Development of Student Worksheets (LKPD) on Ecology and Biodiversity by Using Trigger Questions to Increase Motivation and Learning Outcomes of Junior High School Students in Grade VII

Lini Raudlotul Hikmiyah[1], Khusaini[2]*

[1]Department of Science Education, Faculty of Mathematics and Science Education, Universitas Negeri Malang, Malang, Indonesia,
[2]Department of Physics, Faculty of Mathematics and Science Education, Universitas Negeri Malang, Malang, Indonesia,

*Corresponding author: khusaini.fmipa@um.ac.id

ABSTRACT The study aims to develop teaching materials in the form of LKPD on ecology and biodiversity by using valid and practical trigger questions and to determine their effectiveness in increasing student motivation and learning outcomes. This research is a development research that uses the ADDIE development model which consists of five stages, namely: Analyze, Design, Develop, Implement, and Evaluate. The subjects were one of the science teachers and 31 students of class VII B SMPN 7 Malang. The instruments were expert validation sheets, educator response questionnaires, student response questionnaires, learning motivation questionnaires, and pre-test post-test questions. The results of the development research in the form of teaching materials for ecology and biodiversity LKPD using lighter questions that have been validated by validators. The validation results get an assessment in the very valid category with a score of 100% media experts and 85.88% material experts. While the practicality results get a very practical score with a score of 81% educator response and 81.69% student response. The results of the improvement assessment obtained the N-gain value of the motivation questionnaire of 0.18, which is an increase in the low category. As for student learning outcomes, the N-gain value is 0.61, which is an increase in the medium category. Therefore, the developed LKPD can be said to be effective in increasing student motivation and student learning outcomes.

Keywords LKPD, Ecology, Biodiversity, Triggering questions, Learning motivation, Learning outcomes

1. INTRODUCTION

The education process always develops along with the process of the times. During the Industrial Revolution 4.0, more precisely, education in the 21st century experienced many changes, one of the changes was student-centered learning. However, in practice, currently the learning approach tends to remain teacher-centered (Suryaningsih & Nurlita, 2021). This condition can cause boredom for students and make their low involvement and lack of motivation to learn, making it difficult for them to digest the material presented. In science learning, providing facts about material or ideas is not enough. However, students must also understand the stages of scientific phenomena through direct observation of an event through demonstration and investigation activities, as well as writing down the data obtained from observations, so that students are expected to be skilled in understanding the material (Norrizqa, 2021).

In connection with this, in science learning, there is material that is important to learn, especially Biology, because in the delivery of learning, Biology material is associated with real experience.+p This is done with the aim of helping students analyze phenomena and find solutions to problems that arise around them, especially problems about the environment. One of the science materials related to Biology is Ecology and Biodiversity. This material explores the relationship between living things and their environment, as well as the diversity of living things in Indonesia. This material is important to learn because this material is very relevant to events that arise in the surrounding environment, so students are expected to be able to understand it and apply it to

protecting the environment (Maulida, Supriyati, & Dewi, 2023).

In learning Ecology and Biodiversity, a teaching material is needed to support learning. However, the results of research by Puti & Jumadi (2015), revealed that the development of students' skills is less effective if only using school books for learning (Wiguna, 2016). Therefore, teaching materials are needed as a facility where teachers and students can learn. Teaching materials are one of the media that can support a variety of learning experiences as well as motivate students to learn more effectively (Ni, Anak, & Sujana, 2022). Therefore, it is necessary to develop teaching materials to achieve the expected learning objectives (Asnaini, Adlim, & Mahidin, 2016). One of the teaching materials that can support students in learning is student worksheets (LKPD). According to Afkar & Hartono (2017), LKPD as a learning resource can be utilized by teachers to encourage students to actively participate and reduce students' difficulty understanding a concept (Rahmawati & Wulandari, 2020).

Student worksheets are teaching materials in the form of a collection of sheets in which activities, tasks, and questions that need to be solved by students (Farid & Sudarma, 2022). LKPD is a learning media consisting of a collection of brief materials and tasks centered on one subject. LKPD can be combined with other learning media (Kristyowati, 2018). In Deri (2015), the use of LKPD in the learning process can provide benefits such as simplifying learning and shifting the focus from teachers to students. LKPD can also help students develop concepts through activities that are done during learning. Another benefit of LKPD is that it can increase the efficiency of process skills, scientific attitudes, and motivation of students to learn (Kristyowati, 2018).

Previous studies have shown that many LKPDs were created as learning materials for school students. However, LKPD increasing junior high school students learning motivation has not been widely developed (Novferma, Syafmen, & Wati, 2021). In addition, LKPDs that are available and have been circulating are considered less suitable for use in learning. This is due to the lack of interesting presentations in the LKPD, which only contain explanations of material and practice questions. The LKPD is also not equipped with instructions to assist students in learning activities. To solve the problem, it is necessary to vary the application of various learning models (Wijiati, 2019). Wijiati's research (2019) stated that among the learning models that are suitable for application is Problem-Based Learning (PBL). PBL is a learning model in which new concepts are discovered through problems in a lesson. Learners who use this learning technique are required to solve problems themselves and find answers to understand a concept from the learning material. Learning using this model is considered to foster student motivation because it requires students to participate in learning so that

student motivation will be built (Zaraturrahmi, Adlim, & Zulkarnaen, 2016).

Before learning using the PBL model, a stimulus is needed to stimulate students' curiosity. Stimulus is also needed so that learners actively convey their thoughts about something. One example of a stimulus that can be given is a sparking question, which is an initial question used to attract learners' attention so that they enter the topic to be studied (Pandu, Purnamasari, & Nuvitalia, 2023). Sparking questions also include one of the components of the independent curriculum. Learners are expected to convey their ideas in the form of questions or statements through sparking questions. Trigger questions are given as a strategy used by teachers to start discussions and increase learners' interest in the topic to be studied (Nurhidayati, 2022; Susanti & Darmansyah, 2023). Therefore, teachers must be adept at designing triggering questions that lead to meaningful learning (Pramesti, Sidik, Suryanti, Sari, & Yunaini, 2023).

