

The Quality of Electronic Student Worksheets Based on Critical Thinking Skills on the Concept of Biodiversity at High School Level

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Abstract

21st-century education demands the critical thinking skills of students. Education is also required to create a generation that is skilled at using technology. Electronic Student Worksheets (LKPD) is innovative learning tools to make it easier for students in the learning process. This study aims to describe the practicality and effectiveness of electronic LKPD expectations on the concept of Biodiversity. The research method used Tessmer's Formative Evaluation design, through stages 1) expert review; 2) one-to-one evaluation; and 3) small group evaluation. The validator was 3 experts, the individual test subjects were 3 high school class X students and the small group test subjects were 4 high school class X students. Data obtained from the research instrument in the form of an assessment sheet of practicality and effectiveness of expectations. The results of the research on the practicality of expectations have a very good category based on the responses of students and the effectiveness of expectations has a very good category (including interpretation, analysis, evaluation, inference, and explanation skills) and a good category (including self-regulation skills) based on the assessment of students' critical thinking skills.

Abstrak

Pendidikan abad ke-21 menuntut keterampilan berpikir kritis peserta didik. Pendidikan juga dituntut menciptakan generasi yang terampil menggunakan teknologi. Lembar Kerja Peserta Didik elektronik merupakan inovasi perangkat pembelajaran untuk mempermudah peserta didik dalam proses belajar. Penelitian ini bertujuan untuk mendeskripsikan kepraktisan dan keefektifan harapan LKPD elektronik pada konsep Keanekaragaman Hayati. Metode penelitian menggunakan desain Evaluasi Formatif Tessmer, melalui tahapan 1) *expert review*; 2) *one-to-one evaluation*; dan 3) *small group evaluation*. Validator adalah 3 orang ahli, subjek uji perorangan adalah 3 orang peserta didik kelas X SMA dan subjek uji kelompok kecil adalah 4 orang peserta didik kelas X SMA. Data diperoleh dari instrumen penelitian berupa lembar penilaian kepraktisan dan keefektifan harapan. Hasil penelitian kepraktisan harapan memiliki kategori sangat baik berdasarkan respon peserta didik dan keefektifan harapan memiliki kategori sangat baik (meliputi keterampilan interpretasi, analisis, evaluasi, inferensi, dan eksplanasi) dan kategori baik (meliputi keterampilan pengaturan diri) berdasarkan penilaian keterampilan berpikir kritis peserta didik.

A. Introduction

The 21st century is marked by various advances in the field of information and communication technology (ICT). Sudarisman (2015) explains that the rapid development of information technology has had a significant impact on various fields, especially in the field of education. There was a transition from the age of industrialization to the age of knowledge that required every field to adapt quickly. Triling & Fadel (2009) stated that this century's education is education in the digital era, also known as the industrial revolution era 4.0. Education is required to be able to create a generation that is skilled at using technology, can survive by using life skills, in the form of hard skills and soft skills. Abidin (2014), that in the 21st century there are at least four learning competencies that must be mastered by students, namely high comprehension skills, critical thinking skills, collaboration, and communication skills. Meanwhile, Redhana (2019) stated that the skills that need to be mastered in the 21st century are critical thinking skills, problem-solving, creativity, innovation, communication, and collaboration.

Critical thinking ability is a person's ability to logically, ideologically, systematically, and analyze one or more ideas to make decisions so that they can successfully solve existing problems (Ridhana et al., 2021). Improving students' critical thinking skills can be obtained through learning at school, but currently, face-to-face learning is experiencing obstacles due to the Covid-19 pandemic. One alternative to learning during a pandemic is online following Circular Letter Number 4 of 2020 concerning the Implementation of Education Policies in the Emergency Period for the Spread of Corona Virus Disease (Covid-19). Khasanah et al. (2020) stated that this new policy in the world of education changed learning that had to come to class or a building to be enough at home.

The current state of education requires teachers to prepare learning tools that can enable students to learn online at home. The learning tools needed include Student Worksheets (LKPD). In fact, in schools today, teachers still use LKPD which tends to attract students' attention with a monotonous and less innovative design. The LKPD used only emphasizes answering practice questions so that it makes students feel bored. This is in line with the statement of Kustiani et al. (2020), the designs on the LKPD presented are mostly unattractive, only containing black and white writing for the background. LKPD is only in the form of short entries, reviews of learning materials, and some questions only fill in "dots" with words or short sentences, so it is necessary to develop more effective LKPD.

