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Eligibility of E-Module Biology Material Cell-Assisted Flipping Book

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Abstract

The concept of the cell is a fundamental topic in biology that explores its structure, function, and components as the smallest unit of life. A strong understanding of this subject is essential for students to grasp other biological concepts. However, cell material is often considered abstract and challenging to comprehend. Therefore, innovative teaching materials are needed to enhance student engagement and comprehension, one of which is the use of a *flipping book*-based e-module. A *flipping book* is an interactive digital medium that simulates a printed book, featuring animated page-turning effects that create a more engaging and dynamic learning experience. This study aims to develop and assess the feasibility of a *flipping book*-based biology e-module for teaching cell material to 11th-grade high school students. The research follows the Research and Development (R&D) approach, utilizing the Four-D model, which is simplified into the Three-D model, consisting of the define, design, and develop stages. Validation was conducted through expert appraisal. The study employed purposive sampling, involving 45 students, 3 biology teachers, and 3 experts as respondents. The validation results indicate that the e-module has a high level of feasibility, with average scores of 99.06% from learning experts, 94.44% from material experts, 92.98% from media experts, and 95.55% from biology teachers. Additionally, student trials yielded an average score of 92.07% (considered very good). These findings confirm that the *flipping book*-based e-module is highly valid and suitable as an interactive teaching material to support more effective learning in biology.

Keywords: biology e-module, cell material, flipping book

INTRODUCTION

Learning resources encompass everything that students can use to study and engage with learning materials and experiences in line with the objectives to be achieved. In preparing for the planning of the learning program, teachers need to determine which resources can be used by students to achieve the chosen goals. (Sanjaya, 2014) . Learning resources is a term that describes everything that can be used in student learning activities or learning and teaching activities in an educational environment. These sources can generally be written materials, audio-visual, technology-based materials, objects, events, and people who can support and assist the learning and teaching process (Muhammad, 2018).

The rapid development of technology has had a broad impact on the area of teaching materials. One of them is the development of computer-based interactive teaching materials. This teaching material has evolved in various forms and formats, including games, questions, and traditional teaching materials. This positive side can be utilized in global education (Prastowo, 2014).

Problems in learning that often occur are related to the learning media used; the availability of

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learning resources is still limited. (Melda et al., 2019) . In the teaching and learning process, teachers have the responsibility of encouraging, guiding, and providing learning facilities to help students achieve their goals. Today, the development of educational science is becoming increasingly widespread, influencing the teaching practices of teachers in the classroom. As a result, teachers are developing learning tools to support better learning (Imania, 2022).

Learning materials, also known as teaching materials, are systematically arranged to meet learning needs, encompassing a range of formats such as printed materials, visual aids, audio, multimedia, animation, and personal computers and networks. Learning materials function as the leading learning resource for long-distance students, where they learn from printed materials and can choose from various media that are in sync with their needs and learning conditions (Yaumi, 2013). One of the teaching materials that can be used in the learning process is a printed module, which is further developed into an e-module. Electronic modules have more complex characteristics because e-modules can display/load many media such as images, audio, and video and can also be equipped with tests/quizzes that allow for feedback (Khairani & Titisari, 2022). Electronic modules are a form of independent learning materials that are systematically arranged and displayed in electronic format, in which there is audio, animation, and navigation (Sugianto., Abdullah., Elvyanti., Muladi., 2017)

E-module is a form of presentation of independent learning materials that are systematically arranged into specific learning units, which are presented in electronic format, where each learning activity in it is connected with a link to become navigation that makes students more interactive with the event, equipped with the presentation of video tutorials, animations, and audio to enrich the learning experience (Ministry of Education and Culture, 2017). Teaching materials should be designed to keep pace with the times and technological advances. Technological advances are occurring at a rapid pace, especially in the field of education. As a result, teachers and students need to learn how to use technology effectively in the teaching and learning process. Furthermore, using technology in education, students can master the material independently, review lessons, and know their progress (Zetriuslita et al., 2020). Technology and issues can make the learning process practical and enjoyable, involving students actively. Some of the key uses of technology in education include computers and laptops, internet networks, smartphones, and even student learning media. Therefore, teachers try to disseminate interesting, cheap, and efficient teaching materials by utilizing developments in science and technology (Aka, 2017). The learning methods and media selection are influenced by the knowledge and abilities of the original study material that students must master (Rahmi, 2015).

