

**DEVELOPMENT OF SCIENTIFIC APPROACH BASED STUDENT WORKSHEET ON ANIMAL TOPICS FOR 10th GRADE**

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**ABSTRACT**

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This study aims to design and produce Student Worksheets (LKPD) based on the Scientific Approach for animalia material for 10th-grade students in SMA Yayasan Perguruan Utama Medan. The research used a research and development methodology. The design of the Scientific Approach-based LKPD was carried out using the 4-D development model, namely Define, Design, Development, and Disseminate. The research results show that the developed LKPD based on the scientific approach received a "very feasible" assessment from learning experts at 97.7%, from subject matter experts at 85.71%, and from design experts at 97.9%. Additionally, subject teachers also assessed it as "very feasible" at 96.87%, and students provided a "positive" assessment with a score of 95.96%. The effectiveness test of the developed LKPD based on the scientific approach showed an N-Gain value of 0.64 with a "moderate" criterion. The results of this study indicate that the LKPD for animalia material can be used in the learning process..

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## INTRODUCTION

The government continues to make advancements in the field of education to improve educational progress, such as curriculum changes. The School Level Curriculum (KTSP) has been developed into the 2013 curriculum. In the 2013 curriculum, several changes were made, including transforming competency standards into Core Competencies and emphasizing learning that uses a scientific approach (Ministerial Regulation No. 103, 2013). The scientific approach demands that students play an active role in the learning process, providing them with opportunities to build their own knowledge concepts and train them in problem-solving (Marjan, et al., 2014). Teachers need to have creativity in designing learning activities that support the implementation of the 2013 curriculum. Santoso (2015) states that the 2013 curriculum has been implemented simultaneously in schools, but its implementation has not been fully maximized in all subjects. This is due to the lack of provided teaching materials, necessitating the development of teaching materials to facilitate teachers in their teaching activities.

Student Worksheets (LKPD) are one of the teaching materials used in biology lessons and are used as a guide in conducting research activities and problem-solving or other assignment tasks (Triyanto, 2008). LKPD is one of the learning resources developed by researchers as facilitators. According to Anggo (2013), LKPD has the advantage of helping students in their learning activities, following a logical sequence of thinking, presenting text and image guides that enhance attractiveness, and facilitating understanding of the information presented in both verbal and visual formats. It contains programmed questions, and students interact actively by responding to the questions and completing the exercises. It can be concluded that LKPD can develop students' abilities optimally and improve their learning activities and outcomes. However, some LKPD only consist of questions that do not encourage students to learn and discover concepts (Istikharah and Simatupang, 2017), and they are often used as homework assignments (Hilda, 2015). The use of LKPD that does not emphasize student engagement in learning and does not provide opportunities for students to independently develop their knowledge concepts can lead to low student learning outcomes (Johari et al., 2014). The LKPD used in SMA Yayasan Perguruan Utama Medan does not yet employ a scientific approach. LKPD only contains brief materials and exercise questions that are often assigned as homework. The LKPD does not encourage student involvement

in learning activities, so there is a need to develop LKPD with a scientific approach. LKPD with a scientific approach includes practical activities that involve observation, information gathering, and reasoning based on the obtained information.

Student Worksheets (LKPD) based on the scientific approach used in biology subjects have shown high N-Gain values (Hapiyuddin et al., 2017; Baharuddin and Reni, 2018; Wati and Kuntjoro, 2022). The same is true for the use of e-LKPD in biology (Amthari et al., 2021). If the N-Gain score is greater than 0.7, it falls within the criteria of being highly effective in improving learning outcomes. If the N-Gain score falls between 0.3 and 0.7, it is considered moderately effective in improving learning outcomes. If the score is less than 0.3, it is categorized as less effective. Based on the N-Gain score, the difference in learning outcomes before and after using the development product can be observed, as it facilitates students in the teaching and learning process (Wati, 2017).

