Development of liveworksheet-based interactive LKPD on the biodiversity material of class X

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Article Information	Abstract
	The use of teaching materials with conventional-based student worksheets (LKPD) still dominates, while accessing the internet is easy and facilitates learning. The facilities and infrastructure owned are also very supportive in the application process, so there is a need for developing research that encourages students to be active in learning using the internet with a more enjoyable experience. This research aims to develop valid, practical, and effective Liveworksheet-based interactive LKPD using the ADDIE development model. The research instruments used were validation questionnaires, response questionnaires, learning achievement tests, and observation sheets. The subjects in this study were students of class X MIA 3 (29 students). The results show that Liveworksheet-based interactive LKPD have a very valid with an average value of 3.6. The practicality level based on the results of the student response questionnaire was 82.1%, and the teacher's response value was 89.2%. The level of effectiveness obtained by very good criteria based on the completeness of the classical learning outcomes is 100%. The developed Liveworksheet-based interactive LKPD meet the valid, practical, and effective criteria. Liveworksheet-based interactive LKPD provides an enjoyable experience for students and achieves classical mastery. **Abstrak** Penggunaan bahan ajar dengan lembar kerja peserta didik (LKPD) yang berbasis konvensional masih mendominasi, sementara mengakses internet sudah mudah dan dapat memudahkan proses pembelajaran. Sarana dan prasarana yang dimiliki juga sangat mendukung dalam proses pengaplikasiannya, sehingga perlu penelitian pengembangan yang mendorong peserta didik aktif dalam pembelajaran menggunakan internet dengan pengalaman yang lebih menyenangkan. Tujuan penelitian ini adalah mengembangkan LKPD interaktif berbasis *Liveworksheet* yang valid, praktis, dan efektif menggunakan model pengembangan ADDIE. Instrumen penelitian yang digunakan adalah angket validasi, angket respon, tes hasil belajar, dan lembar observasi. Adapun subjek pada penelitian ini adalah peserta didik kelas X MIA 3 (29 peserta didik). Hasilnya menunjukkan LKPD interaktif berbasis *Liveworksheet* memiliki tingkat kevalidan sangat valid dengan nilai rata-rata 3,6. Tingkat kepraktisan berdasarkan hasil angket respon siswa yaitu 82.1% dan nilai respon guru adalah 89.2%. Tingkat keefektifannya diperoleh kriteria sangat baik berdasarkan ketuntasan hasil belajar secara klasikal yang diperoleh adalah 100%. Artinya LKPD interaktif berbasis *Liveworksheet* yang dikembangkan memenuhi kriteria valid, praktis, dan efektif. LKPD interaktif berbasis *Liveworksheet* memberikan pengalaman yang menyenangkan bagi peserta didik dan mencapai ketuntasan klasikal.

A. INTRODUCTION

Learning is a process in which the teacher and students interact to provide students with broad knowledge of attitudes, knowledge, and skills (Napitupulu, 2019). Learning should be well-designed so that the processes within it run smoothly and effectively (Ananda, 2019). However, there are still many instances of monotonous, teacher-centered learning. One factor influencing this problem is the use of media and teaching materials. Traditional teaching materials that have not been updated tend to cause learning to become monotonous; the cycle is not active, learning is not enjoyable, and learning objectives are challenging to achieve. As a result, media and teaching materials should evolve in line with the education needs of each era.

With the advent of the digital era and global technological advancements, many aspects of life have changed. This condition is evidenced by the numerous sectors competing to implement technology, including the education sector (Maritsa et al., 2021). Thus, to create learning that is interesting and relevant to the times, the world of education must be able to adapt to the changes that occur (Hidayah et al., 2020). This condition is why it is critical to optimize the use of technology in learning activities.

The reality on the ground demonstrates that the use of technology in the learning process has not been maximized. Based on observations made at Madani Alauddin MA, it is known that one of the teaching materials used is Student Worksheets (LKPD). However, the LKPD used is still traditional, presented on sheets of paper. The main feature of printed LKPD is that the content is only written and can only provide visuals in the form of pictures. This form affects students' motivation to learn, causing them to be less innovative in their personal development. According to Herawati et al. (2016), the presence of printed worksheets is less effective as a learning tool in terms of appearance, content, and practicality.

To encourage students to be active, innovative, and self-directed in their learning, especially regarding biodiversity material, we need teaching materials that use appealing and easily accessible media. Using the advancements in science and technology, conventional-based LKPD can be replaced with more innovative LKPD and packaged in an online form to create an interactive LKPD. A website called Liveworksheet is required for this LKPD to be easily accessible, enjoyable, and interactive.

