Problem-Based Learning Worksheet for Grade 11 Biodiversity – Global Prestasi School

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A B S T R A C T

The development of learning products in the form of worksheets aims to increase student engagement in learning. This research aims to develop a problem-based learning geography worksheet on the topic of biodiversity for 11th-grade students at SMA Global Prestasi. The research uses a research and development (R&D) method with the 4D model (Define, Design, Develop, Disseminate). The researcher designed the product, validation instruments, and material analysis. The material analysis phase was conducted by media experts and subject matter experts. Data collection techniques used questionnaires and interviews with descriptive analysis. The validation test met the criteria for being highly valid with a score of 3,8. The student assessment met the criteria for being highly engaging with a score of 3.7. Based on these results, it can be concluded that problem-based learning worksheets can be used to enhance student engagement in learning geography.

Kata Kunci:
Pembelajaran berbasis masalah
Lembar kerja
Pembelajaran geografi

A B S T R A K

Pengembangan produk pembelajaran dalam bentuk worksheet bertujuan dalam meningkatkan keaktifan siswa dalam belajar. Penelitian ini bertujuan untuk mengembangkan worksheet geografi berbasis problem-based learning pada materi keanekaragaman hayati di kelas XI SMA Global Prestasi. Metode penelitian ini menggunakan metode research and development (R&D) dengan model 4D (Define, Design, Develop, Disseminate). Peneliti merancang produk, instrumen validasi, dan analisis materi. Tahapan analisis materi dilakukan oleh ahli media dan ahli materi. Teknik pengumpulan data menggunakan kuesioner dan wawancara dengan analisis deskriptif. Uji validasi memenuhi kriteria sangat valid dengan skor 3,8. Penilaian siswa memenuhi kriteria sangat menarik 3,7. Berdasarkan hasil tersebut maka dapat disimpulkan worksheet berbasis problem-based learning dapat digunakan untuk meningkatkan keaktifan siswa dalam belajar geografi.

Introduction

The rapid development of science and technology drives improvements in the quality of education. This is supported by the continuous renewal of classroom learning processes. The achievement of classroom learning applies key learning principles that emphasize three aspects: student-centred learning, the development of student creativity, and the creation of an enjoyable learning environment (Sari et al., 2022). The achievement of these goals focuses on active learning in the classroom, where each learning activity prioritizes student participation (Hanifah et al., 2022). One way to enhance student participation in learning is through the use of worksheets, commonly known as Student Worksheets (LKPD). The result of learning process is not only to increase knowledge but also increase critical thinking through worksheet (Ardiansyah et al., 2024; Wiranti et al., 2022). Worksheet is teaching materials to strengthen understanding of students in topic that teacher have already explained. A worksheet as a component of learning can be structured to support learning activities. Additionally, a worksheet can serve as an evaluation tool in the learning process, allowing

the teacher to assess students' understanding of the material that has been taught. The development of worksheet can be adapted to the learning model used.

The problem-based learning (PBL) approach focuses on student-centered learning, where students take an active role in the learning process. PBL presents problems at the beginning of the lesson, encouraging students to think critically and acquire essential knowledge from the subject matter (Hermansyah, 2020). The development of worksheets based on Problem-Based Learning provides opportunities for students to understand, solve, and evaluate problems, as well as support their critical thinking skills (Setiyaningrum & Sari, 2023). The PBL approach utilizes real-world problems to encourage students to think critically, develop problem-solving skills, and gain essential knowledge from the subject matter (Nafiah & Suyanto, 2014).

Several studies have shown that the use of PBL-based worksheets (LKPD) has several advantages. For example, research conducted by Safitri et al. (2022) found that the development of digital PBL-based LKPD was feasible for use in learning, with a practicality rating of 87%. This aligns with the study by Suryanti & Festiyed (2023), which concluded that the use of PBL-based worksheets is valid, practical, and effective in improving the learning process. The development of PBL-based LKPD using the 4D method was tested by Pratiwi & Indrayani (2023), with product validity scores of 95% and 97% from subject matter experts, confirming its feasibility. This was achieved through a process of analysis, instructional material design, and product development to assess the viability of the LKPD.

Based on the analysis by researcher Hotimah (2020), the PBL learning model has several advantages compared to other learning models, including: (1) Enhancing students' critical thinking skills in learning, (2) Making it easier for students to master learning concepts, (3) Helping students develop knowledge in learning, and (4) Encouraging students to be more engaged in learning. However, the PBL model also has some drawbacks, such as: (1) Students may struggle to find strategies to solve problems (Dulyapit et al., 2023) and (2) Students may feel that without a proper understanding of the required material, they tend to choose what they want to learn instead.

