

# The Development of Electronic Student Worksheets on the Concept of Animalia to Improve High School Level Critical Thinking Skills

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## Abstract

The development of the 21<sup>st</sup> century is marked by the development of technology and information, one example is the use of electronic Student Worksheets, which usually use paper worksheets, now we can find on the internet. Electronic Student Worksheets has become one of the essential learning technologies, especially during the current COVID-19 pandemic. This study aims to describe the validity, practicality, and effectiveness of electronic LKPD expectations on the concept of Animalia. Students are expected to be able to improve critical thinking skills through the implementation of electronic LKPD in the learning process. The research method used Tessmer's Formative Evaluation design, through stages 1) self-evaluation; 2) expert review; 3) one-to-one evaluation; and 4) small group evaluation. Data obtained from the research instrument in the form of an assessment sheet of validity and practicality of expectations. The results of research on the development of electronic LKPD are include in the valid category with a score of 3.78, the practicality of expectations is included in the very good category with a percentage score of 95.54%, and the effectiveness of expectations is included in the very good category on critical thinking skills of interpretation, evaluation, explanation, and self-regulation, while aspects of analysis and inference have increased to very good.

### Abstrak

Perkembangan abad ke-21 ditandai dengan berkembangnya teknologi dan informasi, salah satu contohnya adalah penggunaan LKPD elektronik, yang biasanya LKPD menggunakan kertas sekarang dapat kita jumpai di internet. LKPD elektronik menjadi salah satu teknologi pembelajaran yang esensial, terlebih saat kondisi pandemi Covid-19 saat ini. Tujuan penelitian ini mendeskripsikan validitas, kepraktisan harapan, dan keefektifan LKPD elektronik konsep Animalia. Peserta didik diharapkan mampu untuk meningkatkan keterampilan berpikir kritis melalui implementasi LKPD elektronik dalam proses pembelajaran. Metode penelitian memakai desain Tessmer, terdiri atas: 1) *self-evaluation*; 2) *expert review*; 3) *one-to-one evaluation*; 4) *small group evaluation*. Data diperoleh dari instrumen penelitian berupa lembar penilaian validitas dan kepraktisan harapan LKPD elektronik. Hasil penelitian pengembangan LKPD elektronik termasuk dalam kategori valid dengan skor 3,78, kepraktisan harapan termasuk dalam kategori sangat baik dengan skor persentase 95,54%, serta keefektifan harapan termasuk dalam kategori sangat baik pada keterampilan berpikir kritis interpretasi, evaluasi, eksplanasi, dan pengaturan diri, sedangkan aspek analisis dan inferensi mengalami peningkatan menjadi sangat baik.

## A. Introduction

The development of the times must be balanced of science in the field of education. The century of globalization or the century of openness, marks the characteristics of the 21st century, which means that human life has changed from the way of life of the previous century. The development of the world of science is one of the characteristics of the development of the 21st century (Wijaya et al., 2016). Learning media has also developed, for example, at this time books or LKPD can be found via the internet. The development of ICT in the 21st century is also growing rapidly.

The role of ICT in education is important, because today education practitioners can benefit greatly from the advancement of ICT (Yuberti, 2014). ICT is used to solve problems in education (Hermanto et al., 2018). Electronic LKPD is one of the results of the use of ICT developments. Currently we are faced with the COVID-19 pandemic, the learning process cannot be carried out directly (offline) but online (online), so the role of ICT such as the use of electronic LKPD is expected to help in overcoming the problems of the learning process.

Students in the learning process tend to be directed to memorize the material without being required to understand the material obtained. The lack of student's interpretation of the material causes students to be slightly motivated in learning, thus making students minimally develop their critical thinking skills (Sanjaya, 2006). Critical thinking skills are the ability to think in an organized manner and evaluate systematically and conclude. Teaching and developing skills are considered essential to be carried out in schools so that student can face problems in their environment (Husnidar et al., 2014). Critical thinking skills can be developed through working on questions using LKPD.

