

# Electronic Whorksheet Development Based on ESD (Education for Sustainable Development) Biodiversity Subject

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**Abstract:** The learning resources used in the learning process only use print media which is limited and does not attract student motivation in the learning process, for this reason learning media is needed that can stimulate student motivation through electronic media in the form of e-workseet. This study aims to develop education for sustainable development (ESD) based biodiversity e-whorksheets learning media products on biodiversity material for class X SMA. This type of research is development research with the ADDIE model consisting of 5 stages, namely the analysis, design, development, implementation, and evaluation stages. This research produced a development product in the form of an ESD-based biodiversity e-whorksheets which was developed based on an assessment from a class X biology teacher at Kasihan 1 Public High School. E-whorksheet was developed with the help of the liveworksheet application. The validation results from the biology teacher were obtained with a percentage of 3.55 with the category "Very Good" in the presentation aspect, the convenience aspect was 3.40 with the criteria "Very Good", the attractiveness aspect was 3.25 with the criteria "Good".

**Keywords:** Biodiversity; Education for sustainable development; E-whorkseet.

## Introduction

Learning plays an important role in achieving educational goals. In the learning process, students are directed to play an active role in building their knowledge so that learning becomes more meaningful. In the 21st century, ESD (Education for Sustainable Development) based learning or sustainable development education must be implemented in schools, especially high schools. UNESCO integrates the principles, values and practices of sustainable development into all aspects of education and learning, with the aim of addressing the social, economic, cultural and environmental problems we face in the 21st century (Listiwati, 2011). According to UNESCO, one of the key competencies for advancing sustainable development is critical thinking (Nurlailah, 2021). Education for sustainable development is a form of effort to accelerate sustainable development goals and the MDGs agenda (Leicht, et al., 2018).

ESD has a goal to prepare students' roles as citizens and educate for Sustainable Development not just

ordinary school education. The main challenges of ESD in schools include establishing a good learning arena through collaboration, developing the ability to communicate across disciplinary and sectoral boundaries, and considering individual student abilities. Meanwhile, to implement ESD properly, schools need to form a good learning organization (Kusumaningrum, 2022). Through ESD students are empowered to act as active agents of change in achieving sustainable development goals, understand the consequences of their actions on the environment and society, and develop skills and abilities in critical thinking, collaborating, and making decisions based on sustainability considerations (Purwadi & Hamdu, 2021; Vioreza, et al., 2023; Vioreza et al., 2022).

The implementation of ESD in its various developments is divided into two categories, namely implementation in the field of formal education, and the field of community. The focus of the implementation of this activity is aimed at the field of formal education. The application of ESD in this field is aimed at educational institutions to educate students and teachers regarding

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the challenges of education for sustainable development (Tjahyadi and Sembada, 2019). Implementation that contains the principles of sustainable development can be carried out by applying active student learning and process-oriented assessments (Supriatna et al., 2018).

In realizing the activeness of students in learning, a learning tool is needed that supports students to be active, one of which is through the use of electronic Student Worksheets made by the teacher. The importance of developing E-whorksheets is based on a number of problems, including that there are not many variations in the available E-LKPD for learning. The importance of developing E-LKPD is also based on technological advances and the completeness of the infrastructure owned by schools or students at this time must be supported by the latest and most innovative teaching materials that can be accessed easily via smartphones or computers. Therefore, educators can develop teaching materials that utilize technology such as electronic student worksheets.

Electronic whorkseet can help students develop their conceptual understanding when teachers are able to guide students through learning activities that maximize hands-on and minds on (Sopandi et al., 2019). Electronic LKPD can be equipped with pictures and videos on learning material so that it can attract students' attention in learning and help students understand the material being studied Winda (Amthari. et al., 2021; Widiyanti & Nisa, 2021). This electronic whorksheets function can replace ordinary printed worksheets so that teaching materials can be more interesting, in-depth and can increase student motivation and creativity (Fauziyah & Hamdu, 2022; Sari, et., 2020). This E-whorksheets can be compiled and developed according to the learning objectives to be achieved and with the creativity of each teacher. Later, students can access this E-LKPD online in the hope of better understanding the content provided by the teacher. Students are expected to learn more independently in order to meet learning objectives.