Geography is a science has social and physical aspects. Geography has three main approaches, which is spatial, environmental, and complex region (Aksa, 2019). The study of geography covers a broad scope, so every component in learning must be presented in a simplified manner. One of the geography topics that emphasizes a geographical approach is the biosphere, specifically biodiversity. Issues related to biodiversity, such as exploitation, illegal logging, poaching, and wildlife trade, pose threats to biodiversity (Malik et al. 2020). Geography lessons on biodiversity provide an engaging discussion about the spatial distribution of living organisms and the factors influencing it (Gede et al., 2021). Additionally, this topic encourages students to conduct deeper analyses of environmental issues such as deforestation, habitat destruction, and climate change, which significantly impact biodiversity (Amelia et al., 2020; Pakaya et al., 2025). Studies on biodiversity-related worksheets (LKPD) from various curricula in Indonesia have been conducted and reconstructed. However, findings indicate that the main issue lies in the low level of students' critical thinking skills (Rachmawati et al., 2020), highlighting the need for more relevant aspects to enhance students' critical thinking. Therefore, this research aims to develop PBL-based LKPD to increase students' interest, enhance their critical thinking skills regarding the factors affecting the distribution of flora and fauna, and analyze the impacts of biodiversity loss. The development of this worksheet evaluates both the validity of its use and students' engagement with it.

Methods

The method of research is Research and Development (R&D). Methode R&D was started with the analyzing process toward problem and then was developed the product to answer the problem (Waruwu, 2024). Methode of R&D is not only focused on the developing product such as film. Book, or sources of learning, but also the process and model of learning (Okpatrioka, 2023). This research creates LKPD or Worksheet based problem-based learning to support the student's improvement in learning activity. The development models are using 4D models with four stages, includes define, design, develop, and disseminate. Model 4D is developed by Sivasailam Thiagarajan, Dorothy S.Semmel, dan Melvyn I. Semmel pada tahun 1974 (Thiagarajan et al., 1974). However, the use of the 4D Model does not extend to measuring product quality, as it focuses solely on product development (Johan et al., 2023).

The 4D Model is often used for the development of systematic, structured, and simple teaching materials. The stages in the 4D Model are explained in detail. Therefore, the researcher chose the 4D Model because it requires a relatively short amount of time and has fewer complex stages. The researcher set a limitation in the study, focusing only on the development of the worksheet product. The process of worksheet development based on problem-based learning with 4D Models has many stages:

Stage 1: Define

The define stage is the initial phase in the development of a worksheet. This stage aims to ensure that the product being developed aligns with current learning needs. The analysis of media needs is adjusted to the basic competencies (KD) that students must achieve (Wiranti et al., 2022). The first step in this process is analysing the teaching materials using the Lesson Plan (RPP).

Stage 2: Design

The design stage in development of the student worksheet is carried out after obtaining observation through classroom learning activities. After that, the researcher creates an outline of the worksheet that will be given to the students. In this stage, the researcher decides the title, learning outcomes, learning objectives, brief learning materials, and various types of questions, such as word search, crossword, matching, fill in the table, and essay. The process of design or plan to uses Canva application because it has attractive and vibrant features.

Stage 3: Develop

After the process of designing therefore researcher carried out the developing stage. This stage includes validation from the several experts, such as subject matter expert, media matter expert, and learning practitioner expert. The validation of this worksheet was conducted by Ms I Gusti Ayu Rai Sawitri, M.Si as a biology researcher also with Mr Arif Suryono, M.Pd as geography teacher. The validation test of worksheet was carried out by Ms Rayuna Handawati, M.Si. The purpose of this expert testing and validation is to assess the feasibility of the material. After that, revision product is revised if the experts provide comments related to revising the developed product. However, if no revisions are needed, the designed product can proceed without further revision. To test of feasibility of the product validated by the media expert team and the subject matter expert team, the following product feasibility criteria are used:

Table 1. Criteria of Validation

Value	Criteria
0-1.5	Not Valid
1.5-2.5	Valid Enough
2.5-3.5	Valid
3.5-4	Very Valid

Source: (Huninhatu et al., 2021.)