Computer-based media that can provide simulations with a combination of writing, animation, video, and photos so that it makes students interested in optimizing the teaching and learning process is called electronic LKPD (Sari, 2019). The advantages of electronic LKPD are that they are available around the clock because they are digital, cost-effective, and environmentally friendly. In this study, researchers developed the Animalia concept electronic worksheet using the Tessmer design. The research steps using the formative evaluation design from Tessmer include the stages of self-evaluation, expert opinion, individual testing, and small group testing.

Kingdom Animalia material is studied in Class X. Animalia material discusses the classification of nine phyla in the Animalia

kingdom. Unclear and colorless images contained in books, as well as many terms that are difficult to understand, make it difficult for student to understand the material (Mailida, 2015). Students are expected to be able to understand Animalia material better through the provision of electronic LKPD in which there are pictures and videos. Thus, researchers interested in developing electronic worksheets, especially on the Animalia concept. The concepts of Animalia there are many phyla and scope, student find it difficult to understand the content of concept. The concept of Animalia consists of phylum, morphology, and simple physiological characteristics along with classification and examples of organisms (Maesaroh & Hernawati, 2016). To help students understand the Animalia concept, an electronic LKPD on Animalia material was developed to improve critical thinking skills at the high school level.

## B. Method

Electronic LKPD development research use Tessmer's formative evaluation design. Tessmer's formative evaluation includes self-evaluation, expert assessment, individual assessment, small group, and field test. Researchers only do up to a small group test. The research was conducted online for five months (September 2020-January 2021) at MAN Kapuas, Central Kalimantan Province.

Data collection techniques in the development of this electronic LKPD were obtained from: 1) data on validity were collected through electronic LKPD validation sheets by 3 experts. 2) Expected practicality data was obtained from the expectation practicality assessment sheet for the contents of the electronic LKPD in a small group test by 4 college students, by responding Yes (if you agree) or No (if you don't agree). Data analysis techniques were analyzed descriptively, as follows:

### 1. Validity

The data from the validation results are then analyzed further by calculating the average. The average is calculated by adding up the entire score of each electronic LKPD obtained and dividing it by the number of electronic LKPD developed. The formula for calculating the validity of the electronic LKPD according to Sugiono (2013) as a whole is as follows:

$$X = \frac{\Sigma X}{n}$$

Description:

X = Average score

$\Sigma X$  = Number of validity of each electronic LKPD

n = Number of electronic LKPD.

The average results of the validity of the known electronic LKPD are matched with the following categories according to Arbainsyah (2016) adapted to Nur (2013):

- 1 < 2 = invalid
- 2 < 3 = quite valid
- 3 < 4 = valid
- 4 = very valid

## 2. Practicality

The responses of all students for each electronic LKPD are added up in each aspect, and then percentage is based on the formula adapted from Arbainsyah (2016):

$$P = \frac{f}{N} \times 100\%$$

Description:

P = Percentage figures

f = Frequency

N = Number of students times the number of aspects

The data on the practical results of the expectations of each electronic LKPD are then analyzed further by calculating the average. The formula for calculating the practicality of the expectations of the electronic LKPD as a whole is as follows (Sugiono, 2013):

$$X = \frac{\sum X}{n}$$

Description:

X = Average score

$\sum X$  = Number of practical expectations of each electronic.

n = Number of electronic LKPD

The results obtained are then compared with the modified categories of Akbar (2013), namely:

- 85.01 – 100.00% = very good
- 70.01 – < 85.00% = quite good
- 50.01 – < 70.00% = good
- 01.00 – < 50.00% = not good

## 3. Effectiveness

The calculation of the effectiveness of expectations starts from calculating the value of students through item questions, instruments for critical thinking skills in each electronic LKPD, recapitulation of electronic LKPD from each student, recapitulation of each electronic LKPD critical thinking skills, then recapitulation of the effectiveness of expectations for every aspect of critical thinking skills.

The recapitulation of the effectiveness of expectations for each critical thinking skill is obtained from the results of the recapitulation of each electronic LKPD of critical thinking skills then the average value is divided by the maximum score per skill and multiplied by 100%.

