



Development of Digital Pocketbook about Fungi in Mount Merbabu National Park as the Supplement of Teaching Material at Senior High School

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Article Info

Article History :
Received July 2020
Accepted August 2020
Published April 2021

Keywords:
Digital Pocketbook;
Fungi in National Park;
Mount Merbabu; Sup-
plement of Teaching
Material

Abstract

The challenge of improving the 21st-century education quality in the industrial revolution 4.0 eras that graduates are expected to have the knowledge skills, abilities in the field of technology, information media, and learning innovation skills for life and career skills. This research was aimed to develop a digital fungi pocketbook in Mount Merbabu National Park to improve student learning outcomes. This research was a Research and Development (R&D) study, which used Borg & Gall model. The data analysis techniques used were descriptive data analysis related to the validity of responses from users, while the N-gain was used to determine the product's effectiveness. The results showed (1) the digital pocketbook developed had very valid criteria regarding aspects of media, language, and material (2) students and teachers gave responses to the digital pocketbook used in learning with very valid response criteria (3) the value of learning outcomes students showed improvement with moderate N-Gain scores. Thus, the digital pocketbook that was developed can be used as an additional learning source in learning Natural Sciences (Biology) in the face of the 21st century and the industrial revolution 4.0.

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INTRODUCTION

Education has an essential role in preparing human resources to overcome complex and challenges problems in the development era. Improving the quality of education is one of the efforts to prepare human resources to be able to solve problems.

Technology for improving 21st-century education quality nowadays should produce human resources with complete competence, known as 21st-century competence. Human resources are expected to have knowledge skills and abilities in technology, information media, learning skills, innovation, and life and career skills (Wijaya et al., 2016).

The 21st-century brought a widespread change in the rapid development of Science and Technology, which led to a change in the learning paradigm. It is marked by changes in curriculum, media, and technology (Yusuf et al., 2015). One significant change is in the field of education, which is often called the industrial revolution 4.0. The changes made are not just the way of teaching, but much more important is the change in the perspective of the concept of education itself (Lase, 2019).

Entering the industrial revolution 4.0 era, in accordance with the times, makes not only the use of Science and Technology in learning but also supports students' learning outcomes. Learning with mobile technology gets a good response from users, among others: being easy to access it, the compatibility of features with scientific content, and its use that supports paperless actions (Taufiq et al., 2017).

In the learning process, teaching materials are needed. According to (Ruwiyatun, 2020), teaching materials are one of the most important components besides students and teachers in the learning process. Teaching materials can be made in print, non-print and can be visually auditive. Teaching material is essential to use in learning because teaching material serves as a tool in learning activities. Teaching materials emphasize more on student activities than on teachers (Setyowati et al., 2013).

The learning process using teaching materials will produce knowledge that is formed through student learning outcomes, and learning outcomes

have an essential role in the learning process. Assessing the process of learning outcomes will provide teachers with information about student development in achieving learning goals through learning activities (Khairani & Safitri, 2017).

Based on a preliminary study through a questionnaire analyzing the need for teaching materials, which was conducted at SMA Negeri 1 Getasan. It showed the need for a digital pocketbook as supplementary teaching materials with fungi material was 81%. It means students need a new digital pocketbook as fungi teaching materials. Teaching materials were used in learning did not have fungi pictures that match their natural habitat. Furthermore, there were not many colored fungi images, and it used long reading text to describe fungi material, so its use is inefficient.

Fungi material is one of the difficult material for students to learn because there are scientific names, sub-points of the fungi discussion (identification, morphological characteristics, the role of fungi). Then, the limitations of text books, inadequate media, and laboratory tools and materials are incomplete (Lubis et al., 2017). The limitations of teaching materials used in the learning process will cause the student learning outcomes are less than the maximum.

Additional supplementary teaching material is needed to achieve the learning objective of fungi topics and make the learning process becomes effective. One of the best teaching material supplements used in fungi sub-material is a digital pocketbook. Pocketbooks can be made digitally to convey one-way subject matter information in the form of digital pocketbooks. Digital pocketbooks are teaching materials that utilize Science and Technology, so electronic devices such as smartphones and laptops are used in learning. In these electronic devices, there are pictures, colors, and fungi materials that are of interest to students to be used practically and efficiently in the learning process.