Student Worksheets in printed form are commonly used. As technology develops, there is a need for LKPD innovation into a digital form that can facilitate learning, especially during the pandemic. Electronic Student Worksheets are run using a computer or smartphone, do not need to be printed, and do not require paper so that they prioritize efficiency and are environmentally friendly. Hafsa et al. (2016) stated that electronic LKPD is one of the media that is integrated with technology in which there are pictures, animations, and videos that are effective to attract the attention of students and so that students do not feel bored in lessons.

The concept of biodiversity is a concept that must be taught at the high school level in class X. This concept is important to be taught to students because it is hoped that by studying the concept of biodiversity, students can increase their insight and knowledge, for example regarding environmental issues that are rife in Indonesia. It is expected that students will know how to maintain, maintain, and preserve biodiversity in Indonesia. According to Nurichah & Wisanti (2012), the concept of biodiversity contains topics that are known to students. This is an important factor in teaching critical thinking skills to students because skills in critical thinking are best achieved when related to topics that are known to students. Previous LKPD research, Nurichah & Wisanti (2012) reported, LKPD based on critical thinking skills on biodiversity material obtained a very good category on each of the criteria developed.

Student Worksheets containing critical thinking skills are necessary so that students have cognitive skills in dealing with everyday life. In addition, as an effort to adapt to the times, the LKPD is made inseparable from the use of technology in the process of its use. So it is necessary to have LKPD which emphasizes critical thinking skills through development research. Therefore, research was conducted with the title "Quality of Electronic LKPD Based on Critical Thinking Skills on the Concept of Biodiversity at High School Level".

B. Method

The development of this electronic Student Worksheet is included in the type of educational design research, namely EDR (Educational Design Research) concerning formative evaluation (Tessmer, 1993). The formative evaluation of Tessmer consists of four stages, namely the self-evaluation stage, expert review, individual test (one-to-one), and small group test. According to Zaini (2018) EDR was developed in the field of

education to overcome several learning problems. Meanwhile, according to Reeves et al. (2010) development research is a formative evaluation.

The research was conducted online in the Odd semester 2020/2021. The research was carried out for 5 months (September 2020-January 2021) at MAN Kapuas, Central Kalimantan Province. Subject determination is heterogeneous based on students' academic abilities and having facilities such as smartphones or laptops to access electronic LKPD.

The instrument of data collection used the instrument of practicality and effectiveness of expectations. The expected practicality data was obtained from the responses of four students to the contents of the electronic LKPD and the expected effectiveness data was obtained from the results of four students of class X MIPA 1 MAN Kapuas in answering the electronic LKPD. This research leads to the improvement of the existing LKPD into the LKPD that should be/desired. So this research is not to create a new LKPD, but to make improvements to the existing LKPD (original LKPD). Four original LKPDs have been repaired, namely LKPD 1 (the concept of biodiversity at the gene, species, and ecosystem level), LKPD 2 (biodiversity in Indonesia), LKPD 3 (efforts to conserve and benefit from biodiversity in Indonesia), LKPD 4 (the classification system of living things).

The technique of collecting data on the practicality of expectations of the electronic LKPD was obtained from filling out the practical expectations test instrument by four students. According to Tessmer (1993), practicality means that it is easy to use by users, and can be given and used by all students. So, after the activity of working on the electronic LKPD ends, students are allowed to provide an assessment on the practicality expectations sheet. The practicality of this expectation was tested through a small group evaluation test by responding YES (if you agree) and NO (if you don't agree). While the expected effectiveness data is obtained through the tasks given on the students' critical thinking skills assessment sheet. The data analysis technique resulted from the practicality of expectations was analyzed by calculating the average. The average is calculated by adding up the entire percentage of each electronic LKPD obtained and dividing it by the number of developed electronic LKPD. The formula for calculating the practicality of electronic LKPD expectations as a whole is as follows (Zaini, 2018 adapted from Nur, 2013):

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

Information:

X = Average score

X = Number of practical expectations per electronic LKPD

n = Number of aspects of electronic LKPD

The expected effectiveness data analysis technique was carried out through a small group evaluation with the subject of four students of class X MIPA 1 MAN Kapuas. The effectiveness test of electronic LKPD expectations on the concept of biodiversity consists of 6 aspects of critical thinking skills (including interpretation, analysis, evaluation, inference, explanation, and self-regulation).

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 scores obtained were determined by modified categories from Akbar (2013), namely 85.01 – 100.00% (very good), 70.01 – < 85.00% (good), 50.01 – < 70.00% (less good), 01.00 – < 50.00% (not good).

