Calculation of electric account as learning context based on project based learning (PBL) and lesson study for learning community (LSLC)

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Abstract. This study presents the application of the project based learning model on the sum of integers. This research uses the lesson study for learning community (LSLC) system. The sample of this study was 22 seventh grade students of Sriwijaya State Junior High School Palembang. The research method used is design research (design research). This study designs project based learning based on account calculations. The stages of this study consisted of experimental preparation, design experiments and retrospective analysis. Based on the results of retrospective analysis, it is shown that by using electricity account calculations as a context in learning students can understand integers and sets.

1. Introduction

Integers are very important material for students to learn [1]. Based on Graduate Competency Standards (SKL) that must be achieved by students for mathematics subjects based on Permendikbud No. 20 namely understanding the concepts of integers, fractions, arithmetic operations and their properties, as well as using them in solving problems of daily life [2]. Guided by Permendikbud No. 24 About the core competencies and basic competencies that must be achieved by students, especially in the integer material that is adding and subtracting integers [3]. Then based on the national standard school exam lattice that is understanding integer operations [4]. The principles and content standards of NCTM are numbers and their operations, algebra, geometry, and measurement analysis [5]. Integer material is very fundamental and continuous because one concept with another concept is interconnected [6]. The introduction of numbers starts with the introduction of natural numbers, numbers, and then integers [7]. Students have difficulty in material related to numbers. Because students tend to be less enthusiastic. Especially for the addition of integer material that is considered quite difficult [8].

Mathematics learning has been more target-oriented, learning that is oriented towards mastery of material competencies, such learning will be less meaningful [9]. This is based on the fact that learning oriented to the mastery of material targets has proven to be successful in short-term "remembering" competencies, but fails to equip children to solve problems in long-term life. Students only as recipients of information so that make students’ thinking skills low or in other words learning that occurs in the classroom is lacking meaningful [8].

Learning Model for Project Based Learning (PBL) is a learning model that is recommended for use [10]. Project based learning (PBL) is one approach that creates a learning environment that can encourage students to construct their personal knowledge of skills [7]. Research in America shows that project-based learning (PBL) shows satisfying results [11]. Project-based learning (PBL) is one of the
solutions to the right learning model to improve mathematical problem-solving abilities that can be seen based on studies from several journals or research findings that are relevant to the Project-based learning [7].

PBL is a learning model that gives students freedom to plan learning activities, carry out collaborative projects, and ultimately produce a product. The main reason for using the PPA is project-based and provides opportunities for students to explore content (material) using a variety of meaningful ways and conduct collaborative experiments [10]. Then based on the 2013 curriculum [12], it is expected that 21st century learning can be implemented. This is to address the demands of an increasingly competitive era. The 21st century learning reflects four things: critical thinking skills, creativity, communication, and collaboration. The alternative that can be used to improve learning outcomes is to use the Collaborative learning model based on Lesson Study Learning Community [13]. The results showed that the critical thinking skills of students in the class taught using the PBL model were better than students taught without the PBL model, then by applying the LSLC system it could support students learning to find mathematical concepts [10, 12, 13].

Lesson Study for Learning Community (LSLC), a system of teacher professional development through collaborative learning assessment and based on the principles of collegiality and mutual learning to build learning communities and improve the quality of learning, which in turn creates dynamic interactions between teachers so that creativity and motivation are built continuously [14]. Lesson Study is one alternative to overcome these problems where Lesson Study is a model of guidance for teachers or lecturers [15]. In LSLC activities a group of teachers collaboratively and continuously implementing, observing, and reporting learning outcomes [16].

Lesson Study for Learning Community (LSLC), a system of teacher professional development through collaborative learning assessment and based on the principles of collegiality and mutual learning to build learning communities and improve the quality of learning, which in turn creates dynamic interactions between teachers so that creativity and motivation are built continuously [18].

Learning at this time in the era of the revolution 4.0 can’t be separated from technology, one of which is learning e-learning [16]. The e-learning learning media that can be used is google classroom as a learning medium to help improve student learning outcomes [19]. Based learning Google classroom provides convenience and fluency in the teaching and learning process for educators and students, the application google classroom can also increase the intensity of interactive communication with students [20]. Design is google classroom intended for teachers, students, guardians and administrators [17].