The teaching material expected to attract students' interest and create a safe learning atmosphere is *flipping book*s in the learning process (Mulyadi et al., 2016). *A flipping book* is an electronic format that can display interactive simulations by combining animation, text, video, images, audio, and navigation to make students more interactive so that learning is more interesting (Diani & Sri Hartati, 2018). This interactive book is a solution to create a more enjoyable and communicative classroom atmosphere, supporting students' understanding of the material presented by the teacher. *Flipping books* also have several advantages, including presenting learning materials in the form of words, sentences, and images; being equipped with colors to attract more students' attention; being easy to create and inexpensive; being easy to carry anywhere; and increasing student engagement in learning activities. Another advantage is that it helps students master abstract things or events that cannot be presented in class. However, the disadvantage of *flipping books* is that they can only be used individually or in small groups, namely only up to 4-5 people, and can only be accessed using mobile data (Wahyuliani., Supriadi., Anwar., 2016).

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Previous studies have developed electronic modules into teaching materials (Fonda & Sumargiyani, 2018; Prasetyo, 2020). Electronic modules based on *flipping book*s offer advantages in accessibility and interactive features compared to other software. Therefore, it is essential to develop teaching materials that align with 21st-century learning needs and the Fourth Industrial Revolution, one of which is the development of a *flipping book*-based biology e-module on cell material for 11th-grade high school students (Nugraha & Rachmadiarti, 2022; Yuyun et al., 2022).

This study introduces novelty in developing a biology e-module using a *flipping book* approach, which has not been widely applied to cell material. Based on an analysis of previous studies, *flipping book*s have been utilized for various biology topics, such as organ systems, ecology, and genetics, with results indicating improvements in student understanding and engagement. However, this study specifically focuses on cell material with interactive features designed to address learning challenges identified through observations and interviews with teachers and students at SMAN 2 Siak Hulu, SMAN 3 Siak Hulu, and SMAN 4 Pekanbaru. Observations revealed several factors hindering effective learning, including (1) a lack of varied teaching methods, leading to low student motivation, (2) students' tendency to be passive during the learning process, and (3) the absence of e-module-based teaching materials in the classroom. Introducing this *flipping book*-based e-module is expected to address these challenges, enabling students to become more active, motivated and better understand cell concepts.

RESEARCH METHOD

This research is a descriptive study that describes the process of developing *e*-modules. *Research and Development* (R&D) is a systematic study to design, develop, and evaluate programs, methods, and learning outcomes that must meet the criteria of internal consistency and effectiveness, according to Seel & Richey in Setyosari (2013). The development procedure in this research refers to the Four-D (4D) model developed by Thiagarajan (Afandi et al., 2021). This model consists of four main stages, namely define, design, develop, and disseminate. However, in this study, the model was developed using the Three-D (3D) approach, which includes the define, design, and develop stages, up to the expert appraisal stage. The detailed stages of the 3D model used in this study are illustrated in Figure 1.

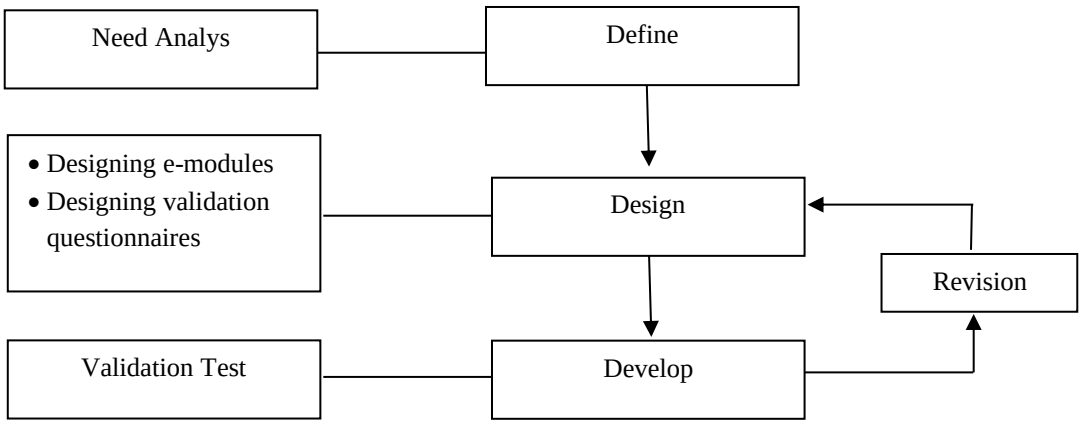

Figure 1. Three-D steps (define to develop stage)
Source: Researcher Modification from Aldresti et al. (2021)

