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APPLYING PBL-BASED STUDENT WORKSHEETS IN INCREASING STUDENTS' MOTIVATION TO LEARN MATHEMATICS IN CLASS VIII-G SMPN 8 DENPASAR IN THE ACADEMIC YEAR 2023/2024

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ABSTRACT

Schools have used various educational approaches, such as learning models, but students' motivation to learn mathematics is still low. This study has the following objectives: (1) to find out whether the application of *Problem-Based Learning* (PBL) student worksheets can increase students' learning motivation in mathematics, and (2) to find out how students respond to the application of *Problem-Based Learning* (PBL) student worksheets during the learning process. The research conducted was a class action research (PTK). Students in class VIII G of SMP Negeri 8 Denpasar in the academic year 2023/2024 are the subjects of this research. The focus of the research is how students are motivated to learn and how they respond to the application of *Problem-Based Learning* (PBL) based student worksheets in learning mathematics. The research was conducted in two cycles, with a cycle consisting of four stages: (1) preparation; (2) action; (3) observation and assessment; and (4) reflection. The report on the results of Classroom Action Research (CAR) shows that the average value of learner motivation in cycle I is 3.35, which is included in the high criteria, while in cycle II it is 3.73, which is included in the high criteria, with an increase of 0.38 and the significance of the increase in motivation. The average learner response score was 52.8, with a standard deviation of 2.26, which showed a positive increase.

Keywords: math learning outcomes, student worksheet, motivation, *Problem Based Learning* (PBL)

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PRELIMINARY

Students have unique perceptions of mathematics. If students perceive that math is fun, in solving difficult and challenging problems in math, they will be optimistic about doing it and more motivated while learning. However, if they assume that math is not easy, they will have lower positive impressions of it and be pessimistic about solving problems (Indaryati, 2015). It is important to find ways to boost students' motivation to learn mathematics, especially in mathematics materials that are considered as complicated, because students who do not want to learn can experience a decline in their academic

performance and lose confidence in completing tasks (Mahendra, 2020). A way that can be applied as a driver of learner motivation is with Problem Based Learning (PBL) based learner worksheets. Student worksheets contain tasks that they must complete and generally contain instructions and steps in completing them. Each job given in the learner worksheet should show the basic skills to be achieved and show a level of proficiency that can be measured. Student worksheets are defined by (Dahar, 2001) as task sheets that allow students and educators to interact and obtain various information. In addition, it allows students to perform tasks independently and represent learning outcomes in achieving learning objectives (Mahendra et al., 2019). The advantage of using student worksheets is that it facilitates educators to organize lessons, allows learners to get used to learning on their own initiative and aids students' understanding in carrying out written tasks (Ruseffendi, 2006). Student worksheets allow feedback to be given directly to learners regarding how much they have understood the topic being learned. In addition, students who successfully complete the challenges in the student worksheets may be more motivated to learn more (Sadia, 2003).

Thus, this Problem Based Learning (PBL, problem-based) model recognizes the types of examples that can be found in daily life routines. (Arends, 2008) asserts that Problem-Based Learning (PBL) is defined as learning that has value that can be given to students' various problem situations that are truly relevant and meaningful. Educators not only have to provide knowledge to their students, but also have to embed the knowledge in the minds of students (Islamiati, 2017). Educators must provide opportunities for learners to see how the ideas they learn are applied directly, providing opportunities for students to develop and apply their own concepts. Problem-Based Learning (PBL) is based on the idea that students should be able to identify problems themselves or with the help of others so that they can better understand the materials. (Benoit, 1998) stated that problems are posed so that students find lessons to solve problems.

