THE VALIDITY AND LEGIBILITY OF DIGITAL LITERACY-BASED REPRODUCTIVE SYSTEM FLIPBOOK TO IMPROVE THE CRITICAL THINKING SKILLS OF GRADE 11TH HIGH SCHOOL STUDENTS

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Abstract

21st century education has an important role to equip students with how to process and use information critically. This can be realized by developing digital literacy-based learning media, one of them is flipbook. The development of the flipbook in this study was applied to reproductive system material because the basic competence of the material requires analysis of information from various sources. The aim of this study was to produce a valid flipbook of reproductive system which had an appropriate level of legibility. The study used Hannafin and Peck development model which consisted of the needs analysis, design, and development phases. The measured parameters included the validation and legibility level of the flipbook. Validation was done by education expert lecturer, reproductive system expert lecturer, and Biology teacher based on the appropriateness of content, presentation, language, and critical thinking components. while the level of legibility of the flipbook was measured using the Fry formulation by analyzed 100 words in each section. The results of the validation showed very valid categories in each component with the average percentage of the presentation was 87.5%, content eligibility 96.3%, linguistic 91.7% , and critical thinking 98.3%. The validation components got 93.5% average percentage with a very valid category. The level of legibility of the flipbook showed level 11 with the appropriate category for high school students. Based on the results of the study, the developed flipbook was declared to be very valid and had an appropriate level of legibility for high school students.

Keywords: digital literacy-based, reproductive system, flipbook, critical thinking skills

INTRODUCTION

The development of digital technology in the 21st century brings fundamental influences to the world of education. The development of this technology leads to technology resources and digital information is very abundant until everyone is free to access and process information from the unlimited virtual world (Partnership for 21st Century Learning, 2015). This causes a large amount of false information (hoax) to be widespread in online media that makes the audience difficulty in determining the correct information (Mastel, 2017).

Education in this era has an important role to equip students on how to process and use information critically, effectively and responsibly (OECD, 2018). One way that can be done is to implement digital literacy at school, so that students can become more critical to parse existing information in the hopes that false information can be minimized (Gumilar et al, 2017).

The selection of media and teaching materials determination used in supporting learning for critical thinking students is a very important component to make learning more effective and efficient (Zuriah et al. 2016). Nowadays, multimedia tools in learning are very beneficial for students to obtain information quickly and efficiently (Sugianto, 2013). One of the uses of multimedia in learning to practice critical thinking is to use e-book because it has several advantages including it can reduce the cost for authors and publishers, saving space and time, easily accessible, not weathered, easily distributed and can display interactive simulations to support the learning process (raharjo, 2002; Hayati et al, 2015).

Media e-book can support the learning Curriculum 2013 in Biology subjects KD 3.12 on the reproductive system, in which it contains demands to the students to analyze, while most of these materials consist of processes that are abstract, that require visualization in the

understanding. This is in accordance with Edgar Dale's theory of learning experience demonstrated in a cone of student learning experiences explaining that visual media is suitable for use in abstract material learning (Arsyad, 2011; Sanjaya, 2006).

The e-book developed was a flipbook type that had a more interactive look, such as a page that can be flipped, can be inserted images and videos, also hyperlinks to access the library directly online. With the superiority,, flipbook can helped students to understand abstract material and practice students' critical thinking skills. This was in accordance with the study that conducted by Amalia (2019) showing that the use of interactive e-books was effective for the improving of students' critical thinking skills. Another study was conducted by Muhlas (2019) stated that the application of flipbook on learning was effective to attract students' reading interest and help students to understand the ecological material used the video and animation in it.

Based on that, the aim of the study was to produce a valid digital literacy-based reproductive system flipbook to improve the critical thinking skills of high school students and had a suitable legibility level.

METHOD

This was a development study used Hannafin and Peck model that consisting of a necessity analysis, design, and development phases. Necessity analysis, design and development phases was conducted in October 2019- February 2020. The next phase was the validation that conducted in March 2020.

Analysis purposes phase included curriculum analysis, student analysis, task analysis, and concept analysis. The design phase included the flipbook design used Flip PDF Pro and the preparation of the validation instruments. The development phase included legibility tests, and continued with flipbook validity test.

The validity of the flipbook was conducted by experts, those was the media expert lecturer, educational expert lecturer, and biology teachers. Validation by experts included the feasibility of presentation, content, linguistic, and features that supporting critical thinking skills The validation result Data was analyzed in a quantitative descriptive and then interpreted into a less valid-very valid category as in Table 1.

