

THE DEVELOPMENT OF INTERACTIVE ELECTRONIC BOOK ON PLANTS GROWTH AND DEVELOPMENT MATERIALS TO TRAIN DIGITAL LITERACY OF STUDENTS

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Abstract

The era of the 21st century is the era for information in digital form that can be spread easily so that digital literacy is one of the skills that needs to be trained. The purpose of this research is to produce an interactive e-book on plant growth and development material to train student's digital literacy skills that are valid, practical and effective. The research refers to the 4D development methods and tested on 16 students grade XII of SMA Negeri 1 Bojonegoro. The validity of the interactive e-book was obtained from the validation of two expert biology lecturers. The practicality of the e-book was obtained from a readability test using Fry's formulas and graphs as well as a response questionnaire students. The effectiveness of the interactive e-book was obtained from the calculation of N-gain pretest and posttest result. Data validity, practicality and effectiveness were analyzed descriptively quantitatively. The results of the validity show an average overall score of 97.50% with a very valid category. The practicality of the interactive e-book that was developed received an average response from students of 98.82% in a very positive category and the readability test level from the fry chart showed level 12. The N-gain of pretest-posttest score average is 0.71 in the high category and the interpretation of the average value of each component of digital literacy is in the medium to high category.

Keywords: interactive e-book, digital literacy, plant growth and development.

Abstrak

Era abad ke 21 adalah era penyebaran informasi yang dapat dilakukan dengan mudah dalam bentuk digital sehingga perlu dilatihkan keterampilan literasi digital. Tujuan dari penelitian ini adalah untuk menghasilkan e-book interaktif pada materi pertumbuhan dan perkembangan tumbuhan untuk melatih keterampilan literasi digital siswa yang valid, praktis dan efektif. Penelitian dilakukan dengan menggunakan metode pengembangan 4D dan diujicobakan kepada 16 siswa kelas XII di SMA Negeri 1 Bojonegoro. Validasi dilakukan oleh dua dosen ahli biologi. Kepraktisan e-book interaktif didapatkan dari uji keterbacaan dengan formula Fry dan angket respons siswa. Keefektifan e-book interaktif didapatkan dari nilai N-gain hasil pretest dan posttest. Data dari uji validitas, kepraktisan dan keefektifan kemudian dianalisis secara deskriptif kuantitatif. Hasil validasi menunjukkan nilai rata-rata keseluruhan 97,50 % dengan kategori sangat valid. Kepraktisan e-book interaktif ditunjukkan dengan hasil angket respon siswa sebesar 98,82% dengan kategori sangat positif dan tingkat keterbacaan di level 12. Keefektifan e-book interaktif didapatkan dari nilai N-gain sebesar 0,71 dengan kategori tinggi.

Kata kunci: e-book interaktif, literasi digital, pertumbuhan dan perkembangan tumbuhan.

INTRODUCTION

The era of the 21st century is an era where technological developments take place very rapidly. Entering the era which is also called the era of revolution 4.0 marked by the large number of human activities that were converted from manual to completely digital (Wihadanto, 2017). Dissemination of information digitally can be obtained from real-time, namely quickly, anywhere, and anytime. (Setyaningsih, et al., 2019).

Based on the data from the Association of Indonesian Internet Service Providers (APJII, 2022) there were more than 210 million internet users from Indonesia in 2021

alone. Currently, most internet users come from young people or the millennial generation (Sari, 2017). This is in line with the data submitted by APJII in 2022 that the largest internet users are in the age group 13-18 years, followed by the age group 19-34 years. Meanwhile, the use of the internet can have a positive impact but can also have a negative impact such as radicalism and the spread of fake news (Beni & Rahman, 2019).

Internet technology also impacted the behavior and the life style of the younger generation where currently children are so familiar with the internet through gadgets, computers, laptops, smartphones, etc. (Chalim, et al., 2018). Meanwhile, Kusuma & Hardiyanto (2015)

showed the result that internet users in Indonesia are mostly using it to looking for information. However, the use of the internet is still underutilized for learning purposes because internet usage in Indonesia is dominant for finding news and entertainment while educational content is only around 5% (Kusuma & Hardiyanto, 2015).