The score obtained is determined by the modified category from Akbar (2013), namely:

- 85.01 – 100.00% = very good
- 70.01 – < 85.00% = quite good
- 50.01 – < 70.00% = good
- 01.00 – < 50.00% = not good

## C. Results and Discussion

The development of the electronic LKPD of the Animalia concept produced consists of four electronic LKPDs, namely: 1) Classification of Animalia, containing a general description of Animalia, 2) Characteristics of Invertebrate Animals, containing characteristics and class divisions of invertebrates, 3) Characteristics of Vertebrate Animals, contains the characteristics and division of vertebrate classes and 4) The Role of Invertebrates and Vertebrates in Life. The advantage of this electronic LKPD is that it is available around the clock because it is digital, saves costs and is environmentally friendly.

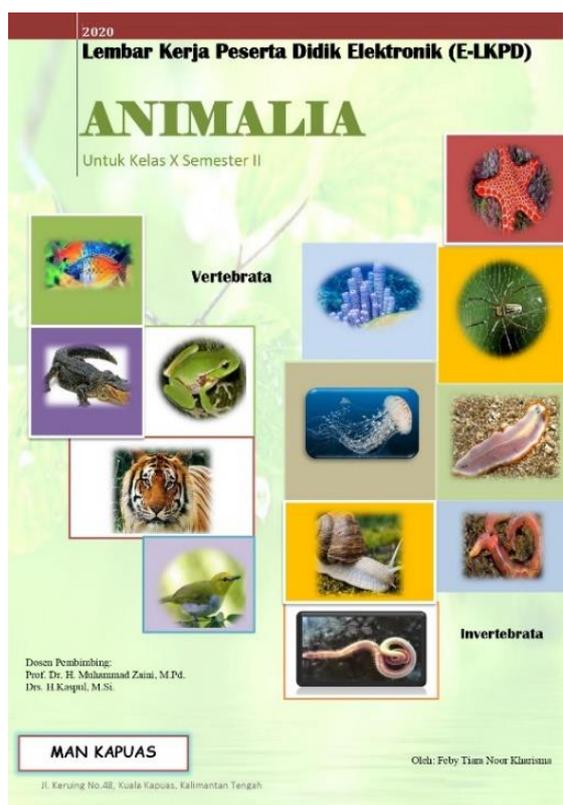


Figure 1 Cover of electronic LKPD

### 1. Validity

A summary of the validation results of the electronic LKPD is shown in Table 1. All electronic LKPDs are valid categories based on 16 validated aspects with a score of 3.78, where the electronic LKPDs can be used but need minor revisions and have been corrected by researchers. The original LKPD cover was still the same, and then revised

based on the appropriate material for each LKPD so that each LKPD has a different cover, and the LKPD also has a main cover covering Animalia material as shown in Figure 1.

**Table 1 Summary of the results of the Validation of the revised Electronic LKPD**

No.	Statement	Electronic LKPD To-				Amount	Average
		I Skor	II Skor	III Skor	IV Skor		
1.	Learning material at the appropriate level becomes a single unit.	4,00	4,00	4,00	4,00	16,00	4,00
2.	Learning media is easy to find.	4,00	4,00	3,70	3,70	15,40	3,85
3.	Height adjustment on ICT advancement.		4,00	3,70	4,00	15,40	3,85
4.	a) Consistent use of font type and size (except tables if any).	4,00	4,00	4,00	4,00	16,00	4,00
	b) Consistent use of spaces (except tables where applicable).	4,00	4,00	4,00	4,00	16,00	4,00
	c) Consistent use of the layout.	4,00	4,00	3,70	3,70	15,40	3,85
5.	a) The photo on the cover is known by students.	3,70	3,70	4,00	4,00	15,40	3,85
	b) Photos known to students.	3,70	3,70	3,70	4,00	15,10	3,78
6.	a) Display charts, pictures, which are easy to understand and attractive*.	3,70	3,70	4,00	4,00	15,40	3,85
	b) The arrangement of the contents is made systematically.	4,00	4,00	4,00	4,00	16,00	4,00
	c) Placing interesting scripts, pictures and illustrations.	3,70	3,70	3,70	4,00	15,10	3,78
7.	a) Combine colors, images (as illustrations).	3,00	3,30	3,70	3,70	13,70	3,43
	b) Bold, italic, underline and color printing if needed.	3,70	3,30	4,00	4,00	15,00	3,75
8.	Tasks and exercises reflect the demands of critical thinking skills.	3,00	3,30	3,70	3,70	13,70	3,43
9.	Critical thinking skills are realized through each of the sub-skills represented.	3,70	3,70	3,70	3,70	14,80	3,70
10.	Intrapersonal skills have adopted self-regulation that is integrated into critical thinking skills.	3,30	3,30	3,30	3,70	13,60	3,40
<b>Overall Average of electronic LKPD</b>							<b>3,78</b>
<b>Category</b>							<b>Valid</b>

