The effectiveness of the implementation of environmental-based learning media toward the mathematical problem-solving ability and the impact on students' nationalism attitudes

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Abstract. The purpose of this study was to determine the effectiveness of the implementation of environment-based learning media on students' mathematical problem-solving abilities and describe the impact of their implementation on students' nationalism attitudes. This study uses Pretest-Posttest One Groups Design. The research sample was 13 students in grade V SD 2 Penebel. Data on students' mathematical problem-solving abilities were collected using tests. Data on nationalism attitudes of students were collected using questionnaires, which were distributed at the end of the experiment. Data analysis used a t-test with a significance level ($\alpha = 0.05$). The impact of learning on students' nationalism attitudes is analyzed descriptively and qualitatively. The results showed the average score of students' mathematical problem-solving abilities before and after being given treatment were 38.46 and 79.81, respectively. The results of paired differences of mean is -41.345. This means that, there is an increase in problem-solving abilities before and after being given treatment. The result of the two-tailed t-test shows that sig. = 0.000, because 0.00 < 0.005. Therefore 0.000 < 0.05, this means students’ problem-solving abilities before and after being given treatment differ significantly. Thus it can be concluded that the implementation of environment-based learning media is effective to improve students' mathematical problem-solving abilities. The results of the distribution of student nationalism attitudes obtained the number of students included in the minimum of a high category is 92.31%.

1. Introduction
Mathematics is a science that plays an important role in the development and advancement of other sciences. Therefore, mathematics needs to be taught in school from an early age. According to [1] there are five process standards in mathematics learning, namely: Problem Solving, Reasoning and Proof, Communication, Connections, and Representation. Of the five standards set, one of them is problem-solving. In line with NCTM, the Ministry of National Education also emphasized that problem-solving is one of the abilities students must possess after learning mathematics [2]. Without the ability to solve mathematical problems, the benefits and strengths of ideas/knowledge and mathematical skills become limited [1]. Someone who has problem-solving abilities not only can solve similar problems, is also expected to be able to solve different problems in everyday life.
Problem-solving refers to finding solutions to new problems and must be carefully distinguished from routine questions in the form of practice questions which are usually in the form of numerical calculation questions in the same type [3]. Next to say, ‘problem’ is a state when knowledge stored in a memory is not ready to use is used in solving problems. [4] states, problem-solving is defined as an effort to find a way out of something difficult and full of obstacles to achieve goals. When a person resolves a problem, he does not merely learn to apply the knowledge he already has but also finds the right concepts and rules and controls his thinking process [5].

From some of these opinions it can be concluded that, problems in mathematics with problem-solving types have characteristics, namely: (1) there are no definite steps/methods to get answers to the question and (2) the question must be imaginable and interesting for students [5] [6] [7] [8]. So problems with a type of problem-solving have characteristics that when someone is faced with a problem, he does not have a definite picture of the solution, but he wants to solve it.

Based on the understanding of the problems that have been described, the characteristics of problem-solving abilities can be formulated, including the ability to (1) formulate problems, (2) interpret and evaluate mathematical ideas both verbally, in writing and in visual form, (3) understand how ideas in mathematics relate to each other and underlie one another to plan solutions, (4) apply strategies/various strategies to produce solutions, (5) solve problems and interpret results that have been obtained, and (6) make generalizations. Solving a problem with a type of problem-solving requires mental activities (thinking) that are more complex than mental activities carried out when solving routine problems. In other words, problem-solving ability is one indicator of positive performance characteristics.

The 2013 curriculum is a character-based curriculum. Early on, at the primary school level, there needs to be positive character planting. According to PP No. 87, the Year 2017 the concrete steps designed to instill positive character are the implementation of the Character Education Strengthening Movement which consists of five main values of the character. [9] states that the five main values of national character are religious, nationalist, independent, mutual cooperation, and integrity. Furthermore, it is said, the value of nationalist character is a way of thinking, acting, and acting that shows high loyalty, concern, and appreciation for the language, physical environment, social, cultural, economic and political nation, placing the interests of the nation and the state above self-interest and the group. Nationalist attitude is useful to foster a sense of unity between heterogeneous citizens of the country (because of differences in ethnicity and religion) and serves to foster a sense of identity and togetherness in a country.