LKPD is an interactive teaching material based on internet technology that combines several learning media such as audio, video, text, and images. It can respond to commands from its users (students). This LKPD can be accessed via electronic devices such as computers and cell phones, making it more convenient to use (Andriyani et al., 2020).

Liveworksheet-based interactive LKPD is designed to make the subject matter more alive. It not only relies on material descriptions but is also equipped with learning pictures and videos, so it is considered very suitable to attract students' interest and can increase students' understanding of the material. In their research, Kalima et al. (2018) concluded that learning through interesting media, such as interactive teaching materials, can positively impact student learning outcomes. Widiyani & Pramudiani's (2021) research on Liveworksheet-based interactive LKPD concluded that it is more effective because it is equipped with various interactive features that prevent students from becoming bored while participating in learning and can pique students' interest in learning.

Compared to printed LKPD, Liveworksheet-based interactive LKPD has many features that can meet students' expectations in learning to use technology effectively and help teachers prepare more interesting materials and assignments. As a result, the Liveworksheet can be used to create interactive and interesting LKPD (Santi, 2020). This research and development are expected to result in valid, practical, and effective interactive worksheets based on Liveworksheet.

B. Material and Method

This research was a type of research and development that used the ADDIE development model that has been developed and refers to the book "Instructional Design: The ADDIE Approach" written by Robert Maribe Branch with development stages: the analysis stage (analyze) consists of problem validation, determining learning objectives, analysis of the characteristics of students, identifying the things needed, determining the delivery system, and preparing a development implementation plan. The design stage entails gathering the components required for product development and development goals and validation instruments. Compiling the primary material, selecting and developing supporting media, developing products and product usage instructions, and formative revisions are all part of the development stage. The following stage is implementation and evaluation.

The subjects in this study were 29 class X MIA 3 students. The data collection instrument was a questionnaire divided into two: an expert validation questionnaire to measure the validity level of LKPD and a response questionnaire to measure the practicality of LKPD. The effectiveness of LKPD is measured using test items.

Two expert validators performed the validity test to determine the level of validity of the LKPD. The calculate validation data using Formula 1.

$$\overline{Ki} = \frac{\sum_{j}^{n} = 1 V_{ij}}{n} \dots \dots \dots \dots \dots \dots \dots \dots \text{Formula 1}$$

Description:
$\overline{Ki}$ = The average criteria of i
V_{ij} = Rating category I by appraisers j
n   = number of appraisals

The validity criteria for each or all aspects of the developed LKPD were determined using the following category in Table 1.

Table 1 Category level of validity

Category	Criteria
3.4< v ≤4	Very valid
2.8< v 3.4	Valid
2.2< v ≤ 2.8	Quite valid
1.6< v ≤ 2.2	Less valid
v ≤ 1.6	Invalid

(Source: Hartanto, 2020)

The practicality of the developed LKPD was seen based on the assessment of educators and students using a response questionnaire. The calculation of practicality data using Formula 2.

$$\bar{X} = \frac{\sum_{j}^{n} = 1 A_{i}}{n} \dots \dots \dots \dots \dots \dots \dots \dots \text{Formula 2}$$

Description:
$\bar{X}$ = Total average
A_{i} = Criterion value I
n   = Number of criteria

The determined practicality value is based on the practicality level category in Table 2.

Table 2 practicality level category

Practicality Category	Criteria
81% - 100%	Very practical
61% - 80%	Practical
41% - 60%	Quite Practical
21% - 40%	Less Practical
0% - 20%	Very impractical

(Source: Hasan et al., 2021)

The level of effectiveness of the developed LKPD was measured using test data on learning outcomes. If the value obtained was ≥ 70 (KKM), then the media could be said to be effective. If at least 80% of students obtained a complete score, then learning was considered successful classically. (Widoyoko, 2017). The data obtained were analyzed using Formula 3.

$$N = \frac{B}{n} \times 100\% \dots \dots \dots \dots \dots \dots \dots \dots \text{Formula 3}$$

Description:
N   : The value obtained by students
B   : Correct number of questions
n   : Number of question items

Table 3 Category level of effectiveness

Completeness Presentation	Category
> 80	Very good
> 60 – 80	Good
> 40 – 60	Enough
> 20 – 40	Less
≤ 20	Very less

(Source: Widoyoko, 2017)

C. Result and Discussion

The development of this LKPD refers to three main aspects, namely valid, practical, and effective. The development model used was ADDIE which consisted of analysis, design, development, implementation, and evaluation stages (Branch, 2009).