Table 1. Interpretation of Likert Scale Criteria

Score Interval	Category	Recommendations
$3.25 < P \leq 4.00$ Or $81.3\% < P \leq 100\%$	Very Valid	Can be used without revision
$2.50 < P \leq 3.25$ Or	Valid	Can be used with minor revisions
$62.5\% < P \leq 81.3\%$		
$1.75 < P \leq 2.50$ Or $43.8\% < P \leq 62.5\%$	Fairly Valid	Can be used with many revisions
$1.00 < P \leq 1.75$ Or $25.0\% < P \leq 43.8\%$	Less Valid	Not yet usable

(Adapted from Sugiyono, 2016)

The flipbook developed was stated to be very valid or can be used without revisions when getting an average score of ≥ 3.25 or 81.3%

The flipbook legibility was measured based on the analysis used the Fry formulation by sampling 100 words in each subchapter which was then calculated the number of sentences and the number of syllables multiplied by 0.6. The final result was converted into Fry graph in Figure 1..
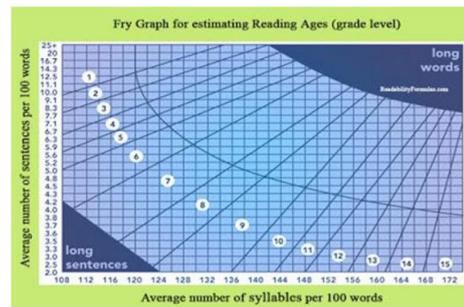

Figure 1. Fry Chart

Interpretation of the flipbook legibility rates at a meeting point between vertical lines indicating the number of sentences and horizonal indicating the number of syllables that have been multiplied by 0.6. The flipbook legibility was stated to be suitable for high school students when it was at 9-12 level.

RESULTS AND DISCUSSION
Flipbook Profile

The result of this research was a valid reproductive system flipbook digital literacy-based to improve the critical thinking skills of grade XI high school students and have an appropriate level of legibility. The Flipbook developed features digital literacy-based features in each subchapter, consisting of 5 key features that can practice students ' critical thinking skills and 2 supporting features.

The main features that are used to practice the critical thinking skills of Facione (2015) were: A. KOFI (activity column), which was a feature that invites students to be active in working on questions both individually and group discussions, this feature can practice interpretation and analysis indicators; B. BIOMA (Biology as My Advanture), which was a feature that presents activities and Internet-based information that aims to invite students critically in addressing an information. This feature can

practice interpretation, analysis, inference, evaluation, and exportation indicators; C. Bio-refleksi, which was a feature aimed at inviting students to regulate self-understanding of the materials that have been studied. This feature provides self-regulatory indicators; D. Bio-Quiz, a feature that presents a question in the Google form page as a means of measuring material understanding. This feature can be trained in interpretation indicators; E. BIOVAL (Biology Evaluation), a feature that presents questions on the Google form page provided at the end of the flipbook to solidify students ' knowledge on how to respond to a spread of information. This feature can practice evaluation and exportation.

The supporting features contained in the flipbook are: A. POIN (information Corner), which was a feature that presents facts related to the reproductive system in addition to the knowledge for students; B. Bio-Net, which was a feature that presents information in the form of linked Internet hyperlinks that can be accessed online.

In addition to containing critical thinking indicators, the features included in the flipbook also integrated menus that contain digital literacy competencies such as those already outlined by Glitser (1997), among others, the Internet search, hypertext direction guided , information content evaluation, and knowledge drafting. Critical thinking indicators and digital literacy components integrate with each other inside the flipbook. The linkages between features with critical thinking indicators and digital literacy components are as follows (table 2).

Table 2. Feature Linkage with Critical Thinking Indicators and Digital Literacy Components

No	Features	Critical Thinking indicators	Digital Literacy Component
1.	KOFI (Kolom Aktivitas)	- Interpretation - Analysis	- Hypertextual navigation - Knowledge Assembly
2.	BIOMA (Biology as My Advanture)	- Interpretation - Analysis - Inference - Evaluation - Explantion	- Hypertextual navigation - Internet Searching, - Content Evaluation
3.	Bio-Reflection	- Self regulation	- Knowledge Assembly
4.	Bio-Quiz	- Interpretation	- Hypertextual navigation - Knowledge Assembly
5.	BIOVAL (Bio Evaluation)	- Evaluation - Explantion	- Content Evaluation - Knowledge
			Assembly
6	Bio-Net (Bio-Internet)	-	- Hypertextual navigation - Internet Searching

The results of the flipbook product are the structure and use, features, and display of flipbook pictured in table 3 as follows:

Table 3. Flipbook Result

Structure and Use
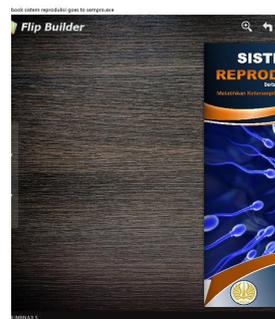
Description :
Accessed online using link :
http://online.flipbuilder.com/jmkb/oqcb/mobile/index.html
Accessed offline using file in .exe format

Description :
Can be accessed using laptop or smartphone

Description :
There are videos and hyperlinks that can be accessed directly from the flipbook

Features

Description :
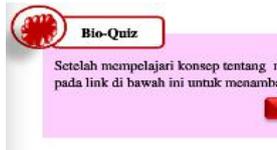The **KOFI** feature contained questions relating to the material that has been studied

Description :
The **Bioma** feature included questions that can train students to be critical in addressing an information
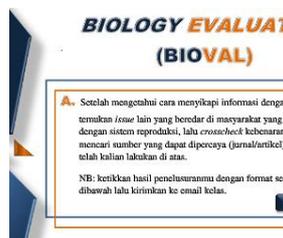

Description :
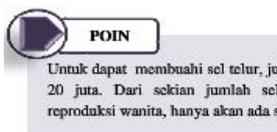The **Bio-reflection** feature invites students to assess self-understanding.

Description :
The **Bio-Quiz** feature contains interpretation questions found on Google forms.

Description :
The **Bioval** feature solidified students' knowledge on how to respond to a spread of information
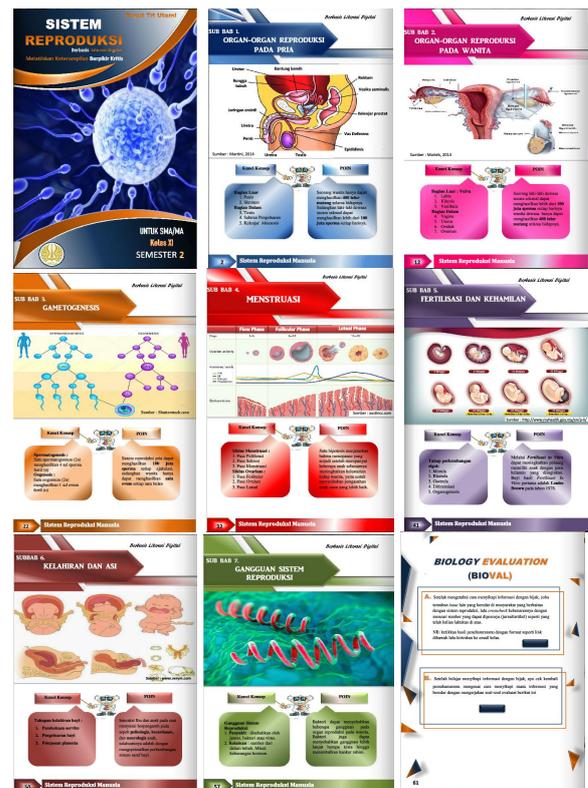

Description :
The **POIN** feature presented facts related to the reproductive system

Description :
The **Bio-Net** feature presents information in the form of Internet-linked hyperlinks that can be accessed online.

<div style="background:yellow">Display</div>

Description :
Each subchapter had different colors and themes to interest students

The flipbook developed was one of the most multimedia-based learning media. It was based on the characteristics of flipbook electronic media (not in print) that can be accessed online or offline on a laptop or smartphone. This was in line with the Rockwell and Mactavish statements (2004) which mention that multimedia was a composite of text, video, audio and animation that was integrated in the computer system.

The used of multimedia in learning aims to help students understand the material of the reproductive system, which was largely abstract. This was in accordance with the statement from Sugianto (2013) that flipbook was a media that focuses on visual aspects to

make learning more effective. Multimedia in the form of flipbook was very effective in assisting the visualization of students and facilitating the delivery of information from teachers (Septiana et al, 2018).

The validity and legibility of the Flipbook

The flipbook had been developed, further tested its validity and level of legibility. The validity test was carried out by three validators, the media expert lecturer, educational expert lecturer, and biology teacher. Validation by experts includes the feasibility of presentation, content, linguistic, and features that supporting critical thinking skills. This was in accordance with BNSP (2014) stating that a good teaching book must meet a minimum of three eligibility components i.e. presentation, content and language. The data recapitulation of the validation results can be seen in table 4.

Table 4. Recapitulation of Flipbook Validity.