Based on interviews with biology teachers at SMA Yayasan Perguruan Utama Medan, it is known that both teachers and students have been using LKPD in the learning process for the animalia topic. However, the LKPD used has not improved the students' learning outcomes, as out of 21 students, only 5 students have achieved the Minimum Mastery Criteria (KKM = 70). This means that only 24% of the students have reached the learning mastery criteria. The learning outcomes obtained are influenced by the LKPD used. The LKPD for the animalia topic used in the school does not apply the scientific approach as expected in the 2013 curriculum. The LKPD used is a simple one, containing a summary of the material, practical activities, and exercise questions. However, the practical activities in the LKPD used do not encourage students to follow all the steps of the scientific approach, which include observing, questioning, gathering information, reasoning, and communicating. From the observation of the current LKPD being used, it only includes one activity, which is observing invertebrate species. On the other hand, LKPD based on the scientific approach includes five activities. Therefore, the LKPD to be developed in SMA Yayasan Perguruan Utama Medan will incorporate these five scientific activities.

The animalia topic covers a wide range of discussions, but students will find it easier to understand through direct observation. The researcher also asked the students for their opinions on the design of the current LKPD they are using. The students expressed that it would be better if the LKPD they use is more visually appealing and includes colorful illustrations as

examples of the topic because black and white LKPDs are less engaging for them to read. LKPD with a scientific approach becomes an alternative to complement the teaching materials used by teachers in biology, especially for the animalia topic. Based on the background information and previous research, it is necessary to develop LKPD using the scientific approach to enhance students' activity, independence, and understanding in the biology learning process, specifically for the animalia topic. Therefore, the research to be conducted is entitled "Development of Student Worksheets (LKPD) Based on the Scientific Approach for the Animalia Topic in Grade X Science Class at SMA Yayasan Perguruan Utama Medan, Academic Year 2021/2022."

**METHOD**

This research was conducted at SMA Yayasan Perguruan Utama Medan from November 2021 to July 2022. The subjects of this study were 21 students in grade X Science at SMA Yayasan Perguruan Utama Medan. This research falls under the category of Research and Development (R&D) and consists of several stages, namely Define (definition), Design (design), Develop (development), and Disseminate (dissemination). The research procedure is outlined in Figure 1.

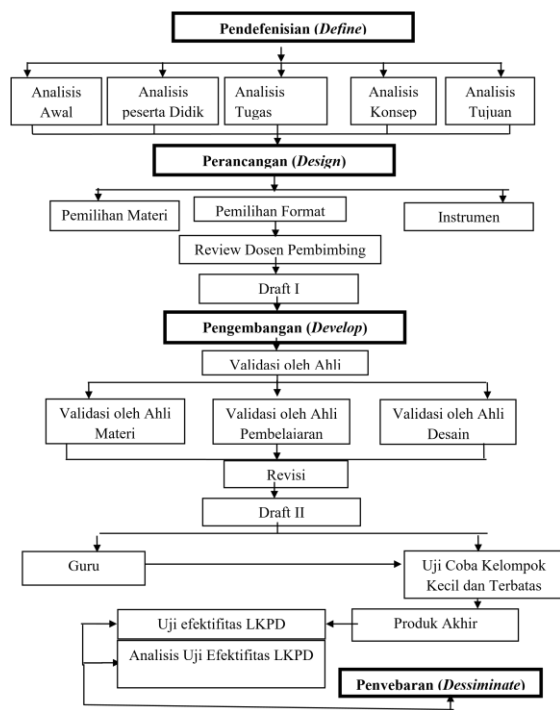


Figure 1. 4D Development Research Model Steps (Trianto, 2014)

**RESULTS AND DISCUSSION**

Assessment by Content Expert

The research findings were obtained in the form of scores, which were then converted into percentages and adjusted to the eligibility criteria. The content expert validator gave a total score of 46 with an average of 3.2. Based on the validation results, the percentage of material presentation eligibility is 85.71% with the criteria of "very eligible". From the assessment by the content expert, criticisms, feedback, or suggestions for improving the product were provided to make it better. The inputs and improvements from the content expert include adding a discussion on reproduction in animalia, increasing the references in material development, improving the writing, and including all sources of the used images in the LKPD.

