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Problem-Based Learning Model Using Local Balinese Wisdom Against Elementary School Students' Science Misconceptions

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ABSTRAK

Kegiatan pembelajaran IPA di Sekolah Dasar (SD) belum berjalan secara efektif. Pemilihan model pembelajaran yang kurang tepat oleh guru dalam membelajarkan siswa menyebabkan siswa kurang memahami dengan baik materi yang dibelajarkan. Penelitian ini bertujuan untuk menyelidiki dan menganalisis pengaruh yang kuat antara model pembelajaran berbasis masalah berkearifan lokal Bali terhadap penurunan yang signifikan miskonsepsi IPA pada siswa Kelas V SD. Penelitian ini termasuk dalam penelitian eksperimen semu, dengan rancangan nonequivalent post-test only control group design. Populasi berjumlah 203 siswa dari 8 Sekolah Dasar (SD). Sampel pada penelitian ini yaitu 32 siswa kelas eksperimen dan 30 siswa kelas kontrol yang sebelumnya telah ditentukan dengan teknik random sampling. Data miskonsepsi IPA siswa diperoleh menggunakan metode tes objektif diikuti dengan metode CRI (Certainty of Respond Index) dan dianalisis dengan uji anava dua jalur. Diperoleh rata-rata miskonsepsi IPA siswa kelas eksperimen sebesar 7,78 pada kategori rendah dan kelas kontrol sebesar 10,73 pada kategori rendah. Analisis statistik inferensial diperoleh hasil bahwa nilai signifikansi menunjukkan sebesar 0,000 yakni lebih kecil dari 0,05 (0,000 kurang dari 0,05). Simpulan penelitian bahwa terdapat perbedaan signifikan miskonsepsi IPA antara siswa yang mengikuti model pembelajaran berbasis masalah berkearifan lokal Bali dan siswa yang mengikuti model konvensional pada siswa kelas V SD.

ABSTRACT

Science learning activities in elementary schools (SD) still need to run effectively. Teachers' choice of an inappropriate learning model in teaching students causes students to need help understanding the material being taught well. This research investigates and analyses the strong influence of the problem-based learning model based on Balinese local wisdom on the significant reduction in science misconceptions in Class V elementary school students. This research is quasi-experimental, with a non-equivalent post-test-only control group design. The population is 203 students from 8 elementary schools (SD). The sample in this study was 32 experimental class students and 30 control class students who had previously been determined using random sampling techniques. Data on students' science misconceptions was obtained using the objective test method followed by the CRI (Certainty of Response Index) method and analysed using the two-way ANOVA test. The average science misconception of experimental class students was 7.78 in the low category, and the control class was 10.73 in the low sort. Inferential statistical analysis showed that the significance value was 0.000, less than 0.05 (0.000, less than 0.05). The research concludes a significant difference in science misconceptions between students who follow the problem-based learning model based on local Balinese wisdom and those who follow the conventional model in fifth-grade elementary school students.

1. INTRODUCTION

Education is a process that has the aim of transferring knowledge, values and personality formation to be able to develop a person's potential (Ainia, 2020; Rahmi et al., 2019). Primary school education is one level that has an important role (Lestari et al., 2020; Yanti & Syahrani, 2021). Elementary school education provides a basic understanding of all subjects, one of which is Natural Sciences (Science) subjects (Rikmasari & Rosesa, 2022; Wijaya, 2020). Science subjects are one of the important subjects taught because they can arouse students' curiosity about all natural phenomena and their problems which can then motivate students to make observations (Maisya et al., 2020; VF Musyadad et al., 2022; Sulthon, 2017).

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Generally, in the science learning process, students already have a number of basic ideas and experiences regarding things related to nature, regardless of whether the knowledge possessed by students is conceptually correct or not (Ependi & Pratiwi, 2020; Pratiwi & Nanto, 2019). Because students actually have concepts that have been formed by themselves, therefore concepts are needed that justify the initial concepts that students have before the science learning process (Maulidah & Aslam, 2016; Yulianti, 2020). Science learning aims to shape students' overall personalities, it is intended to develop knowledge and understanding of science concepts that are useful and can be applied in everyday life (D. Ali et al., 2020; LU Ali, 2018; Diawati et al., 2018; Yeni et al., 2020).