In reality, mathematics learning in Indonesia, even in many countries is still dominated by the activities of exercises for mathematical basics achievement only [10] [5]. This results in the low ability of students to solve mathematical problem-solving. In this era of free competition, mathematics learning that relies on achieving basic skills is not sufficient. Thus learning mathematics, now and in the future should not stop only on the achievement of basic skills, but instead must be designed to achieve high-level mathematical competencies.

The low ability of students to solve mathematical problem-solving in Indonesia, in particular, can also be seen from the results of surveys conducted by world institutions, including the results of the 2015 PISA (Program for International Student Assessment) which shows Indonesia can only rank 69 of 76 countries. Meanwhile, in the same year, the results of the TIMSS study (Trends in International Mathematics and Science Study) showed that Indonesian students were ranked 36th out of 49 countries in terms of conducting scientific procedures.

In addition to the low ability of students to solve mathematical problems, there are still many problems faced in the effort to achieve them. Some of these problems are students' thinking creativity that does not develop and the implementation of learning has not been focused on achieving problem-solving abilities [9] [10] [11]. If we look at the root causes, there are several, including: (1) the mathematics learning model used to date has not been adaptive to the times, which still tends to be ‘teacher-centered’; (2) the implementation of learning is still dominated by the achievement of basic skills only, not yet focused on problem solving activities; (3) the teaching materials used have not been
designed to be oriented towards the values of local wisdom so that they do not lead to the development of character education.

This new perspective is a challenge that must be used as a guide in mathematics learning, the implementation of learning must be able to provide the widest space for students in building knowledge and experience ranging from basic skills to high levels [1]. [12] found that problem-solving is more important taught to students than just giving routine problems that only make the connection between cognitive and a definite settlement procedure. The purpose of mathematical problem solving is not solely focused on finding one correct answer (to find a correct solution), but how to construct all possible reasonable answers, along with all possible procedures and arguments, why does the answer make sense [13]. Furthermore, it is said, problem-solving ability is very important to be owned by students from an early age because students can associate mathematics material that is learned with its benefits in their daily lives.

Various efforts to improve students' problem-solving skills and nationalism attitudes can be done, including by choosing a learning model and implementing it according to the situation and condition of students. Based on Piaget's theory [14], elementary students are in a concrete operational period whose abstract thinking abilities need help manipulating concrete objects or with experiences that are directly experienced. According to Bruner elementary students tend to be in active resistance and the iconic stage, so that in learning abstract mathematical concepts requires media assistance in the form of concrete objects, symbols, and experiences experienced directly by students.

Learning media is a tool or intermediary that can be used to convey the subject matter by the teacher to students which aims to stimulate students to take part in learning activities so that the learning objectives set can be achieved [15], [16] [15] states that the use of media in learning has several benefits, namely: (1) facilitating and stimulating students to conduct discussions and discussions, (2) help and stimulate the process of expressing experiences and problems that are in accordance with reality, (3) helping to contribute the process of experiencing, (4) helps strengthen the results of the discussion in the discussion.

The learning media that is familiar with students' lives, one of which is environmental media. The environment as a source of learning can be interpreted as everything around or around students (living things, inanimate objects, and human culture) that can be used to support learning and learning activities more optimally. [16] states that there are various benefits that can be obtained using the environment as learning media and resources, including: (1) the environment provides various things that can be learned and enrich students' insight, (2) learning activities will be more interesting, not boring, and foster students' enthusiasm to study harder, (3) learning will be more meaningful, because students are faced with the actual circumstances., (4) student activities will be increased by the process of observing, asking questions or interviewing, proving something, and examine the facts, (5) by understanding and living the aspects of life in their environment, it can be possible for the personal formation of students, such as love for the environment.