There are two aspects of assessment for content experts, namely the suitability of the content and language. Based on the assessment from the content experts, the results show a highly suitable rating of 85.71%. The suitability of the content indicates that the main topics covered in the LKPD align with the Core Competencies (KI) and Basic Competencies (KD) of the 2013 curriculum. The development of the LKPD (Student Worksheets) adheres to the learning objectives, and the content description has been adjusted to KI and KD, as required for the development of a good instructional tool (Harahap, 2017). As stated by Kariem et al. (2013), the development of learning resources should consider the curriculum. According to the Ministry of National Education (2006), student worksheets should include basic competencies. Having basic competencies as a reference will help students learn in a focused manner.

The clarity of the content in the LKPD is good, indicating that the material is presented in a structured manner. The LKPD also demonstrates a good depth of content, appropriate for the high school level, and the quality of content elaboration is well-documented through concept maps, real-life examples, relevant illustrations, and providing meanings or definitions of abstract terms. The relevance of exercise questions to the material also receives a very good rating, aligning with the learning objectives, as according to Depdiknas (2004), the requirements and principles of developing LKPD include determining modified learning objectives with LKPD. In addition to aligning with the learning objectives, the activities within the LKPD should also motivate students to learn independently. The independence and activeness of students in completing the LKPD

should be supported by engaging presentations, providing illustrative examples to help students understand the material, and utilizing reliable references. This LKPD utilizes relevant references (Harahap, 2017).

Furthermore, the quality of the illustrations used in the LKPD is considered clear, attractive, and enhances the presentation of explanations, representing the concepts effectively. According to Komalasari (2011), images and photos can provide a visual representation to solve problems. This is supported by the validation results from the content experts, which indicate excellent ratings for the attractiveness of illustrations and images. The second aspect is the language aspect, which is categorized as good. The language aspect has two components: language usage and readability. According to Sahida (2018), language usage and readability in the LKPD facilitate students' understanding. Through the assessment of the questionnaire's aspects, the developed LKPD based on the scientific approach is validated by content experts.

#### Assessment by Learning Expert

The research findings were obtained in the form of scores, which were then converted into percentages and adjusted to the eligibility criteria. The learning expert validator gave a total score of 43 with an average of 3.9. Based on the validation results, the percentage of learning presentation eligibility is 97.7% with the criteria of "very eligible". From the assessment by the learning expert, feedback and suggestions for improvement were also provided to enhance the product. The inputs and improvements from the learning expert include aligning the numbering of competency achievement indicators according to codes 3.9.1, 3.9.2, and so on, and completing the scoring in each scientific activity.

There are two aspects of assessment by learning experts, namely the suitability of content presentation and the components of a scientific approach to learning. The assessment results obtained indicate a highly appropriate rating with a percentage of 97.7%. The evaluation of the content aspect is deemed highly appropriate based on the assessed indicators, which include the expression of ideas or concepts, design of the learning material (LKPD cover), presentation of content, and arrangement of LKPD. The assessment of the components related to the scientific approach to learning also received a highly appropriate rating. Based on these evaluation results, it can be concluded that the

LKPD developed based on the scientific approach is valid according to instructional principles.

#### Validation Assessment by Design Expert

The assessment results were obtained in the form of scores, which were then converted into percentages and adjusted to the eligibility criteria. The design expert validator gave a total score of 47 with an average of 3.9. Based on the validation results, the percentage of design presentation eligibility is 97.9% with the criteria of "very eligible". From the assessment by the design expert, criticisms, feedback, or suggestions for improvement were provided to enhance the product. The inputs and improvements from the design expert include adjusting the spacing between images and text, avoiding excessive use of colors, and changing the image labeling format from being next to the image to being below the image.

There are three aspects of assessment for design, namely the format of the learning materials (LKPD), the cover design of LKPD, and the content design of LKPD. The LKPD was improved based on suggestions and feedback from design experts to produce a better and more engaging learning material. A well-designed LKPD can enhance the attractiveness and motivation of students' learning (Servitri & Trisnawaty, 2018; Suryawati et al., 2020). LKPD can be designed to facilitate active student participation in learning the material (Dini & Nurhayati, 2019; Pentury et al., 2019). It is crucial to create LKPD with a simple design, as overly complex designs can hinder students' comprehension (Anggraini et al., 2017; Makhrus et al., 2018).