Stage 4: Disseminate

After the validation is completed therefore the next stage is implementation. This product will be distributed to grade XI with total 23 students Global Prestasi School. The step of disseminate product is carried out after the researcher has

explained the biodiversity material. To assess the level of students' response toward biodiversity worksheet, an evaluation will be conducted based on the following respondent criteria:

Determine the average scale in each assessment by using a formula:

$$X=\frac{a}{N}$$

Meaning:
X = Average score each question
a = Total score every indicator
N = Total Indicator

Convert an average score based on standard of assessment that can be calculated:

$$\text{Interval (i)} = \frac{higher\ score - lower\ score}{amount\ interval\ class}$$

Therefore, score can be calculated by using scale classification. Then, it could be classifying the result of validation:

Table 2. Criteria of Interesting

Value	Criteria
0-1.5	Not Interesting
1.5-2.5	Interesting Enough
2.5-3.5	Interesting
3.5-4	Very Interesting

Source: (Hikmah et al., 2021)

Results and Discussion

In this development, data is analyzed using qualitative descriptive analysis, based on feedback from validators or practitioners regarding the produced product. Additionally, quantitative analysis is conducted using validation results and questionnaires completed by students, which provide scores for the developed product. The presentation of data from the validation and distribution of the worksheets (LKPD) using the Problem-Based Learning approach, implemented through the 4D method, yielded the following results:

Analysis Stage

Based on analytic stage, the usage of worksheet has not familiar yet in the classroom, thus researcher applied worksheet in grade XI 4 Global Prestasi School has not been yet applied in the process of learning, therefore researcher applied worksheet in the classroom to increase the process of learn especially biodiversity.

The use of student worksheets (LKPD) in the Grade 11 learning environment is implemented using Problem-Based Learning (PBL). The PBL approach is a learning method that incorporates real-world problems, encouraging students to think critically, develop problem-solving skills, acquire knowledge, and grasp essential lesson concepts (Nafiah & Suyanto., 2014). According to the analysis by researcher Hotimah (2020), the PBL model has several advantages compared to other learning models, including: (1) Enhancing students' critical thinking skills in learning, (2) Making it easier for students to master learning concepts, (3) Helping students develop knowledge in learning, (4) Encouraging students to take a more active role in their learning.

However, PBL also has some drawbacks, such as: (1) Students may struggle to find effective strategies for solving problems (Dulyapit et al., 2023). (2) Students may feel that without a clear understanding of the necessary material, they prefer to choose what they want to learn rather than follow a structured approach (Hotimah., 2020).

Design Stage

The stage of design means to give a description in process of creating a worksheet. In the topic of biodiversity, the compilation of worksheet includes acknowledgement, learning objectives, mind map, case study, and exercise. The result of worksheet has been designed and revised.

