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Application of Differentiated Problem Based Learning to Increase Biology Learning Independence at SMAN 1 Poto Tano

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Abstract
The purpose of this research was to explain whether the application of the differentiated Problem Based Learning (PBL) method was able to increase the independence of biology learning in class XI students at SMA Negeri 1 Poto Tano for the 2022/2023 academic year. This research is Classroom Action Research (PTK) which was carried out in 2 cycles. The research subjects were class XI-2 students, totaling 33 students. The data collection technique used is observation which will be carried out during the learning process. The results of this research indicate that the application of the differentiated Problem Based Learning (PBL) method can increase the biology learning independence of class XI 2 students at SMA Negeri 1 Poto Tano for the 2022/2023 academic year. This can be proven by the increase in student independence in learning from cycle 1 by 68.67%, to 85.45% in cycle 2

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Abstrak
Tujuan penelitian ini dilakukan adalah untuk menjelaskan apakah penerapan metode *Problem Based Learning* (PBL) berdiferensiasi mampu meningkatkan kemandirian belajar biologi pada siswa kelas XI SMA Negeri 1 Poto Tano Tahun Pelajaran 2022/2023. Penelitian ini merupakan Penelitian Tindakan Kelas (PTK) yang dilaksanakan dalam 2 siklus. Subjek penelitian yaitu peserta didik kelas XI-2 yang berjumlah 33 peserta didik. Teknik pengumpulan data yang digunakan yaitu observasi yang akan dilakukan selama proses pembelajaran. Hasil penelitian ini menunjukkan bahwa penerapan metode *Problem Based Learning* (PBL) berdiferensiasi dapat meningkat kemandirian belajar biologi siswa kelas XI 2 SMA Negeri 1 Poto Tano Tahun Pelajaran 2022/2023. Hal tersebut dapat dibuktikan dengan adanya peningkatan kemandirian siswa dalam belajar dari siklus 1 sebesar 68,67 %, menjadi 85,45 % di siklus 2

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1. INTRODUCTION

Learning activities at school must be designed in such a way as to ensure the realization of independent learning. Freedom of learning tries to realize the idea of implementing education and learning in schools in accordance with Ki Hadjar Dewantara's thinking. Ki Hadjar Dewantara explains that the purpose of education is to guide all the natures that exist in students, so that they can achieve the highest safety and happiness both as humans and as members of society (Novita Sariel, 2022). The nature that is meant by Ki Hajar Delwantara is that the implementation of education must be carried out by taking into account the nature of nature and the nature of the times. Furthermore, Ki Hadjar Delwantara also stated that the education process should take place in three environments, namely in the family, school, and community, or more commonly known as the Tri Pulsat Pelndukasi. Of the three educational environments, the school environment is the only learning environment that is formally organized (Winkell, 2020).

School as a formal learning environment must be adaptive to the 21st century learning context. 21st century learning embodies the nature of the times that must be colored in the paradigm of learning in schools. Learning in schools must be directed to be able to master 21st century skills. 21st century learning requires humans to have the ability to think well in making decisions and filtering information. Learning can be said to be good if the learning carried out is not only conveying material that must be mastered by students, but the learning must be able to stimulate the ability of students to learn independently (Aprilianti, 2018).

One of the most important aspects in order to realize a learning process that is compatible with 21st century skills is that students must have the motivation to learn. The researcher in this case realized that at SMA Nelgelri 1 Poto Tano, there were challenges in improving students' learning independence. The limitations of conventional learning environments have been a well-identified problem. Students often lose interest and motivation in understanding the subject due to the lack of active involvement in the learning process. This results in low levels of achievement and inability to learn deeply. For this reason, it is necessary to develop a learning environment that is able to motivate students and encourage their active involvement in the learning process.

The application of the Problem-based learning model (PBL) is a multifaceted innovation as an alternative that interests researchers. PBL emphasizes on learning that is focused on students, by providing challenges or problems that are relevant to the real world to be solved collaboratively (Arianti et al., 2023). In the Problem Based Learning learning model, the ability of learners can be optimized, one of which is by direct observation and group work so as to develop the ability to think critically to solve problems and encourage learners to be more active and encourages students to be more active and to develop the curiosity of students in a natural way to help develop their ability to learn and find answers based on existing evidence to improve their learning outcomes (Cahyani, 2016).