C. Results and Discussion

The development of the electronic LKPD on the concept of biodiversity produced consists of four electronic LKPD with each topic, namely: 1) the concept of biodiversity at the gene, species, and ecosystem level, 2) biodiversity in Indonesia, 3) the benefits and conservation of biodiversity in Indonesia, and 4) classification system of living things.



Figure 1 Cover of electronic LKPD

The Practicality of Hope

The practicality of the expectations of the electronic LKPD is determined from 7 aspects of the assessment instrument. The developed electronic LKPD is declared to have practical

expectations if all aspects of the assessment meet the criteria of at least good. The following are the results of research on LKPD development from the results of practical expectations:

Table 1 Average Practicality Test Results of Electronic LKPD Expectations

No.	Aspect	Electronic LKPD To-				Amount	Average	Category
		I	II	III	IV			
1.	Content is easy to learn and understand	100	100	100	100	400	100	very good
2.	Commands given to acquire skills (such as observing, searching, etc.) understandable meaning	100	75	100	100	375	93.75	very good
3.	There is sufficient time to study	100	100	100	100	400	100	very good
4.	a. Content related to (equipment, method, source of material) is known beforehand	100	100	100	100	400	100	very good
	b. How to learn (such as orders/tasks) has been done before	100	100	100	100	400	100	very good
	c. Fun learning atmosphere	100	75	100	100	375	93.75	very good
5.	Interesting learning materials to learn	100	100	100	100	400	100	very good
Overall Average of electronic LKPD (%)							98.21	Very good

Information:

- Categories are 85.01 – 100.00% (very good), 70.01 – 85.00% (good), 50.01 – 70.00% (poor), 01.00 – 50.00% (no good) (Akbar, 2013)
- LKPD I = Concept of Biodiversity at Gene, Species and Ecosystem Level, LKPD II = Biodiversity in Indonesia, LKPD III = Benefits and Conservation of Biodiversity in Indonesia, LKPD 4 = Classification System of Living Things

Based on the expected practicality test, the results of the practical expectations were obtained in a very good category based on an average result of 98.21%. 7 aspects are assessed in the small group test. When viewed from the aspect, it is classified as very good category on the 7 aspects contained in the assessment sheet.

The practicality of expectations was obtained based on the responses of four students of class X MIPA 1 MAN Kapuas. The practicality test of hope is carried out at the small group evaluation stage. Zulyusri et al. (2017) stated trials through small groups as an effort to find out the practicality of the tasks developed. The criteria for the practicality of a product are assessed from its implementation in the field (Plomp & Nieveen, 2007).

The practicality of the expectations of the electronic LKPD is in the very good category, this means that the developed electronic LKPD is very practical to use. The practicality of expectations is achieved through the contents of the electronic LKPD which are easy to learn and understand, the instructions used can also be understood, and the learning materials are interesting to learn. Akker (1999) explains the practicality of expectations is intervention when using a product in a design and development setting.

There are 7 aspects in the assessment of the practicality of expectations, one aspect of which is interesting learning materials to study which get a

very good response, this shows that the contents of the electronic LKPD are interesting and not boring for students. Electronic LKPD is not only presented with writings but also accompanied by videos and pictures. According to Arsyad (2017), the use of visuals (images) has a very important role in the learning process, because it can facilitate understanding and strengthen memory. Visuals can also foster student interest and can provide a relationship between the content of the material and the real world.

Hope Effectiveness

The effectiveness of expectations is carried out at the small group evaluation stage. The implementation of the effectiveness of expectations begins with introducing the electronic LKPD which is equipped with critical thinking skills tasks to students. Furthermore, students are asked to do the tasks contained in the electronic LKPD. The results of data processing on the effectiveness of electronic LKPD expectations are presented in table 2.

Based on the table above, the results of the effectiveness of the expectations of the electronic LKPD on the concept of biodiversity through small group testing are included in the very good category in the aspects of interpretation, analysis, evaluation, inference, and explanation. Then got a good category on the aspect of self-regulation. Based on these data, LKPD is effective to use. This is in line with previous studies (Kustiani et al., 2020; Nabella

et al., 2020; Antika et al., 2020; Hidayati et al., 2020; Arsyad et al., 2019; Zaini & Rusmini, 2016).

Effective in the sense of language means "can cause a significant effect or influence". The effectiveness of a product development according to Plomp & Nieveen (2007) can be viewed from the

consistency between the design and the experience and learning outcomes of students. Akker (1999) explains that the effectiveness of expectations is when the product developed can be used to assess what you want to assess.

