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Development of Electronics Student Worksheet with Flip PDF Professional Based on Scientific Approach to Biodiversity Materials

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ABSTRACT

This study aims to produce an electronic student worksheet (E-LKPD) with Flip PDF Professional Based on a Scientific Approach to Biodiversity Material. The research was carried out at the Biology Education Study Program FKIP UNRI and at Pekanbaru Public High School for students at Pekanbaru Public High School from July to September 2022. This type of research is research and development using the ADDIE and this research is limited to the development stage only. The instruments used were validation sheets and student response questionnaires with a likert scale. The results of this study indicate that the results of validation by the validator are in the very valid category with an average score of all aspects of 3.65. The results of the first phase trial obtained an average score of 3.61 and the results of the second phase trial obtained an average score of 3.58 in the very good category. Based on the research results of the E-LKPD with Flip PDF Professional based on a Scientific Approach on biodiversity material, it shows that the E-LKPD that has been developed is included in the very valid category.

Keywords: electronic student worksheet, flip pdf professional, scientific approach, biodiversity material

INTRODUCTION

21st century learning requires teachers and students to have information and communication technology skills (Kemendikbud, 2020). In education, information and communication technology acts as a mean or tool to enable an effective and efficient learning process. Education is an important part of the government to realize the ideals of the nation (Munawaroh, 2015). With the implementation of the 2013 curriculum, there is a demand for independent learning. Learning activities in the 2013 curriculum have also take advantage of the information role and the communication technology to increase the efficiency and effectiveness of learning (Kemendikbud, 2013). According to Anas et al. (2014) learning in the 2013 curriculum uses a scientific process-based approach. The scientific approach is an attitude based on the way of thinking that follows the scientific

method in dealing with a problem or phenomenon. The implementation of learning in observing, asking, trying, reasoning, and communicating, if an adequate facilities and infrastructure are fulfilled, it will help students in learning activities (Septina *et al*., 2018).

Based on the result of the pre-survey that was conducted at SMAN 2 Pekanbaru, SMAN 8 Pekanbaru and SMAN 13 Pekanbaru as a whole, teachers only used school textbooks in the form of teacher books and student books as teaching materials used and some were sourced from the internet. So, the references resources for the student in learning process are lacking in understanding the concept of learning material, especially in biodiversity material.

To meet the needs of teachers, it is necessary to develop an electronic LKPD based on a scientific approach. With an electronic LKPD based on a scientific approach that is oriented towards scientific steps such as observing, asking, trying, reasoning, and communicating, it is hoped that it can help teachers in their efforts to develop scientific character and help students to solve a problem correctly. But teachers are still using printed worksheets currently, it causes the use of learning resources is not yet effective (Arifin & Kuntjoro, 2019).

Things that can be done based on this problem are by providing innovative learning resources, one of which is the use of Student Worksheets. As an effort to adjust to the current developments, LKPD is made in electronic form so that it is more practical and efficient. This is in line with research conducted by Warsita (2017) regarding a form of technology development in learning that must produce the products, one of which is learning media which is used as a learning resource. According to Dwiningsih et al. (2018) added that this global generation is very sensitive to technology, it means that they have an advantage in the ability to use technology to develop knowledge. LKPD at the present time is LKPD which is followed by the times by using technology, especially in the current online learning process.

Electronic worksheets are student practice sheets that are done digitally and carried out systematically and continuously for a certain period of time (Ramlawati et al., 2014). This electronic LKPD can be accessed by students through the internet network with the hope that it can help students to better understand the material provided by the teacher so that learning objectives can be achieved (Dasari, 2018). Making products is applied in biology learning, one of which is on biodiversity material. Biodiversity material studies the diversity of living things at the level of genes, species and ecosystems, an effort to preserve biodiversity and classification of living things. Biodiversity material is taught in odd semesters of class X SMA. Electronic LKPD based on a scientific approach has the advantage of activating students in the learning process, helping students in developing concepts, training students in discovering and developing process skills, as a guide for educators and students in carrying out the learning process, helping students to add

information about learning concepts through systematic learning activities (Prastowo, 2015).