However, on the other hand, the curriculum emphasizes the need for differentiated learning to accommodate individual differences in learning styles, levels of understanding, and student interests. These extensions enable learning to be completed according to each student's individual learning difficulties and delays, thus enhancing their participation and motivation in the learning process. Differentiated learning is a way for educators or teachers to meet the needs of each learner because differentiated learning is a teaching and learning process that directs students to be able to learn learning materials according to their abilities and needs (Ramadhani et al., 2023).

Differentiated learning is also defined as a way of recognizing and teaching according to students' different talents and learning styles (Morgan, 2014). Teachers facilitate students according to their needs, because each student has different characteristics, so they cannot be given the same treatment. Differentiated learning is not individualized teaching (Marlina et al., 2019). However, it is more likely to be learning that accommodates students' learning strengths and needs with independent and collaborative learning strategies.

The differentiated approach consists of three aspects: content differentiation, process differentiation, and product differentiation (Tomlinson, 2001). 1) Content differentiation covers what students learn. The content is related to the curriculum and the subject matter of the lesson. In this aspect, teachers modify the curriculum and learning materials based on students' learning styles and disabilities. The content of the curriculum is adjusted to the student's condition and ability. 2) Process differentiation involves the way students' process ideas and information. How students learn to interact with mathematics and how intelligence is transferred is a part of what determines students' learning choices. Because of the many different learning styles and learning style choices that students exhibit, classes must be modified in such a way that different learning needs can be accommodated properly. 3) Product differentiation is how students demonstrate what they have learned. Learning products allow teachers to assess the material that students have mastered and provide the next material. Students' learning styles also determine what kind of student learning outcomes will be shown to the teacher.

Researchers realize that PBL based on elaborated learning can be a good solution to improve students' learning independence especially in biology subjects. By applying this training, it is

expected that students will be more actively involved in solving the problems presented, reviewing their understanding, and sharpening their critical thinking and collaborative skills. In addition, with differentiated instruction, teachers can provide more specific and customized assistance according to each student's individual learning profile and abilities, which in turn can increase the level of success in understanding the subject matter.

However, the challenge may be the adoption and implementation of PBL based on elective differentiated learning in the school context. This requires careful preparation from the curriculum, training for the teachers in writing and implementing flexible learning for the elective students, as well as close support from the school and related stakeholders. Moreover, continuous evaluation is needed to ensure that this model is successful in increasing students' learning independence and achieving the desired learning outcomes.

By applying PBL based on elaborated learning in biology subject, it is expected to present a more meaningful learning experience for students. This will not only increase students' motivation in learning various subjects, but also help develop skills that are relevant to the real world and prepare students to face the challenges of the future.

By considering these aspects holistically, it is expected that the implementation of PBL based on differentiated learning in SMA Negeri 1 Poto Tano can become a solid foundation to improve students' learning independence. Therefore, a research study was conducted to investigate the effectiveness of the implementation of the PBL-based differentiated learning model with the research title "The Implementation of Problem-Based Learning Based on Differentiated Learning to Improve Biology Self-Reliance in Class XI Students of SMA Negeri 1 Poto Tano". The results of this research are expected to provide valuable insights for teachers and school staff in order to complete the learning process, improve the curriculum, and identify areas that need to be improved.

2. METHOD

This research is a Classroom Action Research (PTK) conducted to improve the performance of educators, improve the quality of the teaching process, and improve the learning independence of students through reflective actions in a cycle. This research was conducted at SMA Negeri 1 Poto Tano, Poto Tano sub-district, West Sumbawa Regency, NTB with the research subjects being the students of class XI-2 with 33 students. The data collection technique used is observation which will be carried out during the learning process. This research was conducted from September to November 2023 at SMA Negeri 1 Poto Tano.

3. RESULT AND DISSCUSSION

All data in this research was obtained through observation. Observation in this study involved teacher observation and student observation. The teacher's observation was conducted in order to observe the implementation and continuity of the lesson plan (RPP) with the steps of the lesson plan conducted by the teacher in the classroom. Meanwhile, student observation was used to observe the students' behavior which was related to their learning independence during the teaching process.

Observation was carried out using the teacher's observation sheet and student's observation sheet. In this research, the researcher acted as the teacher and a colleague as the observer. The result of the observation in this research is a detailed description of the results of the observation as follows:

Description of Student Observation Results

Observation in cycle 1 was carried out a total of 3 times with 3 rounds. In each lesson, the researcher used the observation tool to observe the students' behavior which was related to the independence of learning during the learning process. The observation bar was used for each student and the data collected was calculated as the average.