Mathematics learning in junior high schools shows that students still face difficulties in exploring the materials (Sumandya et al., 2021). SMPN 8 Denpasar also experienced this. Students in class VIII-G showed unsatisfactory mathematics learning outcomes during the first semester (I. W. Sumandya et al., 2020b). This is the result of interviews and initial observations with the math teacher. This was due to learners not having the ability to maximize their intermathematical connections and were considered to have low skill levels, which caused them to be unable to use their abilities to solve previous problems. Students' mathematical connection skills are considered low, according

to (Ruspiani, 2000) based on field reality. Because math materials are only memorized and students lack the benefits of what they learn, students tend to be passive and unmotivated to learn. It is very important for teachers to know the motivation of students to learn in order to be able to maintain and improve their enthusiasm for learning both in mathematics and other subjects. Learning success is a priority because learning motivation can increase students' enthusiasm for learning and encourage them to participate in learning activities. Because students are encouraged to participate in learning activities, so students who do not have the willingness to receive knowledge can do so with pleasure. Motivation, as Mc. Donald states in (Djamarah, 2011), is a condition within oneself that wants changes in oneself. Therefore, to achieve their goals in learning, motivated students will always try their best. Based on the previous statement, this research was conducted: (1) to determine whether there is an increase in motivation to learn mathematics on the application of PBL-based student worksheets for students in class VIII-G SMPN 8 Denpasar and (2) to identify students' responses in learning mathematics to the application of problem-based student worksheets (PBL) class VIII-G SMPN 8 Denpasar in the academic year 2023/2024.

LITERATURE REVIEW

Theory of Constructivism

Constructivism is a school of knowledge philosophy that emphasizes that knowledge is the result of construction (formation). Knowledge is always the result of a cognitive construction of reality that occurs through one's activities. Based on the constructivistic view, learning is a process of knowledge formation. This formation must be done by the individual who learns. Knowledge cannot simply be transferred from one person's brain (teacher) to another person's head (learner). Learners themselves must interpret what has been taught by adjusting to their experiences (Lorsbach & Tobin in Suparno, 1997). Learning in constructivistic theory is more directed at experimental learning, namely human adaptation based on concrete experiences such as discussions with classmates, which are then formulated and used as ideas and development of new concepts. Therefore, educating and teaching activities are not focused on educators but on students. The things that are prioritized in constructivistic learning are: 1) real learning in a relevant context; 2) process; 3) learning in the context of social experience; 4) learning is done in an effort to construct experience (Islamiati, 2017).

In learning, students must actively seek new information related to the material that has been studied and then connect the information with the knowledge they already have.

Thus, learners can construct knowledge in their minds. Learning means forming meaning. This means that in the learning process there must be a strengthening of meaning, a change in meaning, or a new meaning that is mastered after learning. A person cannot be said to be learning if there is no strengthening of meaning, change in meaning, or formation of new meaning of certain material (Suparno & Carrie, 1997).

According to the constructivist principle, a teacher or teacher acts as a mediator and facilitator who helps the student's learning process go well. The pressure is on the learners who learn and not on the teacher who teaches. The function of mediator and facilitator according to Suparno & Carrie (1997) can be described in several tasks as follows.

1. Provide learning experiences that allow students to take responsibility for design, process and research.
2. Provide or provide activities that stimulate students' curiosity and help them to express their ideas and communicate their scientific ideas. Provide tools that stimulate learners to think productively. Provide opportunities and experiences that best support learners' learning.
3. Monitor, evaluate, and indicate whether learners' thinking is working or not. The teacher shows and questions whether the learners' knowledge applies to a new, related problem. The teacher helps evaluate learners' hypotheses and conclusions.

Problem Based Learning (PBL)

According to Nurhadi (in Wirjana & Sumandya, 2023), Problem Based Learning (PBL) is a learning model that involves and trains students in solving problems related to contextual life, thereby teaching them how to think critically and acquire essential knowledge and concepts. Problem Based Learning is an approach that helps students identify problems from real-life events, gather information through self-determined strategies, and make decisions to solve these problems. Problems in PBL can be specific situations or methods to achieve a goal or process. Through PBL, students can address and solve the issues they face.

Characteristics of Problem Based Learning include organizing teaching around significant questions or problems that are important socially and personally. PBL is interdisciplinary, meaning the subjects discussed are actual problems that can be investigated from various disciplinary perspectives. In this model, students are asked to analyze, develop hypotheses, make predictions, gather information, conduct experiments, and draw conclusions. The primary focus of PBL is positioning the teacher as the designer

and manager of learning, while students are responsible for understanding and mastering mathematical concepts through their learning activities. PBL begins by presenting students with a mathematical problem that they are required to solve (De Graaf & Kolmos, 2003).