1. Analysis

The development of LKPD started from the analysis stage, which was carried out by observing and interviewing teachers. The results of this stage found problems related to teaching materials, which were generally textbooks and could only be used during biology class hours. Students did not have handbooks to study independently outside of class hours. Furthermore, LKPD was used as one of the teaching materials, but the LKPD used was still traditional, presented on sheets of paper. This LKPD included student identity, the material presented in descriptions, and practice questions. LKPD like this was previously lacking in content, appearance, and practicality, causing students to become bored and lose interest in learning. This fact also resulted in a lack of student participation during the learning process, with students relying solely on teacher explanations. Conventional LKPD was also less practical in its application, requiring the teacher to print the LKPD on sheets of paper.

Furthermore, this type of LKPD would be quickly scattered and damaged, making it difficult

for teachers and students to use in the future. Print-based LKPD materials, according to Indriani & Lazulva (2020), are easily damaged and torn. Furthermore, the material presented was only in the form of writing and only provided visuals in the form of images, reducing students' interest in reading it. Students also became bored quickly, resulting in a low understanding of the concept.

Based on the analysis results, there was a need for innovation in creating interactive teaching materials in the form of Liveworksheet-based interactive LKPD so that the subject matter could be alive and could increase student innovation and creativity. The interactive LKPD was also superior in appearance, content, and practicality, allowing it to create an engaging and enjoyable learning environment for students.

2. Design

The design of LKPD began with the compilation of its components, including content and construct components. The cover, basic competencies (KD), learning indicators, learning objectives, material summaries packaged in PowerPoint form, learning videos, discussion questions, and various practice questions comprised the content components (checkboxes, short essays, join with arrows, drag and drop, and drop-down select box).

The LKPD construct component included the design program and supported product visualization. The primary application used was Adobe Illustrator CC 2018, which was used to design LKPD designs beginning with selecting the background color, layout, typeface, and font size. The LKPD raw format was a PDF file. The use of Adobe Illustrator CC 2018 as the primary application in designing worksheets was inextricably linked to its advantages in producing images with sharp quality that did not lose details when zoomed in. Vector images and illustrations were created using Adobe Illustrator. In terms of image sharpness, vector objects were superior. Aside from that, Adobe Illustrator is excellent for organizing writing or typography (Enterprise, 2020).

Furthermore, the preparation of the material through the Microsoft PowerPoint application, in .pptx format, was submitted to Onedrive. Unlike the printed LKPD, where the material was in descriptions, the material on the Liveworksheet-based interactive LKPD was packaged in PowerPoint form. This job is conducted because students generally get bored when reading long material descriptions, so researchers innovated packaging material in PowerPoint with attractive images. Apart from the material compiled in PowerPoint, there was also additional material in the form of learning videos adopted from YouTube.

3. Development

The third stage was development, where the researchers realized the LKPD design in the previous stage to be developed into an interactive LKPD based on Liveworksheet. At this stage, validation was also carried out by the validator to assess the feasibility of the LKPD and provide useful suggestions for improving LKPD.

The developed LKPD was stated to be very valid, with a value of 3.6. The criteria used in determining the validity of LKPD were said to be good if they get an average value of $2.2 < V \leq 2.8$ with quite valid criteria (Hartanto, 2020). The validator's assessment can be seen in Table 4.

Table 4 validator assessment results

Assessment Aspects	Assessment	Criteria
Display	3.9	Very valid
Construct	3.7	Very valid
Material Content	3.5	Very valid
Video Quality	3.5	Very valid
Question Quality	3.5	Very valid
Language	3.5	Very valid
Easiness	3.8	Very valid
Average	**3.6**	**Very valid**

The validated aspects include appearance, construction, content, video quality, question quality, language, and ease of use. After analyzing the display aspect, the LKPD display was very valid, with a value of 3.9. Aspects of the LKPD display include design elements, layout suitability, background color selection, and letter type and size. The design of the LKPD carried a theme consistent with the LKPD's title, namely biodiversity; the combination of background colors and images accurately described the LKPD's contents, which discussed biodiversity. In learning, using appealing designs for media and teaching materials may increase learning motivation and make the material presented more appealing to study (Hamzah et al., 2012). In line with Widiyani & Pramudiani's (2021) finding, an attractive display of LKPD can help students understand the material.