The ease of finding or obtaining information globally even information from different countries, can bring positive and negative influences. In responding to this situation, as well as part of the demands of education government in the 21st century era, it is necessary to teach digital literacy skills to students. Digital literacy is interpreted as a form of ability to understand, analyze, organize and evaluate information that has been obtained from digital technology (Ginancar, 2019).

Science and technology are two sectors that continue to experience renewal where both of them affected other sectors of life, one of which is in the education sector. Education is required to be more advanced and easily accessible to more people (Aspi & Syahrani, 2022). One of the challenges in education field is to improve the quality of the learning process by using the internet and technology advances. In this case teachers as educators has important role to create new innovations using the technology advances for learning process (Pertiwi & Firdausi 2019).

Digital literacy is a person's ability to be able to use digital tools and facilities properly and effectively as stated by Martin (2006) that digital literacy is not only the ability to obtain information digitally but also the individual's ability to analyze and evaluate the information obtained. Thus, the definition of digital literacy is not only the process of students accessing information through digital media, but also the process of student's understanding, processing, analyzing, evaluating and constructing digital information.

Teachers as educators have a responsibility to train students how to use information technology responsibly, critically and effectively (OECD, 2018). According to Gilster (1997), several competencies that are used as indicators for someone having digital literacy skills are ability in internet searching, that is the ability to search the information in the internet using search engine, hyperlinks/hypertext is a skill to read and understand dynamically the hypertext environment, content evaluation is the ability to think critically and provide an assessment of the validity of the information obtained, and knowledge assembly namely as the ability to

organize the knowledge, build a collection of information obtained and evaluate facts and opinions. So there is a need for innovation and creativity from teachers to facilitate students to practice digital literacy skills in the learning process.

As technology development has increased, the interactive e-book can be developed into teaching materials to increase the student's involvement in learning by the activities that used in it. Ebied & Rahman (2015) stated that students who study using the interactive e-books can increase their learning motivation and develop their academic achievement compared to the students who learn using textbooks or regular e-books.

The growth and development of plants is one of the learning materials that require conceptual understanding, memorization, and associating the material with real life. This is what causes students to experience difficulties. As the results of research from Lina (2020) on class XII MIPA students at SMA Negeri 1 Cibungbulang for the 2019/2020 academic year, from the results of a written test, 72% of students did not complete this material. In addition, in research conducted by Pradina & Yuliani (2020) on the material of plant growth and development, it was found that 15.57% of students did not understand the concept, positive misconceptions were 10.00%, negative misconceptions were 4.71%, and experienced a misconception of 20.07%. Factors that cause misconceptions are students, teachers, teaching methods, context and textbooks used.

Based on the problems that has been described, it is necessary to develop teaching materials in the form of interactive e-book which are expected to be a way to improve the quality of student learning in understanding plant growth and development material to train the digital literacy skills. Therefore, the authors chose to develop an interactive E-book using Qr-Code on plant growth and development material to train students' digital literacy skills. The purpose of this study was to produce an interactive E-book on plant growth and development material to train student's digital literacy skills and determine the validity, practicality and effectiveness of the e-book being developed.

METHODS

This research was a development research that used the 4D model which are included by define, design, develop, and disseminate stages. This research was tested on class XII high school students with the aim of knowing the validity, practicality and effectiveness of the

interactive e-book for plant growth and development to train digital literacy.

The validation analyzes results of the e-book is measured by the validation result score using the Likert scale criteria from 1 to 4. Scores of all aspects are summed up and analyzed descriptively.

Based on the percentage of the validation using that formula above, then the score will be interpreted by the criteria for validation assessment. The e-book is categorized as very valid if the percentage of the validation is 85-100%, valid if the percentage is 70-84.9%, quite valid for 55-69.9%, less valid for 40-54.9% and invalid if the percentage is 25-39.9%.