According to Winarti & Kurniastuti (2023), sparking questions are intended to foster curiosity and desire to learn, as well as attract students' attention to the concepts that will be discussed in learning (Susanti & Darmansyah, 2023). Motivation and learning are two parts that influence each other (Surur, Wahyudi, & Mahendra, 2020). The desire students have to learn is the basic definition of learning motivation (Zaeriyah, 2022). According to Palittin, Wolo, & Purwanty (2019) Motivation is the main factor in stimulating the desire to learn and achieve the desired results, as well as providing a sense of enthusiasm and excitement in teaching and learning activities. This is because motivation is a component that contributes to effective learning, so it is included in the principles of learning and learning (Wibowo & Abdi, 2019).

According to Keller in Jusar (2017), there is an ARCS model that is based on the principle of motivation. ARCS stands for Attention, Relevance, Confidence, and Satisfaction. In learning, attention is crucial, as stimulating curiosity helps students focus and engage with the material being taught. Relevance ensures that learning is meaningful, when students see the connection between what they learn and its practical application in life, their motivation increases. Confidence plays a vital role, as a supportive environment that encourages students to express their thoughts and try new things fosters optimism and a stronger desire to learn. Finally, satisfaction is achieved when students reach their goals, creating a sense of fulfillment influenced by both internal and external rewards. These factors work together to enhance students' motivation and learning outcomes (Jusar & Sari, 2017; Wijiati, 2019).

Learning motivation is an internal and external support between motivation and learning outcomes. Motivation is very important in learning. Learners who are highly motivated to learn usually have high learning outcomes.

Similarly, learners who are not motivated to learn will usually have low learning outcomes. Learning motivation acts as a basis for achieving the maximum possible learning outcomes, and is then used to assess the achievement of the desired competencies (Rahman, 2021). Teachers play an important role in overcoming low student learning motivation, teachers must be able to stimulate students' learning enthusiasm to be active in learning. High learning motivation can be seen from students' behavior and contribution in the learning process. Students who have a feeling of joy and enthusiasm will participate when participating in teaching and learning activities and get satisfactory achievements (Tanjung & Louise, 2024).

According to Bakar (2014), in the world of education, motivation can affect student success in learning. Success will be achieved if students have the will and drive to always learn, so learning can take place more effectively if students have learning motivation. Motivation can improve learning outcomes because students are able to achieve their goals so that they can improve student performance (Tanjung & Louise, 2024). Learning outcomes are learner skills that refer to what students get after learning. Learning outcomes will be obtained when students actively participate and play an important role in learning. The learning outcomes examined in this research are the results of cognitive achievement assessed by tests, namely pre and post-learning, which leads to cognitive domain abilities through indicators of knowledge (C1), understanding (C2), application (C3), and analysis (C4) (Surani, 2018).

Based on a brief interview with a science teacher at SMPN 7 Malang, it was found that the issue of low motivation and science learning outcomes at the school was caused by students' lack of curiosity about the material being taught. Curiosity is one of the key factors in the learning process, as it encourages students to actively ask questions, seek information, and participate in learning activities. When this curiosity is low, students tend to become passive, merely receiving information without enthusiasm and lacking engagement in exploring the material. As a result, the learning process becomes less optimal, and students' understanding of the material is limited. This condition directly impacts students' low learning outcomes, both individually and collectively, as minimal motivation and involvement affect the achievement of expected competencies. This highlights the need for efforts to increase learning motivation, such as using more engaging teaching methods, providing relevant challenges, or adopting teaching strategies that can stimulate students' curiosity. Another cause is that only school textbooks are used for learning. Likewise, with the use of LKPD, the science teacher explained that the LKPD used in learning was taken from the package book without additional innovations. This underlies the reduced activeness of students and makes them tend to feel bored in undergoing learning, causing low learning outcomes.

Based on the background mentioned, therefore researchers want to develop science teaching materials in the form of LKPD on Ecology and Biodiversity material. LKPD implements Problem Based Learning model learning equipped with trigger questions to stimulate curiosity and convey ideas in science learning, so that students can be actively involved and easily capture the explanation of the topics studied. The purpose of this study was to develop teaching materials in the form of LKPD on ecology and biodiversity using valid and practical lighter questions and to determine their effectiveness in increasing student motivation and learning outcomes.

2. METHOD

The research method used is Research and Development (R & D) with the ADDIE model. ADDIE is a product development concept. This model was chosen because the stages are systematic, simple, and easy to learn. In addition, several previous studies have also used the ADDIE model in conducting product development. One of them is the development of student worksheets. Product development using the ADDIE model is considered effective because it is a stage that serves as a guiding framework in complex situations. Therefore, this model is
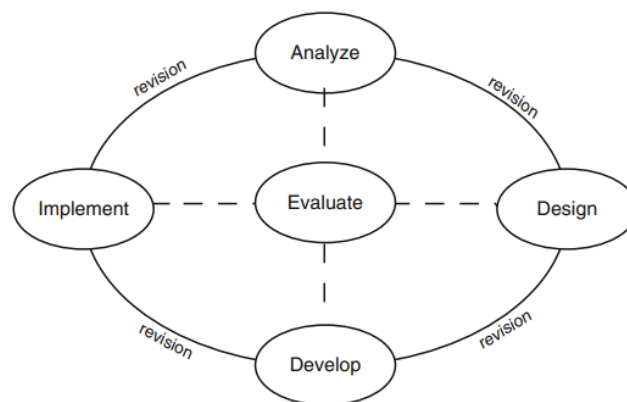

Figure 1 Steps of the ADDIE Model (Branch, 2009)

suitable for producing educational products and other learning devices (Branch, 2009). In the ADDIE model, there are also revisions at each stage, so as to minimize errors in the final stage.

In the ADDIE model there are five steps namely: Analyze, Design, Develop, Implement, and Evaluate. The ADDIE model is carried out until the evaluation stage. The following is a description of the five stages (Batubara, 2020).

Analyze

At this stage, a needs analysis is carried out to identify the needs of the problems experienced by the research subjects. At this stage, a literature review was conducted from various references with the aim of knowing the problems and learning needs of students in the form of teaching materials to support the learning process. In addition, science teachers will be interviewed to find out

the results of initial observations, characteristics of students, and the need for teaching materials to support the learning process. Furthermore, this analysis will be used as a reference in designing LKPD to assist learning activities. The questions given in the interview amounted to six open questions including student learning motivation, student learning outcomes, media and teaching materials used in learning, learning models used, learning using LKPD, and LKPD criteria needed.

