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Development of digital LKPD with a scientific approach to diversity material for SMA/MA students

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ABSTRACT

Teaching materials are an important part of the learning process. One of the teaching materials that can be developed using the Google Sites application is LKPD which presents information and learning instructions and can include images, videos, audio and files. This study aims to determine the quality of LKPD based on the assessment of media experts, materials, teachers, and education experts. The development model used is the 4-D model with stages: Define, Design, Develop, and Disseminate developed by Thiagarajan (1974). Assessment results from material experts get a percentage of 79.16% with a very good category. The assessment of media experts gets a percentage of 95.83% with a very good category. The assessment of education experts received a percentage of 78.85%, with a very good category. Biology teachers gave an assessment with a percentage of 94.95%, categorized as very good. The small group test obtained a percentage of 96.11% with a very good category and in the large group test obtained a percentage of 100.00% with a very good category. Based on these results it can be concluded that digital LKPD with biodiversity material for class X is feasible for students to use in learning biology.

Introduction

The development of the times is always accompanied by the development of technology that is increasingly advanced in accordance with the needs of human life. In the field of education, technology is always needed by teachers to support the learning process. Teaching materials are an important part of the learning process. Teaching materials that are widely used by teachers are printed Student Worksheets (LKPD) that have been determined by the school and due to limited time and energy teachers cannot develop their own teaching materials. Biology learning will be more effective if teachers can apply learning approaches that are in accordance with the characteristics of students and adjust to the curriculum used. Curriculum

2013 in the learning process uses a scientific approach. The scientific approach is used in the learning process to develop students' skills in solving a problem in learning.

In today's digital era, teachers must develop teaching materials that students can use easily. One of them is by using the Google Sites application which can be used to create LKPD which presents information sources and learning instructions in which images, videos, audio and files can be included. Biodiversity is one of the important subject matter in biology for grade X students. The material has a broad scope and the objects in the material are related to things related to real life, so it needs the right way of learning for students to make it easier to understand the material.

The objectives of this development research are (1) Knowing the experts' assessment of digital LKPD with a scientific approach to biodiversity material for X MIPA class students developed. (2) Knowing the response of students to digital LKPD with a scientific approach to biodiversity material for class X MIPA developed. (3) Knowing the feasibility of digital LKPD developed with a scientific approach to biodiversity material used for learning biology for grade X MIPA students.

Method

This development research uses the 4-D development model developed by Thiagarajan[1]. The 4-D model has 4 stages namely Define, Design, Development and Disseminate. In the Define stage consists of the initial analysis of the end, tasks, learners, concepts, specifications of objectives. Planning (Design) the initial design of the product. Development (Develop) consists of expert validation and product trials. The Disseminate stage consists of dissemination. The product developed is a digital LKPD with a scientific approach to biodiversity material which is tested for feasibility by product assessment and product trials to determine the feasibility of digital LKPD products.

The trial design is divided into three stages, the first stage is carried out by a team of experts consisting of material experts, media experts and education experts. The second is the assessment of biology teachers and the third is a trial of students who are divided into small groups of 10 students and large groups of 32 students. Primary data consisted of the assessment of a team of experts and biology teachers. The data includes assessment scores from the aspects of content feasibility, grammar, language, images and videos. Secondary data consists of an assessment of students' responses to digital LKPD. The assessment is obtained from qualitative data in the form of suggestions and input from a team of experts and learner responses and quantitative data in the form of scores from expert team assessments and learner responses.

The data collection technique was carried out using an instrument in the form of a questionnaire sheet. The data that has been collected by the expert team is analyzed by the percentage level of approval on each aspect of the assessment, namely by calculating the number of scores obtained from the research divided by the number of ideal scores for all aspects of the assessment carried out[2].

$$\frac{Total\ score\ obtained}{Maximum\ score} \times 100$$

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

Table 1. Guidelines for the quality range of digital LKPD for material, media, education and teacher experts.