The sampling technique used in this study was purposive sampling. This study employed purposive sampling, where research subjects were selected based on specific objectives rather than strata,

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region, or random selection. The data collection instruments used were validation sheets for validators and student response questionnaires. Data from the validation sheets for teaching materials were then analyzed for evaluation purposes. The analysis carried out was data analysis in the form of descriptions of input and suggestions from three Biology teachers. The data was then selected and summarized so that it could be used as a basis for revising the teaching materials developed. According to the modification Akbar (2013) the formula for descriptive validity level analysis is as follows:

$$V = \frac{TSe}{TSh} \times 100\%$$

Description:
V : E-module validation
TSh : Total maximum score expected
Tse : Total score achieved

The results of the validity of each (experts and teachers) and the results of the combined analysis after being known, the presentation level can be matched or confirmed with the following validity criteria:

Table 1. Validity Criteria According to Validator Assessment

Validity Criteria	Validity Level
85.01% -100%	Very valid, or can be used without revision
70.01% - 85%	Reasonably valid or usable but needs minor revisions
50.01% - 70%	It is less valid; it is recommended not to use it because it needs significant revision.
01.00% - 50%	Invalid or may not be used.

Source: Akbar (2013)

Meanwhile, the results of the calculation of student responses are categorized based on the rules outlined by Purwanto (2012).

Table 2. Criteria for Student Response Calculation Results

Skills Criteria	Category
86% - 100%	Very good
76% - 85%	Good
60% - 75%	Enough
55% - 59%	Not enough
≤54%	Very less

Source: (Purwanto, 2012)

RESULTS AND DISCUSSION

This stage is the validation stage of the cell biology e-module, developed by learning experts, material experts, media experts, and biology teachers from 11th-grade high school. The results of the analysis carried out by the experts are used to consider revising the cell biology e-module that is being developed. If the developed e-module has met the validity criteria (very valid), then the cell biology e-module is valid for use in the learning process.

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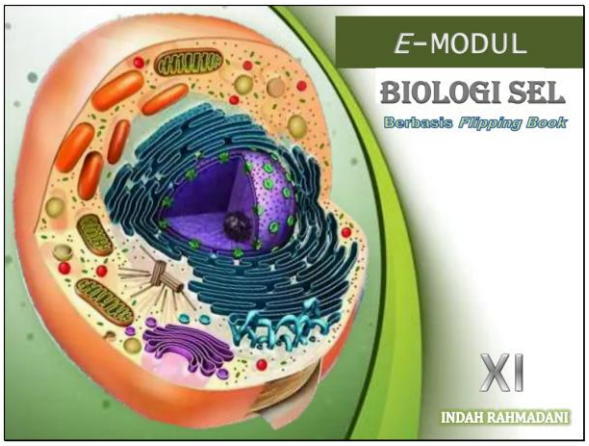

(a)

Kata Pengantar

Puji syukur kehadirat Allah SWT yang telah melimpahkan rahmat, karunia, taufik beserta hidayah Nya sehingga penulis dapat menyusun *E*-modul Biologi Materi Sel Berbasis *Flipping Book* ini. Dalam menyusun *E*-modul Biologi Materi Sel Berbasis *Flipping Book* ini penulis mendapat banyak bantuan dari berbagai pihak yang baik berupa saran, petunjuk ataupun yang lainnya yang tidak dapat di sebutkan satu per satu.

E-modul Biologi Materi Sel Berbasis *Flipping Book* ini merupakan *E*-modul yang dapat digunakan sebagai bahan ajar mata pelajaran Biologi untuk siswa di Sekolah Menengah Atas (SMA) tentang materi Sel. *E*-modul Biologi Materi Sel Berbasis *Flipping Book* ini memenuhi kebutuhan pembelajaran Biologi yang membangun siswa agar memiliki sikap ilmiah, objektif, jujur, berfikir kritis, bisa bekerja sama maupun bekerja mandiri.