The environment that is used in learning activities in schools is all types of environments that are in accordance with the learning objectives that must be achieved and the teaching materials that will be delivered to students. This type of environment is usually in the form of a social environment or natural environment or physical environment. The social environment is very suitable to be used to study social sciences, education, and humanity. One that is in the social environment is local wisdom. According to Rajib [11], local wisdom is the ways and practices developed by a group of people, which comes from an in-depth understanding of the local environment, which is formed from the way and practice of the people who live in the place down- hereditary. Local wisdom values that are full of noble values have not received attention to be integrated into mathematics learning. Students rarely know the values of local wisdom, so students do not interpret and cannot practice it [11]. In Bali, a lot of advice comes from the value of local wisdom that has long existed in the daily life of the community, including the form of slogan and “sesonggan” (proverb). The advice is integrated into student books, worksheets, and learning implementation according to the situation that occurs in the classroom.
Basically, there are two techniques of environmental utilization, namely bringing the class into the environment that is studied (out of class) and bringing the environmental conditions into the classroom. Organizing teaching and learning activities outside the classroom, teachers are required to carefully choose locations that can be used outside the classroom. The environment that can be used is the school environment and the environment outside of school. According to [16] the technique of bringing the class into the environment that is studied (out of class) can be done by using several methods, namely: (1) conducting tourist or flip trip activities, namely visiting the environment that is used as a particular object of study as an integral part of the curriculum implementation, (2) conducting school camping activities, (3) conducting survey activities, namely visiting certain objects that are relevant to the learning objectives, and (4) students doing work practices that are around the school environment.

Some of the previous studies that support this are: (1) research conducted by [17] states that elementary school students' learning achievement in Singaraja City which is taught by a scientific approach oriented to local wisdom assisted by manipulative media is higher than mathematics learning outcomes taught by conventional learning. Good learning results indicate students' problem-solving abilities are also good, so that the research conducted by Ambarawati is relevant to the research that will be conducted by researchers; (2) research conducted by [11] states that the integration of the values of Balinese local wisdom in a mathematical problem-solving learning model has a positive effect on building positive character of elementary students in Buleleng Regency; (3) research conducted by [18] stated that the mathematics learning outcomes of fifth grade students of Elementary School VI in Buleleng Subdistrict were studied with the problem-solving learning model assisted by environmental media in terms of higher cognitive style than the mathematics learning outcomes taught by the conventional learning model. Good learning results indicate students' problem-solving abilities are also good, so that the research conducted by Astriwini is relevant to the research that will be conducted by researchers; (4) research conducted by [19] states that problem-solving learning models assisted by mathematics learning video media affect the problem-solving ability of IV students in Group IV Sukasada District. However, none of the results of the study discussed specifically the use of environmental media in learning mathematics in elementary schools.

Thus it is considered very urgent to conduct research by conducting a comparative test, the advantages of the implementation of environmental media-based learning models on elementary students' mathematical problem-solving abilities, and to see the impact of the implementation of the learning model on students' nationalism.

2. Method

The research method applied is the pre-experimental method, because it does not have a control class and the sample is not chosen randomly. The research design used in this study is one group pretest-posttest design. Before being given treatment, the sample group was given a pretest and at the end of the treatment was given posttest. This design was chosen because it wanted to know about the improvement of students' mathematical problem-solving abilities after being given treatment by applying environmental media based learning models. This research design is presented in Figure 1.

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| Pretest | Treatment | postest |
|---------|-----------|---------|
| O₁      | X         | O₂      |
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**Figure 1. One Group Pretest-Posttest Design** [20]

Information:
O₁: test before being given treatment
O₂: test after being given treatment
X : treatment

The sample of this study were all students in grade V SD 2 Penebel, Tabanan in the academic year 2017/2018, as many as 13 people. The sampling technique used is total samples. This research was carried out in 3 stages, as follows. Stage 1, provides a pretest of problem-solving abilities, before being
given treatment. Phase 2, provides treatment by carrying out using environment-based media of learning in mathematics learning. Stage 3, provides a posttest to measure students' problem-solving abilities after being given treatment.

2.1. Data collection technique
The data of this study are data on mathematical problem-solving abilities, which are collected using a form test consisting of 5 items. Data on nationalism attitudes of students were collected using questionnaires. The test used has been tested for its validity and reliability. Based on the results of expert tests and field tests with product moment correlation techniques, all test items have been declared valid with distribution, 3 questions with sufficient correlation coefficients and 2 questions with high correlation coefficients. Test reliability is calculated using the Alpha-Cronbach formula. Based on field trials, it is known that the reliability of the test with a value of $r = 0.89$ (very high degree of reliability). Thus the tests used have met valid and reliable criteria.