No	Category	Percentage Range (P)
1	Very poor	0%-25%
2	Fairly good	26%-50%
3	Good	51%-75%
4	Very good	76%-100%

Table 2. Guidelines for the Quality Range of Digital LKPD for learners

No	Category	Percentage Range (P)
1	Less good	0-50
2	Very good	51-100

LKPD is said to be feasible and can be used in the learning process as teaching material, if each expert gives an assessment of LKPD in the good category as well as the response of students who must enter the good category[3].

Results and Discussion

The research implementation of the Development of Digital LKPD with a Scientific Approach to Biodiversity Material for SMA / MA Class X students using the 4-D model. The purpose of the define stage is to determine and define the needs in the learning process and collect information sources related to the product to be developed. There are three steps, namely initial and final analysis, learner analysis (task analysis and concept analysis) and goal specification.

The second stage of design consists of media selection carried out to determine the media used to make digital LKPDs selected based on the analysis of students who have learning objectives that help in the learning process. The selection of teaching materials is carried out to identify teaching materials that are relevant to the characteristics of the material according to the needs of students. Then the selection of formats that have the aim to match the selected format according to the learning material. The selection of the form of presentation is adjusted to the digital teaching materials used. Format selection in product development is meant by designing learning content, selecting approaches and learning resources organizing and designing digital LKPD content, designing digital LKPD which includes layout design, images 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.

The third stage of develop (development) which has the aim to produce digital LKPD that has been revised based on input from a team of experts and trials to students. According to Thiagarajan the development stage is divided into 2 steps, namely expert validation is used to validate the content of biodiversity material in digital LKPD before trial and the validation results will be used for initial product revision. Second, product trials, expert validation has been carried out then small group, large group and teacher trials to determine the feasibility of digital LKPD in the student learning class[1].

The developed digital LKPD assessed by material experts is divided into qualitative and quantitative analysis which can be seen in tables 3 and 4.

Table 3. Qualitative data of material expert assessment

No	Feedback and suggestions	Follow-up
1	Examples of biodiversity about ecosystems are not quite right.	Replace the ecosystem level example with another example
2	Definition of biodiversity rechecked	Improvements to the definition of biodiversity and additional sentences

Table 4. Quantitative data of material expert assessment

Aspect	Total score (%)	Category
Content feasibility	75.00	Good
Presentation	87.50	Very good
Evaluation	75.00	Good
Average Score	**79.16**	**Very good**

The material expert assessment on the aspect of content feasibility shows a good category. The assessment has shortcomings including the definition of biodiversity that is less precise and examples of biodiversity at the ecosystem level. The presentation aspect has a very good category and the evaluation aspect obtained a good category.

The developed digital LKPD assessed by media experts is divided into two, namely qualitative and quantitative analysis. Media experts provide an assessment on the aspects of presentation, language and operation/use. Qualitative and quantitative data from media experts can be seen in Tables 5 and 6.

Table 5. Qualitative data of media expert assessment

No.	Feedback and suggestions	Follow-up
1	Learning will be better if it is made coherent from learning 1,2,3	Before using the editor, deactivate the link to the learning, so that it is coherent.
2	Instructions for use are better equipped in the form of videos	Instructions for use have been equipped with a video
3	Layout to be more varied on the material divided into several pages	LKPD material is only a little because it is only an introduction to student activities.

Table 6. Quantitative data of media expert assessment

Aspect	Total score (%)	Category
Presentation	97.92	Very good
Language	87.50	Very good
Usage	93.75	Very good
Average Score	**93.05**	**Very good**

The assessment of media experts after being averaged shows a very good category from the aspects of presentation, language and use, but still has shortcomings in the LKPD, namely in the instructions for use in the form of written instructions. Suggestions from media experts in the instructions for use are better equipped with video instructions so that students are not mistaken in use or have no difficulty in operating the LKPD. In the linguistic aspect, there are sentences that are less clear so that students cannot understand the sentences on the LKPD. In the aspect of use, there needs to be a supporting sentence/explanation of the next sentence.

Education experts provide an assessment of digital LKPD divided into two, namely qualitative and quantitative. Analysis of qualitative and quantitative assessments can be seen in tables 7 and 8.