Penulis menyadari bahwa *E*-modul Biologi Materi Sel Berbasis *Flipping Book* ini masih terdapat banyak kekurangan dalam penyusunannya, tetapi penulis berharap *E*-modul Biologi Materi Sel Berbasis *Flipping Book* ini dapat bermanfaat bagi seluruh pembaca dan semoga dapat membantu proses belajar mengajar. Kritik dan saran yang membangun dari semua pengguna *E*-modul ini sangat penulis harapkan.

Semoga ilmu yang kita pelajari dapat bermanfaat bagi semua pihak.

Pekanbaru, 21 Desember 2022

Penulis

E-modul Biologi Materi Sel Berbasis *Flipping Book* i

(b)

Daftar Isi

KATA PENGANTAR....i
DAFTAR ISI....ii
PETUNJUK PENGGUNAAN *E*-MODUL....iii
TUJUAN PEMBELAJARAN....2
PETA KONSEP....3
PENDAHULUAN....4
I. Komponen kimiawi penyusun sel....5
II. Struktur sel dan fungsi bagian-bagian sel....6
III. Kegiatan sel sebagai unit struktural dan fungsional makhluk hidup....17
IV. Transpor membran....18
V. Sintesis protein untuk menyusun sifat morfologis dan fisiologis sel....23
VI. Reproduksi sel sebagai kegiatan untuk membentuk morfologi tubuh dan memperbanyak tubuh....26
Rangkuman....29
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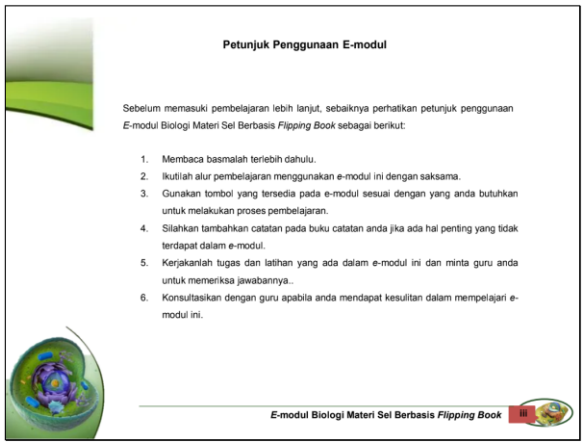
E-modul Biologi Materi Sel Berbasis *Flipping Book* ii

(c)



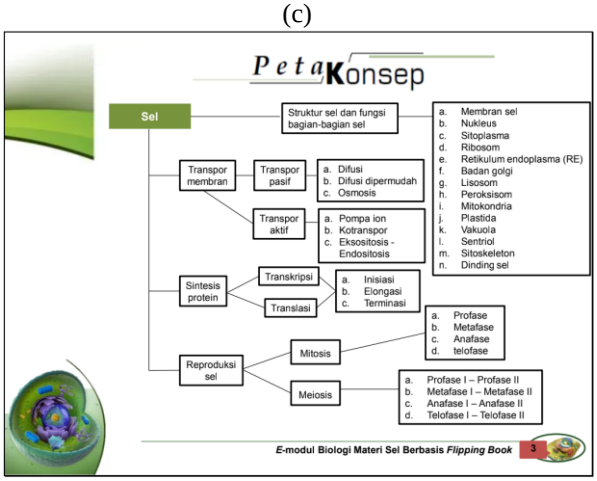
Petunjuk Penggunaan E-modul

Sebelum memasuki pembelajaran lebih lanjut, sebaiknya perhatikan petunjuk penggunaan *E*-modul Biologi Materi Sel Berbasis *Flipping Book* sebagai berikut:

1. Membaca basmalah terlebih dahulu.
2. Ikutilah alur pembelajaran menggunakan *e*-modul ini dengan saksama.
3. Gunakan tomboi yang tersedia pada e-modul sesuai dengan yang anda butuhkan untuk melakukan proses pembelajaran.
4. Silahkan tambahkan catatan pada buku catatan anda jika ada hal penting yang tidak terdapat dalam e-modul.
5. Kerjakanlah tugas dan latihan yang ada dalam e-modul ini dan minta guru anda untuk memeriksa jawabannya..
6. Konsultasikan dengan guru apabila anda mendapat kesulitan dalam mempelajari e-modul ini.