Student Worksheets

Student Worksheets are sheets containing tasks that students must complete. These worksheets typically include instructions and steps to complete a task. The tasks should clearly outline the basic competencies to be achieved. (Wulandari, 2020) states that Student Worksheets play a significant role in the learning process because they can enhance student engagement in learning. Their use in teaching can help teachers guide students to discover concepts through their activities. Additionally, Student Worksheets can develop process skills, increase student activity, and optimize learning outcomes. General benefits include:

1. Assisting teachers in planning lessons.
2. Activating students in the learning process.
3. Helping students keep notes on the material to be learned through teaching activities.
4. Aiding students in systematically acquiring information about the concepts being studied.
5. Training students to discover and develop process skills.
6. Activating students in developing concepts.

Based on these views regarding the benefits of Student Worksheets, this research synthesizes that the benefits of the developed Student Worksheets include activating students in the learning process, helping students systematically gather information about the concepts being studied, and engaging students in developing concepts. Student Worksheets have at least four functions (Saputro et al., 2023) as follows:

1. As teaching materials that can minimize the role of educators but activate students more.
2. As teaching materials that make it easier for students to understand the material presented.
3. As concise teaching materials rich in practice tasks.
4. Facilitating the teaching implementation for students.

Learning Motivation

Learning motivation is one of the factors determining the effectiveness of learning. A student will learn well if there is a driving factor, namely learning motivation. Students will study diligently if they have high learning motivation. According to Sardiman (2007), a person will succeed in learning if they have the desire to learn. This is the first principle and law in education and teaching activities. This desire or drive to learn is called motivation. Therefore, education and teaching will struggle to achieve their goals without motivation or drive in each individual involved in educational activities. According to Mudjiono (2002), learning motivation is crucial for both students and teachers. For students, the importance of learning motivation includes:

1. Making students aware at the beginning of learning, the process, and the final result.
2. Informing students about the strength of their learning efforts compared to their peers.
3. Directing students' learning activities.
4. Boosting students' enthusiasm for learning.
5. Making students aware of the continuity between learning and working, interspersed with rest and play.

These points highlight the importance of learning motivation being realized by students. If students are aware of their learning motivation, they will learn well, thereby improving their academic performance. Thus, in the learning process, teachers play a significant role in enhancing learning motivation. Teachers can foster learning motivation by giving grades, rewards, competition, ego-involvement, quizzes, knowing exam results, punishment, desire to learn, interest, and recognized goals.

According to Sardiman (2007) there are two kinds of learning motivation, namely:

1. Intrinsic motivation is motives that become active and function without having to be stimulated from outside because in an individual there is already an urge to do something. If someone has intrinsic motivation, they will consciously carry out activities in learning and always want to progress so that they do not need motivation from outside themselves. This is motivated by a positive desire, that what will be learned will be useful in the future.
2. Extrinsic Motivation is motives that are active and function because of external stimuli. Motivation is said to be extrinsic when students place their learning goals outside the factors of the learning situation. Various ways can be done so that students are motivated to learn. In accordance with the above opinion, the learning motivation that exists in a person can be divided into two, namely intrinsic motivation (within the

individual) and extrinsic motivation (outside the individual).

RESEARCH METHOD

Instrument and Sample

The method used in this research is classroom action research (CAR). The research subjects were students of class VIII-G of SMPN 8 Denpasar in the academic year 2023/2024, comprising 40 students (20 boys and 20 girls). The objects of the research included their motivation to learn and their responses to the application of worksheets based on the principles of Problem-Based Learning (PBL) in studying mathematics. The types of data and data collection instruments used in this study are detailed in Table 1.

Table 1. Types of Data and Data Collection Instruments

No	Type of Data	Instrument	Time
1	Learning Motivation	Observation Sheet	Every Meeting
2	Student Response	Questionnaire	End of Cycle II

Data Collection

In this study, researchers collected data on two main aspects: learning motivation and student responses to the use of Problem-Based Learning (PBL)-based worksheets in mathematics education. They utilized questionnaires to gather information from students. These questionnaires were designed based on the Likert scale, a common tool in survey research for measuring attitudes and opinions.

