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Development of Mushroom E-Brochure as a Learning Resource for Class X to Improve Representation Ability

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Abstract

Result of observations and interviews with class X biology teachers at SMA Institut Semarang, mushroom material is one of the materials that are quite difficult, complex and abstract for students to learn and understand because mushroom material has scientific names that students must understand, like divisions that are almost the same shape. In terms of representation ability, students still struggle to draw mushrooms, so they cannot distinguish mushrooms according to their division. This study aims to develop, test the feasibility and improve students' representational abilities by using e-brochures as a learning resource. This study is a Research and Development (R&D) and was tested using a one-shot case study design. The research goes through the stages of identifying potentials and problems, collecting data, designing products, expert validation, product revisions, small-scale trials, revisions, and large-scale trials so that the final product is produced. The results showed that the e-brochure was feasible to use with a percentage of material eligibility of 77.5%, media eligibility of 78.5% with appropriate criteria, and product responses of 91.55% with very legible standards. The ability of representation can be seen with the results of the t-test 0.000 <0.05 using SPSS, so it can be concluded that there is a significant difference between the results of the pre-test and post-test. The increase in N-gain of pre-test and post-test data was obtained by 70% with high criteria. Based on these results, it can be concluded e-brochure as a learning resource for class X to improve representation ability is feasible to use, and the response of e-brochure is very legible. Suggestions for further research are the development of mushroom e-brochures as a learning resource for class X to improve representation skills associated with other materials.

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INTRODUCTION

The development of learning resources is one of the essential aspects of realizing the effectiveness and efficiency of the learning process. The implementation of the use of learning resources in the learning process is stated in the 2013 Curriculum that an effective learning process is a learning process that uses various learning resources. Learning resources are everything around the environment that contains information and can be used functionally to help optimize learning outcomes (Sanjaya, 2013). One of the optimizations of learning outcomes that can be done is to stimulate students to learn and accelerate understanding and mastery of the material being studied through interaction with learning resources that are considered attractive by students.

Mushroom material is one of the most challenging materials for students to learn and understand because the mushroom material contains Latin languages and scientific names that must be understood by students. This is one of the causes of students having difficulty learning mushroom material. In the representation ability, students also still have problems drawing mushrooms, so they cannot distinguish mushrooms according to their division. Based on the results of interviews and questionnaires on teacher needs, according to a biology teacher at the Indonesian Institute of High School, the difficulty for students in studying mushroom material is that it is difficult to understand and learn the structure and characteristics of mushrooms from different divisions. Even though the teacher has used adequate media and learning resources, such as the material presented in the PPT, textbooks, and modules, students still have difficulty understanding the mushroom material. The results of the questionnaire on student needs, students of class X SMA Institut Indonesia have difficulty understanding the mushroom material, especially the structure and characteristics of mushrooms, based on class, and students still need other learning resources to understand the mushroom material.

One of the learning materials that are not boring, interesting, and creative for students is to use learning materials in the form of brochures. Brochures are arranged in a concise, clear, structured, systematic, diagrammatic, and illustrated manner. Brochures can be used as an exciting learning resource in classroom learning because of their simple and practical form, in addition to the presence of illustrations, which can attract students' interest to use them. Learning resources were created to provide a positive stimulus to students to be active in carrying out learning activities. Therefore, brochure learning materials can be used as learning resources that help and make it easier for students to understand concepts independently on mushroom material because they are made in such a way that they can provoke student learning attraction so that student learning outcomes can be influential and students are also expected to get sources of information. An abundance of fungal material. In this study, researchers used electronic brochures or called e-brochures with the reason that e-brochures are one of the teaching materials and learning resources that can be developed during a pandemic like now and can be read anytime and anywhere, so that use is very flexible by students as well as teachers. Ease of accessing learning resources from anywhere, anytime, and as needed can create a learning climate from all directions.

The purpose of this study was to analyze the feasibility of the mushroom e-brochure as a

learning resource for class X to improve representation skills and to analyze student responses regarding the mushroom e-brochure as a learning resource for class X to improve representation ability. E-brochure is expected through learning materials in the form of e-brochure can provide a learning experience, and students can understand mushroom material easily.

RESEARCH AND METHOD

The research was conducted at the Indonesian Institute of Senior High School in the odd semester of the 2022/2023 academic year. The research population was all students of class X SMA Institut Indonesia, and the sample of the product trial of the research was 6 students of class XI MIPA 3 for small-scale tests and 27 students of class X MIPA 3 for large-scale trials. The sampling technique used was the random sampling technique. In this study, the data used were data on the feasibility, legibility, and student representation ability. E-Brochure analyzed with quantitative description. Data and data collection techniques are presented in Table 1.