Table 7. Qualitative data of education expert assessment

No.	Feedback and suggestions	Follow-up
1	The instructions in the questioning and associating activities are still unclear and there are similarities in the instructions in the associating and communicating activities.	Changes in instructions on questioning, associating and communicating activities.
2	Need to add a button so that activities can be sorted	Addition of back and continue buttons in the introduction.

Table 8. Quantitative data of education expert assessment

Aspect	Total score (%)	Category
Feasibility of scientific approach	81.25	Very good
Ability	75.00	Good
Average Score	**78.12**	**Very good**

The assessment of education experts on the feasibility aspect of the scientific approach shows a very good category, but there are evaluations on the video, instructions for questioning activities and less clear activities for collecting information and associating. In the aspect of ability, it has a category with improvements in the steps of scientific activities so that students can carry out learning in order according to the instructions in the digital LKPD and do not confuse students when using digital LKPD.

Biology teacher assessment is divided into two, namely qualitative and quantitative analysis. Qualitative analysis is taken from suggestions or input, while quantitative analysis is obtained from data in the form of numbers. Aspects of the biology teacher assessment consist of aspects of content feasibility, presentation, evaluation, presentation of LKPD, language, use, feasibility of scientific approaches and abilities. The results of the biology teacher assessment can be seen in tables 9 and 10.

Table 9. Qualitative data of biology teacher assessment

No.	Feedback and suggestions	Follow-up
1.	Pictures or illustrations need to be improved.	Improving the quality of images or illustrations on digital LKPD.
2.	Learning materials and methods are good and appropriate, it is necessary to improve the writing that is less clear or typo.	Rechecking the writing on the material that is not correct and typo.

Table 10. Quantitative data of biology teacher assessment

Aspect	Total score (%)	Category
Appropriateness of content	95.83	Very good
Presentation	100.00	Very good
Evaluation	100.00	Very good
Presentation of LKPD	87.50	Very good
Language	87.50	Very good
Usage	93.75	Very good
Feasibility of scientific approach	95.00	Very good
Ability	100.00	Very good
Average Score	**94.95**	**Very good**

The biology teacher's assessment on the aspects of content feasibility, presentation, evaluation, presentation of LKPD, language, use, feasibility of the scientific approach and ability is in the very good category. Writing on the material and pictures or illustrations needs to be improved so as not to cause confusion of students.

Learner responses are divided into two, namely small group tests and large group tests. The small group test was conducted by 10 learners. While the large group test was carried out with a total of 32 students. Small group learner responses can be seen in tables 11 and 12. Large group test learner responses can be seen in tables 13 and 14.

Table 11. Qualitative data on small group responses

No.	Feedback and suggestions	Follow-up
1.	The image contrast was improved because it was too transparent.	Reducing image contrast so that it is easily understood by students.
2.	LKPD cannot encourage students in the spirit of learning	Explanation to students directly in the use of LKPD and explain the advantages of LKPD so that students are interested in learning using digital LKPD.

Table 12. Quantitative data on small group response

Aspect	Total score (%)	Category
Language	100.00	Very good
Graphics	95.00	Very good
Usability	93.33	Very good
Average Score	**96.11**	**Very good**

Table 13. Qualitative data on large group response

No.	Feedback and suggestions	Follow-up
1.	In the questioning activity on the Iphone base cannot be logged in.	Explanation on the Iphone base must be logged in using twitter or facebook because the tlk.io application can only be logged in directly using android-based.
2.	Suggestions are still the same in small groups, namely LKPD cannot encourage students in the spirit of learning	Explanations to students directly in the use of LKPD and explain the advantages of LKPD so that students are interested in learning using digital LKPD

Table 14. Quantitative data on large group response

Aspect	Total score (%)	Category
Language	100.00	Very good
Graphics	100.00	Very good
Usability	100.00	Very good
Average Score	**100.00**	**Very good**

The response of students in the small group trial was obtained in the very good category and in the large group test was obtained in the very good category. In the questioning activity on the Iphone base, it cannot be logged in. LKPD cannot encourage students in the spirit of learning.