The reality in the field shows that in science learning, one of the problems that is often found is that there are still misconceptions experienced by many students (Yulianti, 2020). Misconception is an error in understanding in connecting one concept with another concept, between a new concept and a concept that already exists in the student's mind so that a wrong concept will be formed (Irani et al., 2020). Apart from teachers, textbooks and teaching methods, other causes of misconceptions can occur due to students themselves (Ayuni & Arif, 2023; Mukhlisa, 2021). When learning takes place, many students cannot ask questions about material they do not understand and only memorize concept definitions without paying attention to the relationship between one concept and other concepts (Hajiriah et al., 2019; Subrata et al., 2019). Each concept does not stand alone, but each concept has a relationship with other concepts (Karomah et al., 2018). This will result in new concepts not entering the concepts that already exist in students' minds, so that the new concepts have no meaning. Thus, there is a misunderstanding of concepts (misconceptions) experienced by students. The high level of misconceptions about science in elementary schools (SD) is due to the lack of use of learning models that are suitable for application to students in order to generate motivation in learning. This certainly causes students to feel bored so they pay less attention to the concepts being studied. Based on observations at elementary schools in Gugus VII, Buleleng District, they still apply conventional models in teaching their students, teachers also do not understand the characteristics of each student. So students become passive in the learning process which causes low science learning outcomes. Low science learning outcomes were obtained from data collection on students' PTS scores.

Based on data on PTS scores for class V students, it can be seen that the number of students who have not reached the KKM is 115 out of 203 students, which shows that there are more students who have not reached the KKM. The average score of class V students from eight schools with eight classes is still below the KKM. So it can be concluded that the science learning outcomes of fifth grade elementary school students in Cluster VII Buleleng District are still relatively low. One of the factors causing low learning outcomes is the lack of understanding of fifth grade students regarding science concepts. Thus, it causes misconceptions in students and affects their learning outcomes. Based on interviews, students think that photosynthesis only occurs during the day, the sun moves around the earth from east to west, sea water is blue. These statements were obtained by students based on their experiences and students' lack of understanding of concepts, resulting in misconceptions among students. In the learning process, if the teacher makes a mistake in understanding and explaining the science learning concept, students will receive the wrong concept. Understanding concepts is very important in the learning process so that students have the ability to solve problems (Astuti, 2020; Sopiany & Rahayu, 2019). If misconceptions persist in students, it will cause students to experience confusion and will ultimately become an obstacle for students in the subsequent learning process (Apriadi et al., 2018; Pratamawati, 2020). To overcome the problem of science misconceptions among students, one of the things teachers can do is use innovative learning models so that students do not get bored and enjoy learning science.

There are many innovative learning models that can be used by teachers to reduce students' levels of misconception (Rizki et al, 2020). This research uses a problem-based learning model. The problem-based learning model is a learning model that is designed based on problems in everyday life so that students learn to think critically, are able to have problem-solving skills, and gain knowledge through the processes they go through (Haryanti, 2017; Listiagfiroh & Ellianawati, 2019; Tarigan, 2018; Zakiah et al., 2019). The use of a problem-based learning model can increase understanding of concepts because students will be stimulated to carry out investigations to solve the problems given so that students tend to be motivated to master the concepts (Siregar, 2019). So that the problem-based learning model is easily accepted by students, it can be collaborated with local Balinese wisdom. This is based on the fact that local wisdom values are currently ignored in learning, especially science learning in schools. The problem-based learning model based on local Balinese wisdom can improve students' creative thinking processes and increase students' understanding in solving problems through a sense of local wisdom in their environment.

Based on the description of the problem above, it shows that the choice of model in the learning process is very important for teachers to minimize the occurrence of misconceptions. So the aim of this research is to investigate and analyse the strong influence of the problem-based learning model based on

Balinese local wisdom on the significant reduction in science misconceptions in Class V elementary school students.

2. METHOD

The research carried out in this research is quantitative research, with a quasi-experimental type of research. The form of experiment used in this research is non-equivalent post-test only control group design. The population in this study were all class V students in Cluster VII, Buleleng District. The population was tested for equality using one way analysis of variance (one way anova) by analysing the results of the class V science midterm exam for the odd semester of the 2022/2023 academic year. The population equality test criteria are carried out at a significance level of 5% with the test criteria being if the significance value (Sig) is > 0.05 then the averages are the same. If the significance value (Sig) <0.05, then the averages are different. Based on the hypothesis test, a significance value of 0.953 < 0.05 was obtained, so it can be concluded that the average is the same or there is no significant difference in the results of the odd mid-semester test in science subjects for class V elementary school students in Cluster VII, Buleleng District, so that the entire class in the population are included in the drawing. Sampling was carried out using random sampling through a lottery technique. Through random sampling techniques, from 8 classes, 2 experimental classes were obtained, namely SD 2 Banyuning and SD 6 Banyuning, as well as 2 control classes, namely SD 1 Banyuning and SD 5 Banyuning with a total sample of 62 students.