Students' nationalism attitudes were measured using a questionnaire. Questionnaires of students' nationalism were developed through expert validation tests and field trials. There are 15 items of statements about students' nationalism which are stated in a questionnaire using a Likert scale. As an indicator of student nationalism attitudes, including appreciation of one's own culture; safeguarding the nation's cultural wealth; willing to sacrifice; superior and achievement; love the homeland; protecting the environment; discipline; respecting cultural, ethnic and religious diversity. All items developed have met valid and reliable criteria with a value of $r = 0.87$ (very high degree of reliability).

2.2. Data analysis technique
The hypothesis of this study is that there are differences in students' mathematical problem-solving abilities before and after being given treatment with the implementation of learning using environment-based media.

$H_a: \mu_1 \neq \mu_2$

$H_0: \mu_1 = \mu_2$

Information:

$\mu_1$ = average score before treatment (pretest)

$\mu_2$ = average score after treatment (posttest)

Hypothesis testing using t-test with a significance level of $\alpha = 0.05$. Data analysis uses SPSS 16.0 for Windows.

To find out the nationalism attitude of students towards the application of environmental-based media of learning, an analysis was carried out by determining the average score of students' responses with the following formula.

$$\bar{S} = \frac{\sum_{i=1}^{n} S_i}{n}$$  [21]

Information:

$\bar{S}$ = average score of nationalism attitude

$S_i$ = score of the nationalism attitude of the students

$n$ = many students

Furthermore, data on student nationalism attitudes were analyzed descriptively based on average scores, ideal mean, and standard deviation.

| Table 1. Criteria for Classifying Students' Nationalism Attitudes |
|---------------------------------------------------------------|
| **Range of Score**                     | **Criteria**                |
| $\bar{S} \geq M_i + 1.8SD_i$               | Very high                   |
| $M_i + 0.6SD_i \leq \bar{S} < M_i + 1.8SD_i$ | High                        |
3. Results and Discussion

3.1. The Results

Description of the results of pretest and posttest students' mathematical problem-solving abilities is presented in table 2.

| Table 2. Descriptive Statistics |
|-------------------------------|
|                | N  | Minimum | Maximum | Mean   | Std. Deviation |
| Pretest        | 13 | 17      | 75      | 38.46  | 15.788         |
| Postest        | 13 | 46      | 100     | 79.81  | 18.150         |

Table 2 shows that the pretest results obtained an average score of students' mathematical problem-solving ability is 38.46 with the lowest score is 17 and the highest score is 75. The posttest results obtained an average score of students' mathematical problem-solving ability is 79.81 with the lowest score is 46 and the highest score is 100. The result of t-test is presented in table 3.

| Table 3. Paired Samples Test |
|-------------------------------|
| Paired Differences | Mean   | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | t      | df | Sig. (2-tailed) |
| Pretest - Posttest | -41.345| 13.227          | 3.668            | -49.337 to -33.352       | -      | 12 | .000          |

Table 3 shows that, the results of paired differences of mean is -41.345. This means that, there is an increase in problem-solving abilities before and after being given treatment. The result of the two-tailed t-test shows that sig. = 0.000, because 0.00 < 0.005 it means that there is a significant difference between the average of pretest score and the average of posttest score.

At the end of the treatment, students were given a questionnaire on nationalism attitudes. The average score of students' nationalism attitudes is obtained as follows.

\[ \bar{S} = \sum_{i=1}^{13} S_i \div n = 783 \div 13 = 60.23 \]

The highest score is 71 and the lowest score is 50. The data distribution of students' nationalism attitudes is presented in table 4.

| Table 4. Percentage of Student’ Nationalism Attitudes |
|------------------------------------------------------|
| Category | Many Students | Percentage |
| Very high | 9             | 69.23%      |
| Category | Students | Percentage |
|----------|----------|------------|
| High     | 3        | 23.08%     |
| Medium   | 1        | 7.69%      |
| Less     | 0        | 0.00%      |
| Very less| 0        | 0.00%      |

Based on Table 2, it is known that the number of students included in the minimum high category is 12 people with a percentage of 92.31%.

