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DEVELOPMENT OF DIGITAL LKPD WITH A SCIENTIFIC APPROACH TO MUSHROOM MATERIALS FOR HIGH SCHOOL STUDENTS CLASS X

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Abstract

This study aims to evaluate the quality of the digital student activity sheet (LKPD) focused on mushroom materials, as assessed by experts and teachers; to gather students' responses to the digital LKPD utilizing a scientific approach; and to assess the overall feasibility of this digital KTPD in enhancing the learning process related to mushroom materials. This research has been carried out in the form of a 4-D development model. The evaluation of material experts received a percentage of 88.02% with a very good category, so this teaching material is suitable for use as a class x teaching material for mushroom material. The average of the small group test and the large group test was declared very good. The feasibility aspect of the scientific approach received 95.00% with the category of very good and the aspect of ability received 85.00%. The long-term impact study could measure knowledge retention, engagement, and application of concepts over time. This study could explore the potential for cross-curricular connections, particularly with environmental science or technology, to enhance students' understanding of fungal materials and their applications.

Keywords: Google Site, fungus, digital student worksheets (LPKD), scientific approach

INTRODUCTION

Biology learning activities are learning that emphasizes providing direct experience that can develop students' creativity, skills, and knowledge (Tanjung, 2016). One of the important parts of learning is the teaching materials used (Irawati, 2019). So teachers need teaching materials that are able to facilitate the learning process, such as LKPD presented in learning activities that are able to guide students in activities, then the LKPD that is designed must be in accordance with the student's level of thinking (Irawati, 2015). The LKPD was developed using a scientific approach because it provides direct experience to students through activities such as observation, experiments or other activities so that students easily understand the material (Huwaidah et al., 2024; Magdalena et al., 2021; Ramayani et al., 2024).

The use of the internet in learning makes it easier for students to find the subject matter needed (Avischa Esty Wandani et al., 2022). One of them is Google Sites which is in the form of a web that is easy to use. Google Sites can be used by teachers because it is to provide or present sources of information and learning instructions in which videos, images, audio, and files can be included.

Mushroom material is a concrete and broad material, so in the learning process and teaching materials used must refer to existing facts (Lubis et al., 2018). With concrete and broad material, it is necessary to develop teaching materials that are able to provide convenience for students in understanding mushroom material.

This study aims to achieve key objectives: to evaluate the quality of the digital LKPD focused on mushroom materials, as assessed by experts and teachers; to gather students' responses to the digital LKPD utilizing a scientific approach; and to assess the overall feasibility of the digital LKPD in enhancing the learning process related to mushroom materials. The research contributes to the field of biology education by providing a validated

digital learning resource that aligns with scientific methodologies. It offers insights into the effectiveness of digital LKPDs in engaging students and improving their understanding of complex biological concepts. Additionally, the study highlights the importance of expert and teacher evaluations in the development of educational materials, ensuring that resources are both high-quality and pedagogically sound.

RESEARCH METHOD

This study utilized a 4-D development model. The four stages involved are Define, Design, Development, and Disseminate. In the Define stage, initial analyses, tasks, student needs, concepts, and learning objectives were identified. The Design stage focused on selecting teaching materials, formats, and creating the initial product design. The Development stage involved expert assessments and gathering feedback from teachers and students. Finally, the Disseminate stage encompassed the distribution of the developed product, which is a digital LKPD focused on mushroom materials. The feasibility of this digital LKPD was evaluated through product assessments and trials.

The trial design included three assessment stages. The first stage was conducted by a team of experts, including material, media, and education specialists. The second stage involved assessments from biology teachers, followed by student testing in small groups of 10 and large groups of 32. Assessment data were collected qualitatively through suggestions and feedback from the expert team, teachers, and students, and quantitatively through assessment scores. Data collection was executed using questionnaires, and the collected data were analyzed by calculating the percentage of approval levels for each assessment aspect, achieved by dividing the scores obtained by the ideal scores for all assessment criteria.

$$\frac{Total\ score\ obtained}{Total\ maximal\ score}\ X\ 100\%$$

The scores that have been obtained are then averaged and converted into categories, which are as follows.