The instrument used in this research is the science learning outcomes test. The science learning outcomes test uses a test method in the form of objective questionswhich consists of 30 questions and is followed by the CRI method(Certainty of Response Index).CRI is the level of confidence/certainty of respondents in answering each question item (Ayuni & Arif, 2023). Students with high CRI reflect high conceptual confidence/certainty in answering questions, while students with low CRI indicate that answers are only based on guesses (Margunayasa et al, 2021). CRI has several levels of confidence, namely 0 "really guessing", 1 "just guessing", 2 "not sure", 3 "sure", 4 "not sure", and 5 "certain" (Trisnawati, 2019). If a student in answering a question chooses CRI level 5 "definitely", but the answer given turns out to be wrong then the student can be categorized as having a misconception. Test creation is based on basic competencies that have been established in the curriculum and are presented in an instrument grid. The instrument grid is presented in Table 1.

Table 1. Science Learning Results Test Grid

Core Competencies (KI)	Basic Competencies (KD)	Indicator
1. Understand conceptual, procedural and metacognitive factual knowledge at a basic level by observing, asking questions and trying based on curiosity about oneself, God's creatures and their activities, as well as the objects they encounter at home, at school and in the playground.	3.6 Apply the concept of heat transfer in everyday life	3.6.1 Students are able to apply the concept of heat transfer by conduction in everyday life 3.6.2 Students are able to apply the concept of heat transfer by convection in everyday life 3.6.3 Students are able to apply the concept of radiation heat transfer in everyday life 3.6.4 Students are able to apply the concept of conductors in everyday life 3.6.5 Students are able to apply the concept of insulators in everyday life

Before the research instrument is used, a content validity test, item validity test, reliability test, discrimination test and difficulty level test are carried out first. Based on the content validity test using the Gregory test, the content validity result of the instrument was 1.00 in the very high category. The research instrument was tested on 50 respondents with 30 test items, resulting in 30 valid test items. The valid test was then tested for reliability and obtained a result of 0.92, which is in the very high category. In the differential power test, 3 items had the criterion of "fairly good" differentiation, 21 items had the criterion of "good" differentiation, and 6 questions had the criterion of "very good" differentiation. In the test the level of difficulty of the test items is obtained5 questions with "easy" criteria, 22 questions with "medium" criteria, and 3 questions with "difficult" criteria. The statistical analysis used to test the hypothesis was using Two-Way Anova with the help of the SPSS program. Before testing the hypothesis, a prerequisite analysis test is carried out consisting of a data distribution normality test and a variance homogeneity test.

The hypothesis in this research is that there are differences in science misconceptions between students who follow the problem-based learning model based on local Balinese wisdom and students who follow the conventional model in class V elementary school students in Gugus VII, Buleleng District.

3. RESULT AND DISCUSSION

Result

Data on science misconceptions from fifth grade elementary school students that were obtained were analysed using descriptive statistical analysis to determine the mean, median, mode, standard deviation and variance of the results post-test in the experimental class and control class. A summary of the results of descriptive statistical data analysis in the experimental class and control class is presented in Table 2.

Table 2. Description of Post-Test Data on Science Misconceptions in Experiment Class and Control Class

Statistics	Experiment	Control
Mean	7.78	10.73
Median	6	10
Mode	3	8
Standard Deviation	4.62	3.73
Variance	21.40	13.92

Based on Table 2, it is known that the average or mean post-test science misconceptions of experimental class students with M = 7.78 converted into the assessment scale category is in the low category, while the average or mean post-test science misconceptions of control class students with M = 10.73 is converted into the assessment scale category which is in the low category. This shows that there are differences in misconceptions between classes that are taught using a problem-based learning model based on local Balinese wisdom and classes that are not taught using a problem-based learning model based on local Balinese wisdom. After the science misconception data is collected, the data analysis prerequisites are then tested before carrying out the 2 Way ANOVA test to test the hypothesis. Prerequisite tests are carried out on the post-test data that has been obtained. Before testing the hypothesis, an assumption test is first carried out as a prerequisite for hypothesis testing, namely the normality test and the variance homogeneity test. The results of the normality test for the distribution of science misconception data from the experimental and control groups are presented in Table 3.