The fourth stage of disseminate, the product has been assessed, revised, tested and declared feasible by experts and biology teachers then carried out the dissemination stage. The dissemination was carried out on a limited test, namely X MIPA class students and biology teachers of Madrasah Aliyah throughout Yogyakarta.

1. Material expert product revision

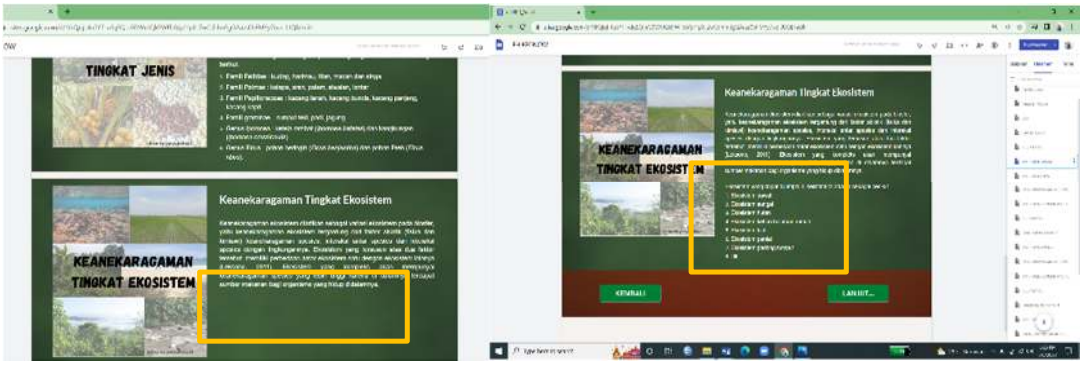

Fig 1. Example of ecosystem before and after revision

The lack of examples of ecosystem diversity because the material presented in a teaching material must be in accordance with student learning needs, basic competencies and interactive[4].

2. Media expert product revision

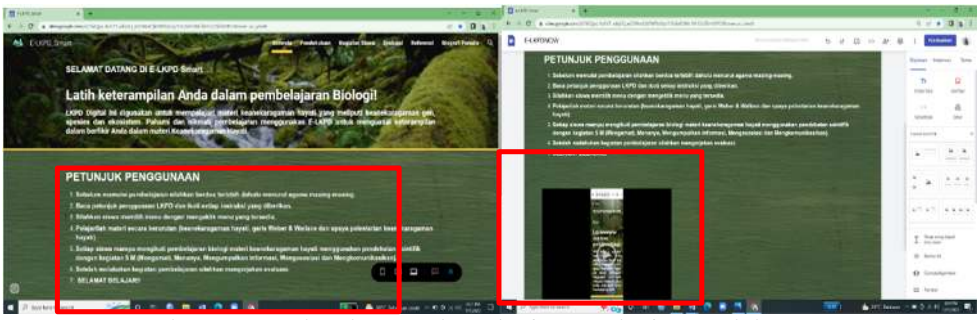

Fig 2. Learning instructions before and after revision

The instructions before being revised did not have a video tutorial on the use of digital LKPDs which made it difficult for students to use them. Instructions for use that help students in learning tend to be active and high curiosity about digital LKPD[5].

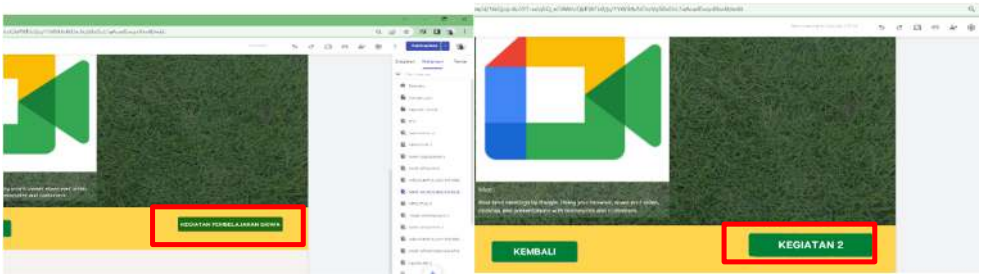

Fig 3. Learning activities before and after revision

Learning activities need to be arranged in order because layouts are said to be good if they have variations, such as clarity of learning steps, use of words, attractive images and material language that is easy for students to understand[6].