Assessment of construct aspects or components of LKPD was in very valid criteria with a value of 3.7. It means that the components in the LKPD were in line with the LKPD components in general. The LKPD components include titles, basic competencies, learning instructions, supporting information, materials, practice questions, and work steps instructions (Prastowo, 2015).

The assessment of aspects of the material's content was a very valid criterion with a value of 3.5. It means that the LKPD material was appropriate and referred to the KI and KD curriculum used in the school. The LKPD's material concepts were also adjusted and sourced from accurate and reliable sources, namely books.

The video quality evaluation was very valid, with a score of 3.5. This result was supported by several factors, including the appearance of interesting learning videos, learning videos that support the content of the material presented, good picture and sound quality, and learning videos that are not boring. Video-based learning media has greatly aided students' learning process, making it easier for teachers to convey learning material (Agustini & Ngarti, 2020).

The assessment of the quality of the questions was very valid, with a value of 3.5. The types of practice questions in LKPD varied widely, starting from check boxes, short essays, join with arrows, drag and drop, and drop-down select boxes. The selection of various questions aimed to make students interested in practicing and provide a fun learning experience because of the variety of questions presented. This result was supported by Riyadi (2021) that giving various questions can significantly affect students' motivation to learn.

With a score of 3.5, the assessment of language aspects was highly valid. The LKPD language has been adjusted to the rules of the Indonesian language to be clear and easy to understand. The language used was said to be good if it is appropriate for the situation and the purpose for which it was intended, and it was said to be correct if it follows all applicable rules and guidelines (Muzaki et al., 2019).

The assessment of the ease of use aspect of LKPD was very valid, with a value of 3.8. The ease of accessing LKPD and the ability to use it on various devices such as cellphones and computers supports the aspect of use. Furthermore, the developed LKPD could be used as independent teaching materials because the user could access it at any time and from any location as long as they were connected to the internet network. Research by Lioba et al. (2021) found that students are interested when educators explain how to use the Liveworksheet-based E-LKPD because it can be accessed wherever students want to study via handphone or laptop.

The LKPD was also revised based on validator suggestions until feasible to produce in the learning process. The following is a comparison of prototype 1 (See Figure 1 (a) before revision) with prototype 2 (See Figure 1 (b) after revision).

Figure 1
Liveworksheet-based interactive LKPD cover. Description: (a) before revision, and (b) after revision (in Indonesia).

The high school logo was replaced on the cover of the LKPD with the Alauddin Islamic State

University of Makassar logo to highlight the author's identity, specifically the university where

the author designed the LKPD. Including the author's name, department, faculty, and the university where the author received his or her education. The font size on the LKPD cover was also increased to make each word more visible.

The introductory section included basic competencies (KD), indicators, learning objectives, and study instructions. Because the validator determined that the learning instructions in prototype 1 still did not explain the function of the LKPD components in the material summary section (Figure 2 (a), a sentence was added to clarify this section (Figure 2 (b).

Figure 2
Liveworksheet-based interactive LKPD introductory section. Description: (a) before revision, and (b) after revision (in Indonesia).

Figure 3
Liveworksheet-based interactive discussion questions section. Description: (a) before revision, (b) after revision with added pictures, and (c) after revision with upgraded question to C4 (analyze) (in Indonesia).