The developed LKPD received positive evaluations, and the final assessment results were obtained in the form of scores, which were then converted into percentages. The percentage of design suitability obtained was 97.9%, indicating a highly appropriate rating. All three validators agreed that the LKPD developed based on the scientific approach is valid, with an average assessment percentage of 93.77%. Furthermore, the LKPD can be utilized for field research purposes.

#### Assessment by Biology Teacher

The biology teacher assessment resulted in a total score of 62 with an average of 3.8. Based on the validation results, the percentage of LKPD eligibility according to the biology teacher's assessment is 96.87% with the criteria of "very eligible".

The following graph shows the percentage of LKPD eligibility based on the validation results from the content expert, learning expert, design expert, and assessment by the subject teacher.

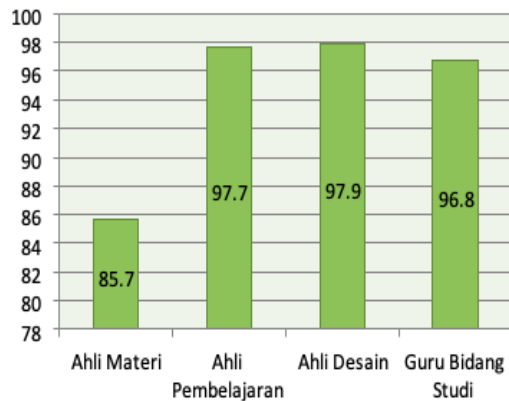


Figure 2. Percentage of eligibility of LKPD from the results of the validation of experts and teachers in the field of study

#### Assessment by students

The developed LKPD has been deemed valid by the expert team and has received evaluation from the biology teacher. Subsequently, the LKPD was given to 6 students to assess their feedback on the LKPD based on the scientific approach. From the assessment results, the LKPD was found to have a percentage of 97.4% eligibility. After conducting a small-group trial, a limited-group trial was conducted. The LKPD based on the scientific approach was provided to 21 students in grade X of the science program at SMA Yayasan Perguruan Utama Medan to obtain student evaluations. The instrument used was a questionnaire consisting of 13 indicators to gather student responses. Based on the evaluation response results, the percentage of LKPD eligibility was found to be 95.96% with the criteria of "positive". The following table presents the average assessment scores given by the students in the small-group and limited-group trials.

Table 1. Average student ratings in small group and limited group tests

Group test	Average percentage
Small group	97,4 %
Limited group	95,9 %
<b>Average</b>	<b>96,6 %</b>

From the assessments, an average percentage rating of 96.6% was obtained for the evaluations conducted on the small and limited groups, indicating a high level of suitability. To assess the practicality of the developed LKPD, feedback from both subject teachers and students

was obtained. The average ratings provided by the subject teachers and students can be seen in the following Table 2.

Table 2. assessment results by the users

Assessor	Percentage	Criteria
Biology teacher	96,8 %	highly eligible
Students	96,6 %	highly eligible
<b>Average</b>	<b>96,7 %</b>	<b>highly eligible</b>

The average percentage of the teacher's assessment of the field of study with students obtained a score of 96.7% with very decent criteria so that LKPD can be used in the learning process.

The students' interest in the learning process is something that is highly important and should not be underestimated. When students are interested, the majority of their attention will be directed towards the learning process, leading to greater active involvement and positive responses (Danu et al., 2016). It is from this student interest that we can see that the developed Learning Material Worksheet (LKPD) is indeed favored by the students. The practicality of an instructional tool is determined by two criteria: (1) the tool is deemed appropriate based on expert evaluations, and (2) the tool can be implemented in the field (Hiroh, 2019). The practicality of this scientific approach-based LKPD was assessed through individual trials and limited-group trials.