Based on the pre-survey, 100% of teachers need this electronic LKPD because it is important to apply it in the learning process about biodiversity material. It is because electronic worksheets can make learning process is more meaningful. So, it was developed with the help of the Flip PDF Professional application. This application was chosen because it is easy to be accessed by simply clicking on the active link provided on the electronic worksheet which can be accessed either using smartphone or laptop anytime and anywhere. The appearance of Flip PDF Professional is attractive in the form of a Flipbook and it is not focused on text only, but it is able to display images, animations, audio, movies, videos from YouTube, Hyperlinks, quizzes, Flash, and others so that the learning process is not monotonous (Mudinillah, 2021). The purpose of using electronic LKPD with Flip PDF Professional is based on a scientific approach to minimize the needs of students and it is able to train in the context of everyday life on biodiversity material. The purpose of this study is to validate and analyze the feasibility of electronic LKPD with Flip PDF Professional based on a scientific approach to biodiversity material (Bagas, 2018).

Based on the description above, the research objective is to develop electronic worksheets with Flip PDF Professional based on a scientific approach as teaching materials and to determine the level of students' understanding of biodiversity material. Basic Competency on Biodiversity material is KD 3.2 analyzing observational data on various levels of biodiversity (genes, species and ecosystems) in Indonesia, the threats and their conservation and KD 4.2 presenting results of observations of various levels of biodiversity (genes, species and ecosystems) in Indonesia and propose an effort to conserve Indonesia's biodiversity based on the results of analysis of conservation threat data on various Indonesian unique animal and plant diversity in various forms of information media.

METHOD

This research was carried out in two places, namely on the campus of the Biology Education Study Program FKIP, University of Riau and at the Pekanbaru State High School in July – September 2022. This type of research is Research and Development (R&D) research using the ADDIE development stages (Analyze, Design, Development, Implementation, and Evaluation). In this study, researchers only conducted research up to the development stage.

Product validation was carried out by 4 validators consisting of 2 Biology Education lecturers and 2 high school biology teachers. The first step was conducted on 10 students of FKIP Biology, University of Riau. The second step was conducted on 20 students in Pekanbaru State Senior High School students who had studied biodiversity material. The instruments used in this study were validation sheets and student response questionnaires. The validation sheet aims to determine the validity criteria of electronic worksheets developed by researchers. The aspects assessed on the validation sheet are design aspects,

pedagogic aspects and content aspects. The response questionnaire aims to determine the feasibility of electronic LKPD and to determine student responses to electronic LKPD. The response questionnaire was designed containing 21 assessment items consisting of 3 aspects, namely design, pedagogic and content feasibility aspects. The validation sheet and student response questionnaire are filled in by giving an assessment using a rating scale.

In this study the data were analyzed with quantitative descriptive analysis. Analysis of the data collected is the result of electronic worksheet validation with Flip PDF Professional. With the percentage formula:

$$M = \frac{\Sigma fx}{N}$$

Information:

M = Score Average

N = Number of validation components

∑fx = Score obtained

Table 1. Electronic LKPD validation assessment criteria

Average score interval	Validity category
3.25 ≤ x □ 4	Very valid
2.5 ≤ x □ 3.25	valid
1.75 ≤ x □ 2.5	Less valid
1 ≤ x □ 1.75	Invalid

RESULT AND DISCUSSION

Analyze Stage

At this analysis stage, researchers conducted it to see conditions in the field related to the learning process about biodiversity in class XI Pekanbaru State Senior High School and to analyze the problems. The process carried out in this stage is curriculum analysis (KI, KD, syllabus analysis), analysis of teaching materials used by teachers and analysis of concepts and students. At this stage, a study was carried out on the curriculum used at the high school level, namely the 2013 revised 2020 curriculum with implementation referring to the guidelines for implementing the curriculum in educational units under special conditions that have been issued by the Ministry of Education and Culture. The results of the curriculum analysis can be seen in table 2 below.