The Likert scale used in this study consisted of five options: strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). Each option represents a level of agreement or disagreement with statements presented in the questionnaire. For positive statements about the effectiveness or benefits of the PBL-based worksheets, the scoring system assigned higher values to responses indicating stronger agreement. Specifically, responses were scored as follows: SA = 5, A = 4, N = 3, D = 2, SD = 1. This scoring system allowed researchers to quantify and analyze student perceptions and attitudes towards the PBL-based worksheets in mathematics learning. By collecting and analyzing responses using the Likert scale, the study aimed to gain insights into how students perceived the effectiveness, utility, and overall impact of the PBL approach on their learning experience.

Data Analysis

Data Analysis Summary

Data analysis involved assessing the data collected on students' learning motivation and their responses to the PBL-based worksheets. The implementation was carried out in two cycles by applying action research (CAR) model by Kemiss and Taggart (1998), consisting of four stages: (1) preparation; (2) action; (3) observation and assessment; (4) reflection. The sources of data obtained in this action are (1) learning motivation and (2) students' responses to the application of problem-based student worksheets (PBL) in mathematics lesson.

The analysis provided insights into the effectiveness of the worksheets and their impact on student motivation and engagement in learning mathematics.

1. Descriptive Analysis:

- Ideal Mean (MI): $\frac{1}{2}(Maximum\ Score + Minimum\ Score)$
- Ideal Standard Deviation (SDI): $\frac{1}{6}(Maximum\ Score + Minimum\ Score)$

2. Motivation Categories:

- Very High: $MI + 1.5\ SDI \leq X$
- High: $MI + 0.5\ SDI \leq X < MI + 1.5\ SDI$
- Medium: $MI - 0.5\ SDI \leq X < MI + 0.5\ SDI$
- Low: $MI - 1.5\ SDI \leq X < MI - 0.5\ SDI$
- Very Low: $X \leq MI - 1.5\ SDI$

The research is considered successful if more than 75% of students achieve "High" motivation. Also considoring successful if the average student response is in the "Positive" category.

The method used in this research is a classroom action research (CAR). The research subjects were taken from students of class VIII-G of SMPN 8 Denpasar in the academic year 2023/2024, with a total of 40 students (20 boys and 20 girls). The objects of the research include their motivation (drive) to learn and the response they give to the application of worksheets based on the principles of Problem-Based Learning (PBL) in studying mathematics.

RESEARCH RESULTS

The implementation of this class action was carried out on students of class VIII-G SMPN 8 Denpasar in the academic year 2023/2024 with a total of 40 students. The material studied was packaged in two learning cycles with one meeting per cycle. All

meetings consisted of six face-to-face lesson hours given twice a week. At the beginning of the meeting, the teacher first conveyed to students that mathematics learning activities in class VIII-G on the subject of Linear Equations and Inequalities of One Variable would be carried out by applying the Learner Worksheet . Teachers and students discuss the details of the subject matter and supporting references. Teachers and students agree on the Problem Based Learning (PBL) learning model. The teacher socializes and explains the essence of the Problem Based Learning (PBL) learning model. On. The application of Problem Based Learning (PBL) based Learner Worksheets , students are given the opportunity to think critically and play an active role with group members in solving problems, presenting in front of the class, and responding to discussion results, and so on. In every learning process, students are divided into learning groups. With each group consisting of 4-5 students. In each learning process in each cycle, students learn by using media in the form of Learner Worksheets facilitated by the teacher. The Learner Worksheet can be used as a guide for students during the learning process in class both in conducting topic investigations and discussions in groups. Finally, to measure the level of motivation of students, a questionnaire of student motivation and also a small note are also designed at this stage.

In the first meeting of Cycle I, the students appeared active in responding to the teacher's questions during the introductory phase, although not all of them did so. During the learning process in the first meeting, the students focused on solving problems in the student worksheet . Some students interacted with the teacher to ask about technical issues, where the students' connection was poor, thus hindering optimal access to the materials. Only a few students were able to present their group discussion results well.