Design.

In the design stage, LKPD product planning is carried out which will be utilized in learning by seventh grade students. Design will be adjusted to the conditions found at the analyze stage. The design carried out is to choose the design format and writing format that will be used based on the results of the needs analysis that has been carried out. In making LKPD, the Canva application is used to design the cover and layout, while the Microsoft Word application is used to write the contents of the LKPD.

Develop

At the development stage, the activities of making products from the plan format that has been made at the design stage are carried out. Then, the framework that has been prepared previously is converted into a product that is ready to be applied. LKPD Ecology and Biodiversity in accordance with learning outcomes and learning objectives are produced in this stage. Products that have been designed are then validated by a team of validators, namely lecturers from the Department of Science Education, State University of Malang.

Implement

At the implementation stage, LKPDs that have been validated are implemented in classroom learning. Before implementing the Ecology and Biodiversity LKPD, students are given a motivation questionnaire and pre-test questions. After being given a questionnaire and pre-test questions, the LKPD will be implemented in teaching and learning activities in the classroom. Furthermore, a motivation questionnaire and post-test questions were given after the implementation of the Ecology and Biodiversity LKPD to identify differences and improvements in student motivation and learning outcomes.

Evaluate

In this stage, the various investigation data obtained are evaluated. In each stage of the development process, the product will be evaluated in accordance with the stages of the ADDIE model which includes revisions to improve the developed product. This is done to identify the advantages and disadvantages of the developed LKPD. At each stage of the development process, the product will be evaluated in accordance with the stages of the ADDIE model which includes revisions to improve the resulting product.

The research design used is One-Group Pre-Test-Post-test Design with the aim of knowing how the use of

ecology and biodiversity LKPD impacts through measuring the comparison of pre-test and post-test assessments. In the investigation, two tests were carried out, namely before the experiment (pre-test) and after the experiment (post-test) (Hamsir, 2017). The research location was at SMPN 7 Malang. One science teacher and 31 students of class VII B were the subjects of this study. The instruments in this research are validation sheets, educator and student response questionnaires, learning motivation questionnaires, along with pre-test post-test questions. The questions tested amounted to 10 items, while the motivation questionnaire given contained 22 statements made based on the ARCS model. This research involves qualitative and quantitative data. Comments and suggestions from validators and teachers regarding LKPD are qualitative data. Meanwhile, the results of the validation test, teacher and student response tests, motivation questionnaire results, and pre-test and post-test results are quantitative data. Quantitative data is processed by utilizing percentage analysis techniques. The validity test, teacher and learner response test, and motivation questionnaire were assessed using an assessment questionnaire that refers to the Likert Scale. The assessment results that have been obtained from the validation test can be calculated and converted into a percentage using the following formula.

Table 1 Criteria for validity

No	Achievement Level (%)	Criteria for Validity
1	0% < P ≤ 20%	Invalid
2	20% < P ≤ 40%	Less Valid
3	40% < P ≤ 60%	Moderately Valid
4	60% < P ≤ 80%	Valid
5	80% < P ≤ 100%	Very Valid

Source: (Novferma et al., 2021)

$$\%P = \frac{number\ of\ scores\ obtained}{maximum\ number\ of\ scores} \times 100\%$$

After the calculation, the results of the validation percentage of the experts' assessment are adjusted to the validity interpretation criteria listed in Table 1.

Table 2 Criteria for practicality

No	Achievement Level (%)	Criteria for Practicality
1	81% - 100,0%	Very Practical
2	61% - 80%	Practical
3	41% - 60%	Practical Enough
4	21% - 40%	Less Practical
5	0% - 20%	Unpractical

Source: (Novferma et al., 2021)

To see the practicality of the LKPD product, the results of the educator and learner response questionnaires were analyzed through a percent calculation form using the practicality interpretation provisions listed in Table 2.

For testing techniques for pre-test and post-test questions include validity tests and item reliability tests. The questions tested amounted to 10 items. The validity test of the questions was carried out using SPSS version 26

software by looking at the resulting output, so it was considered more efficient. While the reliability test is used to obtain information on whether the results of the items on the same subject will be consistent, even though the measurement is carried out at different times and by different individuals, not affected by circumstances, situations, and conditions. This reliability test is carried out on valid questions using SPSS version 26 software by selecting the split-half model because of the objective question type.

For the motivation questionnaire testing technique and the pre-test and post-test results are explained in the following details. The normality test is conducted to determine if the data follows a normal distribution, using either the Kolmogorov-Smirnov test for data with 50 or more samples, or the Shapiro-Wilk test for fewer than 50 samples. If the p-value is greater than or equal to 0.05, the data is considered normal. The paired sample t-test is used to compare the means of two related samples, assuming normal distribution, with Ho accepted when the p-value is greater than equal to 0.05. The normalized gain test is used to assess the improvement in learning outcomes by calculating the difference between pre and post test scores, with the results categorized based on Hake's N-gain formula.

$$< g > = \frac{\% < posttest > - \% < pretest >}{100 - \% < pretest >}$$

Table 3 Interpretation of modified normalized gain

Normalized Gain Value	Interpretation
$-1,00 \leq g < 0,00$	Decreased
$g = 0,00$	Fixed
$0,00 < g < 0,30$	Low
$0,30 \leq g < 0,70$	Moderate
$0,70 \leq g \leq 1,00$	High

The level of acquisition of the N-gain calculation can be identified in line with the N-gain category according to Hake (1999), and has been modified by Sundayana (2018), which is listed in Table 3.

3. RESULT AND DISCUSSION

Development research is used in an effort to develop a teaching material product LKPD ecology and biodiversity material and test its feasibility and effectiveness in increasing student motivation and learning outcomes. The series of LKPD development adopted the ADDIE model which has five stages that are done sequentially.