Table 1. Guidelines for the quality range of digital LKPD experts in materials, media, education and teachers

No.	Percentage Range (P)	Category
1.	0% - 25%	Not good
2.	26% - 50%	Pretty good
3.	51% - 75%	Good
4.	76% - 100%	Excellent

Table 2. Guidelines for the quality range of digital LKPD student responses

No.	Percentage Range (P)	Category
1.	0% – 50%	Not Good
2.	51% - 100%	Excellent

The LKPD assessment is said to be suitable for use in the learning process as a teaching material, if each expert gives an assessment with a good or very good category as well as the response of students who must enter with a very good category.

RESULT AND DISCUSSION

The implementation of research on the development of digital LKPD with a scientific approach to mushroom materials for high school students in class X uses the 4-D development

model. There are five steps, namely the initial analysis, student analysis, task analysis, concept analysis and learning objective analysis.

The design stage aims to design the initial product based on learning objectives which is a benchmark for students' abilities consisting of products and processes during learning activities. The selection of media was carried out to determine the media that will be used for the development of digital LKPD with mushroom materials. The development of this digital LKPD uses Google Sites media that can contain videos, writings, images and animations. Then the selection of the format is carried out in the initial step which aims to have the format chosen according to the learning material. The selection of the format in product development refers to the design of the learning content, the selection of approaches and learning resources to organize and design the content of the digital LKPD, designing the digital LKPD which includes the design of layouts, drawings and writing. The initial design is a digital LKPD design that has been made by the researcher and then given input by the supervisor. Input from the supervisor will be used to improve the digital LKPD before product design is carried out.

Development stage (develop) which has the goal of producing a revised digital LKPD based on input from the expert team and trials to students. According to Thiagarajan (1974) The development stage is divided into 2 steps, namely expert validation is used to validate the content of fungal material in the digital LKPD before the trial is carried out and the validation results will be used for the initial product revision. Second, product development trials, expert validation have been carried out, then tests are carried out for small groups, large groups and teachers to determine the feasibility results of digital LKPD in student learning classes.

The digital LKPD developed by material experts is divided into qualitative analysis and quantitative analysis contained in tables 3 and 4.

Table 3. Qualitative data on the assessment of material experts

No.	Suggestions and feedback	Follow-up
1	Writing an inappropriate scientific nomenclature on evaluation questions	Improvement of scientific nomenclature writing in accordance with the rules of binomial nomenclature

Table 4. Quantitative data on the assessment of material experts

No.	Aspects	Percentage	Category
1	Content eligibility	91,66%	Excellent
2	Linguistics	91,66%	Excellent
3	Penyajian	93,75%	Excellent
4	Evaluation	75,00%	Good
Average		88,02%	Excellent

The assessment of material experts on the feasibility aspect of the content shows a very good category. The linguistic aspect shows a very good category and the presentation aspect shows a very good category. The evaluation aspect shows a good category. From this assessment, there are shortcomings, including the writing of scientific nomenclature that is not appropriate, there are evaluation questions.

The digital LKPD developed by media experts is divided into two, namely qualitative analysis and quantitative analysis. Qualitative and quantitative data from media experts can be seen in tables 5 and 6.

Table 5. Qualitative data on media expert assessments

No.	Suggestions and feedback	Follow-up
1	Basic competency writing does not look good because of baground (lack of contrast/layered)	Adjustment of the baground color in the basic competency writing to make it easy to read

Table 6. Quantitative data on media member ratings

No.	Aspects	Percentage	Category
1	Presentation	88,10%	Excellent
2	Use/Operation	85,00%	Excellent
	Average	86,55%	Excellent

The evaluation of media experts on the aspect of presentation shows the category is very good. From this assessment, there is a shortage of writing that is difficult to read because the color is not in accordance with the writing used. The aspect of use/operation shows the category is very good.

The digital LKPD developed by education experts is divided into two, namely qualitative analysis and quantitative analysis. Qualitative and quantitative data from education experts can be seen in tables 7 and 8.