Digital books can provide many benefits because information can be presented through multimedia in the form of narration, images, colors, animation, video, and audio. This method is expected to be a solution to difficulties, boredom, and a lack of students' interest in understanding learning by utilizing digital pocketbook as the supplement of teaching material (Mutalib et al.,

2012). Teaching material products with pictures can effectively improve student learning outcomes (Hasanah, 2013).

Digital pocketbooks have advantages that can make it easier for students to learn independently such as, it is easier for students to access wherever and whenever, it is not easily damaged because it is in a digital form, not in printed form, and it saves space because it does not require storage space (Alifudin, 2018).

The purpose of this study was to develop a digital pocketbook of fungi in Mount Merbabu National Park to improve student learning outcomes.

METHOD

The study was conducted at SMA Negeri 1 Getasan Semarang, Central Java, on fungi material. This research was a Research and Development (R&D) study using the Gall, Gall, and Borg model. Development research was used to produce products, determine its effectiveness, and test responses from product users. The product was a digital pocketbook supplement. A small-scale trial subject was consisted of ten students, whereas one class with a total of 31 students was a large-scale trial. Data questionnaire based on validator and students' and teachers' responses were used as a validity data collection technique. The effectiveness test of digital pocketbook supplements was taken using Pre-test and Post-test questions and then analyzed using N-Gain.

RESULT AND DISCUSSION

Diversity of Fungi Species in Mount Merbabu National Park to Develop Digital Pocket Book as Teaching Materials.

There were 52 species of fungi identified from exploration in the Mount Merbabu National Park. The most common results were Basidiomycota divisions consisting of 29 species of the Agaricales order, six species of the Polyporales Order, three species of the Hymenochaetales Order, two species of the Geastrales Order, two species of the Tremellales order, two species of the Dacrymycetales order, one species of the Gomphales order, five species from the Ascomycota division (two species of the Order Geastrales, two

species of the Tremellales order, two species of the Dacrymycetales order, one species of the Gomphales order, five species from the Ascomycota division (one Peltigerales order, two Pezizales order, and two Xylariales order). Species of fungi in the Mount Merbabu National Park on Selo climbing lane, Boyolali, Central Java still have very good diversity.

The fungi found was Basidiomycota and Ascomycota divisions. The distinctive characteristic of Basidiomycota is having basidium. Meanwhile, Ascomycota is shaped like a bowl called ascocarp, while in the body, Basidiomycota is called basidiocarp (Sulaiman, 2019). The fungi found has sexual and asexual reproduction. Sexual reproduction by marriage between 2 different types of hyphae, hyphae (+) and hyphae (-), form plasmogamy. Then, asexual reproduction is formed by conidial spores. Fungi have two ways of reproduction, namely, sexual and asexual (Tjokrokusuma, 2015). The fungi habitat in this study was soil, leaf litter, tree branches, dead wood, and tree trunks.

Frequency of abundant fungi diversity is due to the availability of plant manure and other degraded materials that accumulate and increase soil fertility (Srinivas et al., 2015).

Digital Pocket Book Validation

Digital pocketbook validation assessment was carried out by three expert lecturers, namely media expert, linguist, and material expert. Table 1 shows the assessment results that focus on content suitability, language suitability, and material suitability.

Table 1. Expert Validity Results

Expert Validator	Percentage %	Result
Media	95	Very valid
Language	83	Very valid
Material	88	Very valid
Average	89	Very valid

The aspect of validity includes media, language, and material aspects. Each aspect is 95%, 83%, and 88%, and the overall score is 89%. It is categorized as very valid. Then it can be applied in learning to improve student learning outcomes. The appearance of this digital pocketbook is also equipped with a sequence of presentation of learning material. Starting from the process of

identifying fungi, photographing pictures of fungi in accordance with their natural habitat, to the concept of material (the characteristics of fungi, reproduction and the role of fungi for living things). This is also in line with research conducted by (Parmin, *et al.* 2012) the strategy of organizing learning material contains *sequencing* which refers to the order in which the learning material is presented and *synthesizing*, which refers to efforts to show students the relationship between facts, concepts, procedures and principles contained in learning material.

The digital pocketbook is validated by expert validators and then revised according to the three expert validators' entries. The revision of the three expert validators can be seen in table 2.

Table 2. Revised Digital Pocket Book

Expert Validator	Suggestion
Media	The writing color must be corrected because it does not contrast with the background color.
Language	add an interesting picture of the fungi used as student discussion material
Material	Add a chart of the fungi life cycle, improve definition, and follow the International Code of Botanical Nomenclature (ICBN) guidelines in writing taxon levels.