3.1 Details of the Stages of Developing Student Worksheets

Analyze Stage

The first stage in this research is analyze. Analysis is carried out to investigate the needs through the problems faced by the research subjects. In this stage, a literature review was conducted from various sources and interviews with science teachers with the aim of knowing the problems and learning needs of students in the form of teaching materials to support learning activities. The results of the analysis indicate that there is still a lack of motivation and low student learning achievement in science subjects. This situation can be seen through students who are still passive in learning because of the low curiosity of students, causing the material taught to be less understood by students, and able to affect student learning outcomes that are less than satisfactory. Another cause is that the focus of learning is still on school textbooks. Likewise, with the use of LKPD, the science teacher explained that the LKPD used in learning was taken from the package book without additional innovations. This underlies the lack of activeness of students and makes them more easily feel bored in carrying out learning as a result of the low learning outcomes obtained. The results are commensurate with the study conducted by Khaira et al., (2020), who pointed out that so far teachers and students only use science textbooks which mostly contain writing, making students less interested. According to Lubis (2018), teaching materials that focus on textbooks make students feel bored in learning. This factor causes students to lack interest in reading and studying textbooks. Based on this analysis, data evaluation indicates that the level of student motivation and learning outcomes is still low. To overcome this, researchers developed teaching materials in the form of LKPD on ecology and biodiversity material equipped with lighter questions in each sub-material.

Design Stage

The second stage is design. What was done at the design stage was to plan the contents of the LKPD to be practiced in learning by seventh grade students. Making LKPD is supported by the use of Canva application for cover design and layout and Microsoft Word application for writing the contents of LKPD. The contents of the LKPD are the cover, preface, table of contents, instructions for use, learner identity, learning outcomes, learning objectives, worksheets for three subchapters of ecology and biodiversity material equipped with triggering questions at the beginning of learning, reflection sheets, and bibliography. Evaluation at this stage was carried out by revising parts of the LKPD design that were less appropriate and less relevant to the topic based on input from lecturers (Figure 2).

Figure 2 Design front and back cover of the LKPD

Figure 3 Trigger questions at the beginning of each sub-material

Development Stage

The third stage is development. At this stage, the design framework made in the design stage is developed into a product that is ready to be used during the implement stage. The specifications of the product made, namely LKPD, consist of three sub-materials accompanied by lighter questions at the beginning of each sub-material. Usually, lighter questions only appear in teaching modules for teachers. However, in this LKPD, lighter questions are added so that they can attract students' attention to learn the material. Lighter questions are used in the LKPD to increase motivation and stimulate student curiosity. A sparking question is an initial question used to attract attention and direct learners into the topic to be learned (Pandu, Purnamasari, & Nuvitalia, 2023). Sparking questions are also one of the components of the Merdeka curriculum. Lighter questions are given as a strategy that teachers use to start discussions and stimulate students' interest in the topics that need to be learned (Nurhidayati, 2022; Susanti & Darmansyah, 2023).

In addition to use triggering questions (Figure 3), the developed LKPD also applies the syntax of the Problem Based Learning model because it is considered to encourage a sense of interest, and requires students to actively participate in solving problems by finding answers to understand a concept of learning material, so as to build student motivation (Zaraturrahmi, Adlim, & Zulkarnaen, 2016). There are five PBL syntaxes applied in this LKPD, namely orienting students to the problem, organizing students to learn, guiding individual and group investigations, developing and presenting results, and analyzing and evaluating the problem-solving process. The developed LKPD is also equipped with articles and videos of problems related to concrete events experienced in life, so that students are expected to find solutions to the problems given and apply the solutions designed in life to preserve their environment. There are three problems included in the ecology and biodiversity LKPD, namely the problem of the exploding caterpillar population caused by

ecosystem imbalance, plastic waste that damages the marine ecosystem, and endemic Indonesian animals that are threatened with extinction. Articles and videos included in the LKPD are accompanied by links and barcodes for easy access to the intended website source. The LKPD is also equipped with pictures of phenomena that occur as well as images of flora and fauna so that students can
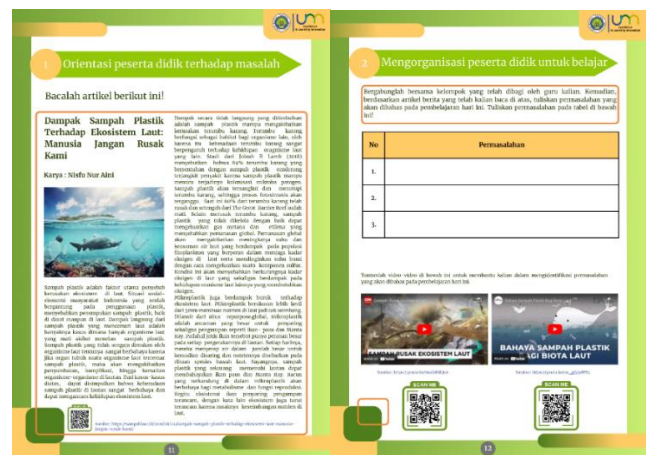

Figure 4 Problem Articles and Videos on LKPD

recognize the biodiversity of Indonesia's endemic animals and plants (Figure 4).

At this stage, in addition to developing LKPD, teaching modules, pre-test post-test questions, motivation questionnaires before and after learning, educator and learner response questionnaires and validation sheets are also carried out. Then the LKPD and its devices that have been completed, will be validated by a team of validators, namely expert lecturers. The validation carried out intends to assess the feasibility and validity of the teaching materials that have been made. The following shows the results of the percentage analysis of product validation in Table 4.

The results of the validator's assessment get a very valid level of achievement for LKPD and pre-test post-test questions, and valid achievement for teaching modules. Evaluation at this stage is carried out after the validation

Table 3 Data analysis of validation test results

Category	Score Obtained	Percentage	Criteria of Validity
LKPD Media Expert	65	100%	Very Valid
LKPD Material Expert	73	85,88%	Very Valid
Teaching Module	40	80%	Valid
Pretest Posttest	550	100%	Very Valid

process, namely in the form of improvements to the LKPD and teaching modules that have been made based on feedback from validators. In the improvement of the products prepared, there is one thing that needs to be improved, namely the objectives of meeting three need to be linked to the curriculum and adapted to learning activities.

After validation, the LKPD is assessed for its practicality to be used in learning. To assess the practicality of LKPD products, the percentage of the results of the response scores of educators and students is used. Educator and learner response questionnaires are given after the learning activities apply the LKPD that has been prepared. Table 5 shows the percentage results of educator and learner responses.