Table 2 Average Results of the Electronic LKPD Expectancy Effectiveness Test

No.	Aspect	Max Score	LKPD ELEKTRONIK Ke-				Average	Score (%)	Category
			I	II	III	IV			
			average	average	average	average			
1.	Interpretation	14	12.38	12.63	12.75	13.13	12.72	90,88%	very good
2.	Analysis	10	8.44	9.13	8.90	9.00	8.87	88,68%	very good
3.	Evaluasi	20	16.25	16.88	18.00	19.00	17.53	87,66%	very good
4.	Inference	24	20.00	21.27	22.75	20.00	21.01	87,52%	very good
5.	Explanation	20	16.63	16.00	19.00	17.50	17.28	86.41%	very good
6.	Self Regulation	12	9.75	10.13	10.50	10.25	10.16	84,65%	very good

Information:

- Categories are 85.01 – 100.00% (very good), 70.01 – 85.00% (good), 50.01 – 70.00% (poor), 01.00 – 50.00% (no good) (Akbar, 2013)
- LKPD I = Concept of Biodiversity at Gene, Species and Ecosystem Level, LKPD II = Biodiversity in Indonesia, LKPD III = Benefits and Conservation of Biodiversity in Indonesia, LKPD 4 = Classification System of Living Things

The effectiveness of the expectations of the electronic LKPD is determined from the results of the critical thinking skills task carried out by students on the electronic LKPD. Several other studies (Rachman et al., 2017; Hairiani et al., 2016; Zaini & Jumirah, 2016) explain that effectiveness is measured from learning outcomes, student activity, student analytical skills, process skills, performance skills, spiritual assessment, assessment critical thinking, assessment of social skills, assessment of student activities and assessment of teacher activities.

All aspects of critical thinking skills assessed include interpretation, analysis, evaluation, inference, explanation, and self-regulation which are categorized as good and very good. This is obtained from the scores obtained in each aspect of the KBK, each aspect of the KBK in the LKPD is averaged and a score is obtained with that category. According to (Wiyono, 2009) critical thinking skills need to be developed in students so that students can more easily understand concepts more deeply, be sensitive to problems that occur so that they can understand and solve problems and are able to apply concepts in different situations. According to Zaini & Asnida (2010) the effectiveness of the learning instrument is fulfilled based on a) the completion of cognitive learning outcomes, b) the achievement of good categories on the results of the assessment of behavioral characteristics, social skills, and critical thinking skills, c) visible student activity in the learning process.

Critical thinking skills have been represented by one sub-skill in each electronic LKPD. Critical thinking skills in electronic worksheets are based on Facione (1990), this is in line with previous studies (Sari et al., 2019; Nuraini, 2017; (Susilowati et al., 2017) which explains that each critical thinking skill has its characteristics. different scores and criteria for each skill.

Based on the results of the study, the electronic worksheets developed were effective based on critical thinking skills, which were classified as very good in the aspect of interpretation (90.88%), analysis (88.68%) evaluation (87.66%), inference (87.52%), and explanation (86.41%). The aspect of self-regulation got a good category (84.65%). Research by Ozmen & Yildirim (2005) shows the student worksheets are more effective than traditional teaching materials and methods.

Electronic LKPD given to students is not only presented with writings but also accompanied by videos and pictures. According to Arsyad (2017), the use of visuals (images) has a very important role in the learning process because it can facilitate understanding and strengthen memory. Visuals can also foster student interest and can provide a relationship between the content of the material and the real world.

Electronic LKPD given to students can improve critical thinking skills because a meaningful learning experience is formed. The meaningful learning experiences obtained, for

example, form knowledge and build a mindset towards critical thinking skills. Crespo & Pozo (2004) stated that the use of worksheets in learning can improve student learning experiences. Through the LKPD provided, students gain knowledge about biodiversity from various levels, the biodiversity that exists in Indonesia, and the benefits and conservation of biodiversity.

The electronic LKPD developed has fulfilled the six critical thinking skills from Facione (1990) and has fulfilled all the existing sub-critical thinking skills. However, the developed LKPD cannot be used to measure students' interpersonal skills. This is due to the weakness of researchers in preparing electronic LKPD at an early stage (self-evaluation) and experiencing obstacles due to the COVID-19 pandemic.

D. Conclusion

Electronic LKPD on the concept of biodiversity has expected effectiveness with a very good category including interpretation skills of 90.88% (very good), analysis of 88.68% (very good), evaluation of 87.66% (very good), inference of 87.52% (very good), explanation of 86.41% (very good), and self-regulation of 84.65% (good).

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