Table 1. Data and Data Collection Techniques

Data	Teknik	Instrumen	Analisis	Sumber	Waktu
E-brochure eligibility data	Questionnaire	Validation questionnaire	Media feasibility analysis	Media experts and material experts	At the validation stage
E-brochure readability data	Questionnaire	Teacher feedback questionnaire & student response questionnaire	Readability data analysis	Biology teacher, students of class XI MIPA 3 and X MIPA 3 SMA Institut Indonesia	At the trial stage
Data representation ability	Soal	Questions about students' representation abilities	Data analysis of students' representation abilities	tudents of class XI MIPA 3 and X MIPA 3 SMA Institut Indonesia	At the trial stage

The data on the feasibility and legibility of the e-brochure were analyzed using the Sugiyono (2016) formula as follows:

$$P = \frac{f}{N} \text{x } 100\ \%$$

Description:
P = percentage of score obtained
f = total score obtained
N = maximum score (Sugiyono, 2015: 137)

Student representation ability data were analyzed using the N-gain test and t-test.

A. N-gain test

The improvement of students' representation ability can be known through the N-gain Test or Gain Normalization. In this study, the N-gain test was with the help of Microsoft Excel. The N-gain test in this study uses the formula according to Sundayana as follows.

$$Normalization\ Gain\ (g) = \frac{posttest\ score - pretest\ score}{ideal\ score - pretest\ score}$$

The criteria for the value of N-gain are as follows.

N-gain Value	Interpretation
$1.00 \leq g \leq 0.70$	Tall
$0.70 < g \leq 0.30$	Currently
$0.30 < g \leq 0.00$	Low
$g = 0.00$	Permanent
$-1.00 \leq g < 0.00$	There is a decrease

Table 2. Criteria for N-gain

(Table Source: Sundayana (2016))

The indicator of the success of this research is that if the mushroom e-brochure is said to be legible, it has a minimum of moderate to high criteria with an N-gain value of 0.69-1.00.

B. t-test

The t-test used in this study is the Paired Sample t-test (the two-average difference test) which aims to find out the data obtained by the researchers there are differences before and after the research. Processing the data in this study Paired Sample t-test with the help of SPSS. The proposed hypothesis is as follows.

H0: there is no significant difference in students' representation ability before and after using mushroom e-brochure to improve representation ability

H1: there is a significant difference in students' representation ability before and after using the mushroom e-brochure to improve representation. The criteria in this test are if the value of t count > t table or sig. < alpha 0.05, then H0 is rejected, and H1 is accepted.

RESULTS & DISCUSSION

The result of product development in this research is a mushroom e-brochure as a learning resource for class X to improve representation ability. The developed e-brochure can be accessed easily via Pdf. The developed e-brochure consists of essential competencies, achievement indicators, materials, and discussion questions that will be discussed in class, and students are asked to observe mushrooms in the surrounding environment.

1. E-Brochure Eligibility

Based on the results of the analysis of the e-brochure validation instrument by material experts and media experts, it is known that the developed E-brochuree is suitable for use in the learning process. The percentage results obtained from the two experts are already above 75%. The results of the feasibility of E-brochure by experts are presented in table 3.

Table 3. E-Brochure Feasibility Results by Experts

Validator	Value Percentage	Category
Material Expert	77.5%	Eligible
Media Expert	78.5%	Eligible

Material experts also provide suggestions and conclusions about feasible products that must

be revised before being tested on students. Material experts also offer suggestions for improvement, namely the need to use "approach," an approach point of view in presenting material by referring to KD, in KD. 3 the main keyword is linking, "then conclude the product is feasible but revised first before being tested on students. This is following research which states that the teaching materials developed must follow the established curriculum and basic competencies (Sofnidar & Yuliana, 2018). Media experts suggest that the improvement is that the design is too "crowded" with text that almost covers the display. The design is prioritized for the target students to make it look clearer. This is following research (Asmuki & Hasanah, 2020) that the learning resources applied have been designed according to learning needs and targets, which means that existing learning resources are intentionally created or designed to help students and educators while studying.