Based on experts' suggestion about digital pocketbooks, these digital pocketbooks are then revised and tested for small scale learning. Digital pocketbooks are developed with the Microsoft Publisher application. This digital pocketbook on learning Natural Sciences (Biology) was made offline (Figure 1). Students use digital pocketbooks with the help of electronic devices in the form of mobile phones and laptops. According to (Wibowo, 2014), Microsoft Publisher can be used as a development of multimedia electronic as teaching materials.

This digital pocketbook has product specifications such as fungi digital pocketbook supplements referring to the 2013 curriculum, fungi images in accordance with their natural habitat with attractive colors for students, simple digital pocketbook designs, fungi learning materials are made concise, varied and creative, and it can be used by students anywhere, so it is more practical in

its use. Furthermore, (Ibrahim, *et al.* 2010) explained that the element in developing learning media is the use of colored pictures to attract students' attention. The booklet is presented with colorful pictures to attract further students' visual abilities (Sulaiman, 2019). Therefore, using a digital pocketbook accompanied by colored images on fungi material will increase student attention in learning so students can learn well.



Figure 1. Digital Pocket Book

Effectiveness of Digital Pocket Books

The effectiveness of the product could be seen by using the N-Gain formula. Using N-Gain was to determine the student learning outcomes improvement before being given a *pre-test* and after being given *post-test* teaching. N-Gain was used to measure differences in the value of the pre-test and post-test. The results of the N-Gain were included in the medium category. The pre-test, post-test, and N-Gain scores are presented in table 3.

Table 3. N-Gain Results

	X Science 1
Pre-test	50.93
Pos-test	79.83
N Gain	0.60
Score Interpretation	Medium

The results of the analysis of the effectiveness of the learning outcomes of Class X MIPA 1 from SMA N 1 Getasan, with the number of students 31, the pre-test score is 50.93, and the post-test score is 79.83, obtaining an N Gain of 0.60. When measured by its category, the Gain N Score is in the Medium-g category. In other words, (g) is

categorized as a medium because the N Gain score is at $0.69 > (g) \geq 0.29$. Based on the criteria interpretation scale, the score obtained falls into the medium category. These results indicate a digital pocketbook on fungi material is useful in student learning outcomes. The result of N Gain Low-g or (g) is categorized as low if $(g) < 0.30$ from the N-gain calculation (Modification: Evawani, 2013, p.21). The results of the *pre-test* and *post-test* diagram can be seen in Figure 2.

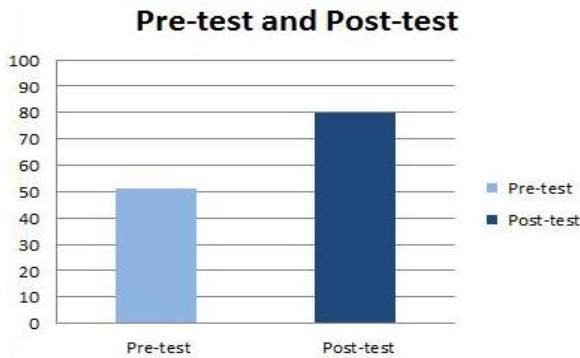


Figure 2. Pre-test and post-test of student learning outcomes

Students and Teachers Responses

Student and teacher responses to digital pocketbooks fall into a very valid category. The results of students' responses in the field test can be seen in Figure 3, and the results of the teacher's response can be seen in Figure 4.

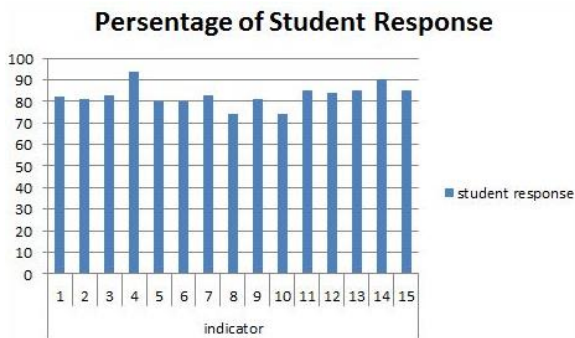


Figure 3. Results of students responses on thefield test

Indicator description: (1) The display of this digital pocketbook is engaging with a percentage of 82%, (2) this digital pocketbook as teaching material create enthusiasm in learning biology with fungi material, with a percentage of 81%, (3) this digital pocketbook as teaching material allows me to learn according to my ability, with a percentage of 83%, (4) with the picture of fungi diversity, it allows me to learn efficiently, with a percentage of 94%, (5)