The validity of the Animalia Concept Electronic Student Worksheet received a score of 3.78 from the results of an assessment by a team of experts, namely two supervisors for Biology Education FKIP ULM and a Biology teacher at MAN Kapuas. Indicators of learning material at the appropriate level into a single unit, consistent use of font type and size, consistent use of spaces, and systematic arrangement of contents get a score of 4.00. The average score of 3.78 belongs to the valid category. This is supported by previous studies by Yuantini et al. (2019) which states that the results of the validity test are valid with a score of 3.77, and Faridah (2019) with a score of 3.84.

Language validation is used to assess the accuracy of the language designed in the LKPD. Substance or material validation is used to evaluate the ability of the LKPD which aims to achieve the demands of basic competencies and determine achievement indicators. Content or content validation is used to evaluate cumulative achievement indicators that are in line with the personality of students. Media validation is used to

evaluate the alignment of the specified section with the designed LKPD (Royana et al., 2019).

The assessment of the writing format aspect emphasizes the consistency of the type and size of the letters, consistently using spacing, layout, bold printing, italics, underlining and color when necessary. In the aspect of consistency of type and font size as well as the use of spaces, a score of 4.00 was obtained by the expert team.

In the aspect of learning media, it is easy to find and has a high adaptive power to advances in science and technology in accordance with the development of electronic LKPD, where the designed electronic LKPD can be opened anywhere by students and teachers via smartphones or laptops with the internet. The use of technology as a learning medium also makes the teaching and learning process efficient because it makes it easier for a teacher to convey information.

The assessment of the media aspect emphasizes the photos on the cover and the photos in the electronic LKPD are known to students, displays images that are easy to understand and attractive, the composition of the content is made

systematic, placing interesting manuscripts, pictures and illustrations, and combining colors and illustrations picture. The photos contained in the Animalia concept electronic LKPD are easy to understand because most of them are found in the surrounding environment. According to Wahyuningsih (2011) the use of media such as pictures and photos is very helpful in the learning process because it makes students motivated and active in the learning process, so that learning

materials are easy to understand. The use of pictures can also attract the attention of students so that students do not get bored quickly in the teaching and learning process.

## 2. The practicality of hope

A summary of the practical results of the contents of the electronic LKPD is shown in Table 2 below:

**Table 2 Summary of the Practical Results of Electronic LKPD Expectations**

No.	Aspect	Electronic LKPD To-				Average
		I Score	II Score	III Score	IV Score	
1.	The content is easy to learn and understand.	100	100	100	75	93.75
2.	Commands given to acquire skills (such as observing, experimenting, etc.) understandable meaning.	100	100	100	75	93.75
3.	There is sufficient time to study.	100	100	100	100	100
4.	a) The content related to (equipment, method, source of material) is known beforehand.	100	75	100	100	93.75
	b) Ways of learning (such as orders/tasks) have been carried out before.	100	100	50	100	87.5
	c) Fun learning atmosphere.	100	100	100	100	100
5.	Interesting learning materials to learn.	100	100	100	100	100
<b>Overall Average of electronic LKPD</b>						<b>95.54</b>
<b>Category</b>						<b>Very Good</b>

The group test was conducted to determine the practicality of expectations, carried out by 4 students who filled out the practicality of expectations instrument by giving answers "Yes" or "No". The small group test resulted in an electronic LKPD with practical expectations in the very good category based on 7 aspects that students responded to. Student responses showed a positive response to the electronic LKPD with a percentage of 95.54%. Aspects of time to study are quite available, the learning atmosphere is fun, and interesting learning materials to learn get an average score of 100%. The developed electronic LKPD is done using a laptop or smartphone in which there are photos, videos, and even matching images whose choice of options can be shifted, making it interesting for students to learn. Meanwhile, in the aspect of how to teach (such as orders/tasks) that have been

carried out previously, the average score was the lowest, namely 87.5%, because the use of electronic learning media such as electronic LKPD is rarely used in schools. According to Plomp & Nieveen (2007) the practicality is seen from the user being able to use the material easily.