2. Readability of E-Brochure

Based on the questionnaire analysis of the teacher's responses to the e-brochure, it is known that the e-brochure developed is very legible for use in the learning process. The percentage of scores obtained from the responses of the two teachers was above 80%. Based on the results of the analysis of the teacher's response to the e-brochure on each indicator, it is known that the teacher strongly agrees if the material contained in the E-brochure helps students achieve the lesson objectives, the display of the cover page and the combination of images and writing in the e-brochure attract attention. The teacher also feels helped by the mushroom e-brochure and agrees that the mushroom e-brochure can be used as a source of learning mushroom material because there is concise and detailed material about mushrooms.

Based on the results of the questionnaire analysis of student responses to the e-brochure on the small-scale test and the large-scale test, it can be seen that the e-brochure developed is very legible and is used for the learning process. The results of student responses to the readability of e-brochures are presented in table 4.

Table 4. E-brochure Readability Response Results

Criteria	Small Scale		Large Scale	
	Number of Students	Percentage	Number of Students	Percentage
Very Readable	5	83.3%	27	100%
read	1	16.7%	0	0%
Enough Read	0	0%	0	0%
Less Read	0	0%	0	0%
Cannot be read	0	0%	0	0%

The results of student and teacher responses to the mushroom E-brochure as a whole are presented in Table 5.

Table 5. Results of Student and Teacher Readability Responses to E-Brochures (Small Scale)

Student Response (%)	Teacher Response (%)	Description
85.5%	**95%**	**Very Readable**

Table 5 shows that the mushroom learning resources in the e-brochure developed for all aspects asked received a response category with the category of readable-very legible. This is indicated by the achievement of a response score of >75%, namely 85.5% student responses, and 95% teacher responses; however, students provide suggestions on e-brochures to improve learning resources, namely in the e-brochure there should be a page so that readers do not misread. The teacher also suggested that the use of materials be further developed, for example, more examples of mushrooms in the surrounding environment. Learning resources can be motivating, able to increase representation, and able to attract students' attention to repeat the material because learning resources can be opened anywhere and anytime.

In the large-scale test, the results of student responses to the e-brochure are in table 6.

Table 6. Results of Student Responses to the e-brochure on Each Indicator (Large Scale)

Student Response (%)	Description
91.55%	**Very Readable**

Based on table 6, it is known that students' responses to the e-brochure are 91.55%, with very legible criteria. When compared with the results of student responses on small-scale trials, there is a difference between student responses on small-scale and small-scale trials. On a small scale, student responses are indicated by an achievement score of >75%, which achieves the criteria for reading-very legible, but on a large-scale trial, student responses are indicated by an achievement of >80%. The state of the mushroom E-brochure can be opened using a pdf so that it is practical and easy to use without the need for a supporting application. In line with the research conducted (Suryadhianto & Mujianto, 2020), information technology is an alternative to providing science and technology. It can support the learning process because the ease of accessing learning resources becomes efficient and effective.

3. Student Representation Ability

The learning process at this stage using the mushroom e-brochure in a large-scale trial using discovery learning contained in the mushroom e-brochure includes stimulation, problem identification, data collection, data processing, proving, and drawing conclusions. The stimulation stage, students are given the opportunity to access and read the mushroom e-brochure, then the teacher provides stimulus questions contained in each section of the material to stimulate students to think critically. The problem identification stage, students are invited to ask questions related to the material being taught, then students have discussions with their groups and work on independent assignments contained in the mushroom e-brochure. The data collection stage, students collect information from the material contained in the mushroom e-brochure and the results of group discussions. At the data processing stage, students process the data from the discussion and interpret it on independent tasks available in the mushroom e-brochure. The proof stage, students verify the

results of the discussion with the theory contained in the e-brochure. Students and teachers correct together the results of the discussion answers and students' independent assignments. The stage of drawing conclusions, students submit a summary of the results of the discussion. During the learning process using the mushroom e-brochure, students actively asked and discussed with group friends and teachers.

The results of students working on the representation ability questions related to the contents of the e-brochure and its relation to KD 3.7 can be seen in table 7.

KD	E-Brochure Content	Indicator	Evaluation Tool	Results and associated with KD 3.7
3.7 Classify fungi based on characteristics, ways of reproduction and relate their role in life	In the e-brochure there is a picture of the division	Describe the general characteristics of the divisions in the fungi kingdom	Visual Problem In the question presented a picture of one of the mushroom divisions, students can detail mushrooms based on the characteristics of the mushroom picture.	Students complete by being able to detail the characteristics of one of the mushroom divisions using the pictures provided in the problem
	In the e-brochure, there are pictures, characteristics, reproduction, and roles of these division fungi.	Analyzing fungi based on their characteristics, ways of reproduction, and linking their role in life	Visual Problem In the questions presented with pictures of various divisions of fungi, students are able to analyze the characteristics, reproduction methods, and roles of fungi by using tables.	Students complete by being able to analyze the characteristics, reproductive methods, and roles of fungi using tables
	In the e-brochure, there are pictures, characteristics, reproduction, and roles of these division fungi.	Distinguishing characteristics, ways of reproduction, and linking the role of fungi (same)	Visual Problem In the questions presented pictures of various divisions of fungi, students are able to distinguish different groups of fungi based on their morphological characteristics, reproduction methods, and roles by using	Students complete by being able to distinguish the characteristics, and ways of reproduction and linking the role of fungi using tables