Table 4 Practicality analysis results

Category	Score Obtained	Percentage	Criteria of Practicality
Educator Response	69	81%	Very Practical
Student's Response	1646	81,69%	Very Practical

The processing results of the educator response questionnaire get a percentage value of 81% which is classified as very practical criteria. While in the learner response questionnaire obtained a percentage of 81.69% with very practical criteria.

From the validation results of media experts and material experts, it was found that the LKPD was very feasible to use according to the percentage results of the validator's assessment. While the results of the response questionnaire of educators and students found that the LKPD is very practical to be implemented in the context of learning.

For pre-test and post-test questions, after being validated through validators, the questions were tested on VIII grade students before being implemented into learning with the aim of seeing the validity and reliability of the items that had been prepared. Then the results of the trial questions were tested for validity and reliability by utilizing SPSS software version 26. After the test was completed, it was found that there was one constant question and nine valid items. The number of pre-test and post-test questions is 10 items that lead to the ability of the

cognitive domain. In the trial of this question there were 51 respondents, namely class VIII students of SMPN 7 Malang. After conducting a validity test, the items will be tested for reliability. The reliability test on this item was carried out with the help of SPSS using a split half model because the type of question was objective. Based on the test results, the reliability value of the items using the Spearman-Brown formula is 0.666, so it can be concluded that the reliability level of the questions is included in the high category.

Implementation Stage

The fourth stage in this study is implement. At this stage, the LKPD that has been validated is implemented in classroom learning. Implementation was carried out during science learning for students in class VII B SMPN 7 Malang by applying the One-Group Pre-Test-Post-test Design research design. The choice of design is due to its ability to compare pre- and post-treatment conditions, so that the treatment results are considered more accurate (Sugiyono, 2013). Learning was conducted with four meetings in line with the teaching module that had been made. At the beginning of learning, students were given a motivation questionnaire and pre-test questions and after implementing the LKPD in learning, students were given a motivation questionnaire and post-test questions to see the increase in motivation and student learning outcomes.

To process the results of the student learning motivation questionnaire, the normality test, t-test to see the difference and N-gain test to determine the increase in student motivation before and after learning. The motivation questionnaire given amounted to 22 statements, which were made by referring to the ARCS model, namely attention, relevance, confidence, and satisfaction. The

Table 5 Description of motivation questionnaire according to ARCS indicators

Indicator	Description
Attention	a. Students' interest in the subject matter presented by the teacher
	b. High curiosity or curiosity of students towards further science material
Relevance	a. The relationship of the material with everyday life
	b. Correlation of the material explained with science problems
Confidence	a. Dare to express opinions
	b. Confidence in understanding science lessons
	c. Dare to solve problems in science problems
	d. Confidence in doing assignments and exams
Satisfaction	atisfaction in doing science questions or ssignments
	atisfaction in doing science tests
	atisfaction in understanding IPA material

motivation questionnaire is described in accordance with the ARCS model indicators in Table 6.

From the description of the motivation questionnaire in Table 6, it will be arranged in more detail into 22 statements given to students. After obtaining the results of the motivation questionnaire, the next step is to process the data obtained using statistical tests. The first stage before the calculation of N-gain, the normality test and t test were carried out to process the motivation questionnaire. For the normality test results obtained $p_{value} = 0,751(p \geq 0,05)$ for motivation questionnaire before learning and $p_{value} = 0,773(p \geq 0,05)$ for motivation questionnaire after learning, so it is found that the data is normally distributed. As for the t test, the results obtained $p_{value} = 0,001(p \leq 0,05)$, then Ho is rejected. This means that there is a significant difference in learning motivation between before and after learning using the Ecology and Biodiversity LKPD. Furthermore, the calculation of the N-gain value of each aspect of the motivation questionnaire is written in Table 7.

Table 6 The results of the calculation of student motivation questionnaire

Aspect	N-gain Value	Category
Attention	0,23	Low
Relevance	-0,01	Decreased
Confidence	0,23	Low
Satisfaction	0,25	Low

Based on Table 7, the results of the motivation questionnaire test for each aspect, namely attention, confidence, and satisfaction, have increased with a low category. While the relevance aspect has decreased. The N-gain value of all aspects of motivation is obtained from the average value of the four aspects and gets a value of 0.18, which is an increase that is included in the low improvement category.

The results of the motivation questionnaire given found that all aspects of motivation increased with a low category except for the relevance aspect which decreased. This is because students feel less concerned with the connection between science and concrete situations in life. In addition, the time of science learning which is carried out during the month of Ramadan and at the end of class hours also triggers some students not to participate well in participating in learning activities because they feel tired so that students feel they do not understand the concepts that have been taught in learning. This is similar to research conducted by Wijiati (2019), who found that aspects of suitability and satisfaction decreased. The decline in motivation was due to students' rejection of learning activities at that time. This is because learning activities are carried out outside of class time, making students feel tired and want to go home quickly.

Overall, the N-gain value of learner motivation based on the analysis is 0.18 which shows a low improvement category. According to the N-gain representation table

from Sundayana (2018), which writes that the N-gain value which is between $0.00 < g < 0.30$, is classified in the low category. Based on the N-gain analysis, it can be concluded that learning motivation increased after learning using the ecology and biodiversity LKPD. These results are in accordance with a study conducted by Wijiati (2019) where it was found that the standard gain value achieved from the calculation was 0.016 which shows a low category. Based on this analysis, it was found that there was an increase in student learning motivation after applying PBL-based LKPD learning assisted by concept maps.

Furthermore, in order to process the pre-test and post-test results, there are several stages, namely the normality test, Wilcoxon, and N-gain. The stages of analysis are written below:

Normality Test

The normality test is used in determining the normality of the data distribution, in order to determine further statistical testing. The Shapiro-Wilk normality test results show that the pre-test and post-test data are not normally distributed because the $p_{value} = 0,000(p \leq 0,05)$.

Wilcoxon Test

This test was chosen because getting pre-test and post-test data is not normally distributed, therefore the Wilcoxon test must be used. The following is the hypothesis formulation for this test:

Ho: There is no significant difference in learning outcomes between before and after learning using the Ecology and Biodiversity LKPD.