In the discussion section (Figure 3 (a)), there was a picture of a group of roses and leguminous plants, besides that there were also discussion questions. The revision contained in this section was the addition of images as material for analysis to answer discussion questions (Figure 3 (b)). Discussion questions were also upgraded to level c4 (analyzing) to stimulate students to think critically and discuss (Figure 3 (c)). This is because in prototype 1, the questions were considered too easy and the answers were already available on the LKPD, if not improved, it was feared that students would just directly copy the answers without any thought and discussion processes.
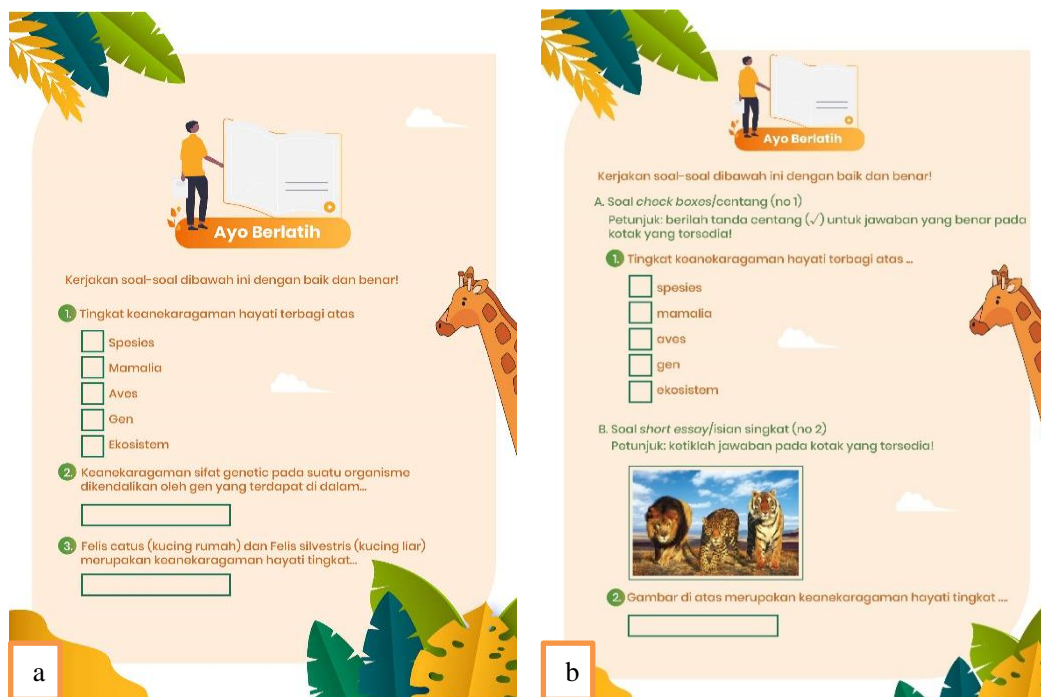

Figure 4
Liveworksheet-based interactive LKPD questions practice section. Description: (a) before revision, and (b) after revision (in Indonesia).

The types of practice questions in LKPD varied widely, starting from check boxes, short essays, join with arrows, drag and drop, and drop-down select boxes. The difference between prototype 1 and prototype 2 lay in the addition of instructions for working on each type of problem. This aimed to make it easier for students to answer questions because the questions contained in the Liveworksheet-based interactive LKPD were questions that were rarely encountered by students so that with instructions for working on the questions, it would help students work on the questions.

4. Implementation
a. Practicality Level of LKPD
The measurement of the practicality level of LKPD was based on a response questionnaire from educators and students. The results of the LKPD practicality test can be seen in Table 5 and Table 6. Based on the educator response data analysis in Table 5, a score of 75 with a percentage of 89.2%. The results of the educator's response showed that LKPD was in very practical criteria. So, the developed Liveworksheet-based interactive LKPD was very practical to use.

Table 5 Results of educator response

Aspect	Score		Criteria
	Obtained Score	**Maximum Score**	
Presentation Technique	30	32	Very practical
Language Suitability	6	8	Very Practical
Material suitability	22	24	Very practical
Ease	17	20	Very practical
Total score	**75**	**84**	
Percentage	**89,2%**		
Criteria	**Very practical**		

Table 6 Results of student response

Aspect	Score		Criteria
	Obtained Score	Maximum Score	
Benefit	83,4	100	Very practical
Language	82,2	100	Very practical
Display	82,2	100	Very practical
Material Content	81,6	100	Very practical
Ease of use	81,2	100	Very practical
Total score	**410,6**	**500**	
Percentage	**82,1%**		
Criteria	**Very practical**		

Based on the analysis of student response data in Table 6, a score of 410.6 with a percentage of 82.1%. The results of student responses showed that LKPD was in very practical criteria. So, the developed Liveworksheet-based interactive LKPD is very practical.

The practicality of LKPD was assessed using several criteria, including benefits, language, appearance, content, and ease of use. The product development benefits are one of the aspects to evaluate its practicality. Dwijayani (2017) discovered in her research that the learning media developed were quite practical because they benefited both teachers and students. Some of the benefits provided were that the learning media could increase students' enthusiasm for learning, help them learn independently, and motivate them to learn because they thought it was more practical to use media. After all, it could be accessed using electronic devices. According to Kosasih (2021), Liveworksheet-based interactive LKPD had a higher level of flexibility because it supported various conditions and opportunities inside and outside the school environment. LKPD can also improve the efficiency of independent learning by allowing students to access and study it whenever and wherever they want.