In the limited-field trials, the practicality of the developed LKPD was examined to determine its effectiveness. The questionnaire used in these trials measured the students' responses using a Likert scale with four scoring options. The students provided an average rating of 96.6%. From the results of these trials, it can be observed that the researcher-developed LKPD based on the scientific approach can be considered practical based on the positive responses from students who used the LKPD. This finding is consistent with Fauziah et al.'s (2013) study, which states that the majority of students responded positively to the implementation of the scientific approach. The evaluations from both teachers and students have demonstrated the practicality of the scientific approach-based LKPD, with an average assessment rating of 96.7%. Once the LKPD has been deemed valid and practical, the next stage is the dissemination phase to assess the effectiveness of the scientific approach-based LKPD that was developed.

In this phase, the students were given a pretest before using the scientific approach-based LKPD. The pretest consisted of 30 multiple-choice questions. The results showed that 15 students had not achieved the mastery learning level

(Minimum Mastery Criteria = 70), with only 6 students reaching the level. The average score obtained in the pretest was 66.8. The next stage involved the learning process using the scientific approach-based LKPD. The students were asked to take a posttest, and an improvement in learning outcomes was observed by comparing the pretest and posttest scores. All students achieved scores above the Minimum Mastery Criteria, with an average posttest score of 86.3. The students also engaged in group activities related to the scientific approach within the LKPD. These activities included scientific observations of invertebrates and vertebrates..

The activities with a scientific approach in the Learning Material Worksheet (LKPD) were implemented successfully by the students, but there were difficulties in the observation activities. The students were only able to observe vertebrate or invertebrate animals in their surrounding environment, while the competency achievement indicators required them to observe animals in the sea or lake. Observations in the sea and lake were not possible, so the students had to learn about the types of animals in the sea or lake through textbooks, materials in the LKPD, or other sources provided by the teacher. The LKPD that included scientific activities made the learning meaningful for the students, and they had the opportunity to engage in observation, ask questions, gather data/information, associate, and communicate. The students were able to complete each activity successfully. The observations also showed that the students were interested in working on the activities in the LKPD, and each member of the group actively participated in the work.

Based on the results of the pretest, posttest, and completion of activities in the LKPD, it can be concluded that the scientific approach-based LKPD is considered effective for use in the learning process for the animalia topic. This is consistent with the findings of a study conducted by Khalifah and Gufran (2017), which showed that students responded positively to the LKPD during the learning process using the scientific approach, with a percentage of 63.89%. The students also had a positive response to the learning activities, with a percentage of 52.78%, and their learning outcomes met the individual mastery criteria with a minimum score of 70. This is also in line with the statement by Danu et al. that positive student responses can be used as an indicator that students feel more comfortable with the teaching materials used in the learning process. The majority of students' attention will be focused on the learning process because of their interest in the teaching materials, and they will not quickly

get bored with the ongoing learning, allowing their critical thinking skills to improve (Danu et al., 2017). From all the stages of research and development of the scientific approach-based LKPD product, it can be concluded that the LKPD is valid, practical, and effective for use in the learning process.

## CONCLUSION

Based on the research findings and discussions presented, the following conclusions can be drawn from this study: The assessment results of content experts on the scientific approach-based Learning Material Worksheet (LKPD) for the animalia topic obtained a rating of highly appropriate (85.71%). The assessment by instructional experts also yielded a rating of highly appropriate (97.7%), as did the assessment by design experts (97.9%). The average ratings from content experts, instructional experts, and design experts for the scientific approach-based LKPD were 93.77%, indicating a highly appropriate rating. The assessment by teachers of the scientific approach-based LKPD for the animalia topic obtained a rating of highly appropriate (96.87%), while the assessment by students received a rating of highly appropriate (95.96%). The average percentage rating by subject teachers and students for the scientific approach-based LKPD was 96.7%, indicating a highly appropriate rating. The scientific approach-based LKPD developed for the animalia topic has proven to be effective in improving the learning outcomes of 10th-grade students at SMA Yayasan Perguruan Utama Medan, as evidenced by the results of the pretest and posttest scores, as well as the N-gain score of 0.60, which falls within the "moderate" category.

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