Content in effective ESD learning tools based on Pradipta's research (2021) shows that surrounding environmental phenomena can be raised in tools ESD-based learning which is completed with three ESD concepts, namely ecology, economics, and social. This is supported by Wiyoko and Aprizan (2020) that the use of the environment as learning content is an appropriate means to facilitate the transfer of knowledge in learning.

Based on interviews conducted with biology teachers at SMAN 1 Kasihan regarding biology learning innovations, it was found that teachers had not developed learning innovation products. In its application the teacher still delivers material using the power point assisted lecture method, this method of delivery is certainly not able to increase student

motivation when participating in learning. Moreover, in the current conditions, learning is still in adjustment from online to offline learning, it really needs a stimulus to develop students' abilities in learning biology. The learning model that is often used by teachers in teaching is discovery learning. Preparation for the transition from online to offline is not 100%, therefore it is necessary to make children aware and condition them so that they can adapt to direct learning. The curriculum used by the teacher in applying biology learning in class X using the independent learning curriculum. In the implementation of this curriculum, teachers admit that they have no difficulties in implementing it. Teachers in the teaching and learning process use learning resources provided by the school and the government in hardcopy form. Learning during a pandemic made practicum activities unable to be carried out because it was hampered by conditions that were less likely. Besides that, teachers have never used ESD-based electronic teaching materials, ESD content needs to be presented in a teaching material so that curriculum objectives can be achieved in improving 21st century skills and efforts to preserve natural resources through education.

The material presented in this E-whorksheets is biodiversity. The choice of this material is because the scope of this material is very broad so it is necessary to classify good material so that it can make it easier for students to learn it.

Based on the problems above, researchers have an idea to develop an ESD-based biodiversity E-whorksheets. It is hoped that the development of innovative teaching materials can increase student motivation when participating in class learning.

## Method

The development model used to develop ESD-based e-LKPD on biodiversity material is the ADDIE development model. The ADDIE development model consists of 5 stages, namely the analysis, design, development, implementation, and evaluation stages. Development research is a research method used to produce certain products and test the effectiveness of these products (Sugiyono, 2019). The observation process up to the stage of evaluating the ESD-based biodiversity E-worksheets application which was carried out on September 21-December 31 2022.

The procedure for developing learning media is to use a model. The ADDIE development model consists of 5 stages, namely the analysis, design, development, implementation, and evaluation stages. As for the stages are as follows:

*Analysis Stage*

Analysis of product development needs is an important thing to do to ensure that the product to be developed is in accordance with user needs (Rusdi, 2018). The analysis phase consists of initial analysis, needs analysis, curriculum analysis, concept analysis, and instructional analysis.

*Design Stage*

The design stage consists of determining the development team, compiling a development schedule and collecting included materials such as material descriptions, pictures, videos, questions and learning activity steps, as well as making flowcharts and storyboards as initial product designs which aim to facilitate researchers in developing biodiversity e-whorksheets based on ESD materials on biodiversity systems. This ESD-based E-whorksheets was developed with the help of a liveworksheet application. The contents of the biodiversity e-whorksheets are determined by designing a storyboard which will be used as a reference for making a whorksheets framework. This is in line with Rahman’s statement (2019) which states that storyboards are designed to present ideas in a systematic visual form in making teaching materials.

*Development Stage*

The ESD-based biodiversity e-whorksheets that has been prepared will be validated by the validator with the aim of knowing the feasibility level of the resulting product. The ESD-based E-LKPD validation that was developed was carried out by a class X biology teacher at Kasihan 1 Public High School. After being validated by the biology teacher, the product can be revised based on comments and suggestions from experts so that the product produced is in accordance with the needs of students and is attractive.

Conducted interviews with biology teachers to identify problems with biology learning innovation at SMAN 1 Kasihan. Important points raised in this interview include the use of curriculum, availability of teaching materials, student responses during learning, innovative teaching materials developed, learning resources used, learning tools used, use of technology in learning, and facilities that support learning activities.