			tables.	
	In the e-brochure, there is a circular flowchart of how to reproduce mushrooms.	Conceptualizing fungi based on the mode of reproduction	Visual Problem In the problem presented a narrative about the reproduction of fungi, students are able to conceptualize the reproduction of fungi by using diagrams.	Students complete by being able to conceptualize ways of reproduction and by using diagrams
	In the e-brochure, there are pictures, characteristics, and roles that refer students to identify cases of mushroom diversity.	Identifying mushroom diversity	Verbal Questions In the case presented questions, students are able to identify the diversity of fungi and name the species.	Students complete by being able to identify the diversity of fungi and name the species
			Verbal Questions In the case presented questions, students are able to identify the diversity of fungi and name the species	Students complete by being able to identify the diversity of fungi and name the species
	In the mushroom e-brochure, there is a picture of a problem caused by a fungus which is then discussed, and students are able to interpret and provide solutions to the problem.	Interpret a problem by providing a solution using simple statements	Verbal Questions In the problem presented a problem, students are able to interpret a problem by providing solutions using simple statements.	Students complete by being able to interpret a problem by providing solutions using simple statements
KD 4.7 Presenting an investigative report on the diversity of fungi and their role in life	In the mushroom e-brochure, there are pictures of mushrooms, how to reproduce, and their role in life.	Identify the results of investigations on the diversity of fungi and their role in life.	Observing and reporting the results of investigations of the diversity of fungi in the surrounding environment	Students complete by being able to represent mushrooms found in the environment

Based on table 7, it is known that the results of students completing work on questions of representation ability and achieving KD 3.7 and KD 4.7. Students achieving KD 3.7 and 4.7 are given mushroom e-brochures about representational skills in the form of essay questions and

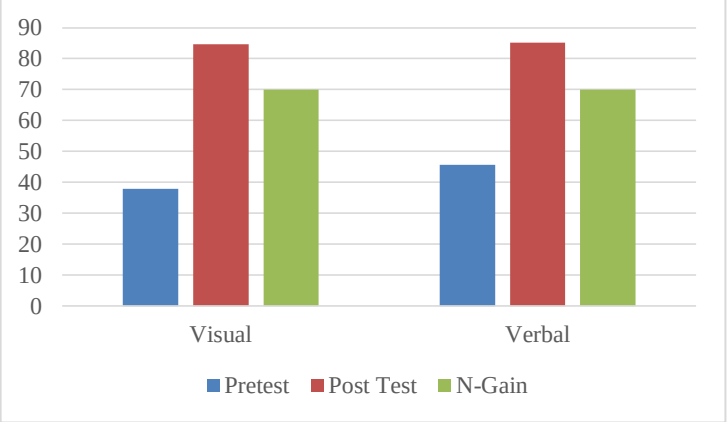
assignments available in the e-brochure, namely observing and reporting the diversity and role of mushrooms in the environment around students. Giving essay questions can train students to choose facts that are relevant to the problem at hand so that students can represent answers and express a thought that is fully integrated (Fauzan, 2020).

Based on the results of the student's representation ability test during the pretest and posttest on a large-scale trial, analysis was carried out in the form of (1) N-gain test, namely, Gain Normalization which was used to determine the average increase in learning outcomes in students' representational abilities. (2) The t-test is the Paired Sample t-test (two-average difference test) which aims to find out the data obtained by the researchers there are differences before and after the research.

A. N-Gain Test

The improvement of students' representation ability can be known through the N-gain Test or Gain Normalization. In this study, the N-gain test was with the help of Microsoft Excel. The N-gain test was used to measure the increase in science process skills and cognitive learning outcomes before and after being given treatment during learning (Nismalasari et al., 2016). The results of the distribution of Pretest, Posttest, and N-Gain values per indicator (%) are presented in Figure 1.