Analysis of the readability level was carried out by testing 5 samples of text snippets in the e-book using the Fry's Formula by taking fragments of 100 words contained in the e-book to be tested for each sample. Out of these 100 words the level of readability will be assessed by counting the number of sentences and the number of syllables in 100 words and then converted into a fry chart.

Analysis of the results of student responses seen from the results of the questionnaire given to students calculated based on the "yes" and "no" categories. Student responses were asked to answer the "Yes" and "No" columns for each question that had been presented. Classification of the results of the answers are classified into Guttman scale score criteria with "Yes" answer scored 1 and "No" scored 0. Student response results are interpreted based on criteria in the Table 1 below:

Table 1. The Criteria of Practicality Scores

Score	Criteria
0-20	Not Practical
21-40	Less Practical
41-60	Enough
61-80	Practical
81-100	Very Practical

(Riduwan & Sunarto, 2013)

Analysis of the effectiveness of the interactive e-book obtained from the results of the post-test and pre-test scores. The scores will be obtained to the value of N-gain. Analysis of the pretest and posttest scores was carried out to find out the increase in student's digital literacy skills by the N-gain values.

The N-gain value then will be interpreted into several categories with high, medium or low. The interactive e-book is said to be effective if it obtains an N-gain value with a value of $0.7 < g \leq 1$ which is in the high category or $0.3 < g \leq 0.7$ (Riduwan & Sunarto, 2013).

RESULTS AND DISCUSSION

The development research produces the interactive e-book on plant growth and development equipped with a QR-Code to train digital literacy skills for class XII students that are valid, practical and effective. The e-book that produced can be accessed online because it has several features to train student's digital literacy skills. The e-book is designed using Canva then converted to Flip PDF software. (Prastowo, 2013) said that Flip PDF software is effective to produce a good learning media.

The materials contained in the interactive e-book includes: the understanding of plant growth and development, germination, primary growth, secondary growth and the factors that affect plant growth and development. Components in the e-book include: front cover, e-book features, competencies, content, and glossary. Interactive e-book can be accessed online using a laptop or smartphone with an active internet state. The e-book is equipped with features that contain videos and images that can be enlarged so they look clearer. The following is an interactive e-book display that was developed. Saw Figure 1 and Figure 2.








Figure 1. Front Cover



Figure 2. Inner Page

The presentation of interactive e-book is packaged interactively with several features suitable for training students' digital literacy skills. The features in the e-book can described below:

Table 3. Features in Interactive E-book

Feature	Description
 Yuk Kita Amati	“ Yuk kita amati ” is a feature that contains activities to train digital literacy hypertextual navigation indicator. This feature contains activities that ask students to access video or web about the material on plant growth and development that has been provided.
 Ayo Mencari	“ Ayo Kita Mencari ” is a feature to train digital literacy internet searching indicator. This feature contains activities that ask students to search for the material being studied with the aim that students can understand the use of search engines on the internet to find sources of information.
 Informasi +	“ Informasi+ ” is a feature to train digital literacy hypertextual navigation indicator. Information+ contains a link that connects students to articles or videos to get more information related to the material being discussed.
 Bio Evaluasi	“ Bio Evaluasi ” is a feature that contains activities to train digital literacy content evaluation indicator. This feature is equipped with article links as a source of information in the form of content on the internet which contains some information related to plant growth and development. Students are asked to evaluate the truth of the information from the internet.
 Yuk Meneliti	“ Yuk Meneliti ” is a feature used to train digital literacy knowledge assembly indicator. The feature contain activities that ask students to study and analyze information obtained from several sources into information that is related to one another.

The interactive e-book was validated by 2 expert lecturers with the results of validity being very valid. The following is the interactive e-book validation data result: Saw the Table 4.