Below is a table of the results of the observation of the implementation of the learning process that has been carried out by using the problem-based learning (PBL) learning model to improve students' learning independence.

Table 1. 1
Recap of Student Observation Results in Cycle 1

No	Indicator of Learning Independence	Percentage (%)
1	Honest	74,24 %
2	Discipline	69,70 %
3	Responsbility	71,97 %
4	Proactive	59,09 %
5	Teamwork	68,18 %

Based on the table, it can be seen that the level of student independence is still very low, from each indicator no one has achieved maximum results. Among the five indicators of student learning independence, it can be seen that the proactive indicator has the lowest level compared to other indicators, which is only 59.09. Followed by the cooperation indicator 68.18%, discipline indicator 69.70%, and graduation 74.24%. After taking the average of all the indicators, the achievement of student independence in learning is only 68, 67%, still very far from expectations, which is an average of 80%.

At the stage of reflection in cycle 1, it is concluded that the implementation of the action through the application of the PBL method with differentiation has not been able to improve student independence in accordance with the conditions expected by the researcher. Based on the results of the observation in this condition is caused by several factors:

1. They are still dependent on the teacher's explanation in solving problems
2. The limited teaching materials available in the school to support the implementation of the KBM.

Based on the results of the observation, it can be concluded that:

1. Teachers should further elaborate the steps of learning in differentiated PBL.
2. Students should be rounded up with teaching materials without a hand-out/module as a substitute for the existence of a student booklet.

Recommendations on the results of student observation in cycle 1 were then followed up or improvements were made in cycle 2. After being given action, in cycle 2 there was a significant change in the independence of students in learning by using the differentiated PBL model. We can see this in the recapitulation table of student observation results in cycle 2 of this study;

Table 1. 2.
Recap of Student Observation Results in Cycle 1

No	Indicator of Learning Independence	Percentage (%)
1	Honest	90,91 %
2	Discipline	84,09 %
3	Responsbility	87,88 %
4	Proactive	82,58 %
5	Teamwork	81,82 %

Based on table 4. 3 above, it can be said that in cycle 2 there was a very significant improvement in student independence in learning. In cycle 2, the average achievement of the original indicator of learning independence is 85, 45%. This means that what is expected in the learning process by applying the PBL model has been achieved. Complete data on the results of student activity observation can be seen in appendix III.

a. Description of Teacher Observation Results

Based on the results of the observation both in cycle 1 and cycle 2, it can be stated that the completion of the learning steps carried out by the teacher is in line with the learning steps found in the lesson plan of the problem-based learning (PBL) model. In each lesson, the teacher has already given an explanation that is related to the problem to be solved by the students. The teacher also motivates students so that students are actively involved in solving problems so that the knowledge that has been learned can be directly applied in daily life. Before starting the lesson, the teacher presents the learning objectives and presents the problems that the students have to solve.

In every lesson, the teacher always guides students to form small groups of 4-5 students. After the groups are formed, the teacher distributes Student Worksheets (LKS) and explains the work steps and materials and tools that students must prepare. The worksheet then encourages students to be able to retrieve information through experimentation or seek information from various sources, find explanations, and solutions. After students complete the problem solving task, the teacher guides students to compile a group work report and present it in front of the class. At the end of the lesson, the teacher guides students to summarize the material that has been learned in each lesson. After finishing the lesson, the teacher must provide follow-up on the learning that has been done.

The provision of treatment using the differentiated Problem-based learning (PBL) model, to increase student learning independence after a process in 2 cycles, student learning independence is an average of 68.67% in cycle 1 proactive indicators ranked the lowest achievement which is only 59.09%. The sub-indicators of the proactive indicator are as follows;

1. Take initiative in action
2. Able to utilize flexibility
3. Have principles in action (not consultant)
4. Acts with a sense of responsibility.

So it can be said that students in cycle 1 students do not yet have their own initiative in learning, and have not been able to utilize the existing learning modules to be utilized in the learning process. The dependency on the scroll is still very high, the students have not been familiar with the differentiated PBL model. Not yet accustomed to discussing and solving problems without the participation of the teacher. Still very dependent on the teacher in getting

answers to every question that becomes the topic of discussion. Not yet brave enough to take their own position in terms of expressing opinions, still following the majority opinion.