Ha: There is a significant difference in learning outcomes between before and after learning using the Ecology and Biodiversity LKPD.

From the Wilcoxon test that has been carried out, the results obtained $p_{value} = 0,000(p \leq 0,05)$ then Ho is rejected. This means that there is a significant difference in learning outcomes between before and after learning using the Ecology and Biodiversity LKPD.

N-gain Test

N-gain test is needed to identify the improvement of learning outcomes before and after teaching by applying LKPD. The results of the N-gain test analysis are written in Table 8.

Table 7 Pretest and posttest result

Learning Outcome Score						
Tes	Min	Max	Average	SD	N-gain Value	Category
Pretest	40	90	71,00	19,182	0,61	Moderate
Posttest	90	100	88,67	13,322		

Table 8 displays the output of the increase in scores from the pre-test and post-test. This is evident through the increase in the average score as well as the acquisition of N-gain of 0.61 which indicates that student learning outcomes have increased in the moderate category.

The increase in student learning outcomes is obtained through the results of pre-test and post-test measurements. From the measurements taken, it was found that the pre-test and post-test scores had increased both from the average score and the results of the N-gain analysis. From the N-gain calculation, a score of 0.61 was obtained with a moderate improvement category. The score is in line with the N-gain representation table from Sundayana (2018), which writes that the N-gain value which is between $0.30 \leq g < 0.70$, is classified as a moderate category. Based on the results of the analysis, it can be said that after learning using LKPD ecology and biodiversity there is an increase in student learning outcomes.

Evaluation Stage

The fifth stage of this research is evaluation. The evaluation stage is carried out at each stage of development by making improvements. In the final stage, the product was improved by adding a reflection sheet according to the comments given by the science teacher. After developing the LKPD in accordance with the stages of the ADDIE model, the results showed that the LKPD was very feasible and practical to use in learning. In addition, there is a significant difference between motivation and learning outcomes before and after learning and an increase in student learning motivation in the low category and student learning outcomes in the moderate category. So the LKPD developed can be said to be effective for increasing student motivation and learning outcomes.

4. CONCLUSION

Based on the development research that has been carried out, a teaching material in the form of LKPD on ecology and biodiversity material is obtained which is equipped with lighter questions at the beginning of each sub-material. The developed LKPD is declared very valid and practical to be applied in learning, according to the results of the assessment conducted by media expert validators and material experts, science teachers, and from student responses. The results of the study found that based on the N-gain calculation, student learning motivation increased with a low category. While student learning outcomes have increased with a moderate category. Based on the results of the t test for the motivation questionnaire and the Wilcoxon test for student learning outcomes, it was found that there were significant differences before and after learning, so the effectiveness of the developed LKPD was considered effective in increasing student motivation and student learning outcomes.

REFERENCES

Afkar, F. I., & Hartono, R. (2017). Pengembangan Lembar Kegiatan Peserta Didik dengan Model Pengembangan 4-D pada Materi Mitigasi Bencana dan Adaptasi Bencana Kelas X SMA [Development of Student Activity Sheets with the 4-D Development Model on Disaster Mitigation and Disaster Adaptation Material for Grade X High School]. *Jurnal Pendidikan Geografi*, *22*(2), 135–147. https://doi.org/10.17977/um017v22i22017p135

Asnaini, Adlim, & Mahidin. (2016). Pengembangan LKPD Berbasis Pendekatan Scientific untuk Meningkatkan Hasli Belajar dan Aktivitas Peserta Didik pada Materi Larutan Penyangga [Development of LKPD Based on Scientific Approach to Improve Learning Outcomes and Student Activities on Buffer Solution Material]. *Jurnal Unsyiah*, *04*(01), 208–219.

Bakar, R. (2014). The Effect of Learning Motivation on Student?s Productive Competencies in Vocational High School, West Sumatra. *International Journal of Asian Social Science*, *4*(6 SE-Articles), 722–732. Retrieved from https://archive.aessweb.com/index.php/5007/article/view/2672

Batubara, H. H. (2020). Model Penelitian dan Pengembangan Media Pembelajaran [Learning Media Research and Development Model]. In *Media Pembelajaran Efektif*. Semarang: Fatawa Publishing.

Branch, R. M. (2009). *Instructional Design: The ADDIE Approach*. Springer US. Retrieved from https://books.google.co.id/books?id=mHSwJPE099EC

Deri, O. D. (2015). *Pengembangan Lembar Kerja Siswa Pembelajaran Learning Cycle 5E Materi Pengelolaan Lingkungan Di SMP N 11 Semarang [Development of Student Worksheets for Learning Cycle 5E Environmental Management Material at SMP N 11 Semarang]*. Universitas Negeri Semarang.

Farid, A., & Sudarma, K. (2022). Meningkatkan Minat dan Hasil Belajar Kelompok Melalui LKPD Berbasis Cooperative Learning Tipe Two Stay Two Stray [Improving Group Learning Interest and Results Through LKPD Based on Cooperative Learning Type Two Stay Two Stray]. *Jurnal Edutech Undiksha*, *10*(1), 126–134. Retrieved from https://doi.org/10.23887/jeu.v10i1.42138

Hake, R. R. (1999). Analyzing Change/Gain Scores. *Dept. of Physics Indiana University. Unpublished.[Online] URL: Http://Www. Physics. Indiana. Edu/~ Sdi/AnalyzingChange-Gain. Pdf*.

Hake, R. R. (2002). Relationship of individual student normalized learning gains in mechanics with gender, high-school physics, and pretest scores on Mathematics and Spatial Visualization. *Physics Education Research Conference*, *8*(August 2002), 1–14. Retrieved from https://scholar.google.com/citations?view_op=view_citation&hl=en&user=10EI2q8AAAAJ&citation_for_view=10EI2q8AAAAJ:IjCSPb-OGe4C

Hamsir. (2017). Penerapan Metode Eksperimen Terhadap Hasil Belajar Fisika Peserta Didik SMA Negeri 1 Turatea Kabupaten Jeneponto [Application of Experimental Methods to Physics Learning Outcomes of Students of SMA Negeri 1 Turatea, Jeneponto Regency]. *Jurnal Penelitian Dan Penalaran*, *4*(1), 732–741.