Table 7. Qualitative data on the assessment of educators

No.	Suggestions and feedback	Follow-up
1	It should be noted that the video if possible not only contains material but there are problems that are used as a reference for learning	Improvement of the material video by adding problems that are in accordance with the material as a learning reference
2	Instruction sentences are made like sentences in learning objectives	Improvement of instruction sentences in LKPD to make the learning process easier

Table 8. Quantitative data on the evaluation of educators

No.	Aspects	Percentage	Category
1	Qualifications of the scientific approach	82,14%	Excellent
2	Ability	75,00%	Good
	Average	78,57%	Excellent

The evaluation of educators on the qualification aspect of the scientific approach shows an excellent category. The ability aspect shows a good category. From this assessment, there are shortcomings in the instruction sentences that are not clear, causing students to have difficulty using LKPD in learning.

The digital LKPD developed by teachers is assessed by teachers divided into two, namely qualitative analysis and quantitative analysis. Qualitative and quantitative data from teachers can be seen in tables 9 and 10.

Table 9. Qualitative data on teacher assessment

No.	Suggestions and feedback	Follow-up
1	The writing of sentences presented in the material needs to be improved so as not to cause double meanings	Improving sentence writing on the material so that it does not cause double meanings

Table 10. Quantitative data on teacher assessment

No.	Aspects	Percentage	Category
1	Content eligibility	83,33%	Excellent
2	Linguistics	75,00%	Good
3	Presentation	100,00%	Excellent
4	Evaluation	100,00%	Excellent
5	Presentation	87,50%	Excellent
6	Use/Operation	93,75%	Excellent
7	Qualifications of the scientific approach	95,00%	Excellent
8	Ability	85,00%	Excellent
	Average	89,94%	Excellent

The assessment of the biography teacher on, the linguistic aspect is in the good category, the content qualification aspect, the presentation aspect, the evaluation aspect, the presentation aspect, the use/operation aspect, the scientific emphatic eligibility, and the ability aspect is in the very good category.

The students' responses were divided into two, namely the small group test and the large group test. The small group test was carried out by 10 students. Meanwhile, the large group test was carried out by students by 32 students. The responses of small group students can be seen in tables 11 and 12. The response of large group test students can be seen in tables 13 and 14.

Table 11. Qualitative data on student responses to small group tests

No.	Suggestions and feedback	Follow-up
1	Colors lack contrast in questioning activities	Improvements in questioning activities are that the colors are adjusted to make it more contrasting and easier for students to learn

Table 12. Quantitative data on student responses in small group tests

No.	Aspects	Percentage	Category
1	Language	100,00%	Excellent
2	Graphics	100,00%	Excellent
3	Benefits	86,66%	Excellent
	Average	95,55%	Excellent

Table 13. Qualitative data on the response of large group test students

No.	Suggestions and feedback	Follow-up
1	The menu of questioning activities is too small	Improvement in questioning activities by increasing the size of the questioning menu to make it easier to use LKPD
2	In the activity of asking the base of the Iphone cannot log in	There needs to be an explanation of the basis of the iphone to log in using Twitter because tlk.io application can only log in using android.

Table 14. Quantitative data on student responses to large group tests

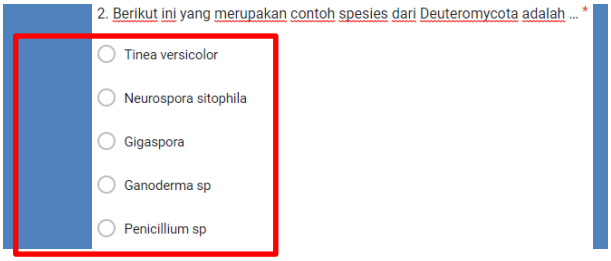
No.	Aspects	Percentage	Category
1	Language	93,75%	Excellent
2	Graphics	94,53%	Excellent

3	Benefits	77,08%	Excellent
Average		88,45%	Excellent

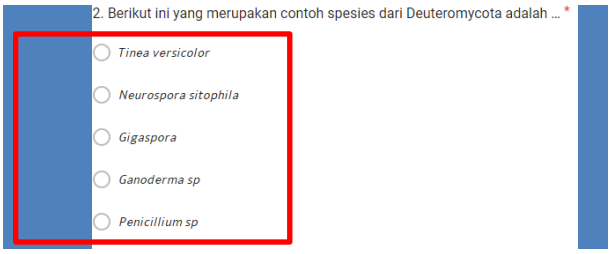
The response of students in the keil group test was obtained in the very good category and the large group test was obtained in the very good category. In the questioning activity, it is necessary to explain to students to log in, especially students who use Iphone-based electronic devices.