3. Education expert product revision

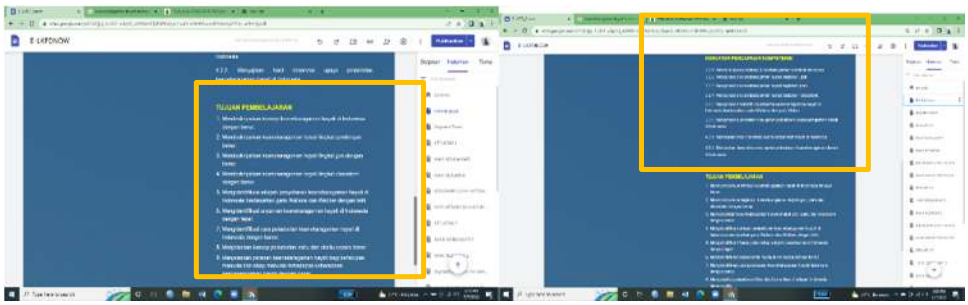

Fig 4. KI, KD, IPK and learning objectives before and after revision

The suitability between KI, KD, IPK and learning objectives is expected to be created or directed to encourage students in the learning process[7].

4. Biology teacher product revision

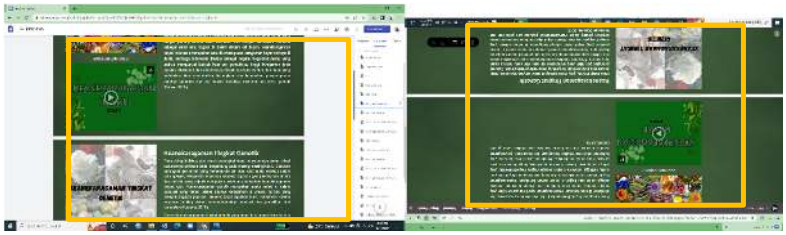

Fig 5. Content before and after revision

According to if the material presented in a teaching material is in accordance with the learning needs of students, basic competencies and interactive[4].

5. Learner response product revision

a. Small group test

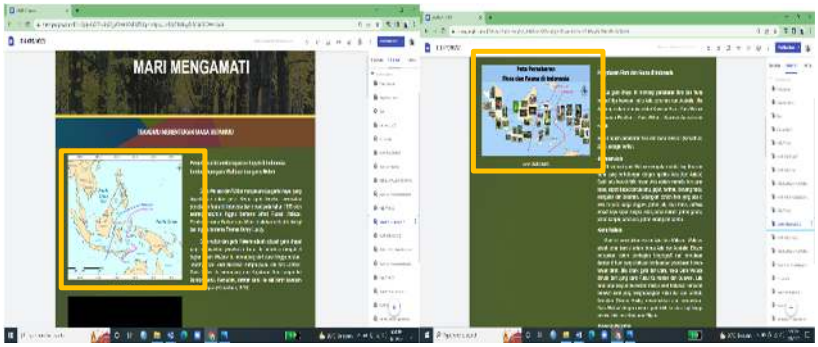

Fig 6. Images or illustrations before and after revision

According to the use of focused and concrete images will attract the attention of students so that they can provide a positive response in learning[8].

b. Large group test

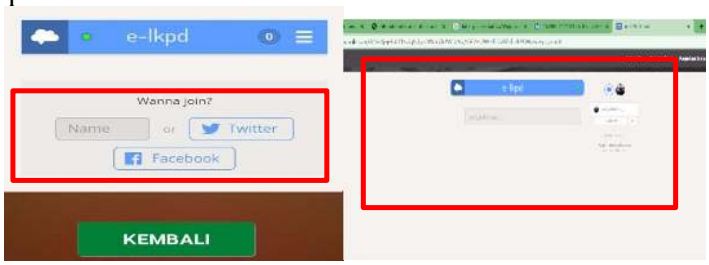

Fig 7. Questioning activities before and after revision

There needs to be a direct explanation on the Iphone base to log in using twitter or facebook because the tlk.io application can only be logged in directly using an android-based. This research was conducted by developing teaching materials, namely digital Learner Activity Sheets (LKPD) in learning Biology SMA / MA biodiversity material. The 4-D model research has 4 stages, namely Define, Design, Development and Disseminate. At the Defining stage consists of initial analysis of the end, tasks, students, concepts, specifications of objectives. Planning (Design) the initial design of the product. Development (Develop) consists of expert validation and product trials. The Disseminate stage consists of dissemination.