Table 3. Data Distribution Normality Test Results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig.
Standardized Residual for Misconceptions	0.083	62	0.200	0.982	62	0.519

Based on Table 3, it can be seen that the significance value using Kolmogorov-Smirnov and Shapiro-Wilk calculations shows that it is greater than 0.05 (> 0.05). So it can be stated that the data is normally distributed. The results of the homogeneity of variance test analysis are presented in Table 4.

Table 4. Varins Homogeneity Test Results

		Levene Statistics	df1	df2	Sig.
Misconceptions IPA	Based on Mean	1.822	3	58	0.153
	Based on Median	1.023	3	58	0.389
	Based on Median and with adjusted df	1.023	3	52.838	0.390
	Based on trimmed mean	1.694	3	58	0.178

Based on Table 4, it can be seen that the significance value of science misconceptions is 0.178, which is greater than 0.05 (0.178 > 0.05). So it can be stated that the distribution of science misconception data is homogeneous. Hypothesis testing is carried out when the data has met the prerequisite tests, namely the normality test and the variance homogeneity test. Based on the prerequisite tests that have been carried out, the results obtained show that the data from the experimental group and control group are normally

distributed and have homogeneous variance. So the data can be continued to carry out hypothesis testing with the 2 Way ANOVA Test. The test criteria are if the significance value is <0.05 then H_0 is rejected. A summary of the results can be seen at Table 5.

Table 5. Summary of Two Way Anova Calculation Results

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	1038.087	3	346.029	122.237	0.000
Intercept	5566.238	1	5566.238	1966.308	0.000
Treatment	129.842	1	129.842	45.868	0.000
Error	164.187	58	2.831		
Total	6461.000	62			
Corrected Total	1202.274	61			

Based on Table 5, the results of the analysis using the 2 Way ANOVA Test (two way ANOVA) can be seen that the significance value shows 0.000, which is smaller than 0.05 (0.000 < 0.05). So it can be concluded that H_0 is rejected and H_1 is accepted. This shows that there are differences in science misconceptions between students who follow the problem-based learning model based on local Balinese wisdom and students who follow the conventional model in class V elementary school students in Gugus VII, Buleleng District.

Discussion

Based on research studies, the problem-based learning model based on local Balinese wisdom has an influence on the science misconceptions of fifth grade elementary school students. The results show that there is a significant difference in science misconceptions between classes that are treated with problem-based learning models based on Balinese local wisdom and classes that do not receive treatment with problem-based learning models based on local Balinese wisdom or use conventional learning models. This can occur due to more active teaching and learning conditions (Suswati, 2021; Widayanti & Nur'aini, 2020). The teaching and learning process using a problem-based learning model based on local Balinese wisdom connects students with real problems that exist in their daily lives (Doli et al., 2022; Mardiana, 2019). Then, from this problem, students are stimulated to be able to study the problem given based on the knowledge and experience that students have previously had, so that new knowledge and experience is formed.(Vina Febiani Musyadad et al., 2019; Wijayanti & Wulandari, 2016; Wulandari1 et al., 2018). Students actively think in solving problems related to their daily lives when learning is assisted by a problem-based learning model based on local Balinese wisdom (Dewi et al., 2016; Tarigan, 2018; Wardani & Suniasih, 2022).

This learning model provides opportunities for students to more actively contribute to learning, because students are required to be active in finding and solving problems given through the stages of the scientific method (Imelda et al., 2019; Sangila et al., 2017). Through the stages of the scientific method, students can learn knowledge related to the problem, then can discover their own concepts, and at the same time have the skills to solve problems (Devi & Bayu, 2020;Komisa et al., 2023). When students are given the opportunity to actively discover their own concepts and solve their own problems, students experience a meaningful learning process which results in the concepts students learn tend to last a long time and are not easily lost, so students do not experience misconceptions. Apart from that, the presence of Balinese local wisdom can improve students' creative thinking processes and increase students' understanding in solving problems through a sense of local wisdom in their environment.