3.2. Discussion

Based on the results of the study it was known that there were differences in students' mathematical problem-solving abilities, before and after being given treatment through the implementation of learning using environment-based media. As a result of the implementation of the learning given is the attitude of students' nationalism are mostly in the very high category.

Students' mathematical problem-solving ability experienced a significant increase after being given treatment in the form of the implementation of mathematics learning using environment-based media. In the implementation of learning, the first researchers use worksheets and videos that use environmental media assistance. The use of worksheets and videos with environmental media makes students able to understand abstract mathematical concepts through real objects in nature. This media environment makes students learn to associate mathematical material that is being studied with its benefits in real life. Thus, mathematics learning takes place meaningfully for students. With meaningful learning, students not only memorize formulas, but they can also understand mathematical concepts based on real experience in learning. Understanding mathematical concepts obtained meaningfully, making students able to understand the problems, problems formulate, choose the right ideas and strategies to plan problem-solving.

[5] states, the implementation of problem-solving learning strategies begin with the presentation of problems that are in accordance with the situation of students' daily lives (contextual problems) until the discovery of concepts independently by students can improve students' mathematical problem-solving abilities. Contextual problems are presented as a stimulus and then students are gradually guided to master the concept of the material being studied. As well as understanding and living the aspects of life that exist in their environment, it can be possible for the personal formation of students and students' nationalism. This is also in line with the results of research conducted by [18] stating that Mathematics learning outcomes of fifth grade students of SD Gugus VI, Buleleng Subdistrict, who took part in learning with a model of problem solving assisted by environmental media in terms of cognitive style, higher than learning outcomes of mathematics learning with conventional learning models. Furthermore, the results of research conducted by [19], stated that the problem solving learning model assisted by video had a positive effect on students' problem solving abilities IV in Group IV Sukasada District and the results of research conducted by [17] stated student learning achievement Elementary Schools in Singaraja City which are taught with a scientific approach oriented to local wisdom assisted by manipulative media are higher than the mathematics learning outcomes taught by conventional learning. Good learning outcomes indicate students' problem-solving abilities are also good [23].

Second, in conducting group discussions, each group member is serious about carrying out discussions and not just relying on one person. Students are given the opportunity to practice solving the problems of daily life in LKS. Each student is ready to present the results of the discussion because they will get added value if they do it well. The teacher directs the group's representatives to explain the results of the group's work, this motivates students to be brave enough to think and be able to write down the problems given.

Third, the teacher provides guidance and motivation to students with advice from local Balinese wisdom. Integration of advice or slogans originating from the value of Balinese local wisdom, during learning can foster positive character of students, motivate students by living and practicing the values contained in the advice of local wisdom, and increasing students' nationalism. For example, at the end of the student, LKS has listed the slogan "siat-siat wayange pamputne mapunduh dadi abesik di gedogane" (meaning: like a war in a puppet in the end all puppets will reunite in a petal). In addition to
being listed in student worksheets, the teacher also reiterated the slogan orally by explaining its meaning. This slogan has meaning, although there are differences of opinion in the discussion, all this is done to get a right decision. Students are invited to practice emotional management and learn to respect differences of opinion. This is also consistent with the results of research conducted by [11] stating that the integration of the value of Balinese local wisdom in a mathematical problem-solving learning model has a positive effect on building a positive character of elementary school students in Buleleng Regency.

The application of environmental media assisted learning models in mathematics learning in class V SD Negeri 2 Penebel went well, the constraints faced were able to be overcome through a reflection of each learning process, so that the applied learning had improved students' mathematical problem-solving skills and students' nationalism attitudes.

4. Conclusion
Based on the results of the study and discussion, it was found that students' mathematical problem-solving abilities differed significantly, with a higher average score after attending mathematics learning using environment-based media compared to before being treated. Thus it can be concluded that environment-based learning media is effective in improving the ability to solve mathematical problems of elementary school students. Nationalism attitudes of students after participating in learning using environmental-based media by integrating the values of local wisdom, most were in the very positive category. These results indicate that the learning carried out has a positive impact on students' nationalism.

Based on the results of this study, it is recommended to teachers and policyholders in the field of education, in an effort to improve students' mathematical problem-solving ability and foster an attitude of nationalism in order to carry out learning using environment-based media and integrate local wisdom values in an effort to build positive character of students.

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