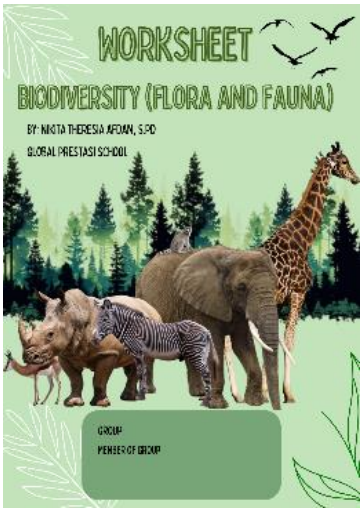

Figure 1. Design Cover

Figure 2. Case Study Display

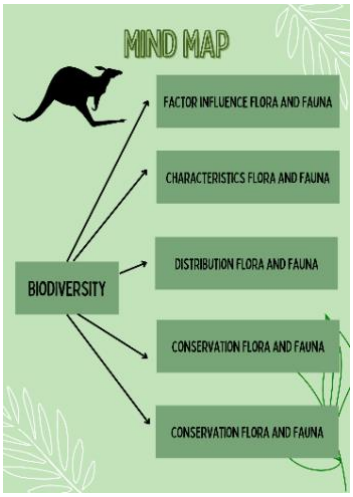

Figure 3. Mind Map

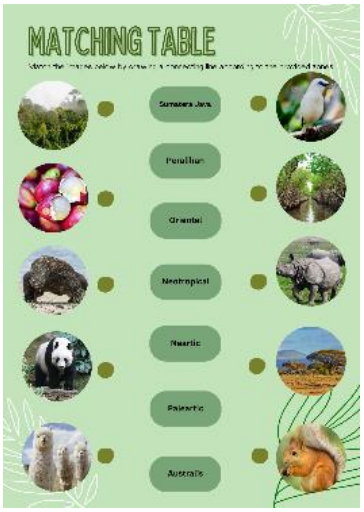

Figure 4. Exercise Display 1

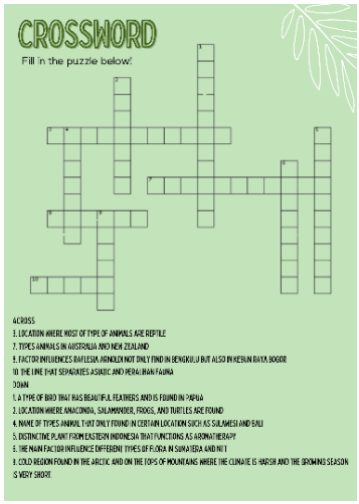

Figure 5. Exercise Display 2

Figure 6. Exercise Display 1

The stage of design is made by researcher using Canva software. Then, researcher arranges the structure and adds the indicator, instruction, and attach video link.

Development Stage

After doing the process of design worksheet, next step, the researcher develops the worksheet-based suggestion from media experts, material experts, and learning practitioners. There are several suggestions has been delivered through validator such as giving a study case in worksheet. The purpose of this worksheet to shaping the memory after learning biodiversity.
This table below shows the result of validation test of worksheet product:

Table 3. Validation Results

No.	Assessment by	Score	Ideal Score	Category
1.	Subject Matter Expert	3.8	4	Very Valid
2.	Media Expert	3.8	4	Very Valid

The experts provided comments suggesting the inclusion of case studies in the worksheet to enhance students' critical thinking skills. After conducting a trial of the worksheet with validators or subject matter experts, the results—based on Table 3—indicate that the overall validation by experts concludes that the biodiversity learning worksheet is suitable for use in classroom instruction with total score 3.8. Then,

next validation was conducted by media expert. The assessed aspects include the size of the worksheet (LKPD), cover design, and content design (Purwono, 2008). The results show a total score of 3.8, indicating that it is suitable for use.

Table 4. Media Expert Results

No.	Assessment	Score	Ideal Score	Category
1.	Media Experts	3.8	4	Very Valid

Based on the overall validation by subject matter experts and media experts, the feasibility of the PBL-based worksheet (LKPD) received an average score of 3.8 out of the ideal score of 4. The product's feasibility is largely influenced by feedback and suggestions from experts. One of the revisions suggested by subject matter experts was to add case studies to the LKPD to further enhance students' critical thinking skills.

Figure 7. Additional study case through video

After the process revision from expert then Worksheet based problem-based learning is distributed and used to the students of grade XI 4 with total 23 students. Students have been divided into 4 until 5 students group learning. After students gather with their group, researcher asking group of discussion to fill the exercise in the worksheet.

After the students fill the worksheet, then students ask to fill in the questioner. Based on the results of the questionnaire given to the students, the following findings were obtained:

Disseminate stage

After the process revision from expert then Worksheet based problem-based learning is distributed and used to the students of grade XI 4 with total 23 students. Students have been divided into 4 until 5 students group learning. After students gather with their group, researcher asking group of discussion to fill the exercise in the worksheet.

After done to fill in the questioner, then students ask to fill in the questioner. Based on the results of the questionnaire given to the students, the following findings were obtained:

Table 5. Results of Usage of Worksheet

Aspect	Total Amount	Average	Assessment Categories
Material Presentation	8	4	Very Interesting
Quality Presentation	7	3,7	Very Interesting
Content and Writing	5	3,72	Very Interesting

The results of questionnaire with 23 students in grade XI 4 Global Prestasi School, overall development of worksheet based on problem-based learning in biodiversity topics is very interesting. Besides, some students who were interview interestingly to learn geography by giving charming worksheet. The development of problem-based learning worksheets enables students to actively engage in the learning process and utilize critical thinking skills.

Conclusions

In conclusion, worksheet based on problem-based learning in biodiversity topics is able to be used in the process of learning in the class. This is evidenced by the validation results from subject matter experts and media experts.

Based on the validation, a total score of 3.8 was obtained, which falls under the "highly valid" category. The students' assessment of the worksheet resulted in an average score of 3.7, indicating that it is "highly engaging." The researcher suggests that future development of the worksheets (LKPD) can explore the use of other

learning models and include effectiveness testing for worksheet usage.

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