Table 4. Validation Result of the Interactive E-book

No	Aspects	Score	Percentage Criteria
Components Of Content Feasibility			
1	The suitability of the material presented in the e-book with the basic competence	7	87.5
2	The material suitability for the learning purposes	8	100
3	The material suitability with the activities in the E-Book	8	100
4	There is a concept map of plant growth and development material	8	100
5	There are pictures, videos, and websites to make it easier for students to understand the material	7	87.5
6	There are features to increase	7	87.5

	students' understanding of plant growth and development material		
7	Activities in the E-Book contain links related to information on plant growth and development	8	100
8	Activities in the E-Book can train students to receive and process information from digital media	8	100
9	The e-book contains a sequence of student activities in receiving and processing information from digital media	6	75
10	The e-book facilitate students to browse the web	8	100
11	The e-book facilitate students to understand hypertext direction guides via integrated web links	8	100
12	The activities in e-book train students to check the validity of information from the web	8	100
13	The activities in e-book train students to organize knowledge and evaluate facts and opinions	7	87.5
14	“Ayo Mencari” facilitates students to search the information using search engines on the internet	8	100
15	“Informasi+” facilitates students to understand directions or hypertext on a web browser	8	100
16	“Yuk Kita Amati” facilitates students to understand directions or hypertext on a web browser that displays images and videos.	8	100
17	“Bio Evaluasi” facilitates students to analyze the validity of information from a web.	7	87.5
18	“Mari Meneliti” facilitates students to organize knowledge by building a collection of information obtained by several sources.	8	100
Average of The Components of Content Feasibility		95.14 Very Valid	
Presentation Components			
19	Presentation of the E-Book in a coherent manner	8	100
20	Components are interconnected and related	8	100
21	The activities in the E-Book arranged in a coherent manner	8	100
22	Topics explained clearly	8	100
23	The topics listed are suitable for the material on plant	8	100

	growth and development		
24	There are learning objectives	8	100
25	The learning objectives are suitable for the activities contained in the E-Book	8	100
26	Display E-Book is not excessive	8	100
27	Use color variations well	7	87.5
28	Include new things to attract students' attention	7	87.5
Average Presentation Components			97.50 Very Valid
Linguistic Components			
29	The language used uses standard language	8	100
30	The Indonesian language used is in rules with the refined spelling	8	100
31	The language used is easy for student's understanding	8	100
32	Use simple sentences	8	100
33	Use sentences that are easy for students to understand	8	100
34	The words used in the e-book do not let students misled into the wrong interpretations	8	100
Average Linguistic Components			100 Very Valid
Average			97.50 Very Valid

The results of the validity data of the interactive e-book on plant growth and development material to train students' digital literacy skills were obtained from the assessment of expert lecturers in the fields of education and materials. The components considered were adapted from the National Education Standards Agency (BSNP) by grouping them into three, namely the content feasibility component, the presentation feasibility component, and the language component. The total elaboration of all components is 34 aspects of assessment.

The content feasibility component consists of 5 sub-chapters with an average of 95.14% so that it can be categorized as very valid or very feasible to use. BSNP (2014) stated that one of the components of content feasibility is to include examples in the student's life environment with contextual material so that it can train students' thinking skills optimally. The e-book that has been developed contains the relation between plant growth and development material and student's environment. In addition, through activities on the available features, students can access videos and articles, most of which contain material explanations

accompanied by examples of events that can be found in their surroundings.

The content feasibility component consists of several aspects. In the feasibility aspect of the suitability of the material and supporting material, the average values obtained are 95.83 and 91.66 with very valid criteria. The suitability of the material in teaching materials is an important point that needs to be considered to be adjusted to the provisions of competency standards and basic competencies that are set so that it can help students to understand learning material well (Triyanto, et al., 2020).