The questionnaire was used to find out the teacher's assessment of the ESD-based biodiversity E-whorksheets. Questionnaires are prepared based on aspects of feasibility, usefulness, attractiveness, and language. Choice of answers in the questionnaire Student and teacher response questionnaires were determined using a Likert scale consisting of 4 alternative answers, namely Very Good (SB), Good (B), Enough (C), Not Good (TB).

The results of the biodiversity e-whorksheets assessment were then analyzed quantitatively using the following formula.

**Table 1.** Category Instrument Validation Level

Formula	Criteria
$Mi + 1,5 Sbi \leq X \leq Mi - 3,0 Sbi$	Very Good
$Mi + 0 Sbi \leq X \leq Mi - 1,5 Sbi$	Good
$Mi - 1,5 Sbi \leq X \leq Mi - 0,5 Sbi$	Less
$Mi - 3 Sbi \leq X \leq Mi - 1,5 Sbi$	Very Less

(Source: Sari et al., 2017)

Information:

X : Actual score

Mi : Average ideal score

Sbi : Standard deviation of the ideal score

Maximum score :  $\sum$  assessed criterion items  $\times$  highest score

Minimum score :  $\sum$  criteria items assessed  $\times$  lowest score

This research was only carried out up to the E-LKPD development stage, namely with product validation by the biology teacher, this happened because the research time was limited.

**Result and Discussion**

*Product Development Results*

The product developed in this biology learning innovation practice activity is in the form of an electronic ESD-based biodiversity worksheet which in its application uses the help of a livework sheet. The details of the results of product development that have been carried out are as follows.

The initial analysis was carried out to find out the basic problems faced in the biology learning process in class X students of SMA Negeri 1 Kasihan. Researchers collected information that occurred in the field and problems regarding the use of innovative biology learning resources in the learning process by conducting interviews with biology teachers. So that researchers can develop the right product to overcome the problems that occur in the field.

The results of the interviews that have been conducted are: (1) The school uses the independent learning curriculum in class X in its application the school and teachers encounter no problems; (2) In learning biology in class X the teacher has never developed innovation in biology learning. In its implementation the teacher only uses learning tools available and commonly used in learning; (3) Limited learning resources used; and (4) The teaching materials used are teaching materials provided by schools and the government in printed form.



*Student Analysis*

Student analysis is carried out to determine the characteristics of students including learning motivation which will later be used as a reference in developing learning resources. Based on interviews that have been conducted with biology teachers, the results show that there is no optimal use of technology that can facilitate teaching and learning activities.

*Curriculum Analysis*

Curriculum analysis is used to review the applicable curriculum and to determine the competencies to be achieved. The curriculum used at SMAN 1 Kasihan in class X uses the independent learning curriculum.

*Material Analysis*

The content presented in the biodiversity e-whorksheets is adapted to the independent learning curriculum phase E for class X on the subject of biodiversity. The questions outlined in the LKPD are accompanied by illustrated pictures and articles as a lighter for students to solve the problems given. This is consistent with the characteristics of 21st century learning in the opinion of Dayu (2022) which states that solving various types of unusual problems in conventional and innovative ways, identifying and asking important questions that clarify various points of view and produce better solutions.

*Analysis of Learning Innovation Product Development*

The content presented in the ESD-based biodiversity E-whorksheets is as follows: The title page contains the identity of the student and the title of the E-LKPD , Topic and time allocation, Learning outcomes of Phase E, Learning objectives , Instructions for using biodiversity e-whorksheets Problem orientation, Critical thinking zone, Creative zone , Environmental exploration, Student creativity zone, Science literacy zone, Kepo Room, Reflection on learning. As for some of the biodiversity e-whorksheets designs, they are presented in Figure 1.