No.	Component validity	Score			Average (%)	Category
		V1	V2	V3		
1.	Presentability	3.50	3.50	3.50	87.5%	Very valid
2.	Feasibility Content	3.89	3.89	3.78	96.3%	Very valid
3.	Linguistic worthiness	4.00	3.00	4.00	91.7%	Very valid
4.	Critical Thinking	4.00	3.80	4.00	98.3%	Very valid
	Average	3.85	3.55	3.82	93.5%	Very valid

Based on the recapitulation result in table 4 by three validators, it showed that the Ffipbook developed very valid in each component of its assessment, covering the component of presentability, content, linguistic and critical thinking. The percentage of presentation qualification got an average of 87.5%, the content feasibility got 96.3%, the linguistic worthiness got 91.7% and the critical thinking got 98.3%. The entire component got an average percentage of 93.5% with a very valid category.

Flipbook presentability eligibility components included graphic quality, cover, font type and size suitability, and page layouts. This component got an average percentage of 87.5% with a very valid category. This was because the flipbook presentation had been adjusted with Arsyad (2011) and Sugianto (2013) that focused on the visual aspects such as images, videos, and layouts that were interesting, as well as using normal typeface, unadorned, and not using capital letters as a whole.

However, there was a need to have visual improvements to the cover to make it more interesting and can add to the students' interest in reading the flipbook. It was in accordance with the statement of Retariandalas (2017) that to attract interest, a program should have an interesting and good look.

The content eligibility components got an average percentage of 96.3% with a very valid category. The content eligibility components of the flipbook were developed based on the 2013 curriculum. The presented material was elaborated or systematic with syllabus. This was in accordance with the opinion of Sadjati (2008) that the submission of books should be presented systematically or in order to facilitate students in learning the material therein.

At the beginning of the flipbook were provided concept maps that serve to help students to relate concepts in a material. This was in accordance with the opinion of Waers (2015) stating that through concept maps, students can visually present how the concept relates to one another in a subject matter.

The linguistic feasibility component got an average percentage of 91.7% with a very valid category. This indicated that the linguistic feasibility component was based on the KBBI, according to writing the word local or foreign with italics, scientific word also had a separate rule in the writing (Kemendikbud, 2016).

Nonetheless, the feasibility component was still in need of improvement in language used to match the students' thinking levels. Use of language in the flipbook should use easy-to-understand sentences to align with the criteria specified by BNSP (2014) stating that the linguistic in the book was expected to have informative, communicative criteria, according to the students' thinking level, according to the rules and used of the correct terms.

The last component was the feasibility of feature supporting critical thinking. This component got an average percentage of 98.3% with a very valid category. This suggested that the activities and materials in the flipbook already reflect all critical thinking indicators. It was backed by the research development of flipbook by Amalia (2019) which generated ebook to practice critical thinking skills with very valid categories. That was because the ebook developed had integrated indicators of critical thinking in it.

The indicators that located on the flipbook was according to the critical thinking indicators outlined by Facione (2015) consisting of interpretation, analysis, inference, evaluation, explanation, and self-regulation. These indicators were intergrated in every feature on flipbook.

Critical thinking indicators were trained by analyzing the validity of information relating to the reproductive system spread in the community through digital media and ways to deal with it, so as to make students smarter in responding information. It was supported by research of Gumilar et al. (2017) which mentioned that teachers need to practice students to use the web correctly and critically in response to information.

The flipbook legibility was measured using the Fry formulation by sampling a total of 100 words in each subchapter and then interpreted to obtain the following level of legibility (table 5).

Table 5. Recapitulation of Flipbook legibility

The subsections	∑ sentences	∑ Syllables	Syllable * 0.6	Level
1	6	260	156	10
2	7	276	165.6	11
3	7	277	166.2	11
4	8	266	159.6	10
5	6	274	164.4	11
6	8	280	168	11
7	7	273	163.8	11
Average	**7**	272.3	**163.4**	**11**

The legibility level was determined through the Fry graph indicating the result of the meeting between the average point of the sentence and the average point of the syllables multiplied by 0.6 at the meeting point (7; 163,4). The point was interpreted and showed the reader's class level results at level 11.

According to Saroni et al. (2016), the results of the class level of readers obtained were still approximate, then legibility level should be added or reduced by one level. Based on this, legibility on the flipbook developed was still said to be appropriate because it still resideed in the level range of 9-12.

CONCLUSION

The results of the study, the developed digital literacy-based reproductive system flipbook was declared to be very valid and had an appropriate level of legibility for high school students. Validity was measured on the basis of content, presentation, linguistic and critical thinking eligibility by experts with a very valid result with a percentage of 93.5%. Flipbook legibility was at level 11 which showed the results suitable for high school students.

Sugestion

It should takes a direct trial to students to find out the effectiveness of flipbook in the training of critical thinking skills so that flipbook can be deployed.

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