The content feasibility component related to digital literacy gets an average rating of 96.73 with a very valid category. Digital literacy cannot be separated from a person's ability to use and utilize digital technology and media to produce, share and consume digital content or information selectively and critically (Hague and Payton, 2010). The digital literacy ability of internet searching is facilitated through the "*Ayo Kita Mencari*" feature which gets 100 points or is very valid to practice information retrieval skills by searching engines on the internet. Next are the "*informasi +*" and "*Yuk Kita Amati*" features which are used to train students' digital literacy skills on hypertext indicators or direction guides to get a score of 100 or very valid. Digital literacy cannot be separated from the skills to find and understand information obtained digitally (Paul, 2005). The "*Bio Evaluasi*" feature gets a score of 87.5 or is very valid for training content evaluation skills by analyzing the validity of information from a web. Content evaluation skills are important for analyzing and sharpening critical thinking to get the right information when receiving information from digital media (Hague and Payton, 2010). The last feature is "*Yuk Meneliti*" to practice digital knowledge assembly literacy skills which get a score of 100 or very valid. The ability to build thoughts and ideas from existing and newly acquired information to create understanding (Hague and Payton, 2010).

The next component is presentation feasibility. The average result of the presentation feasibility value is 97.50% so that it can be categorized as very valid. Of the 10 elaboration aspects of the presentation feasibility component assessed, two aspects that scored 87.50% points were the use of color variations and the inclusion of new things to attract more student's attention. These two aspects need to be considered because they are included in the learning support so that students can be more interested in carrying out the learning process. A

good display of the presentation can increase students' interest in using the interactive e-book developed (Puspita & Irwansyah, 2018).

The third component is the language component. Assessment of the aspect of the language component has an average rating of 100%, which means that the developed e-book can be categorized as very feasible to use. The use of communicative and easy-to-understand language can assist students in facilitating understanding of the material and providing optimal learning outcomes (Prastowo, 2013).

Overall, from all aspects of evaluating the validity of the interactive e-book that was developed, the average value of the results of the validation process was 97.50 with a very valid or very feasible category.

Practicality Test of interactive e-book developed using Fry charts and student response questionnaires. The following is the result of an interactive e-book readability test based on the Fry chart test:

Table 5. Readability Levels

No	Page	Σ Sentences	Σ Syllable x 0,6	Level
1	3	5,8	165,6	12
2	10	5,9	165	12
3	15	5,5	162,6	12
4	20	4	159	12
5	22	4,6	160,8	12
Average		5,2	162,6	12

The readability test for each sample means that the interactive e-book developed is at level 12, which can be said that it can be interpreted as the interactive e-book developed is practical and suitable for use in the learning activities of class XII. The readability test value according to the Fry formula can be illustrated in the Fry Graph shown in Figure 3.

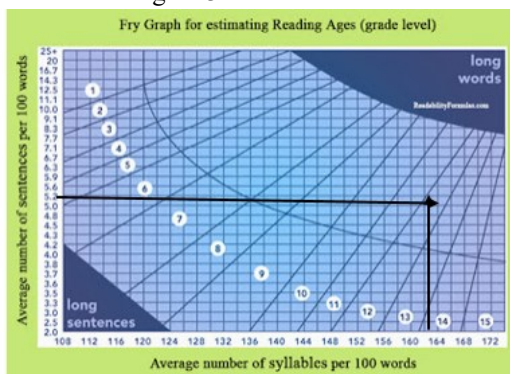


Figure 3. Average Result of Readability

Of the five samples tested with Fry's formula, it was found that all text excerpts from five samples showed level 12 which indicates that the e-book is feasible and practical to use for class XII. The readability level of a discourse must be adjusted to the target audience (Suladi, 2015). This is in line with what was conveyed by Tarigan (2013) that the level of ease and difficulty in a reading is an important point that must be adjusted to the target reader so that the reader can understand the contents of the reading.

In addition, the practicality of the interactive e-book was also assessed from the results of the student response questionnaire. The results of student response data were obtained from distributing questionnaires to 16 students of class XII MIPA SMA Negeri 1 Bojonegoro. Questionnaire distribution was given to students after learning activities using the interactive e-book. The assessment aspects of the student response questionnaire are divided into two, namely aspects of presenting concepts that are adapted to digital literacy and aspects of physical presentation. In the aspect of presenting concepts that are adapted to digital literacy, an average rating of 100% is obtained which is categorized as very feasible to use. While the aspect of physical presentation obtained an average rating of 97.65% with a very positive category (Riduwan, 2012). Aspects related to digital literacy and the features in it show a very positive response, with an average of 100.