Figure 1. Design E-LKPD based ESD

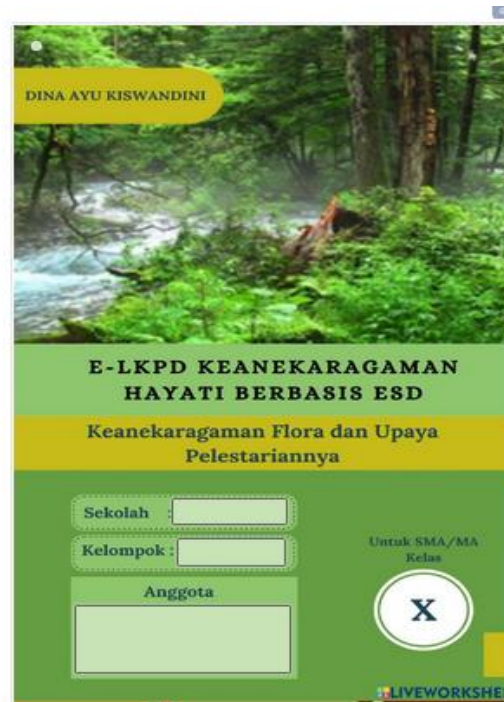


Figure 2. E-LKPD in Liveworksheet Application

*Results of the E-LKPD Assessment by Biology Teachers*

The E-whorksheets feasibility assessment was carried out by biology teachers and students at SMAN 1 Kasihan. the teacher's assessment was carried out by Mr. Suyadi. This assessment is based on 3 criteria, namely eligibility, convenience, attractiveness, presentation. The feasibility results of the biology teacher's assessment are presented in table 2 below.

Table 2. ESD-based E-LKPD Assessment Results

Aspect	Average (%)	Criteria
Presentation aspect	3.55	Very good
Aspects of convenience	3.40	Very good
Aspect of attractiveness	3.25	Good

The results of the product validation that has been carried out show that the biodiversity e-whorksheets that has been prepared meets the eligibility requirements for use in learning with the criteria of "very good" and "good".

The average score of all aspects of the assessment given by the teacher has very good categories in 2 aspects, namely the presentation aspect and the convenience aspect, but in the attractiveness aspect, the appearance/attractiveness aspect of the E-whorksheets has an application design model/style that still needs improvement so that users are more comfortable and increase the interest of students to learn it. so that it can be concluded that biodiversity e-whorksheets is suitable for use in biology learning. The media used in learning provides the benefits and absorption of the material, the more attractive the appearance, the better high student

interest in learning (Elci et al., 2021). However, there are several suggestions for improvement which are presented in table 3 below.

**Table 3.** E-LKPD Repair Results

Suggestions and Input	Follow-Up
Detailing the revised usage	Revised
Fix the typo writing	Revised
Tidy up table layout	Revised
Improve color contrast	Revised

In writing, there are several sentences with typos that need to be corrected to make it easier for students to learn them. This is in accordance with the statement that the language on the e-worksheet must be presented in accordance with PUEBI and the writing of sentences must be good and correct (Zahroh & Yuliani, 2021).

Based E-whorksheetsThe developed ESD is equipped with video links and material links presented in liveworksheet application so students can observe directly on the application. The presentation of ESD based biodiversity e-whorksheets is in accordance with the characteristics of 21st century biology learning, because take advantage of technology. Like opinion Pratiwi, et al. (2019) which states that in the 21st century, education plays an important role in ensuring students have the skills to learn and innovate, skills use information technology and media still able to work using life skills.

## Conclusion

Based on the research that has been done it can be concluded that: (1) E-whorksheets is prepared based on the results of student needs analysis, curriculum analysis, material analysis; (2) The e-whorksheets was developed using the liveworksheet application; (3) The results of the biology teacher's assessment of ESD-based diversity e-whorksheets got the "Good and Very Good" category.

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## Author Contributions

The main author, Dina Ayu Kiswandini, contributed to designing the research, conducting the research, and writing research articles. The second author, Slamet Suyanto, played a role in guiding the implementation of the research and writing article. The third author, Anggi Tias Pratama, played a role in guiding the implementation of the research. The four author, Sugma Rizki Tri Utami Yustisiana, played a role in assisting the implementation of the research.

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## Conflicts of Interest

The authors declare no conflict of interest.

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