During learning, students often cannot ask questions about material they do not understand. Apart from that, students only memorize concept definitions without paying attention to the relationship between one concept and other concepts (Hajiriah et al., 2019; Subrata et al., 2019). Each concept cannot stand alone, but each concept has a relationship with other concepts (Karomah et al., 2018; Safitri & Ardana, 2020). This results in new concepts not entering the concepts that already exist in students' minds, so that the new concepts will not have meaning for students. Thus, there is a misunderstanding of concepts (misconceptions) experienced by students. The use of a problem-based learning model based on local Balinese wisdom is able to increase understanding of concepts because students are stimulated to carry out investigations to solve the problems given so that students tend to be motivated to master the concepts. The use of a problem-based learning model is supported by local Balinese wisdom through Local wisdom activities carried out in Bali can be used as knowledge for students. Students are given problems, which in this case are contextual problems related to class V thematic learning Theme 6 Sub themes 1 and 2 Lesson 1 to Lesson 5. On the subject of heat and its transfer, one of the Balinese people's activities by utilizing heat energy is making suckling pig. Suckling pig is one of Bali's traditional culinary delights. When making

suckling pig, fire is used as a source of heat energy. One of these activities that is often encountered by students living in Bali is the knowledge that fire is a source of heat energy.

Implementing learning using a learning model based on local Balinese wisdom, students are given the opportunity to practice problem solving skills, gain appropriate knowledge and concepts, and foster independence and collaboration between students. Students work in groups during the learning process to be able to formulate problems, analyse problems, communicate, and combine the information they have obtained to draw conclusions about the problems given (Haryanti, 2017). After students find a solution to the problem given, students can put the results they get on the Student Worksheet (LKPD) that was given previously. This can prevent misconceptions experienced by students because of students Read and understand carefully the problem given. Reading and understanding activities are carried out so that students are able to identify questions and visualize the situations they face in order to more easily solve the problems given. Through this long process, students experience for themselves how to find solutions to the problems given, then can communicate them as a group to the teacher and other groups. Having discussion activities between groups prevents students from having misconceptions because if students are wrong, other students can help and the teacher also plays a role in providing appropriate concepts so that students do not experience misconceptions about the material being discussed. Apart from that, the existence of learning tools such as teaching materials and learning media helps students to find the correct concepts which can then be used to solve the problems given.

The combination of a problem-based learning model with local Balinese wisdom creates an active learning climate because students are stimulated to carry out investigations to solve the problems given so that students tend to be motivated to master concepts. This finding is strengthened by previous research findings that learning using the problem-based learning model succeeded in reducing students' misconceptions. Based on the results of calculations using the formula for reducing misconceptions, it can be concluded that using a problem-based learning model in the learning process has succeeded in reducing students' misconceptions. This finding is strengthened by previous research findings stated The application of the PBL learning model can significantly influence students' conceptual understanding of the material (Setiawan & Rusmana, 2020). Apart from that, using the PBL learning model has an effect on student learning outcomes (Permatasari et al., 2019; Saraswatha et al., 2016; Serevina et al., 2018). These results show Problem-based learning models can help students understand the concepts being taught correctly and prevent misconceptions.

The problem-based learning model based on local Balinese wisdom has a significant impact on the misconceptions of class V students at Gugus VII Elementary School, Buleleng District, and Academic Year 2022/2023. The implication of this research is that for students the use of a problem-based learning model based on local Balinese wisdom provides students with the opportunity to be actively involved and construct their own knowledge. For teachers, implementing a problem-based learning model based on local Balinese wisdom makes teachers more enthusiastic about being able to provide an active learning atmosphere for students. The limitations of this research are that it was only carried out on fifth grade elementary school students and was limited to students' science misconceptions using a problem-based learning model based on Balinese local wisdom, so there are many other learning models that can be used to reduce students' science misconceptions. So, it is recommended for further research to use this study as an additional reference source regarding problems in learning, especially the application of problem-based learning models based on local Balinese wisdom or the application of the same model with different dependent variables.

4. CONCLUSION

There is a significant influence on science misconceptions between the group of students who follow the problem-based learning model based on local Balinese wisdom and the group of students who follow the conventional model in fifth grade elementary school students. This research makes an important contribution in understanding the importance of choosing a learning model that is suitable to be applied to increase student activity. So that in the learning process students are active in every learning activity and are ultimately able to master the appropriate concepts. It is recommended that students be more active and creative in the learning process so that they can understand the material well and avoid misconceptions through the use of a problem-based learning model based on local Balinese wisdom. It is recommended that teachers innovate learning with learning models that can activate students, such as problem-based learning models based on local Balinese wisdom, so that students can more easily understand the material through everyday problems and reduce the occurrence of misconceptions. So teachers can also know more about each student's cognitive style, which is certainly different through the problem solving process using a problem-based learning model based on local Balinese wisdom.

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