Table 2. Results of curriculum analysis

No	2013 Curriculum (before the pandemic)	2013 Curriculum (during a pandemic)
1.	KD 3.2 Analyzing observational data on various levels of biodiversity (genes, species and ecosystems) in Indonesia as well as threats and conservation	KD 3.2 Analyzing observational data on various levels of biodiversity (genes, species and ecosystems) in Indonesia
2.	KD 4.2 Presenting the results of observations of various levels of biodiversity (genes, species and ecosystems) in Indonesia and suggestions for efforts to conserve biodiversity in Indonesia based on analysis of data on threats to sustainability of various biodiversity of typical Indonesian animals and plants in various forms of information media	KD 4.2 Present the results of the identification of proposed efforts to conserve Indonesian biodiversity based on the results of data analysis on the threat to the preservation of various Indonesian unique animal and plant diversity communicated in various forms of information media

After analyzing the syllabus, then analyzing the teaching materials used by the teacher, namely LKPD. Based on the results of the analysis, there are deficiencies in the LKPD used by teachers at school. These deficiencies can be seen from the aspects of design, pedagogy and content feasibility. The results of the analysis of teaching materials can be seen in the following table 3.

Table 3. Results of teaching materials analysis

Indicator	Description
Design aspects	1. Sub-material is not included in the LKPD 2. Several LKPDs also do not include time allocation, basic competencies, learning objectives, work methods and learning resources 3. Illustrations, pictures, tables and the like have not been presented clearly, effectively and attractively 4. LKPD is not yet in electronic form as required by students during distance learning
Pedagogic aspects	1. There is no brief discourse/theory 2. LKPD has not used a scientific approach

Indicator	Description
Content eligibility aspects	1. The LKPD used does not represent all the material guidance that refers to core competencies and basic competencies 2. Several LKPDs have not included questions related to events or incidents that occur in everyday life 3. The LKPD does not refer to scientific approach indicators

In each KD, an analysis of concepts and material regarding biodiversity was carried out. Concept analysis was prepared based on the content of the material and basic competencies (KD). Concept analysis was carried out by identifying the main concepts taught regarding biodiversity material for class X SMA. The results of the analysis can be seen in Table 4 below.

Table 4. Results of concept analysis on biodiversity material

Subject matter	Sub material/topic of electronic LKPD	Meeting	Time allocation
Biodiversity	1. Biodiversity (Group the levels of biodiversity in Indonesia)	1	2 JP
	2. efforts made for the preservation of biodiversity in Indonesia	2	2 JP
	3. Classification of Living Things	3	2 JP

Student analysis was carried out by paying attention to the characteristics, abilities and experiences of students. This analysis aims to determine the characteristics of the targeted students, namely students who have studied biodiversity material. In this study the students who became the sample were the students of class XI SMA. In terms of the learning process, supporting infrastructure and the use of technology in learning, students who meet these criteria are students of SMAN 2 Pekanbaru.

Design Stage

At the design stage, preparing learning media that are in line with KD, KI and indicators in the K13 curriculum has been done. Biodiversity material contained in KD 3.2 and KD 4.2 is the subject of discussion in the electronic LKPD which will be developed because the mechanism is easy to find in everyday life. After selecting the topics to be included in the electronic LKPD. The initial design is a student worksheet designed to design the concept of the electronic LKPD to be developed, which includes shape, color, and size. The development of Electronic Worksheets uses consistent colors as in the picture

below, this is in line according to Daryanes et al. (2023) who developed learning media to get a better colors between slides.

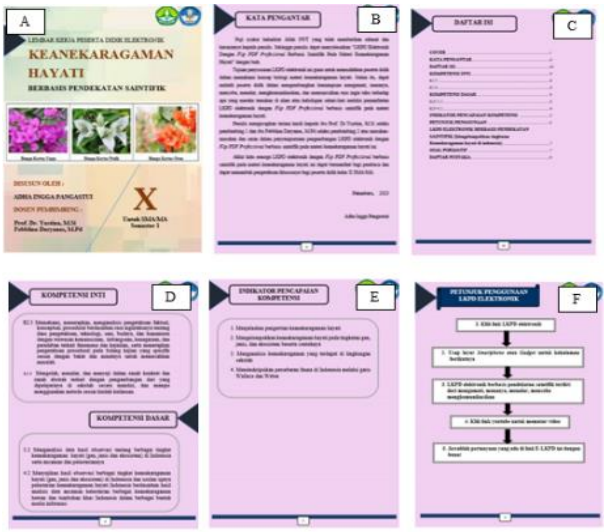

Figure 1. LKPD structure, a. Cover, b. Foreword, c. Table of Contents, d. Core competencies and basic competencies, e. Competency achievement indicator, f. Instructions of using electronic LKPD with the Flip PDF professional application