E-modul Biologi Materi Sel Berbasis *Flipping Book* iii

(d)



E-modul Biologi Materi Sel Berbasis *Flipping Book* 3

(e)

Pendahuluan

1 Mengamati Sel Sebagai Penyusun Tubuh

Amati gambar berikut. Kemukakan beberapa pertanyaan kepada guru anda mengenai hal-hal yang ingin anda ketahui berkaitan dengan sel-sel penyusun tubuh. Misalnya, komponen apa saja yang terkandung di dalam sel tubuh.

Jika diamati menggunakan mikroskop, seluruh makhluk hidup, baik yang mikroskopik maupun makroskopik, tersusun dari bagian-bagian kecil yang disebut sel. Sel merupakan tingkat struktural kehidupan terendah yang memiliki seluruh sifat kehidupan, seperti reproduksi, pertumbuhan dan perkembangan, pemanfaatan energi, respon terhadap lingkungan, homeostatis (pengaturan tubuh), serta adaptasi terhadap lingkungan di sekitarnya. Di dalam setiap sel, keteraturan kehidupan diatur pada tingkat molekular. Pada organisme multiseluler, seperti tumbuhan dan hewan, terjadi kerja sama berbagai jenis sel yang terspesialisasi dan bergabung membentuk tingkatan struktural kehidupan yang lebih tinggi, yaitu jaringan, organ dan sistem organ.

Gambar 1. Tubuh manusia tersusun dari sel-sel

Apa sebenarnya sel itu? Disini kita akan membahas tentang struktur sel dan fungsinya, organel-organel sel yang terdapat didalam sel, perbedaan struktur sel tumbuhan dengan sel hewan, serta mekanisme transpor pada membran sel.

E-modul Biologi Materi Sel Berbasis *Flipping Book* 4

(f)

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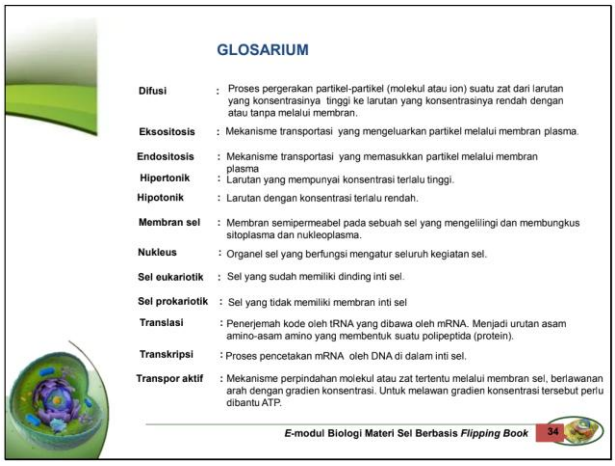

(g)

Figure 2. Cover (a), Foreword (b), Table of contents (c), Instructions for using the e-module (d), Concept map (e), E-module contents (f), Glossary (g)

The results of the validator assessment can be seen in the following table:

Table 3. Validation results of the cell biology e-module by experts

No	Expert Field	Rated aspect	Percentage	Validity Level
1.	Learning Expert	Media design	96.2%	Very Valid
		Program	100%	Very Valid
2.	Subject Matter Expert	Content quality	94.4%	Very Valid
3.	Media Expert	Media design	90.8%	Very Valid
		Program	94.4%	Very Valid
Validation average			**95.2%**	**Very Valid**

1) Learning Expert Validation

This study aims to validate the use of e-modules as a basis for improving and enhancing the quality of e-learning modules in the learning process. The aspects assessed are media and program design. Based on Table 3 above, it can be seen that the validation of learning media by learning experts has a very valid level of validity. In the media design aspect, it achieves a validity rate of 96.25%, indicating a high level of validity. Then, in the program aspect, it gets a percentage of 100%.

In the media design aspect, the cover and content are assessed. The cover aspect comprises three indicators: screen display, letter typology, and image quality. A common cover contains at least three main components, namely, title, letters, and images. In this cover aspect, the researcher received comments or suggestions from the validator, so the researcher made slight improvements to the cover aspect, including the color of the image used on the cover is not attractive, the text on the screen display does not match the needs, and the image used is also too small.