The assessment of digital LKPD on material experts is divided into three aspects, namely content feasibility, presentation and evaluation. In the aspect of content feasibility obtained a percentage of 75.00% which has a good category, the presentation aspect obtained a percentage of 87.50% with a very good category. In the evaluation aspect, a percentage of 75.00% was obtained in the good category. The average percentage of material expert assessment obtained a percentage of 79.16% with a very good category. The material expert assessment has suggestions in the form of understanding and examples of biodiversity that are less precise and images or illustrations must have a source. This is in accordance with the opinion of Prastowo that the material presented in a teaching material must be in accordance with the learning needs of students, basic and interactive competencies[4].

The assessment of digital LKPD conducted by media experts includes three aspects, namely aspects of presentation, language and use. The assessment of the presentation aspect shows the percentage of the presentation aspect of 97.91% which is in the very good category. This shows that digital LKPD is very good to use as teaching material according to the presentation aspect. Then the language aspect shows a very good category with a percentage of 87.50%. The assessment of the use aspect has a percentage of 93.75% which has a very good category. The results of the overall media expert assessment showed a percentage of 95.83% which was in the very good category, with this digital LKPD according to media experts worth using as digital teaching materials for SMA/MA class X students on biodiversity material. This is in accordance with the opinion of Sugiyono that the assessment of LKPD is said to be feasible and can be used in the learning process as teaching material, if each expert provides an assessment of LKPD in the good category as well as the response of students who must enter the good category[3].

Education expert assessment which includes two aspects, namely the feasibility of the scientific approach and ability. Both aspects have different categories. In the feasibility aspect, the scientific approach shows a percentage of 82.25% which has a very good category, then the ability aspect has a percentage of 75.00% with a good category. Digital LKPD is said to be feasible because it has a percentage of 78.85% with a very good category, thus showing the feasibility of digital LKPD used as digital teaching materials. Digital LKPD can be used if each expert gives an assessment of LKPD in the good category as well as the response of students who must enter the good category[3].

Biology teachers provide an assessment which is divided into nine aspects, namely the feasibility of content, presentation, evaluation, presentation of LKPD, language, use, feasibility of scientific approaches and abilities. The content feasibility aspect gets an average score of 95.83% with a very good category, the feasibility of the content of a teaching material is said to be good according to if the material presented in a teaching material is in accordance with the learning needs of students, basic competencies and interactive[4]. The presentation and evaluation aspects get an average score of 100.00% with a very good category, this is supported by the opinion of Rahmawati and Wulandari that LKPD is said to be good, it must pay attention to the preparation of teaching materials consisting of learning objectives, order in the description, attracting the interest and attention of students, ease of understanding, activeness of students and exercises and questions[9].

The LKPD presentation and linguistic aspects get an average score of 87.50% with a very good category. According to in the LKPD if it has variations, such as clarity of learning steps, use of words, interesting images and material language that is easy for students to understand[6]. In the aspect of use, the score is 93.75% with a very good category, the feasibility aspect of the scientific approach gets a score of 95.00% with a very good category. The scientific approach according to the aspects that need to be considered in the scientific approach must be designed in such a way that students actively construct concepts, laws or principles through the stages of observing (to identify or find problems), formulating problems, asking questions or proposing hypotheses, collecting data with various techniques, analyzing data, drawing conclusions, and analyzing the data. various techniques, analyze data, draw conclusions and communicate the concepts, laws or principles found[10].

