The effect of basic mathematical abilities on learning outcomes of physics education students

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Abstract. Research has been conducted to determine the effect of basic mathematical abilities on learning outcomes of physics education students in the Measurement Method subject. This is done based on the observations of researchers in the learning process of the Measurement Method. There are significant differences in the teaching and learning process. Students with weak basic mathematical abilities tend to be difficult to understand every materials in the subject. The population of this research is fourth semester students of Physics Education academic year 2018/2019. This research is an experimental research. The method of data collection in this research was taken through basic mathematical abilities test and student learning outcomes test. Data were analysis using regression analysis. From the results of this research, it can be concluded that there is an influence of basic mathematical abilities on student learning outcomes in the Measurement Method subject with a magnitude of influence of 6.7%. It’s means that the success of student learning in the lecture Measurement Method is related to students’ basic mathematical abilities. So it can be said that the final grades of students in the Measurement Method subject is influenced by the basic mathematics ability possessed by the student.

1. Introduction
Education is important in exploring the potential of a person. Studying physics requires various effective ways to develop thinking skills [1]. Someone who has his own learning arrangement will be responsible for his learning activities (Fauzi & Widjajanti, 2018). In participating education in college can not be separated from the teaching and learning process. Learning refers to what should be done by a student, while teaching refers to what should be done by a lecturer. The teaching and learning process determines success in education, so, a good relationship between students and lecturers is very important to build.

Counting lessons in the world of education are subjects that have begun to be taught at the elementary school level. In elementary school counts just focusing on mathematics subjects, developing at the junior high school level, the calculation lesson begins to be applied to science lessons but only to the basic calculation. Science subjects for high school level are no longer integrated science, but are starting to be separated into three subjects namely physics, biology and chemistry.

In learning physics, it is not just a theoretical lesson that has no benefits in daily life [2], the first thing that is demanded is the ability to understand concepts, principles and laws, then students are expected to be able to reconstruct in their own language in accordance with level of maturity and intellectual development. Physics learning developed is the ability to think analytically, inductively and deductively in solving problems related to natural events, both qualitatively and quantitatively using mathematics, and can develop knowledge, skills and confidence.
Physics lessons are related to mathematics, where every problem in physics can be solved mathematically. In physics, mathematics holding a major role, in addition to its ability to solve physics problems from simple to the most complicated forms. According to [3] mathematics is a research of calculations, theories and concepts that already exist with real calculations. Mathematics is very helpful for someone's reasoning in solving physics problems which is not easy. This is in line with the opinion of [4] that the transfer of mathematics learning to science is considered as important for the development of education and industrial society. To introduce and use mathematics as a language of communication in students at school, it needs to be done carefully and gradually (accordingly intellectual level of students) [5]. Difficulties in mathematical reasoning can be caused by the level of intelligence possessed by students [6] [7].

[8] Thought that physics material is very abstract. So as a lecturer in physics education must understand the mathematical abilities of students. The problem that is often faced by lecturers in physics education is finding students difficult to solve physics problems related to mathematics, while physics lessons at the college level almost entirely have mathematical calculations. Another problem faced by physics education lecturers is that before giving physics material, the lecturer did not provide a mathematical basis because the mathematical material that will be used to solve physics questions is considered to have been taken in basic mathematics subjects in the first semester at beginning of class. Therefore, researchers feel the importance of conducting research on the effect of basic mathematical abilities on the learning outcomes of physics education students. Therefore, researchers feel the importance of conducting research on the effect of basic mathematical abilities on the learning outcomes of physics education students.

2. Method
This research was conducted at the Indraprasta PGRI University. While the time of this research was conducted in the even semester of 2018/2019 learning year which was held from March 2018 to May 2019. The population in this research were all fourth semester students of Physics Education which consisted of 3 classes. The sample of this research is all members of the population with a total of 88 students. The sample used in this research consisted of 3 classes totaling 88 students.

At the beginning of the class, each class is given a Basic Mathematics Ability Test to measure the extent of the basic mathematical abilities that each student as a supporter of their understanding of the lecture material they will receive. Then at the end of the lecture, they are given a Learning Outcomes Test to measure their success in understanding each lecture material given in the Measurement Method subject. Therefore, in this research there were 2 variables, namely basic mathematical abilities as independent variables and learning outcomes as dependent variables.

This research uses a set of test instruments. The tests used in this research have 2 (two) pieces, namely: the basic mathematical ability test, which is in the form of a set of questions in the form of descriptions that are used as a reference to see the basic abilities of mathematics possessed by each student; and learning outcomes tests, namely in the form of a set of questions which are also in the form of descriptions that are used to measure student learning outcomes after receiving lectures. The data obtained were analyzed to determine whether or not there was an effect of basic mathematical abilities on the learning outcomes of physics education students in the Measurement Method subject. In analyzing both variables, the calculation process uses SPSS 17 software.

3. Result and Discussion
Before conducting a regression test, the data is first prerequisite, namely the normality test and the linearity test between the independent variable and the dependent variable. Based on the results of the normality test, it was obtained that the significance value for the basic mathematics ability variable was 0.060 greater than 0.05. Likewise the significance value for the student learning outcome variable is 0.123 greater than 0.05. So it can be concluded that the two variables studied had normal distributed data.
Based on the results of the linearity test, it was found that the significance value obtained for this research data was 0.351 which was greater than 0.05; so it can be concluded that there is a significant linear relationship between the basic mathematical ability variables and the learning outcome variables. After going through the normality test and linearity test, the data obtained is in the regression analysis. From the table of regression analysis results, a regression equation can be made between the independent variable and the dependent variable. In general, the formula for a simple linear regression equation is \( y = a + bx \). To find out the regression coefficient value, namely \( a \) and \( b \); can be seen from column B in the table. The value of \( a \) is a constant number of unstandardized coefficients. In this research the magnitude of -3.601. This value is a constant number which means that if there is no basic mathematical ability, the student learning outcomes are -3.601. While the value of \( b \) is the regression coefficient number, which in this research is 0.109. This value implies that for each addition of one unit to the value of basic mathematical abilities, the student learning outcomes will increase by 0.109. Because this regression coefficient value is positive, then it can be said that the basic mathematical ability variable has a positive effect on the student learning outcome variable. So the regression equation is \( y = -3.601 + 0.109x \). Research results are supported by statements [9], mastery of mathematical concepts is the result of one's learning activities to understand and understand an object or objects through observation and one's experience in completing math problem.

Follow-up research was carried out by (Laoste & Heidmets, 2019) about the impact of educational robots as learning tools on mathematics learning outcomes in basic education. Through education robotics brings joy, motivation, and growth in mathematics and STEAM skills into the classroom. Preliminary results from a pilot experimental study conducted in Estonia in 2018 are the results of a pilot study and discuss the pros and cons of using robots in mathematics education.

4. Conclusion
Based on the results and discussion that has been described, it can be concluded that there is an influence of basic mathematical abilities on student learning outcomes of Physics Education in the Measurement Method subject with a magnitude of influence of 6.7%. This means that the success of student learning in the lecture Measurement Method is related to students' basic mathematical abilities. So that it can be said that the final grades of students in the Measurement Method subject is influenced by the basic mathematical abilities possessed by the student.

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