The fourth stage is the dissemination of products that have been assessed, revised, tested and said to be feasible by experts and biology teachers, then the dissemination stage is carried out. The distribution was carried out in a limited test, namely class X MIPA students and Madrasah Aliyah biology teachers in Yogyakarta.

Revision of material expert products



a

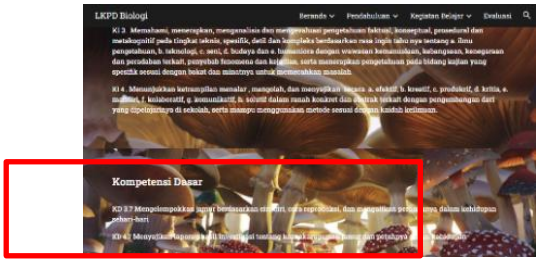


b

Figure 1. Improvement of the writing of scientific nomenclature in the evaluation questions in accordance with the binomial rules of nomenclature, Figure a before revision and Figure b after revision

Writing a good and correct scientific nomenclature must be in accordance with the Binomial nomenclature rules, this can make it easier to learn it in the grouping or classification of living things (Tsalatsatunnisa et al., 2018).

Revision of media expert products



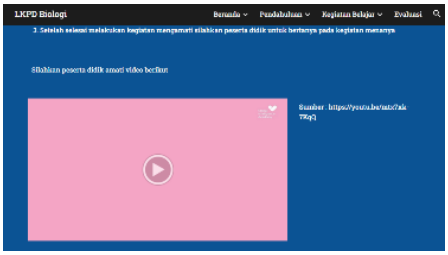
a

b

Figure 2. Correction of under-contrast background colors to make the text easy to read, image a before revision and image b after revision

The criteria for a good picture are the selection of images with good brightness, not blurry, and inconspicuous colors and equipped with appropriate image descriptions and having clear image sources that can make students interested and motivated in learning (Lilis et al., 2019).

Revision of Education expert products



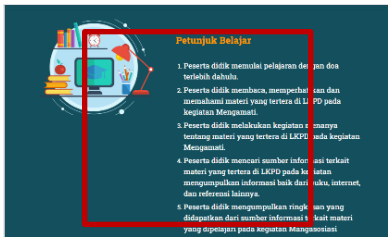
a

b

Figure 3. Improvements to video quality and additional issues for learning references, image a before revision and image b after revision

Learning using video messages that are delivered is more interesting, it encourages and increases student motivation so that students remember the material more (Khairani et al., 2019).

a



b

Figure 4. Improvement of learning instructions to make it easier for students to use LKPD in learning, picture a before revision and figure b after revision

Inclear instruction sentences cause students to have difficulty using LKPD in learning. The appropriateness of the instruction sentence for use in learning is a component that must be clear in the teaching materials (Prastowo, 2015).

Revision of biology teacher products

a

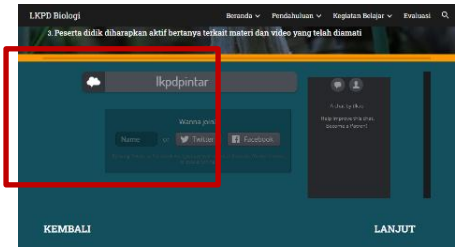
b

Figure 5. Correction of sentences that are *typo* on the material so as not to cause double meanings, picture a before revision and picture b after revision.

The use of words that are in accordance with the great dictionary of Indonesian (KBBI) makes the language easy to understand (Muqodas et al., 2015).

Revision of student response products

Small group test



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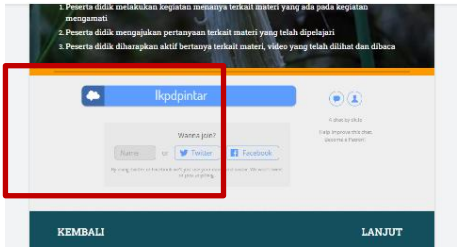

b

Figure 6. Improvement in questioning activities by changing contrasting colors to make it easier for students to use LKPD in learning, picture a before revision and picture b after revision.