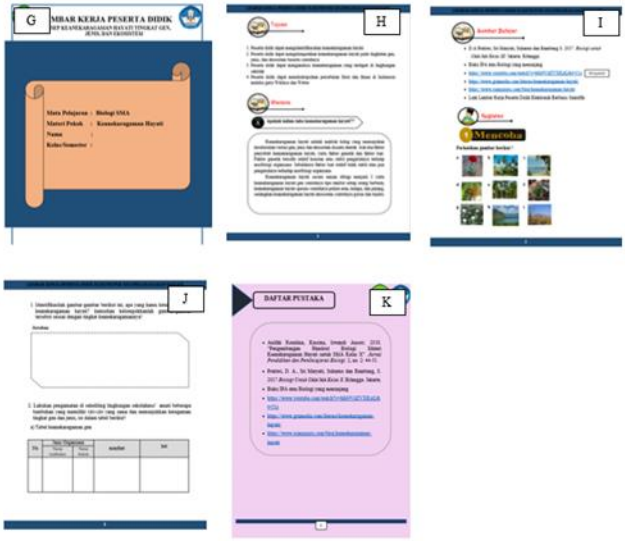

Figure 2. LKPD structure, g. Student identity sheet, h. Biodiversity goals and discourse, i. Learning resources and electronic LKPD quizzes, k. Bibliography with Flip PDF professional application

a. The front cover consists of the title, University logo, picture, author's name, materials and target users of the electronic LKPD (Figure 1a) with the theme of biodiversity according to the material in the LKPD and uses lilac color.
b. The preface contains thanksgiving, thanks to the supervising lecturer and suggestions for students and teachers (Figure 1b).
c. The table of contents section contains the main topics as well as reference pages that can be used as a reference for electronic LKPD readers (Figure 1c).
d. Core Competencies and Basic Competencies are part of the Core competencies and basic competencies that are adapted to the syllabus and lesson plans for biodiversity subjects. (Fig. 1d).
e. This competency achievement indicator aims to assist teachers in developing the learning materials delivered (Figure 1e).
f. Instructions for using electronic LKPD are to make it easier for students to answer a question that has been given by the teacher (Figure 1f).
g. Student identity sheets are made for students to fill in their name, class, and learning materials (Figure 2g).
h. Objectives, discourse and learning resources are broken down so that students understand the material presented by the teacher to achieve learning objectives (Figure 2h-i).
i. The electronic LKPD quiz contains questions designed to measure students' understanding and is also equipped with a scientific approach to measurement related to biodiversity material (Figure 2i-j).
j. Bibliography The bibliography contains the reference sources used in the preparation of the electronic LKPD (Figure 2k).

Development Stage

Electronic Student Worksheets (LKPD) with Flip PDF Professional which have been designed and developed are validated by experts. The suggestions given by experts are used to improve the material and design of the electronic LKPD with a professional Flip PDF based on a scientific approach to the material on biodiversity that has been prepared. After the revision, the first step (10 students) and the second one (1 class) were carried out.

The results of the validator's assessment of the electronic LKPD with Flip PDF Professional which has been developed are divided into three aspects, namely design aspects, pedagogic aspects and content feasibility aspects. All the validation values of the electronic LKPD with Flip PDF Professional for 3 meetings can be seen in table 5.

Table 5. Validation result

Aspect	**E-LKPD score**						**Average**	**information**
	E-LKPD 1	**Information**	**E-LKPD 2**	**Information**	**E-LKPD**	**Information**		
Design	3,61	VV	3,66	VV	3,75	VV	3,67	VV
Pedagogic	3,75	VV	3,56	VV	3,75	VV	3,70	VV
Content eligibility	3,58	VV	3,61	VV	3,59	VV	3,58	VV
Average	3,65	VV	3,61	VV	3,69	VV	3,65	VV

Information: VV = Very Valid

Based on table 5, it can be seen that the average score of the three electronic LKPDs is in terms of design aspects, pedagogic aspects and content feasibility. The highest score aspect was in the electronic LKPD meeting-1 pedagogic aspect, namely 3.75 very valid category. The aspect with lowest score was in the electronic student worksheet with pedagogic aspects meeting, namely 3.56 very valid categories.