The results of this study are supported by previous research by Diani et al. (2019) that LKPD is practical to use and can be continued with field trials. However, this study only up to small group evaluation. So that it is not continued for the field test stage (field test).

## 3. The effectiveness of hope

A summary of the practical results of the contents of the electronic LKPD is shown in Table 3 below.

**Table 3 Summary of the practical results of the contents of the electronic LKPD is shown below**

Critical Thinking Skills Aspect	Score Max	Electronic LKPD To-							
		I		II		III		IV	
		Average	%	Average	%	Average	%	Average	%
Interpretation	14	13,00	92,86	12,00	85,71	12,75	91,07	13,50	96,43
Analysis	10	8,00	80,00	9,75	97,50	9,25	92,50	9,5	95,00
Evaluation	20	-	-	18,63	93,15	18,25	91,25	18,50	92,50
Inference	24	19,88	82,83	21,25	88,54	21,38	89,08	23,00	95,83
Explanation	20	18,88	94,40	19,25	96,25	19,13	95,65	19,25	96,25
Self-regulation	12	10,25	85,42	-	-	10,75	89,58	11,00	91,67

Aspects of critical thinking skills of interpretation, evaluation, explanation, and self-regulation showed a very good category, while aspects of critical thinking skills of analysis and inference increased from good to very good. The evaluation aspect is not found in the electronic LKPD I, and the self-regulation aspect is not found in the electronic LKPD II. This is a drawback of researchers who cannot complete all aspects of critical thinking skills in several electronic worksheets. The effectiveness of expectations can be seen based on the results of students' critical thinking skills in doing electronic LKPD tasks.

This is supported by previous research by Indriani et al. (2017) getting an effective score with an average score of 73.71% which meets good criteria for LKPD work. According to Plomp & Nieveen (2007) the effectiveness of a product development can be viewed from the consistency between the design and the experience and learning outcomes of students.

Critical thinking skills are developed according to Facione's critical thinking assessment criteria. Examples of questions that contain interpretation skills on the developed electronic LKPD are such as matching pictures, describing the material being studied, and revealing whether students have difficulties with the material. Interpretation is the ability to understand and express the meaning or meaning of the problem (Hayudiyani et al., 2017). The analytical skills on the electronic LKPD ask students to analyze, and ask students to present arguments accompanied by the right reasons. Evaluation skills on the electronic LKPD ask students to assess the assumptions received from the statement, so that it can give students confidence to solve a problem at hand. Inference skills on electronic worksheets ask students to formulate problems, make hypotheses, search literature to prove answers, and draw conclusions. In the explanatory aspect, students explain statements and opinions that have been expressed to become a strong opinion (Pratiwi et al., 2016). Self-regulation skills on electronic worksheets ask students to reflect on themselves and verify the results obtained from the application of the implementation of the cognitive skills involved, revealing errors or deficiencies to correct errors and their causes. In addition, Pratiwi et al. (2016) self-regulation aspects can regulate their existence in dealing with problem solving. A person's ability to have awareness examines self-cognitive activities, the elements used in these activities, and their results.

## D. Conclusion

Electronic LKPD on the Animalia concept has a valid category based on 16 validated aspects with a score of 3.78, and the practicality of expectations has a very good category based on 7 aspects that students respond to. Student responses showed a positive response to the electronic LKPD with a percentage of 95.54%. The effectiveness of expectations is stated to be very good in the aspects of critical thinking skills of interpretation, evaluation, explanation, and self-regulation, while aspects of critical thinking skills of analysis and inference have increased from good to very good.

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