The criteria for a good picture are the selection of images with good brightness, not blurry, and inconspicuous colors and equipped with appropriate image descriptions and having clear image sources that can make students interested and motivated in learning (Lilis et al., 2019).

Large group test

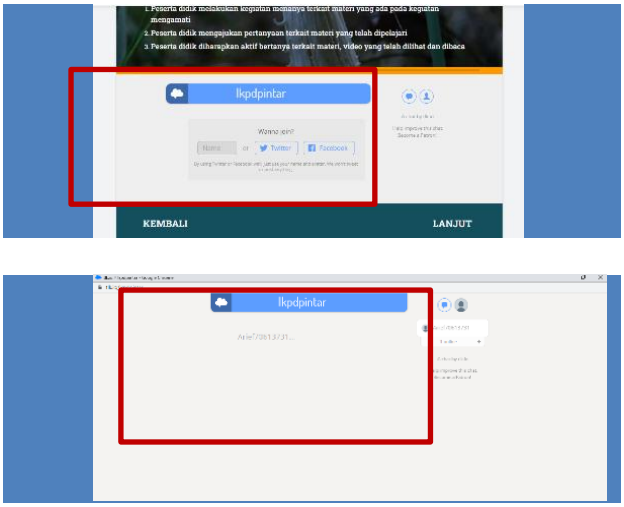

Figure 7. Improvements by adding a Twitter feature to the tlk.io application to make it easier to log in to iphone-based electronic devices, picture a before revision and picture b after revision

There needs to be an explanation directly on the basis that the Iphone must log in using Twitter or Facebook because tlk.io application can only log in directly using android-based.

Discussion

This research was carried out in the form of a digital student activity sheet (LKPD) for high school students on mushroom material. This research uses a type of research and development with a 4-D model, which has 4 stages, namely Define, Design, Development and Disseminate. At the definition stage, it consists of an analysis of the beginning-end, assignments, students, concepts and learning objectives. The planning (design) stage consists of the selection of teaching materials, the selection of formats and the initial design of the product. The development stage consists of expert assessments, teachers and student responses. The disseminate stage consists of the dissemination of the developed product.

The assessment of the digital LKPD is carried out by material experts which is divided into four aspects, namely the feasibility of content, language, presentation and evaluation. In the aspect of content feasibility received a percentage of 91.66% with a very good category, the linguistic aspect received a percentage of 91.66% with a very good category, the presentation aspect received a percentage of 93.75% with a very good category, and the evaluation aspect received a percentage of 75.00% with a good category. The average assessment from material experts received a percentage of 88.02% with a very good category, so this teaching material is suitable for use as a class x teaching material for mushroom material. The suggestions from material experts are inappropriate writing of scientific names and inappropriate answer keys in evaluation questions. According to (Tsalatsatunnisa et al., 2018) writing a good and correct scientific nomenclature must be in accordance with the Binomial nomenclature rules, this can make it easier to learn it in the grouping or classification of living things.

The assessment of digital LKPD on media experts is divided into two aspects, namely the aspect of presentation and the aspect of use/operation. In the aspect of presentation, it got a percentage of 88.01% with the very good category and the use/operation aspect got a percentage of 85.00% with the very good category. This shows that the digital LKPD is very good to be used as a teaching material. The average assessment of media experts received a percentage of 86.55% with a very good category supported by opinions (Nisfiyah & Susanti, 2019) that good teaching materials for students must be able to understand and clarify the material and in accordance with the level of knowledge and age level of students.

The assessment of digital LKPD on education experts is divided into two aspects, namely the feasibility of a scientific approach and ability. These two aspects received different category assessments. In the feasibility aspect, the scientific approach got a percentage of 82.14% with the very good category and in the ability aspect got a percentage of 75.00% with the good category. In the assessment, the two aspects received an average assessment with a percentage of 78.57% with the category of very good. Good teaching materials in accordance with curriculum 13 must use a scientific approach, this is in accordance with the opinion (Susilana & Ihsan, 2014) The application of a scientific approach can help teachers develop more varied learning activities to facilitate students to optimize the development of their potential so as to help optimize learning outcomes.