Jusar, I. R., & Sari, S. G. (2017). Pengaruh Motivasi Belajar Dan Minat Belajar Mahasiswa Berdasarkan Latar Belakang Sekolah Terhadap Hasil Belajar Mata Kuliah Konsep Matematika II Mahasiswa PGSD Universitas Bung Hatta [The Influence of Student Learning Motivation and Learning Interest Based on School Background on Learning Outcomes of the Mathematics Concept II Course of Elementary School Teacher Education Students at Bung Hatta University]. *PAKAR Pendidikan*, *15*(2), 28–34. https://doi.org/10.24036/pakar.v15i2.60

Khaira, N., Yusrizal, Y., Gani, A., Syukri, M., Elisa, E., & Evendi, E. (2020). Development of Student Worksheets Based on Comics to Improve Students' Motivation and Learning Outcomes on Material

Vibration, Waves and Sound. *Jurnal Penelitian Pendidikan IPA*, *6*(2), 143. https://doi.org/10.29303/jppipa.v6i2.424

Kristyowati, R. (2018). Lembar Kerja Peserta Didik (LKPD) IPA Sekolah Dasar Berorientasi Lingkungan [Elementary School Science Student Worksheets (LKPD) Environmentally Oriented]. *Prosiding Seminar Dan Diskusi Nasional Pendidikan Dasar 2018*, *0*(0), 282–287. Retrieved from http://journal.unj.ac.id/unj/index.php/psdpd/article/view/10150

Lubis, M. A. (2018). The Development of Teaching Comics to Improve Interest in Reading Civic Education in MIN Ramba Padang, South Tapanuli Regency, Indonesia. *Budapest International Research and Critics Institute (BIRCI-Journal) : Humanities and Social Sciences*, *1*(3), 71–83. https://doi.org/10.33258/birci.v1i3.31

Maulida, I., Supriyati, T., & Dewi, N. R. (2023). Peningkatan Hasil Belajar IPA Materi Ekologi dan Keanekaragaman Hayati Indonesia dengan Model Student Teams Achievement Development (STAD) Kelas 7 E SMPN 02 Tengaran [Improving Science Learning Outcomes on Ecology and Biodiversity of Indonesia with the Student Teams Achievement Development (STAD) Model for Class 7 E of SMPN 02 Tengaran]. *Kecemerlangan Pendidikan IPA Untuk Konservasi Sumber Daya Alam*, 631–640. Semarang.

Ni, M. S. S., Anak, A. G. A., & Sujana, I. W. (2022). LKPD sebagai Media Pembelajaran Interaktif Berbasis Pendekatan Saintifik dalam Muatan IPA Sekolah Dasar [LKPD as Interactive Learning Media Based on Scientific Approach in Elementary' School Science Content]. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *6*(2), 311–320. https://doi.org/10.23887/jppp.v6i2.48304

Norrizqa, H. (2021). Berpikir Kritis dalam Pembelajaran IPA [Critical Thinking in Science Learning]. *Prosiding Seminar Nasional Pendidikan IPA*, 147–154. S2 IPA Unlam Press.

Novferma, Syafmen, W., & Wati, I. (2021). Pengembangan LKPD Berilustrasi Komik dengan Konteks Budaya Jambi untuk Meningkatkan Motivasi Belajar Siswa SMP Kelas VII [Development of Comic Illustrated LKPD with Jambi Cultural Context to Increase Learning Motivation of Grade VII Junior High School Students]. *Focus ACTion Of Research Mathematic*, *4*(1), 105–124. https://doi.org/10.30762/factor-m.v4i1.3261

Nurhidayati, U. (2022). Menempa Kompetenasi dan Peran Guru Penggerak dalam Memenuhi Kebutuhan Belajar Murid melalui Pembelajaran Berdiferensiasi [Developing the Competence and Role of Leading Teachers in Meeting Students' Learning Needs through Differentiated Learning]. *Jurnal Ilmiah Pro Guru*, *8*(1), 279–291. Retrieved from http://journal2.um.ac.id/index.php/jipg/article/view/31241/10783

Palittin, I. D., Wolo, W., & Purwanty, R. (2019). Hubungan Motivasi Belajar dengan Hasil Belajar Siswa [Relationship between Learning Motivation and Student Learning Outcomes]. *Magistra: Jurnal Keguruan Dan Ilmu Pendidikan*, *6*(2), 101–109.

Pandu, R., Purnamasari, I., & Nuvitalia, D. (2023). Pengaruh Pertanyaan Pemantik Terhadap Kemampuan Bernalar Kritis dan Hasil Belajar Peserta Didik [The Influence of Provocative Questions on Students' Critical Reasoning Skills and Learning Outcomes]. *Pena Edukasia*, *1*(2), 127–134. Retrieved from https://journal.cvsupernova.com/index.php/pe

Pramesti, C., Sidik, R. S. R., Suryanti, Sari, A. S. L., & Yunaini, F. (2023). Diseminasi Pertanyaan Pemantik Menuju Pembelajaran Bermakna [Dissemination of Sparking Questions Towards Meaningful Learning]. *Khaira Ummah*, *2*(01). Retrieved from https://journal.unisnu.ac.id/khairaummah/article/view/657

Puti, S., & Jumadi. (2015). Pengembangan Modul IPA SMP Berbasis Guided Inquiry untuk Meningkatkan Keterampilan Proses dan Sikap Ilmiah [Development of Junior High School Science Modules Based on Guided Inquiry to Improve Scientific Process Skills and Attitudes]. *Jurnal Pendidikan Matematika Dan Sains*, *3*(1), 79–90. https://doi.org/10.21831/jpms.v5i1.7239

Rahman, S. (2021). Pentingnya Motivasi Belajar Dalam Meningkatkan Hasil Belajar [The Importance of Learning Motivation in Improving Learning Outcomes.]. *Merdeka Belajar Dalam Menyambut Era Masyarakat 5.0*, (November), 289–302. Gorontalo: Pascasarjana Universitas Negeri Gorontalo.

