert.

The next assessment was carried out by peer reviewers and biology teachers. The assessment comprised 12 aspects with 34 indicators. Based on validation by the peer reviewer, a total score of 1523 is obtained out of a maximum score of 1700, resulting in a score of 90.12%. The result obtained from the peer reviewer is 90.12% with the category of excellent. In addition to assessment, the peer reviewer also provided suggestions and input for the quality of the e-module product. Furthermore, the assessment results from the biology teachers yielded a total score of 164 out of a maximum score of 170, resulting in a score of 97.34% with the category of excellent. Biology teachers also provided suggestions for the e-module, which were subsequently improved by the researcher.

After the Canva-based e-module on Biotechnology was validated by experts, peer reviewers, and biology teachers, the next step involved conducting a response test with 35 students from class X at SMA N 2 Banguntapan. This was done using a response questionnaire. The questionnaire consisted of 9 aspects: content aspect, usefulness, language, display quality, video, format, ease of operation, screen design appearance, and suitability, with 17 statement indicators. The results obtained from the student response questionnaire towards the e-module were 82.48%, categorized as strongly agree. This is in

line with the opinion of (Ratna, 2021) that a module can be considered effective if the participant's response falls within the agree category with a percentage of 61-80. Similarly, according to (Lasmiyati & Harta, 2022), the content within the e-module is chosen and developed based on the competencies to be achieved and is systematically designed to reach the learning objectives. This is supported by (Prastowo, 2014), who states that readability of teaching materials encompasses five aspects: using proper and correct Indonesian language, terms complying with Enhanced Spelling Rules (EYD), clarity of language used, and ease of reading. Furthermore, (Rusman et al., 2013) also state that good media will encourage students to actively provide feedback, responses, and encourage students to perform practices correctly.

Based on the obtained student responses, it is evident that the students strongly agree, thus indicating that the e-module can be utilized as a learning medium for biotechnology in biology for 10th-grade high school students. Furthermore, when looking at the scores of all statement items, the results of developing this e-module are also in line with the perspective presented by (Najuah & dkk, 2020). They emphasize that the purpose of publishing modules is to present a message in a non-verbal manner, overcoming students' limitations in terms of space, time, and sensory abilities. Both print and e-module formats, when appropriately and diversely utilized according to students' needs, can enhance learning interest and motivation, allow direct communication with the environment and other learning resources, and empower students to learn independently and evaluate their own learning outcomes. Thus, this statement aligns with the opinion (Dewi Jumiarni, 2023) that modules can be a solution because they possess five main characteristics that serve as their strengths: being self-instructional, self-contained, stand-alone, adaptive, and user-friendly. Besides, e-modules are very practical because they are easily accessed by students wherever and whenever.

The advantages of the research product, in the form of the Biotechnology e-module, include: a) accessibility that allows usage via smartphone or laptop anytime and anywhere; b) the e-module content presents materials with images, videos, article links, engaging biotechnology information, and interactive learning assessments using the Wordwall website; c) the e-module serves as independent learning media with sections that can be used autonomously. In this research, the researcher also encountered challenges and limitations in developing the Biotechnology e-module. Some of them include: a) generalization limitations because the research is based on issues at SMA N 2 Banguntapan, making it potentially challenging to apply in other schools; b) the research focuses solely on the development and quality of the e-module, neglecting the practical usage of the e-module, thus making it difficult to measure its effectiveness in addressing school issues; c) some content is inaccessible in PDF format and can only be accessed through links; d) there are assessments of learning activities that cannot be conducted within the e-module.

Conclusion

Based on the research findings and discussions in the previous chapter, it can be concluded that:

1. The development of a Canva-based E-module on Biotechnology, specifically on tissue culture and vaccine subtopics, for 10th-grade high school students has been successfully accomplished. The research development utilized the ADDIE model consisting of the analysis, design, development, implementation, and evaluation stages. However, the implementation and evaluation stages were not conducted in this study.
2. The assessment of the e-module's quality by subject matter experts, media experts, peer reviewers,and biology teachers resulted in a percentage of 97.34% with the category of Very Good (VG). Based on the acquired quality assessment results, it signifies that the Canva-based e-module on Biotechnology is suitable for use as a biology learning medium, specifically for the tissue culture and vaccine subtopics, for 10th-grade high school students.

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