From the results of design validation, the average value of 3.67 is obtained in a very valid category. It shows that the design aspect is in line with the appearance of the electronic LKPD, the format, layout settings, and the type and size of letters on the LKPD. Developed electronic LKPD already presents an attractive display accompanied by clear pictures and videos. Learning videos in electronic worksheets function to convey the contents of the subject matter being delivered or being studied. It makes students better understand the subject material. In addition, the electronic LKPD is right in choosing the type of application that was used, namely the Flip PDF Professional application. Electronic LKPD with the Flip PDF Professional application can be accessed through the internet by simply clicking on the active link provided (Sriwahyuni et al., 2019).

The validation results of the pedagogic aspects on the electronic LKPD about biodiversity based on a scientific approach, the average value of 3.70 is obtained with a very valid category. It shows that the pedagogical aspect is in line with the learning objectives that use a scientific approach in electronic worksheets.

From the results of the validation of the content feasibility aspect, the average value of 3.58 is obtained with a very valid category. In the feasibility aspect, this content served to measure the quality of the electronic LKPD that has been developed from a pedagogical

perspective, namely the electronic LKPD that has been developed is in line with the core competencies (KI) and basic competencies (KD), competency achievement indicators (IPK), the approach used and there are questions to measure biodiversity material. Learning approaches have various types, one of which is a scientific approach or often referred to as a scientific approach. The scientific approach is a learning approach that is carried out through the process of observing, asking, trying, reasoning, and communicating. Judging from the existing approach process, the scientific approach leads to scientific which is appropriate to biology subjects (Kliyanti *et al*., 2018).

It can be concluded that the electronic LKPD with Flip PDF Professional is based on a scientific approach to biodiversity material with the process of observing, asking, trying to reason and communicating which is developed is feasible to use. This can be proven by the average validation value of the three aspects, namely 3.65 which is stated to be very valid. So, electronic LKPD with Flip PDF Professional based on a scientific approach to biodiversity can be used in the Biology learning process for students. The development of electronic worksheets can inspire teachers to create interesting learning process in class so that teachers' critical and creative thinking skills can increase because according to Daryanes & Putra (2021, 2022) , teachers who have critical thinking skills and creative thinking skills can create innovative learning.

The first step of the trial was conducted on 10 students of 8th semester in biology education. The aim is to see the usability of the electronic LKPD used. The results obtained from the response questionnaire can be seen in table 6 below:

Table 6. Response questionnaire assessment results in limited the first step of the trial

Aspect	**E-LKPD score**						**Average**	**Information**
	E-LKPD 1	**Information**	**E-LKPD 2**	**Information**	**E-LKPD 3**	**Information**		
Design	3,59	VG	3,66	VG	3,68	VG	3,64	VG
Pedagogic	3,61	VG	3,63	VG	3,66	VG	3,63	VG
Content eligibility	3,53	VG	3,56	VG	3,57	VG	3,55	VG
Average	3,58	VG	3,62	VG	3,64	VG	3,61	VG

Information: VG = Very Good

Based on table 6 above, the results of the first limited step of the trial (students) as the whole obtained an average score of 3.61 from student 10. The assessment results were included in the Very Good category (VG). Judging from the average score every

component of the questionnaire, the assessment responses are also in the Very Good (VG) category. The highest score is found in the design aspect, which is 3.64 in the Very Good category (VG). The lowest score is on the content feasibility aspect with an average of 3.55 in a very good category, so it can be seen that the electronic LKPD with Flip PDF Professional on biodiversity material has good quality and suitable to use.