The content aspect comprises three indicators: screen display, typographic style, and image quality. General content, at least, contains four indicators, namely, title, suitability of the material to learning objectives, sub-material, and material structure. In this case, the researcher developed an e-module according to the general structure, which includes a title, learning instructions, competencies to be achieved, supporting information, exercises, and evaluations. In the structural aspect of this e-module, the researcher received comments and suggestions from the validator and made slight improvements to the content.

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Previous research results indicate that validating e-modules is a crucial step in ensuring their effectiveness in learning (Febdhizawati et al., 2023). Research conducted by Zendrato et al. (2022) found that well-validated e-modules can increase student engagement and improve learning outcomes. An attractive media design and an optimally running program contribute to improving students' conceptual understanding. (Ratau & Bugis, 2024)

2) Subject Matter Expert Validation

This study aims to determine the validation of e-modules as a basis for improving and enhancing the quality of learning e-modules. The aspect assessed is the quality of the content. Based on Table 3 above, it can be seen that the results of the assessment by material experts for all aspects obtained an average percentage of 94.44%, indicating a very high level of validity. In this aspect of content quality, it is divided into several sub-aspects, namely, the presentation of content, the depth of material, and the use of language.

Aspect eligibility Contents to obtain the percentage value of validity are 100% with the category 'very valid'. The aspect of content feasibility consists of three criteria: the suitability of SK and KD, as well as their alignment with student and teaching material needs. Based on the percentage of validity obtained by the researcher from material experts it can be assessed that the validation e-module cell biology based on *flipping book* has fulfil validity Contents in the form of completeness material Which under KI, KD and learning objectives, in the aspect of content feasibility there are comments/suggestions from material experts so that researchers make improvements to the aspect of content feasibility.

The aspect of the material's depth received a percentage of 93.33%, which falls within the category of very valid. The aspect of presentation feasibility consists of three criteria, namely the alignment with the material, the addition of insight, and the moral values. In terms of the depth of the material, comments and suggestions from material experts enable researchers to make improvements in this aspect. Based on the results evaluation by the expert material aspect, the Language got a percentage of 90%, which falls within the very valid category. The criteria assessed in the language aspect consist of four criteria, namely readability, clarity of information, conformity to Indonesian language rules, and effective and efficient use of language. The percentage results show that the e-module has a structural accuracy sentence, which in accordance with EYD, uses Language that is simple and unambiguous. Therefore, e-modules can be used as independent teaching materials for students. However, the researcher received advice from experts. The material is to check the use of EYD in the questions and suggestions from experts. The researcher has corrected the material.

3) Media Expert Validation

This study aims to determine the validation of e-modules as a basis for improving and enhancing the quality of learning e-modules. The aspects assessed are media and program design. The results of the validator's assessment can be seen in the following table;

Based on Table 3 above, it can be seen that the results of the assessment of media experts for all aspects obtained an average of 92.62% and demonstrated a very high level of validity. In the media design aspect, it is divided into two aspects that are assessed: cover and content. In the program aspect, it is divided into three aspects that are assessed: media interactivity, ease of use, and language use.

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The results of the validation of the biology module by media experts on the cover aspect achieved a percentage of 88.88%, which falls within the very valid category. On the cover aspect, there are three indicators: appearance screen, text readability, and image quality. Based on percentage, the e-module of cell biology, based on a flipping book, has fulfilled the requirements aspect. The results of the validation of the biology e-module by media experts on the content aspect achieved a percentage as high as 92.72%, which falls within the category of 'very valid'. In terms of content, there are four key indicators: screen display, font typology, image quality, and video quality. Based on the percentage, it shows that the e-module of cell biology, based on the *flipping book*, has fulfilled the aspect content. According to Suarsana and Mahayukti (Sugihartini & Jayanta, 2017), the advantages of e-modules include their interactive nature, which facilitates navigation, allows for the display and loading of images, audio, video, and animations, and is equipped with formative tests and quizzes that provide immediate, automatic feedback. Another advantage of e-modules in the learning process lies in the problem-based learning stages, namely student orientation to problems, organizing students to learn, guiding individual and group investigations, developing and presenting work results, and analyzing and evaluating the problem-solving process.