Rahmawati, L. H., & Wulandari, S. S. (2020). Pengembangan Lembar Kegiatan Peserta Didik (LKPD) Berbasis Scientific Approach Pada Mata Pelajaran Administrasi Umum Semester Genap Kelas X OTKP di SMK Negeri 1 Jombang [Development of Student Activity Sheets (LKPD) Based on Scientific Approach in General Administration Subjects for Even Semester of Grade X OTKP at SMK Negeri 1 Jombang.]. *Jurnal Pendidikan Administrasi Perkantoran (JPAP)*, *8*(3), 504–515. https://doi.org/10.26740/jpap.v8n3.p504-515

Sintia, I., Pasarella, M. D., & Nohe, A. D. (2022). Perbandingan Tingkat Konsistensi Uji Distribusi Normalitas pada Kasus Tingkat Pengangguran di Jawa [Comparison of Consistency Levels of Normality Distribution Tests in the Case of Unemployment Rates in Java]. *Prosiding Seminar Nasional Matematika, Statistika, Dan Aplikasinya*, 322–333. Samarinda.

Sugiyono. (2013). *Metode Penelitian Kuantitatif Kualitatif dan R&D* (1st ed.) [Qualitative Quantitative Research Methods and R&D (1st ed.)]. Bandung: Alfabeta. Retrieved from https://id.scribd.com/embeds/391327717/content?start_page=1&view_mode=scroll&access_key=key-fFexxf7r1bzEfWu3HKwf

Sundayana, R. (2018). *Statistika Penilaian Pendidikan [Educational Assessment Statistics]*. Bandung: Alfabeta.

Surani, E. (2018). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Representasi Ganda untuk Meningkatkan Minat dan Hasil Belajar Fisika Peserta Didik SMA [Development of Student Worksheets (LKPD) Based on Multiple Representations to Improve High School Students' Interest and Physics Learning Outcomes]. Universitas Negeri Yogyakarta.

Surur, A. M., Wahyudi, M. E., & Mahendra, M. A. (2020). Upaya Meningkatkan Motivasi Belajar Melalui Metode Artikulasi Sebagai Perangsang Timbulnya Kompetensi [Efforts to Increase Learning Motivation Through the Articulation Method as a Stimulus for the Emergence of Competence]. *Factor M*, *2*(2), 141–156. https://doi.org/10.30762/f_m.v2i2.2282

Suryaningsih, S., & Nurlita, R. (2021). Pentingnya Lembar Kerja Peserta Didik Elektronik (E-LKPD) Inovatif dalam Proses Pembelajaran Abad 21 [The Importance of Innovative Electronic Student Worksheets (E-LKPD) in the 21st Century Learning Process]. *Jurnal Pendidikan Indonesia (Japendi)*, *2*(7), 1256–1268.

Susanti, A., & Darmansyah, A. (2023). Analisis Strategi Penguatan Profil Pelajar Pancasila Dimensi Bernalar Kritis di SD Negeri 44 Kota Bengkulu [Analysis of Strategy for Strengthening Pancasila Student Profile Critical Reasoning Dimension at SDN 44 Bengkulu City]. *Edubase : Journal of Basic Education*, *4*(2), 201–212. Retrieved from https://www.journal.bungabangsacirebon.ac.id/index.php/edubase/article/view/1027

Tanjung, A. K. P., & Louise, I. S. Y. (2024). Development of Student Worksheets with Discovery Learning Models Based on Augmented Reality in Chemical Bonding Materials to Increase Learning Motivation and Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *10*(3), 1063–1074. https://doi.org/10.29303/jppipa.v10i3.6684

Wibowo, D. E., & Abdi, S. (2019). Hubungan Antara Motivasi Berprestasi dengan Disiplin Belajar Siswa [The Relationship Between Achievement Motivation and Student Learning Discipline]. *Guidance: Jurnal Bimbingan Dan Konseling*, *16*(12), 29–33. Retrieved from https://uia.e-journal.id/guidance/article/view/441

Wiguna, M. C. (2016). Pengembangan LKPD IPA Berbasis Keterampilan Proses untuk Meningkatkan Sikap Ilmiah dan Minat Siswa SMP [Development of Science LKPD Based on Process Skills to Improve Scientific Attitudes and Interests of Junior High School Students]. *Jurnal Pendidikan Matematika Dan Sains*, *4*(2), 176–

183. Retrieved from http://journal.uny.ac.id/index.php/jpms Jurnal

Wijiati, S. (2019). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Problem Based Learning (PBL) Berbantuan Peta Konsep Untuk Meningkatkan Motivasi dan Hasil Belajar Fisika Peserta Didik SMA [Development of Student Worksheets (LKPD) Based on Problem Based Learning (PBL) Assisted by Concept Maps to Improve Motivation and Physics Learning Outcomes of High School Students]. *Rabit : Jurnal Teknologi Dan Sistem Informasi Univrab*, 0–135.

Winarti, E., & Kurniastuti, I. (2023). Pengenalan Pertanyaan Esensial Untuk Pengembangan Bahan Ajar Yang Hots Kepada Guru Sekolah Dasar [Introduction to Essential Questions for Developing Hot Teaching Materials for Elementary School Teachers]. *Abdimas Altruis: Jurnal Pengabdian Kepada Masyarakat*, *6*(1), 56–62. https://doi.org/10.24071/aa.v6i1.5391

Zaeriyah, S. (2022). Peningkatan Motivasi dan Hasil Belajar Siswa Menggunakan Model Project Based Learning (PjBL) Berbasis Tik-Tok [Improving Student Motivation and Learning Outcomes Using the Tik-Tok-Based Project Based Learning (PjBL) Model.]. *Ideguru: Jurnal Karya Ilmiah Guru*, *8*(1), 106–111. https://doi.org/10.51169/ideguru.v8i1.458

Zaraturrahmi, Adlim, & Zulkarnaen. (2016). Pengembangan Lembar Kerja Peserta Didik (LKPD) Berbasis Masalah Pada Pokok Bahasan Cermin Untuk Meningkatkan Motivasi Dan Hasil Belajar Siswa Di SMP Negeri 2 Banda Aceh [Development of Problem-Based Student Worksheets (LKPD) on the Topic of Mirrors to Improve Student Motivation and Learning Outcomes at SMP Negeri 2 Banda Aceh]. *Jurnal Pendidikan Sains Indonesia*, *4*(1), 178–186. Retrieved from http://jurnal.unsyiah.ac.id/jpsi.