Analysis of Students Mathematical Concept Understanding Ability in Operation Research Course

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Abstract. The purpose of this research to improve the students' mathematical concept understanding ability who receive the Scientific approach with PBL model learning compared to students who receive conventional learning in operation research courses through pretest. The sample was two classes of 2019 who took an operation research course. The data was analyzed by quantitative technique. The result of the research base on the pretest explained that it is known that the students' mathematical concept understanding ability is low.

1. Introduction
Mathematics is one of the subjects given from elementary school to college. This is because mathematics is one of the places as well as providing the experience for students to be able to develop intelligence and skills in problem solving. According to Sinaga in Agustina (2016), mathematics is the focus and attention of educators to students so that they can apply mathematical concepts and principles in daily life [1].

Students' mathematical concept understanding ability is important for students because it has instructional goals to achieve meaningful learning, which is done by understanding their daily mathematical experiences [2]. Concept understanding is needed in learning because it can determine students' proficiency in explaining the relationship between concepts and applying them in solving math problems [3]. Based on this, understanding mathematical concepts is needed in the process of solving math problems, which is the main focus of the education system [4].

Many problems in daily life are related to calculations such as profit and loss in buying and selling. Solving this problem in mathematics can be simplified by forming a model so that it is easier to solve. Especially in mathematics, this is a linear program. Courses that require an understanding of concepts because they are related to compiling mathematical models in solving problems is Introduction to Operations Research (PRO). This course explains the various ways/methods of solving a linear program. Based on the Final Score of Semester 2019, the PRO course of FMIPA students at Padang State University is classified as moderate. In addition, the results of classroom observations, it was seen that students working on problems related to linear program material experienced errors in determining mathematical models to determine solutions. Another study also states that in learning, students are more likely to memorize the steps of the process without understanding the benefits of this course in solving real problems [5]. According to Brousseau, student learning difficulties can be influenced by three factors, namely due to concept restrictions, inappropriate concept teaching, and someone's knowledge that cannot be used in different contexts [6]
Based on this, learning is needed that trains students to understand the concept of a mathematical problem. The scientific approach is learning based on disclosure/research. A learning approach that produces problem-solving-based work can encourage students' ability to produce contextual work [7]. This is also supported by the learning process in the approach carried out in stages that are in accordance with the problem-solving process, namely observing / theoretical, asking and formulating problems, reasoning and investigating a problem, and forming networks or analyzing. [8, 9, 10, 11]. One of the mathematics learning models that use many practical problems is the Problem Based Learning (PBL) model [12, 13, 14]. PBL can also improve students' understanding of concepts and train them to find, develop, and apply in solving everyday problems [15]. Based on the above, research was carried out by applying the learning application of the scientific approach with the PBL model in the introductory operation research course on students' mathematical concepts understanding ability.

2. Method
This study is quasi-experimental research design, or the research design used is the Nonequivalent Control Group Design, which consists of two classes, namely the experimental class and the control class, to compare students' mathematical concepts understanding ability with different treatments [10]. Before treatment, each class was given a pretest and posttest after treatment. The pretest and posttest used a test with the same indicators, but the editorial was different. This is done to measure students' mathematical concepts understanding ability in the PRO course. The experimental class was given treatment in the form of learning with the scientific approach with the PBL model, and the control class was given learning with a conventional approach.

The research was conducted at the Mathematics Department, Faculty of Mathematics and Natural Sciences, Padang State University. The population of this research were all students of the Mathematics Department class 2017 who took PRO courses in the even semester 2019/2020, which were divided into four classes. The sample in this research were two classes of students class 2017 who took the PRO course, which was determined randomly. Furthermore, the two classes were randomly selected to determine the treatment given. The variables used are learning with the scientific approach with the PBL model as independent variables, and students' mathematical concepts understanding ability as dependent variable.

The research instruments were learning instruments and data collection instruments. Learning instruments include learning tools, namely Semester Class Plans (RPS) and Class Program Units (SAP). RPS and SAP are prepared according to learning steps with a scientific approach with the PBL model for each meeting and material taught and validated theoretically. The data collection instrument consisted of a test instrument. Test of student’s mathematical concepts understanding ability which is carried out before (pretest) and after treatment (posttest). The test instrument is prepared based on the indicators of the student’s mathematical concepts understanding ability. The test is validated and tested to determine the validity, reliability, discriminatory power test, and difficulty index of each question number. This aims to show that the item is valid, reliable, and fit for use. In this study, the test was validated by asking for expert consideration, namely the lecturer who taught the Operations Research Introduction course. The data analysis was carried out quantitatively. Before the t-test is carried out, the prerequisite test is the normality and homogeneity test.

3. Results and Discussion
The data used to obtain the results of this study were student pretest data. The pretest instrument that has been made consists of 4 questions with eight questions. This test instrument is prepared in accordance with the indicators of understanding mathematical concepts that have been mentioned in the literature review. A valid and reliable pretest instrument was given to the research subjects in both classes, namely the experimental class and the control class. The instrument has been tested for validity by a validator who is a lecturer who teaches the Introduction to Operations Research course. Based on the data analysis from the pretest instrument, the students' ability to understand mathematical concepts is as follows:
Table 1. Pretest Results of students' mathematical concepts understanding

|               | Eksperimen | Control |
|---------------|------------|---------|
| Summary       | 2500       | 2325    |
| n             | 35         | 36      |
| Mean          | 71.42857143| 64.58333333 |
| Higher Score  | 91.67      | 91.67   |
| Lower Score   | 25         | 0       |
| Score max     | 100        | 100     |
| Score min     | 0          | 0       |
| SD            | 20.1389895 | 20.05696253 |
| Variance      | 405.5788982| 402.281746 |

Based on the data in the table above, the average score of students in the experimental class is higher than in the control class. In the experimental class, the pretest average was 71.43 with the highest score 91.67, and the lowest score was 25, while in the control class, the pretest average was 64.58 with the highest score 91.67 and the lowest score 0.

In addition, based on the results of students' answers to the conceptual understanding ability pretest, students experience problems interpreting and translating a problem into a mathematical model, where this is an indicator of conceptual understanding. Figure 1 is the answer of students who only see the problem solving with graphs but do not understand the concept in completion. In Figure 2, it is the answer of students who do not understand the concepts in the mathematical model, so they experience errors in determining the area of a graph. In this case, lecturer should encourage the students to express mathematical ideas not only in the verbal but also in the writing, and the lecturer should make a learning process meaningfully, learning students actively, and discussion [17].

Figure 1. One of Student Answer

Figure 2. One of Student Answer
4. Conclusion
Based on the results and discussions that have been stated previously, it can be concluded that the students' conceptual understanding is not good enough or can be said low. This is because students experience difficulties and errors on the indicators of concept understanding, namely, students are not able to interpret and translate the mathematical model of the questions given.

Based on the results, the learning model with the scientific approach and the PBL model can be applied by lecturers in introductory operations research courses to improve students' ability to understand mathematical concepts.

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