The results of the validation of the biology e-module by media experts on the aspect of media interactivity achieved a percentage of 93.33%, which includes a highly valid category. In the aspect of media interactivity, there are three indicators, namely, media that is presentative, media that is communicative, and media that is interesting. Based on the percentage, the *flipping book*-based cell biology e-module has fulfilled aspects of media interactivity. The results of the validation of the biology e-module by media experts on the aspect of ease of use achieved percentages as high as 100%, which includes the category' very valid'. In the aspect of ease of use, there are three indicators, namely, presented in a coherent manner, easy to operate, and clear instructions. Based on the percentage, the *flipping book*-based cell biology e-module has fulfilled the ease of use aspect. The results of the validation of the biology e-module by media experts on the aspect of language use achieved percentages as high as 90%, which includes the category of 'very valid'. In the aspect of language use, there are four indicators, namely readability, clarity of information, conformity to Indonesian language rules, effective and efficient use of language. Based on the percentage, the *flipping book-based cell biology* e-module *has fulfilled*aspects of language use.

4) Teacher Validation

This research aims to determine the validity of e-modules as a basis for improving and increasing the quality of e-learning modules when used in the learning process. Teacher responses were obtained using an instrument in the form of a questionnaire responding to teaching materials given to three class XI biology teachers. After carrying out the validator assessment, results can be seen in Table 4 below:

Table 4. Validation results of *the flipping book-based* cell biology e-module by grade XI high school teachers.

No	Rated aspect	Validity Percentage (%)			Average percentage	Validity level
		NJ	GW	EZ		
1.	Media design	95.62	96.59	94.43	95.88	Very Valid
2.	Program	93.33	96.66	96.66	95.55	Very Valid
Average (%)		94.47	96.62	95.54	**95.71**	**Very Valid**

Based on Table 6 above, it can be seen that the data analysis results obtained an average percentage of 95.71% from the three teachers, which meets very valid criteria. The aspects assessed are media and program design. In the media design aspect, it is divided into two aspects that are assessed: cover

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and content. In the program aspect, it is divided into six aspects that are assessed: clarity of purpose, sequence of presentation, motivation, interactivity, completeness of information, and use of language.

In terms of coverage, the validity percentage was 94.16%, which was categorized as very valid. In the cover aspect, there are three indicators, namely, screen display, letter typology, and image quality. A common cover contains at least three main components, namely, title, letters, and images. However, we must understand that, in reality, the field cover can vary. In this aspect, the researcher received comments and suggestions from the validator, and as a result, made some improvements to the cover aspect. In the content aspect, an average percentage of 96.96% was obtained, which falls within the category of very valid. In terms of content, there are three indicators, namely, screen display, letter typology, and image quality. General content contains at least four indicators, namely, title, suitability of material to learning objectives, sub-material, and material structure. In this case, the researcher developed an e-module based on the general structure. general, which includes the title, learning instructions, competencies to be achieved, supporting information, exercises, and evaluations.

One aspect of language achieved a percentage as high as 93.33%, falling within the very valid category. The aspect of clarity of objectives is an important component that must be considered. in develop *e* - module This. The objectives outlined in the e-module must align with the material to be studied. Based on the percentage of validity obtained by researchers from learning experts, it can be assessed that the objectives used in *the* e-module are in accordance with the material that students will learn. The aspect of the order of presentation makes the category very valid, with a percentage validity of 97.77%. Based on the assessment by the expert validator, it can be concluded that the e-module developed has fulfilled the aspect of Presentation. The presentation aspect can be fulfilled because the *flipping book*-based cell biology e-module is presented in an interesting, coherent, and easy-to-understand manner.

Aspects of motivational giving are also included in this category, with a percentage of 100%. The aspect of providing motivation can be fulfilled because the *flipping book*-based cell biology e-module can improve teacher skills and student understanding. Based on this aspect, the motivational provision, the researcher received no comments or suggestions from the validator. So, the Researcher did not make any improvements to the motivational aspect. Aspect interactivity is also included in the category, which is very valid, with a percentage of 86.66%. The aspect of providing motivation can be fulfilled because *the* e-module of cell biology based on *flipping books* is presentative, communicative, and interesting. Based on this aspect, the interactivity, the researcher did not receive any comments or suggestions from the validator. So, the Researcher did not make any improvements to the interactivity aspect. The aspect of completeness of information is also included in this category, which is very valid, with a percentage of 95.55%. The motivation aspect can be fulfilled because the *flipping book*-based cell biology e-module aligns with the material and basic competencies. Based on the completeness of this information, the researcher did not receive any comments/suggestions from the validator. Therefore, the Researcher did not make any improvements to the completeness of information. The aspect of language use, including in this category, is highly valid with a percentage of 100%. The aspect of providing motivation can be fulfilled because the *flipping book*-based cell biology e-module is in accordance with Indonesian language rules.