According to Hamdilah (2016) the scientific approach is a creative and innovative approach, so the students have to look for their own knowledge or ideas by applying a scientific approach in the learning process, students become more active and can construct their own knowledge by maximally involving all students' abilities to search and investigate. In addition, a scientific approach can help teachers convey a lot of material quite well. This is in line with the general impression of respondents who stated "the presented electronic LKPD is very attractive in the terms of appearance and content, so that it can improve students' abilities in the process". "The appearance of the LKPD is interesting and the activities in the student worksheets will stimulae students' abilities, especially in biodiversity material." The electronic LKPD based on a scientific approach also motivated the respondents for the material presented, this is in line with the general impression of the respondents who stated "electronic LKPD with Flip PDF Professional based on a scientific approach can motivate students and help students in learning process". According to Sudarisman (2015) and Daryanes et al. (2023) who explained that pictures, videos, sounds and illustrations have function in attracting students' attention, clarifying an idea and illustrating existing facts.

Furthermore, the results of the revised trial I will be tried out at a wider stage, namely trials to schools or phase II trials. After the first limited step of the trial, the second step was carried out on 20 students of class XI MIPA 5 at Pekanbaru State Senior High School. This step was carried out on August 22 and September 12 in 2022 offline at the Pekanbaru State High School.

Table 7. Results of response questionnaire assessment in the second step of trial

Aspect	**E-LKPD score**						**Average**	**Information**
	E-LKPD 1	**Information**	**E-LKPD 2**	**Information**	**E-LKPD 3**	**Information**		
Design	3,46	VG	3,50	VG	3,48	VG	3,59	VG
Pedagogic	3,70	VG	3,75	VG	3,65	VG	3,70	VG
Content eligibility	3,49	VG	3,62	VG	3,61	VG	3,57	VG
Average	3,55	VG	3,62	VG	3,58	VG	3,58	VG

Information = VG = Very Good

From the results above, the average value of 3.58 was obtained from 20 students. The assessment results were included in the Very Good category (SB). Judging from the average score in every component of the questionnaire, the assessment responses are also in the Very Good (SB) category. The highest score is found in the pedagogic aspect, which is 3.70 in the Very Good category (SB). The lowest score is on the content feasibility aspect with an average of 3.57 in the very good category, so it can be seen that the electronic LKPD with Flip PDF Professional on biodiversity material is of good quality and suitable for use. Based on research (Sari & Lepiyanto, 2016) on the developed LKPD, namely that the developed LKPD is appropriate to be used as a reference in the learning process in class X SMA. This is indicated by the recapitulation of data or scores given by media experts, namely 79.66%. The feasibility of the material tested by experts also shows that the material that has been developed is feasible to use, by showing a score or value of 81.22%. In addition the assessment from the team of experts, the LKPD that has been developed is good categorized to use based on the assessment given by students who have been recapitulated and show the final result of 80.3% so that this LKPD is very good to use.

It can be concluded that the electronic LKPD with Flip PDF Professional is based on a scientific approach to biodiversity with the process of observing, asking, trying, reasoning and communicating which was developed with the average score of 3.61 and an average score of 3.58 which is stated to be very good so it is feasible to use. Therefore, electronic LKPD with Flip PDF Professional based on a scientific approach to biodiversity material can be used in the biology learning process for students at SMAN.

Based on the results of the validity analysis, the first limited step of the trial (10 students) and the second step (1 class) it can be concluded that the resulting electronic worksheets with Flip PDF Professional are valid and very good. It shows that electronic worksheets with Flip PDF Professional based on a scientific approach to biodiversity material are appropriate to use so that they can help students learn independently.

CONCLUSION

The electronic LKPD with Flip PDF Professional that was developed was declared valid by the validator with the value of 3.65. The result of electronic LKPD with Flip PDF Professional was declared very good by students in first limited step with a score of 3.61 and in the second step of trial with a score of 3.58 by students in 1 class. Based on the results of the study it can be concluded that electronic student worksheets (E-LKPD) with Flip PDF Professional based on a scientific approach to biodiversity material produced valid and excellent products.

Electronic LKPD with Flip PDF Professional Based on a Scientific Approach that has been developed can be used by students and teachers as a learning resource on biodiversity material for class X SMA.

The stages of developing the implementation of the Electronic LKPD with Flip PDF Professional Based on a Scientific Approach to Biodiversity Materials need to be carried out as a refinement of the development stages that have been carried out by researchers.

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