The research results in Cycle I consist of student learning motivation. Data analysis results show that the average score of student learning motivation during the learning process in Cycle I was 3.35, which falls into the high category. The percentage of student learning motivation during the learning process in Cycles I and II is presented in Table 2.

Table 2. Students' Motivation (Encouragement) in Cycle I and Cycle II

Mean Range	Criteria	Cycle I		Cycle II	
		Students	Percentage (%)	Students	Percentage (%)
$3.75 \leq X$	Very High	16 students	40%	18 students	45%
$2.92 \leq X < 3.75$	High	11 students	27.5%	22 students	55%
$2.09 \leq X < 2.92$	Medium	0 students	0%	0 student	0%

$1.26 \leq X < 2.09$	Low	12 students	30%	0 student	0%
$X \leq 1.26$	Very Low	1 student	2.5%	0 student	0%

Based on Table 2, it shows that student learning motivation was very high (38%), high (17%), medium (0%), low (12%), and very low (1%). The distribution of student learning motivation in Cycle I shown in Table 2 indicates that student learning motivation had not yet met the predetermined success criteria. Moreover, Table 2 shows that the average score of student learning motivation in Cycle II was 3.73, which falls into the high category, where student learning motivation was very high (45%), high (55%), medium (0%), low (0%), and very low (0%).

Based on the results obtained in Cycle I and Cycle II, a hypothesis test will be conducted to determine whether the proposed action hypothesis is accepted or rejected. Before the hypothesis test is conducted, all research results from Cycle I and Cycle II will be presented as shown in Table 3.

Table 3. Students' Responses During Cycle II

Evaluation Results	**Cycle I**	**Cycle II**	
	Motivation	**Motivation**	**Students' Responses**
Number of Students	40	40	40
Total Score	134	149	2112
Average Score	3.35	3.73	52.8
Standard Deviation	1.27	0.88	2.26

In Cycle I, the average score of student learning motivation was 3.35 with a standard deviation of 1.27, and in Cycle II, the average score of student learning motivation was 3.73 with a standard deviation of 0.88. When compared, the average score in Cycle II is higher than the average score in Cycle I, indicating an increase in the average score of learning motivation by 0.38. Therefore, the application of Problem-Based Learning (PBL)-based Student Worksheets can increase the motivation of students in mathematics for class VIII-G at SMP Negeri 8 Denpasar in the 2023/2024 academic year. Thus, the first action hypothesis is accepted. The average score of student responses to the application of Problem-Based Learning (PBL)-based Student Worksheets in an effort to increase student motivation in mathematics for class VIII-G is 52.8 with a standard deviation of 2.26. Based on the established criteria, this falls into the very positive category. Therefore, the third action hypothesis is accepted.

The evaluation of the range in cycle I and II related to student responses is presented as follows

Table 4. Evaluation in Cycle I and II

Mean Range	Criteria	Students' Responses	
		Number of Learners	Percentage (%)
$52.50 \leq X$	Strongly Positive	40 people	100%
$44.15 \leq X < 52.50$	Positive	0 people	0%
$35.84 \leq X < 44.15$	Fairly Positive	0 people	0%
$27.51 \leq X < 35.84$	Less Positive	0 people	0%
$X \leq 27.51$	Poorly Positive	0 people	0%

Based on the evaluation of student responses in Cycle I and Cycle II regarding the implementation of Problem-Based Learning (PBL) in mathematics for class VIII-G at SMP Negeri 8 Denpasar, the results are highly favorable. According to Table 4, all students (100%) provided responses that fall within the "Strongly Positive" category, with an average score of 52.50 or higher. This indicates that the students had an overwhelmingly positive reaction to the PBL-based Student Worksheets throughout both cycles. No students' responses fell into the "Positive," "Fairly Positive," "Less Positive," or "Poorly Positive" categories, highlighting the effectiveness of the PBL approach in enhancing student engagement and motivation in mathematics. This strong positive feedback underscores the success of the PBL implementation in fostering a supportive and motivating learning environment for the students.