5) Trial results data of *flipping book-based* cell biology e-module

The module validity trial stage involves testing the e-module development on a limited sample. Data in the module trial were obtained from the results of student validation sheets on cell material. The

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limited validity trial of the e-module was conducted in three schools. Each school was tested on 15 students. In this study, the sample used was students who had studied cell material. At this stage, the e-module used was one that had been corrected for its shortcomings or revised according to the validation results and suggestions provided by learning experts, material experts, and media experts. The results of the limited validity trial are based on student responses to *the* e-module that was developed. The trial was conducted by providing students with an e-module link, followed by an opportunity to view and read the e-module, and then distributing questionnaires for assessment. The results of the analysis of student assessments of *the* e-module coverage of the cell biology e-module can be seen in the following table:

Table 5. Average results of limited trials of *flipping book*-based cell biology e-modules

No	Assessment Aspects	Validity Percentage (%)			Average (%)	Category
		S1	S2	S3		
1.	Contents	90.90	91.27	95.03	92.4	Very good
2.	Presentation of Material	89.77	93.33	95.55	92.88	Very good
3.	Use of language	91.66	91	94.33	92.33	Very good
4.	Benefits of materials and media	88.33	89.33	93.33	90.33	Very good
Average (%)		90.42	91.15	94.66	92.07	Very good
Category		Very good	Very good	Very good		

Based on Table 5, it can be seen that the average student assessment for all three schools is very good, with a percentage of 92.12%. The aspects assessed are content, presentation of material, use of language, and utilization of materials and media. In the aspect of content achieved, the validity percentage is 92.4%, which falls into the very good category. In the content aspect, there are four assessment criteria, namely screen display, text readability, image quality, and video quality. Upon presenting the material results evaluation, learners achieved an average percentage of 92.88%, which falls into the very good category. In the aspect of the presentation of material, there are three criteria: the material presented is interesting, the material presented is coherent, and the material presented is easy to understand.

Language use gets an average percentage of 92.33% in the very good category. Aspect presentation consists of four criteria evaluation, namely readability, clarity of information, conformity to Indonesian language rules, and effective and efficient use of language. The benefits of materials and media received a percentage of 90.33%, categorized as very good. In terms of appearance, it consists of four criteria, namely, the material can increase understanding, interest in using media, and motivation to learn, and it can be used as an independent learning medium.

Other research conducted by (Habibi, 2017) showed that the use of *flipping books* obtained validation results of 85% from the assessment of material experts and 88% from the assessment of media experts, and after being tested on students, the *flipping book media* was included in the very good criteria with a percentage of 88%. *Flipping books* are designed with *Ms. Word and* then converted into PDF format, which is then imported into *Flip PDF Professional software*. This Flip PDF *Professional software* is easy to use for creating learning media and can also generate test or evaluation materials. This *software* is very easy to use, allowing teachers who are not proficient in computer operation to also utilize it. Then, if you develop learning media using this software, it can be published online or offline (Arsal., Danial., Hala., 2019) .

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This statement is in accordance with Hamalik (1986) in Arsyad (2016) that the use of learning media, such as modules, in the teaching and learning process can arouse new curiosity and interest, stimulate motivation, and enhance learning activities, thereby exerting a psychological influence on students. Another supporting statement was stated by Asyhar (2012) that the use of learning media, such as modules, provides new knowledge to students, thereby increasing student participation and activity in the entire learning process.

CONCLUSION

The biology e-module of cell material is compiled using the *Flipping book* application, then saved in the form of a link that can be accessed and downloaded by students using gadgets. The cell material in the e-module is equipped with clear images and videos, quizzes, and assignments. The interactive e-module was validated by learning experts, material experts, and media experts with the category "Very valid". Assessments by teachers and students also showed a very good response. The results of the validation and product assessment showed that this e-module met the feasibility and validity categories. However, the conclusion that the e-module can be used in the field still needs to be proven through limited trials in learning. Therefore, it is recommended that this study be continued with a small-scale trial to measure the effectiveness of the e-module in improving student learning outcomes.

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