2. Method

The research methodology used in this study is design research. The subjects of the study were students of Srijaya Palembang Middle School class VII in the 2019/2020 school year. This study consists of 3 stages, namely (1) Preliminary Design At this stage the researcher designs learning the material of integer sum using electricity account calculations. At this stage the researchers conducted a literature review related to the material that will be content in the learning design and context that will be used in this study, namely the calculation of electricity bills, (2) The Design Experiment This research experiment was conducted on students who have the ability different namely students who have high, medium and low abilities. This trial was conducted in a small group consisting of 4 people, the distribution of groups was also based on the level of student ability evenly (3) Retrospective Analysis is the data obtained from this trial phase was analyzed to see the ability of students to complete the worksheets of students.

3. Result and Discussion

Learning model that can be used to make students more active in the learning process is the Project Based Learning (PBL) model. Project Based Learning (PBL) is a learning model that uses problems as a first step in gathering and integrating new knowledge based on experience and collaborative activities [6]. Collaboration strategies can be applied through the Lesson Study system [21]. This study uses a lesson study system, lesson study activities that are activities carried out collectively and require cooperation with a cooperative team. The stages in implementing LSLC are the Plan, do, see This
research uses the Design Research method in which there is a cyclic process (loop cycle) of the design and testing of learning activities [19]. There are three stages in Design Research, namely: (1) Preparation for research, functions to implement the initial ideas of the literature review before designing learning activities. (2) Teaching Experiment, aims to collect data to answer research questions consisting of a series of activities that are designed, tried and revised, and (3) Retrospective Analysis, analysis of the results of the data from the previous stage to then be evaluated to develop further designs so that research objectives are achieved [22]. Based on the results of previous researchers show that the critical thinking skills of students in the class taught using the PBL model are better than students taught without the PBL model, then by applying the LSLC system can support students learning to find mathematical concepts [10, 12, 13].

3.1 Preparation and Planning
Preparation and planning are things that need to be prepared before research. There are three stages, namely: (1) preliminary, serves to implement the initial ideas of the literature review before designing learning activities. (2) Teaching Experiment, aims to collect data to answer research questions consisting of a series of activities that are designed, tried and revised, and (3) Retrospective Analysis, analysis of the results of the data from the previous stage to then be evaluated to develop further designs so that research objectives are achieved [22]. This research was only carried out in phase 1 namely preliminary preparation or preliminary research. As for the implementation agenda table can be seen in the table 1.

Table 1. Research agenda

| Date        | Activities                                                                 |
|-------------|-----------------------------------------------------------------------------|
| February 2020 | Researchers Preparing LKPD, RPP, Guidelines for Reporting, and Teacher's Guide for addition material integers. |
| March 2020  | Validation and Prediction of LKPD answers Material sum of integers with mathematics teachers. |
| May 2020    | Trial LKPD material for the addition of integers to small groups (Small Group). |

3.2 The implementation
The research was conducted in SMP Palembang. The class observed was class VII.B. The series of activities carried out by researchers are as follows:

3.2.1 Joint Validation Teacher
Researchers validate students 'worksheets and predict students' answers with the teacher to get information on whether the student worksheets are appropriate and able to be understood by students in terms of construct, content and language. Furthermore, after being validated, the researchers revised the student worksheets. Validation and prediction of answers is done by the Mathematics teacher (Ms. Lipa Meisinta and Ms. Sunaryati). At the time the researcher validated the student worksheet to the teacher there were some improvements (Table 2).