In cycle 1, the indicators of honesty and responsibility had relatively modest levels of achievement, namely 74.24% for honesty and 71.97% for responsibility. From this it can be read that in cyclical 1 students have started to accept responsibility, and can complete it well. Can report data as it is, as well as try to be honest by not copying other people's work without mentioning the source in doing each assignment given. But even so, the percentage of achievement is still far from expectations.

To help you understand more clearly the differences in the results of observations of student independence in cyclical 1 and cyclical 2, let's look at the table below:

Table 1.3.
Comparison of Student Independence Observation Results in Cyclical 1 and Cyclical 2

No	Indicator of Learning Independence	Cycle 1	Cycle 2
1	Honest	74,24 %	90,91 %
2	Discipline	69,70 %	84,09 %
3	Responsbility	71,97 %	87,88 %
4	Proactive	59,09 %	82,58 %
5	Teamwork	68,18 %	81,82 %
	Average	68,67 %	85,45 %

The results of the observation in cycle 2 showed that the independence of students in learning by using the PBL model was higher than in cycle 1 which was shown through the activity of the learning process, namely by increasing the achievement of each indicator of students' independence in learning from 68.67% in cycle 1 to 85.45% in cycle 2.

The significant increase in each indicator indicates that students have high ability to solve the problems given by the teacher. Students are able to work together with others in the group and develop an attitude of responsibility by completing the task. When presenting the results of the report, each student has been able to develop a sense of self-confidence.

Based on the results of the observation, the highest percentage was obtained in the honest indicator, then able to be responsible. This is due to the application of Problem-Based Learning. In the learning process, the teacher acts as a facilitator, while students are more active participants so that students will feel responsible for finding their own information through the direction and guidance of the teacher to solve the problem.

Savoi and Hulghels (in Madel Welna, 2010: 91) also said that PBL has the characteristics of giving students a big responsibility in solving and directly carrying out the self-learning process. In the problem-solving process, students are organized into small groups. If students are not able to cooperate with each other, it will be difficult to retrieve information from various sources. For that reason, PBL is able to train students' cooperation. Tan (2003: 30) stated that the characteristics of PBL are collaborative, communicative, and cooperative learning that is carried out in groups, learning by doing, teaching each other (peer teaching) and doing presentation (in M. Taulfiq Amir, 2009: 22).

Problem-based learning is a learning model that encourages students to think critically, solve problems, learn independently, and develop skills for participating in teams. The problem solving process is carried out collaboratively and is completed with agility (Barrows & Kellson, (2004) in Yatim Riyanto, 2010: 285). The PBL learning process in high school can train students' learning independence, especially in class Based on the explanations above, it can be stated that the development of the Problem Based Learning (PBL) learning model can increase students' learning independence.

These results are also substantially similar to the results of the research results, as well as other research results as I studied in CHAPTER II of this research report, where the PBL implementation can be used as an option for research analysis that can be used to implement the results to teach students who are not confident. The implementation of PBL teaching and learning in research is also similar to the teachings of Ki Hadjar Deliwantara's educational philosophy that in carrying out learning must pay attention to the nature of nature and the nature of the times of the students.

4. CONCLUSION

Based on the results of research and discussion, it can be concluded that:

The implementation of a differentiated Problem Based Learning (PBL) model can increase the independence of students in biology learning in class XI 2 SMA Negeri 1 Poto Tano Year 2022/2023. This can be proven by increasing student independence in learning from cycle 1 to 68.67%, to 85.45% in cycle 2.

Thorough preparation and the diversity of South Sulawesi's diverse learning media are very important for the successful application of differentiated PBL methods in learning

5. SUGGESTION

Based on the results of the research and the discussion of differentiated PBL in biology subjects, the researcher proposed suggestions as a guide.

1. For Teachers
   a. Teachers should apply differentiated Problem Based Learning (PBL) in classroom learning activities which are completed with the material to be studied, because this learning model has proven to have a significant impact on students' learning independence.
   b. It is best if learning by implementing the developed Problem Based Learning (PBL) model is solved with real problems so that students are challenged to successfully solve it because it is useful in their daily lives.
2. For School Principals

a. School principals are expected to provide support to class teachers to use various variations of learning models to train students' learning independence, especially differentiated Problem Based Learning (PBL) which is supported by the necessary tools and materials.

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