The assessment of digital LKPD for biology teachers is divided into eight aspects, namely the feasibility of content, the linguistic aspect, the presentation aspect, the evaluation aspect, the presentation aspect, the use/operation aspect, the feasibility of the scientific approach and the ability aspect. In terms of feasibility, the content got a percentage of 83.33% with a very good category. In accordance with the opinion of Arifin and Kuntjoro (2019), a teaching material is said to be good if the material presented is in accordance with the learning objectives. The linguistic aspect got 75.00% with the good category. The presentation aspect got a percentage of 100.00% with the very good category, the evaluation aspect got a percentage of 100.00% with the very good category.

In the aspect of presentation, it got a percentage of 87.50% with the category of very good, the aspect of use/operation got a percentage of 93.75% with the category of very good. The feasibility aspect of the scientific approach received a percentage of 95.00% with the category of very good and the aspect of ability received a percentage of 85.00% with the category of very good. The average assessment of biology teachers received a percentage of 89.94% with the very good category, which was supported by opinions (Nisfiyah & Susanti, 2019) that good teaching materials for students must be able to understand and clarify the material and in accordance with the level of knowledge and age level of students.

Students' responses to digital LKPD are divided into three aspects, namely the language aspect, the graphic aspect and the usefulness aspect. To find out the response of students, they

are divided into small groups and large groups. The responses of small group test students were carried out to 10 students of class X E 4 with random selection in one class. The results of the students' responses in the small group test in the language aspect got a percentage of 100.00% with the category of very good. The graphics aspect got a percentage of 100.00% with a very good category and the usefulness aspect got a percentage of 86.66% with a very good category, in the aspect of usefulness students experienced difficulties in accessing digital LKPD because of a weak network and LKPD still could not encourage students in the spirit of learning on mushroom material. Students can learn more efficiently if there are interesting teaching materials so that they can learn optimally, which means that students are motivated from within themselves to learn (Puspitasari et al., 2018).

The response of large group test students was carried out by taking all students in one class X E1 which amounted to 32 students. The response results of large group test students in the language aspect got a percentage of 93.75% with the category of very good. The graphics aspect got a percentage of 94.53% with a very good category and the usefulness aspect got a percentage of 77.08% with a very good category, in the aspect of usefulness, students have difficulty accessing digital LKPD because of a weak network and LKPD still cannot encourage students in the spirit of learning on mushroom material. Students can learn more efficiently if there are interesting teaching materials so that they can learn optimally, which means that students are motivated from within themselves to learn (Puspitasari et al., 2018).

The results of the small group test assessment conducted on students in class X E4 got an average percentage of 95.55% with the very good category, while the average result of the large group test in class X E1 got a percentage of 88.45% with the very good category. Based on the average of the small group test and the large group test, the digital LKPD can be said to be feasible and used as a teaching material for the biology of fungal material. Good teaching materials for students must be able to understand and clarify the material and in accordance with the level of knowledge and knowledge of the age of the students (Nisfiyah & Susanti, 2019).

Digital LKPD that has gone through the development stage and is declared feasible based on an assessment with a minimum category of good. Good teaching materials for students must be able to understand and clarify the material and in accordance with the level of knowledge and age level of students (Nisfiyah & Susanti, 2019). The results of the digital LKPD product with a scientific approach to mushroom material were distributed to biology teachers of Madrasah Aliyah (MA) throughout DIY and students of class X MIPA SMA N 2 Banguntapan. The website link to access the digital LKPD with a scientific approach to fungal materials is as follows: https://sites.google.com/view/lkpdbiologi/beranda

CONCLUSION

The research on the development of a digital LKPD using a scientific approach to fungal materials for class X MIPA students yielded positive assessments from material, media, and education experts, as well as biology teachers, indicating its high quality. Students also responded very favorably to the digital LKPD in both small and large group tests, confirming its suitability for biology learning. Future research could focus on several areas, including longitudinal studies to assess the long-term impact on student learning outcomes, exploring the integration of the digital LKPD into broader curricula, and examining its scalability and adaptability across different educational contexts and topics in biology.

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