this digital pocketbook as teaching material can encourage me to learn, with a percentage of 80%, (6) Delievering of fungi material according to daily life and obtain a percentage of 80%, (7) the material presented in the fungi digital pocket book is easy to understand and obtains a percentage of 83%, (8) with this digital pocket book, encouraged me to discuss with other friends, a percentage of 74%, (9) Delievering of digital pocket book as teaching material, increasing my curiosity, by a percentage of 81%, (10) in this digital pocket book, there are several sections for me to find my own concept, with a percentage of 74%, (11) The language used in this digital pocket book is clear and easy to understand, with a percentage of 85%, (12) the language used is simple and easy to understand, with a percentage of 84%, (13) the sentences in the paragraphs used are explicit and sequential, with a percentage of 85%, (14) The picture presented is clear and will increase my understanding of the material, with a percentage of 90%, (15) the material presented uses communicative language so I can easily understand it, with a percentage of 85%.

The overall validity percentage is 83%. If measured using a Likert scale, it is in the range of 66-100%. On the criteria scale, the interpretation of the score gets the category of strongly agree. So, this digital pocketbook can be used in learning to improve student learning outcomes. Overall, the use of digital pocket opening in learning is new for students, making students very enthusiastic about learning. Students can easily learn fungi material because pictures of fungi are in accordance with their natural habitat in a digital pocketbook. Learning materials are accompanied by pictures with attractive colors that can attract the reading interest of many people (Rangsing, 2015). A pocketbook developed with colored illustrations can make it easier for students to learn the material contained in a pocketbook (Yazid, 2016).

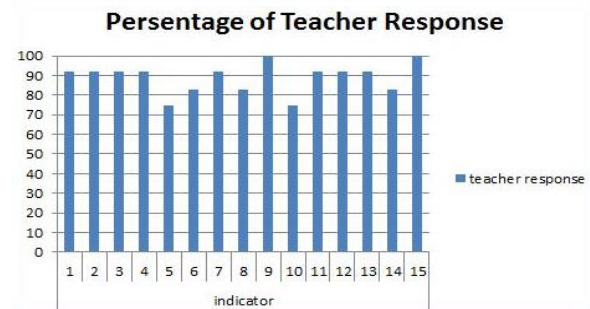


Figure 4. Teacher Response Results

Indicator description: (1) the display of digital pocketbook as teaching material makes users interested in showing, with a percentage of 92%, (2) display of proportional digital pocketbook as teaching material according to students' needs, with a percentage of 92%, (3) the suitability of the digital pocketbook display in accordance with the learning environment by 92%, (4) digital pocketbook as teaching material facilitate students in learning by 92%, (5) digital pocketbook as teaching material provides students the opportunity to learn according to their abilities by 75%. (6) fungi material presented in digital pocket books in accordance with competency standards and basic competencies of 83%, (7) the concept presented in the digital pocket book is clear so that it does not cause confusion, with a percentage of 92%, (8) the material presented is in accordance with the image of fungi in the Mount Merbabu by 83%, (9) without explanation from the teacher, teaching materials from digital pocket books can be used as a source of independent learning for students, with a percentage of 100%, (10) the material presented is in accordance with the role of mold in the environment by 75%, (11) the language and images presented are clearly visible and will increase students' understanding of the material by 92%, (12) reading text and writing in digital pocket books are clear and easy for students to understand by 92%, (13) the material presented uses communicative language so students easily understand it by 92%, (14) the picture presented is clear and will increase students' understanding of the material by a percentage of 83%, (15) this digital pocket book as teaching material, students can use as a source of learning in school and outside of school, with a percentage of 100%.

The overall validity percentage score is 89%. With a Likert scale, the percentage of 89% is in the range of 66-100%. On the score interpretation criteria scale, the percentage of 89% means strongly agree. Then the digital pocketbook can be used as a useful supplement of teaching materials.

CONCLUSION

The validity of digital pocketbooks is in a very valid category based on the validator's assessment, namely, media experts, linguists, and material experts. Then this product can be used as a

teaching material supplement of fungi in learning Natural Sciences (Biology). The results of the effectiveness test of student learning outcomes fall into the medium category. It means the product developed can effectively improve student learning outcomes. Students and teachers strongly agree that teaching materials from this digital pocketbook are used in the learning process of fungi material.

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