Aside from the benefits, the LKPD was also equipped with a usability guide. LKPD was said to be simple to use if teachers and students had no difficulty using it to achieve learning objectives. In their research, Annisa et al. (2020) discovered that the ease of using teaching materials can positively respond to the learning being carried out, one of which is increasing student attention during the learning process. Furthermore, Irawan & Hakim (2021) stated that a medium used in the learning process is practical if teachers and students have no difficulty using it to produce higher-quality learning.

More features also supported the LKPD practicality. These features include the easy-to-understand language or sentences, the attractive pictures in line with the content of the material, an attractive appearance, the size of the LKPD fitted the cellphone screen so that it was comfortable to use, and integrated video with PowerPoint, as well as the ease of accessing the LKPD.

b. LKPD Effectiveness Level

The measurement of the level of effectiveness of LKPD was based on tests of learning outcomes from students. The following is the percentage of learning achievement tests described in Table 7.

Table 7 Percentage level of LKPD effectiveness

Score	Completeness of students	Number of students	Persentase
70-100	Complete	29	100%
0-69	Incomplete	0	0%
Total		**29**	**100%**

Based on the data analysis in Table 7, all 29 students were declared complete in the learning process with a percentage of 100%. LKPD can be said to be effective if the score percentage reaches 80% classically based on the KKM that has been set. As a result, it can be concluded that LKPD is effective in its application because all students achieve very high scores on their learning outcomes tests. This statement is in line with Widodo (2020), which claimed that developing teaching materials is effective if it can increase learning outcomes by up to 80%. Rumansyah (2016) found that using interactive teaching materials had a more significant positive effect on improving students' understanding.

One of the effectiveness of a product can be seen in learning activities and student learning outcomes. If the product being developed can increase learning activities and student learning outcomes, it is effective in its use (Adnan et al., 2019). Furthermore, Laili et al. (2019) stated that effectiveness could be an impact.

This interactive LKPD was effectively used in the learning process because there were questions of various types. The existence of multiple questions could increase students' desire to

practice questions to improve their knowledge. The form of this question also affected the mastery of learning. Kosasih (2021), in theory, knew that the existence of various questions could increase students' desire to practice questions. Furthermore, Riyadi (2021) stated that giving different questions can significantly increase students' willingness to learn.

This interactive Liveworksheet-based interactive LKPD was created to optimize learning through internet technology. Because internet technology is rapidly evolving, the world of education must not fall behind in learning technology and must constantly update knowledge and new learning trends. The Liveworksheet-based interactive LKPD is expected to help students learn independently and actively. Educators can make the material easier to present by using teaching materials that are creative, innovative, and adaptable to the latest technological advances. As a result, developing effective and efficient learning activities is essential.

5. Evaluation

The evaluation was the final stage of E-LKPD development. The evaluation phase was carried out at each stage of the ADDIE model's development, which means that each stage, from analysis to the final stage, was evaluated. Thus, improvements or revisions are immediately made if deficiencies are found at each stage. Direct revisions accelerate the production of final LKPD products that are valid, practical, and effective.

Several studies also explain that the Liveworksheet-based interactive LKPD positively impacts students' learning process and assists students in obtaining classical mastery. Ilmy et al. (2022) found a positive impact of using Liveworksheet-based interactive LKPD on learning outcomes in biodiversity material; Rahmadayanti et al. (2022) on the matter of the circulatory system; and Hilmia et al. (2022) on the Protista concept.

The findings of mutually supportive results with several previous studies indicate that the Liveworksheet-based interactive LKPD makes students more interested in the learning process and improves learning outcomes. These findings suggest that the Liveworksheet-based interactive LKPD can be widely used to solve similar learning problems, mainly to enhance student interests and learning outcomes. According to Audie (2019); Nurfadhillah et al. (2021), a learning process that attracts students' interest in learning makes transferring information easier to understand. According to Nurdyansyah & Aini (2022); Tasyari

et al. (2021), students who are enthusiastic about taking lessons can understand better. Hasan (2022) added that students who understand the subject matter well have a better chance of classical mastery.

D. Conclusion

The Biodiversity Liveworksheet-based interactive LKPD was valid with a value of 3.6 (very valid) to apply in the learning process. This LKPD was practical, with a student response questionnaire score of 82.1% and a teacher response value was 89.2%. So, it shows the developed Liveworksheet-based interactive LKPD is very practical. This LKPD is also effective in increasing student learning completeness. It is because students' classical mastery is very good, with a percentage of 100%. So it shows that the developed Liveworksheet-based interactive LKPD effectively improves student learning outcomes. The overall results of this study show that the Liveworksheet-based interactive LKPD positively affects students' interest and learning outcomes.

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