Figure 1. Distribution of Pretest, Posttest, and N-Gain Values per Indicator (%)



Based on the results of the N-gain test analysis, it is known that the first bar chart of visual indicators has an average pretest value of 37.96% with an increase in the average value in the posttest of 84.57% and an N-gain of 70%. Improvement on visual indicators in the high category. Based on the data, visual abilities increased after being given a learning resource in the form of e-brochures of mushrooms which during learning e-brochures contributed to helping students' understanding by presenting perspective pictures of mushrooms in the surrounding environment. so that students can practice visual representation skills to solve problems in the form of images and be able to interpret mushrooms according to the understanding of each student and minimize the occurrence of misconceptions about mushroom material. In line with research (Hertati et al., 2020) that visual representations will help students to equate their perceptions (understanding). Visual representation also has a meaningful relationship because it is used to represent the results

of observations using the five senses, especially learning biology is bound by learning that is abstract, complicated and prone to misconceptions. Students are expected to be able to interpret learning and prevent misconceptions by having visual representations (Rau, 2017), so that visual representation abilities in biology learning can represent elements presented in the form of photos, tables, and diagrams (Utami et al., 2021).

In Figure 1, the second bar graph shows that the verbal indicator has an average pretest value of 45.68%, with an increase in the posttest average value of 85.19% and an N-gain of 70%. The increase in verbal indicators is also included in the high category. Based on the data, verbal ability increases after being given a learning resource like a mushroom e-brochure that can help students understand concepts instead of memorizing theories and construct their understanding concretely. Concept mastery is essential for every student after learning because it can be used to solve a problem related to the concept owned by students. Concept mastery by students is not only about knowing one concept, but students can connect one concept to another in various situations (Siahaan et al., 2020). In the learning process, the e-brochure can also contribute to validating the concept of students' understanding of mushrooms when conducting discussions between friends and teachers so that students can master it. Students can also describe concepts, objects, or processes, expressing something as part of a concept or problem (Lestari et al., 2018). The appearance of various representations in explaining a concept will allow students to understand the concept of multiple representations according to their specific abilities (Kusdiastuti, 2016). The ability to represent students' verbal indicators can also develop 21st-century skills, namely in communication skills, which include conveying thoughts clearly orally and in writing and giving opinions and facts in clear sentences. Then students are allowed to use their abilities to express their ideas during discussions and when solving problems from the teacher. Thus, through this skill, it is hoped that students will be able to communicate thoughts and ideas effectively using written, spoken, and technological media (Nurjanah, 2019).

Based on the student's representation ability test data, students provided information that the material presented was clear, complete, and concise. Students can be motivated, feel helped, and improve visually and verbally representation skills in studying mushroom material by using e-brochures, marked by a significant increase in grades. This is in accordance with the opinion of (Wahyuni, 2009) in (Hanim et al., 2016), namely students' interest in multimedia is because multimedia is a more lively and presentative learning tool, so that multimedia helps students and teachers a lot in the learning process. Learning is an effort to direct students into the learning process to obtain learning objectives according to what is expected (Fatkhurrokhman et al., 2018).

B. t-test

The t-test used in this study is the Paired Sample t-test or the two-average difference test, which aims to find out the data obtained by the researcher there are differences before and after the research. The data processing in this study was a Paired Sample T-Test with the help of SPSS 20 software. The hypothesis proposed was H0: there was no significant difference in representational

ability before and after using mushroom e-brochure to improve representation ability, and H1: there was a significant difference in representation ability between before and after using mushroom e-brochure to improve representation ability. The results of the t-test processing are described in Table 8.

Table 8. Results of t-test using SPSS

Count Value	Significance Level	Test Decision
0.000	**0.05**	**H_0 rejected**

Based on table 8, it is known that the t-count using SPSS is 0.000 <0.05, which then gets the decision to test H0 rejected because the t-count value > t table or sig. < alpha 0.05, then H0 is rejected, and H1 is accepted so that it can be concluded that there is a significant difference in students' representational abilities before and after using the mushroom e-brochure to improve representation skills. The research conducted (Farizi et al., 2020) showed that there were differences in interest in learning and student learning outcomes after using the project-based learning model. This is evidenced by the first hypothesis test using the t-test on the posttest result of 0.00, which means less than the error level of 0.05; H0 is rejected while H1 is accepted, which concludes that the two classes have significant differences.

CONCLUSION

Based on the results of research and discussion, it can be concluded that the Mushroom E-Brochure as a learning resource to improve representation ability is in the eligible category. The product readability is included in the very legible criteria. The results of the representation ability test on the pretest and posttest scores of each indicator with the N-gain test, namely the visual and verbal indicators, have high criteria.

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