In Cycle I, students got an average score of 3.35 with a standard deviation of 1.27, and during Cycle II, they got an average score of 3.73 with a standard deviation of 0.88, which showed an increase in learning motivation by 0.38. Therefore, the research findings show that the success of applying PBL-based student worksheets at SMPN 8 Denpasar in the academic year 2023/2024 led to an increase in the motivation of students in class VIII-G. The first action hypothesis was accepted based on the presentation. In mathematics lessons in class VIII-G, the score obtained by students through responses to the application of PBL-based student worksheets on average was 52.8, with a standard deviation of 2.26. The second action hypothesis was accepted because it was included in the very positive criteria based on several conditions set (Sumandya et al., 2020a).

DISCUSSION

According to the analysis of the research results, the average learning motivation of 3.35 with a standard deviation of 1.27 was included in the high category at the end of the first cycle (W. Sumandya, 2020). Furthermore, at the end of cycle II, the data analysis of the response given by students to the application of PBL-based student worksheets for students in mathematics class VIII-G SMPN 8 is included in the very positive criteria (Widana, 2023). With an average value of 3.73 and a standard deviation of 0.88, the

learning motivation of students is included in the high category. The data shows that there is an increase in the learning motivation of students in class VIII-G SMPN 8 Denpasar which is caused by the successful application of PBL-based student worksheets (Widana et al., 2023).

Student worksheets contain a collection of text and images that can make the material more evocative and facilitate students' understanding. Furthermore, the elements of suitability of PBL-based student worksheets strongly support cognitive development in fostering learners to seek more information, analyze and evaluate problem-solving methods. The experience of finding and solving problems motivates students. Very positive responses from the students indicate desires to learn (Wulandari, 2013).

(Sardiman, 2006) supports this fact by showing several roles of motivation in learning activities, namely: (1) stimulating students to do something; (2) determining the goal of how to achieve; (3) making plans to achieve success; (4) making them dare to take part; (5) growing their interest; and (6) increasing their observation. The development of learning motivation will certainly make them learn better. As mentioned above, the results of this study are in line with and support the standardized theory. So, the results of this study can prove that the application of PBL-based student worksheets can increase students' learning motivation to take part in mathematics lessons in class VIII-G SMPN 8 Denpasar in the academic year 2023/2024.

CONCLUSIONS

Based on the data analysis and discussion of this research, the following conclusions can be drawn. The result shown there is an increase in motivation to learn mathematics through the implementation of Problem Based Learning (PBL) based Student Worksheets (LKPD) in class VIII-G of SMPN 8 Denpasar in the academic year 2023/2024. This can be seen from the average motivation scores of the students in cycle I which was 3.35, categorized as high, and in cycle II which was 3.73, also categorized as high. There is a significant increase of 0.38 in motivation. There is a positive response to mathematics learning through the implementation of Problem Based Learning (PBL) based Student Worksheets (LKPD) among the students of class VIII-G of SMPN 8 Denpasar in the academic year 2023/2024. This is indicated by the average response score of the students being 52.8 with a standard deviation of 2.26. Thus, there is a positive increase.

Based on the research findings, several suggestions can be proposed. 1To mathematics teachers, it is recommended to implement Student Worksheets (LKPD) based on Problem

Based Learning (PBL) to enhance students' motivation to learn mathematics. For teachers interested in using Student Worksheets (LKPD) based on Problem Based Learning (PBL) in mathematics lessons, it is advised to carefully observe and anticipate the weaknesses identified by the researchers, in order to generate a learning activity that can optimize students' learning outcomes. For future researchers, it is suggested to try implementing Student Worksheets (LKPD) based on Problem Based Learning (PBL) in learning with different subjects and materials.

Some important conclusions from this research can be formulated into two important points.

1. It is proven that using PBL-based student worksheets can increase students' learning motivation in mathematics class VIII-G SMPN 8 Denpasar academic year 2023/2024. This is indicated by the average value of learning motivation in the first cycle which is 3.35, which is included in the high criteria, and 3.73 in cycle II (high criteria). There was an increase of 0.38, which proved a fairly high increase in motivation.
2. Students in class VIII-G of SMPN 8 Denpasar in the academic year 2023/2024 showed a positive response to learning problem-based student worksheets (PBL). With a mean score of 52.8 and a standard deviation of 2.26. This data shows there is a positive increase.

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