The ability aspect obtained an average score of 100.00% with a very good category. All aspects assessed by biology teachers get a very good category, but there are still shortcomings in the LKPD, namely images and illustrations need to be clarified. Text writing in the material needs to be checked so that it looks clear and there are no typos. This is supported by the opinion of Siregar and Idha which states that the use of focused and concrete images will attract the attention of students so that they can provide a positive response in learning[8]. The average result of the assessment from the biology teacher gets a score of 94.95%, so the digital LKPD can be used as teaching material for class X biology material on biodiversity.

Learners' responses to digital LKPD are divided into three aspects, namely language, graphics and usefulness. To find out the response of students, it is divided into small groups and large groups. Data collection of small group learner responses was carried out on 10 students of class X MIPA 2 with random selection in one class. This is in accordance with Saleha's theory that the product trial was followed by 10 students who were randomly selected in one class to determine the response of students based on their ability and level of understanding[11]. The response of students in the linguistic aspect obtained an average of 100.00% with a very good category, the understanding of students in the aspect of the language used in the LKPD can be understood directly and does not confuse students in understanding the content of the material used. The graphical aspect obtained a score of 95.00% with a very good category, some students still have difficulty observing the images in the digital LKPD so that they need to be revised to make them clearer. This is in accordance with the opinion of Siregar and Idha that the use of focused and concrete images will attract the attention of students so as to provide a positive response in learning[8]. In the aspect of usefulness obtained a score of 93.33% with a very good category, the shortcomings are caused by LKPD has not been able to motivate students to learn biodiversity material. According to the teaching materials used for teachers and students in the learning process are systematically arranged both written and non-written which can create or motivate effective and efficient learning[12].

The large group test was carried out using all X MIPA 1 class students totaling 32. The data collection of students' responses is intended to determine the LKPD product developed[11]. The results of students' responses in the linguistic aspect obtained a score of 100.00% with a

very good category. In the digital LKPD developed, students can understand the contents of the LKPD and the language used. Language that is straightforward and easy to understand can help students in the learning process, besides that it concludes the learning process effectively and does not cause confusion for students[13].

The graphic aspect obtained a score of 100% with a very good category, but there are obstacles in learning questioning activities because some students are still confused about logging in to the questioning activity application because it uses an Iphone base. Therefore, it is necessary to have a direct explanation on the Iphone base to log in using twitter or facebook because the tlk.io application can only be logged in directly using an android-based. Teaching materials can be said to be more effective for teachers must pay attention to the elements in making teaching materials, one of which is clear learning instructions. In the aspect of usefulness, the score is 100.00% with a very good category. According to the teaching materials used for teachers and students in the learning process are systematically arranged both written and non-written which can create or motivate effective and efficient learning[12].

The results of the small group test assessment conducted by MIPA 2 students obtained an average of 96.11% with a very good category. While the results of the large group average conducted by MIPA 1 students obtained an average of 100.00% with a very good category. Therefore, based on the average of small and large group tests, digital LKPD can be said to be feasible and used as teaching materials for biology biodiversity material. This is in accordance with Sugiyono's opinion that LKPD is said to be feasible and can be used in the learning process as teaching material, if each expert gives an assessment of LKPD in the good category[3].

Digital LKPDs that have gone through various stages of development and are declared feasible based on an assessment with a minimum good category in accordance with Sugiyono's opinion that LKPD is said to be feasible and can be used in the learning process as teaching material, if each expert gives an assessment of LKPD in the good category[3]. The results of digital LKPD products with a scientific approach to biodiversity material were distributed to biology teachers of Madrasah Aliyah (MA) throughout Yogyakarta and students of class X MIPA SMA N 1 Ngemplak. The website link to access digital LKPD with a scientific approach to biodiversity material is https://sites.google.com/webmail.uad.ac.id/e-lkpdsmart/beranda

Conclusion

Based on the results of the research conducted, it can be concluded:

1. The assessment of material experts, media experts, education experts and biology teachers on digital LKPD with a scientific approach to biodiversity material for X MIPA class students is very good.
2. Students' responses to digital LKPD with a scientific approach to biodiversity material in small group tests and large group tests are very good.
3. Digital LKPD developed with a scientific approach to biodiversity material is suitable for learning biology for X MIPA class students.

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