Table 2. Suggestion Teachers of Mathematics, Srijaya Negara Jonior HighSchool

| Teacher            | Suggestions for Improvement                                                                 |
|--------------------|----------------------------------------------------------------------------------------------|
| Lipa Meisinta, S.Pd| 1. Separate the main material and supporting material from basic competencies.                |
|                    | 2. The word capacity is replaced by power so that it is easily understood by students.         |
|                    | 3. in the answer column two columns are made, the first column is for the type of household appliance and the second column is the length of usage (hours). |
|                    | 4. in the answer column made four columns, the first column type of stairs, the second column the cost of use, the third column of |

|
Teacher Suggestions for Improvement

Sunaryati, S.Pd

1. additional use, the fourth column of the total additional costs (second day project).
2. add a description of some activities that are usually done while on vacation.
3. question number three and number four behind, problem number three becomes problem number four and vice versa problem number four becomes problem number three.

3.2.2 Small Group

After the student worksheets (LKPD) along with other learning tools are validated to the mathematics teacher at Sriwijaya State Junior High School Palembang Palembang, the researchers tested three students who had different abilities (one high ability, two medium ability, and one low ability person). When a small group of researchers cannot go directly into the field because of the Covid-19 plague. So learning cannot be done face-to-face and must go through online learning. One way that can be used to do the learning process online is to use google classroom [5].

Based on the results of the small group on the first day there are differences in the answers of high, medium and low ability students. Students with high women 90% can complete project based learning (PBL) on the first day correctly. while medium-capable students on average 67% can complete project based learning (PBL) on the first day correctly, then students with low ability 45% can complete project based learning (PBL) on the first day correctly. The results of the analysis of students' answers on the first day can be seen in the table 3.

Table 3. Results of Analysis of the Answers of Students First Day

| Students | Project Based Learning first day   | %  |
|----------|-----------------------------------|----|
|          | 1 2 3 4 5 6 7 8 9 10 11          |    |
| T (L)    | 100 100 100 100 100 100 100 75 50 | true 90% |
| S (P)    | 100 100 100 100 100 100 100 75 70 60 | 72% |
| S (L)    | 70 100 100 100 100 100 100 70 60 25 | 63% |
| R (P)    | 60 100 50 100 100 100 100 75 30 20 | 45% |
| % True   | 50 100 75 100 100 100 100 75 25 | % % |

Then based on Table 3 and Table 4, the small group on the second day there are differences in the answers of high, medium and low ability students. Students who are 85% highly capable can complete Project Based Learning (PBL) on the second day correctly. While medium-capable students on average 80% can complete project based learning (PBL) on the second day correctly then students with low ability 50% can complete project based learning (PBL) on the second day correctly. The results of the analysis of student answers on the second day can be seen in the table 4.

Table 4. Analysis Results of the Second Day Answer

| Students | Project Based Learning Second Day | % True |
|----------|-----------------------------------|--------|
|          | 1 2 3 4                           |        |
| T(L)     | 100 100 100                        | 85 85% |
| S (P)    | 100 100 100                        | 60 80% |
3.2.3 Open class

After the project was tested on a small class, this project was tried on a large class of 22 students. This study was designed using the calculation of electricity bills. The result of this project assignment is the electricity account calculation report at the student's home. In this activity the teacher starts by exploring students’ knowledge about the calculation of electricity bills. Then the teacher informs the purpose of making the project and continues with the presentation of each group in turn. After one of the groups presents the answer, the question and answer session continues.

Figure 1 shows that when working on the project there are some students who have difficulty. Then the model teacher asks the student to "ask for help" to a group of friends. There are some students who ask to help teach a group of friends.

Based on the results of students' answers on the first day on average > 75% of students can calculate the total electricity usage in one day. Students who can calculate electricity consumption rates in one day <50%. Students who can calculate electricity consumption rates are only students with high knowledge. Most students have difficulty when multiplying decimal numbers. Then based on the results of students' answers on the second day on average <60% of students had difficulty determining the additional costs of electricity used during holidays. Students who can calculate so that electricity costs remain stable on average <20%.

4. Conclusion

Based on the results and discussion that have been explained, it can be concluded that students can understand the sum of integers based on the learning trajectory that is designed using electricity account calculations. On the first day of Beset Learning Project on average > 50% of students answered correctly then on the second day of Beset Learning Project> 50% of students could answer correctly after being given directions. So overall the research design, Project Based Learning model, and LSLC really help students to understand the material of integer addition.

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