Two "no" answers were given by 2 students on one aspect of the same assessment, namely the aspect of the text contained in the e-book can be read easily. The text size used in e-book is on a scale of 14-16. At this text size, when read in textbook form it will look large, but when viewed in e-book or digital form, the size is classified as standard. Meanwhile, a negative response to the assessment aspect includes new things so that it attracts students. Interactive e-book as a form of development of student teaching materials should be written in a font size that students can easily read and equipped with pictures to make it easier for students to understand concepts (Martha, 2018). Therefore, the developed interactive e-book uses a writing size of 14 and uses pictures that can support students' understanding of concepts. Overall, student responses to the questionnaire obtained an average score of 98.82 as a very positive category (Riduwan & Sunarto, 2013).

The effectiveness of interactive e-book was obtained from students' pretest-posttest scores which were then calculated and analyzed for the N-gain value to

determine the increase in students' digital literacy skills. Following are the results of the student's N-gain values:

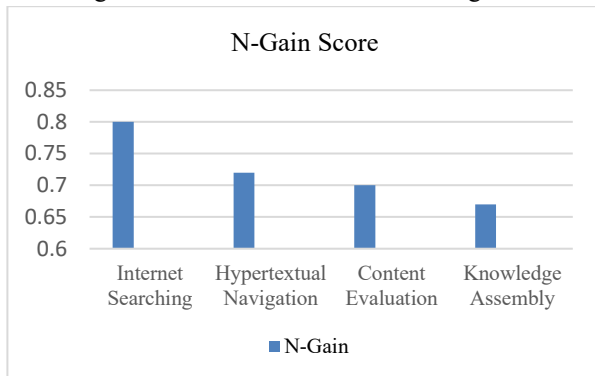


Figure 4. The Effectiveness of the Interactive E-book

From the data results above, it can be interpreted that the highest average N-gain value is on the digital literacy indicator, namely internet searching of 0.80 with the high category. Then the average N-gain value is 0.72 for the Hypertextual Navigation with high category and the average N-gain value is 0.70 with the medium category for the content evaluation indicator and the lowest is 0.67 for the knowledge assembly indicator. Overall, the average N-gain value is 0.71 in the high category. From the pretest and posttest learning outcomes data as well as the N-gain score, it can be concluded that the developed interactive e-book can improve students' digital literacy skills.

Based on the results of the posttest scores obtained by students, all students get a complete score with a score above 75 as the KKM standard. The highest understanding of the concept is in plant germination material which indicates indicator 3.1.1. Analyzing the germination process in plant growth and development by searching the germination processes of 3 different types of plants that have a high level of achievement. This is indicated by the posttest scores obtained by students showing the highest N-gain among other indicators with 12 students getting a score of 100. Meanwhile, the lowest achievement indicator is 4.1.2 Analyzing internal and external factors on plant growth and development. From the data available obtained along with an analysis of its relevance to the source of the article and video presented. The N-gain value obtained is 0.67 in the medium category. This is because students are asked to analyze the relevance of information from several sources to build knowledge that is in accordance with the digital knowledge assembly literacy indicator.

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CONCLUSION

The development of an interactive e-book on plant growth and development material to train student's digital literacy skills is stated to be very valid or very feasible with an average score of 97.50. The practicality of the interactive e-book that was developed was stated to be very practical with the Fry chart readability test showing readability at level 12 and student responses to the questionnaire given with an average score of 98.82 in a very positive category. The effectiveness of interactive e-book were declared effective with an average N-gain pretest and posttest which increased by 0.71 in the high category.

SUGGESTION

Teacher need to verify the internet is in a good condition during the learning process because students need internet connections to access the features in the e-book. Students and teacher need to prepare smartphone or devices that can be used for the e-book.

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