

The Effect of Using Electric Circuit Props Based on Bruner's Thinking Stage of Concept Understanding Mathematics on Conjunctions and Disjunctions

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Abstract: This study aims to determine the effect of using electric circuit props based on Bruner's thinking stage on understanding mathematical concepts in conjunction and disjunction material in class X semester II SMA Negeri 1 Tarutung. The research method used is a quasi-experimental quantitative method. The research design used a post-test only control group design. The instruments given to a sample of 32 in class X₆ were taken randomly (random sampling). The research instrument used has been tested so that it is declared valid and reliable. By using the Liliefors test to test the normality of the students' mathematical concept understanding score data, it was obtained that $L_{count} = 0.1289$ when compared with L_{table} for $n = 30$ and the significant level $\alpha = 0.05$, namely $L_{table} = 0.161$, it turned out that $L_{count} < L_{table}$ then the data from the students' understanding of mathematical concepts is normally distributed. Because the two data are normally distributed, a hypothesis test is carried out. Based on the calculation of the regression analysis, the regression equation $\hat{Y} = (-8,27) + 1,08X$. In this equation, the linear regression direction coefficient (b) = 1.08 is positive, which means that the two variables have a positive linear relationship. Concept understanding will increase with the effect of using electric circuit props by 1.08 times. Based on the linear regression equation, the correlation coefficient is calculated, namely $r = 0.8735$. These results indicate that there is a strong relationship between the use of electric circuit props and understanding of mathematical concepts. Then from the calculation results, the coefficient of determination (r^2) = 76.30% means that the influence between the use of electric circuit props on understanding mathematical concepts is 76.30%, and the rest is influenced by other variables or factors.

Keywords: Electric Circuit Teaching Aid, Understanding Mathematical Concepts and Bruner's Learning Theory.

Introduction

Education is one form of the realization of a dynamic and development-laden human culture. Therefore, the change or development of education is something that should happen in line with changes in the culture of life. According to Hamalik, (2008:1) "education is an integral part of development". The educational process cannot be separated from the development process itself. Development is directed and aims to develop quality human resources and the development of economic sectors, one with the other is interrelated and takes place simultaneously. Education is the right effort to prepare quality human resources and the only container that can be viewed and should

serve as a tool to build high-quality Human Resources (HR) (Trianto, 2010).

The low quality of education in Indonesia is the main cause of indonesia's lack of human resources (HR). So that this problem is in the public spotlight both in print and in electronic media that Indonesian education is still relatively low. This is seen in the management of Indonesia's natural resources mostly managed by experts from outside the country.

School is a formal means of education that seeks to shape individuals who have the skills to think, skills and attitudes to be able to compete with the real world. However, the learning results obtained by students show that the goals of the school are always not achieved judging from the grades

obtained by students, especially in math subjects. Based on the experience of researchers when attending SMA Negeri 1 Tarutung, students do not like math subjects because they are considered difficult and boring. Some students say that math lessons are complicated lessons and many formulas to keep in mind.

Mathematics is a science of numbers, which deals with the relationship between numbers, and the operational procedures used in solving problems with numbers. But it is precisely in math subjects that are not liked by many students. As revealed by (Wahyudin, 2008) that "Mathematics is a difficult subject to teach or learn". Meanwhile (Abdurrahman, 2009) revealed that "from the fields of study taught in schools, mathematics is the field of study that is considered the most difficult by students". The thought that mathematics is a difficult lesson has given rise to a bad perception of math lessons because students tend to feel bored and lazy to learn mathematics. In addition to the low mathematical ability of students, it can be caused by the way the presentation of lessons is less interesting, lack of understanding of the concept and presentation of subject matter, learning style (modality), low intelligence, individual differences in the teaching and learning process and lack of use of media and learning props. The presentation of less effective and less interesting material can be seen from the teaching methods commonly used by teachers in teaching is the method of Q&A and lectures. This method does not utilize the learning style that each student has and emphasizes the teacher as a source of information so that students are not actively seen in the learning process in the classroom so that students cannot see and understand the material delivered by the teacher. Therefore, in the learning process in the classroom teachers must know the learning style of students in order to produce maximum results, because basically everyone learns in a different style. Providing learning motivation to students is a good step to create a comfortable atmosphere in carrying out learning activities in school.

Props are learning media that contain or carry the characteristics of the concepts learned. Learning props play an important role in the

success of teachers in delivering subject matter, one of which is a tool designed based on the material to be studied. These props play a very important role in the learning process. Props can facilitate understanding, strengthen memories, foster student interest and can provide a connection between the content of the subject matter and the real world.

One of the props that can be used is an electrical circuit. The electrical circuit consists of two parts, namely, a series series and a parallel circuit. A series circuit is an electrical circuit consisting of two or more lights arranged in rows or sequences. Similarly, the voltage source is also connected in rows. While the parallel circuit is two or more light bulbs connected in parallel and each light bulb has its own voltage source. Electrical circuit props are very useful for students in studying conjunction and disjunction materials, because these props can be used to prove the truth on conjunction and disjunction.

Jerome Bruner was one of the people who recommended a cognitive development plan for designing the curriculum. Like John Dewey, bruner described the knowledgeable man as someone skilled at solving problems. That is, the knowledgeable person is able to interact with the environment in testing hypotheses and attracting generalizations. Therefore, the purpose of education should be to develop the intellect. The curriculum should educate development and inquiry and discovery. Bruner is also famous for learning his inventions, because basically learning it we have to find it ourselves in order for us to understand it better (Komarudin, 2009).

The use of electrical circuit props can also build students' curiosity in studying conjunctions and conjunctions because they can find and prove directly the truth of the conjunction and disjunction.

Because of the many problems that result in less than optimal mathematics learning, breakthrough efforts are needed to improve student learning outcomes. One that can be done is to provide an understanding of concepts for each mathematical learning. The ability to understand mathematical concepts is one of the important goals in learning, providing the understanding that the materials

taught to students are not only as rote, but more than that. With understanding students can better understand the concept of the subject matter itself. Understanding the concept of mathematics is also one of the goals of every material delivered by the teacher, because the teacher is the student's guide to achieve the expected concept. This is in accordance with the purpose of teaching, namely so that the knowledge conveyed can be understood by learners.

So that in this study is done in the following way: 1). Researchers conduct learning by preparing the understanding of mathematical concepts and combined with electrical circuit props by utilizing the learning style owned by students themselves, 2). Optimizing efficiency rather than the time of the teaching and learning process and in the presentation of teacher subject matter must include all active in learning, 3). Make a learning plan in advance before doing classroom learning and choose props as a means that can help in delivering the learning material to be taught, 4). First the researcher conducts a review into the location and what will be observed is the understanding of the student's concept with before and after giving the treatment of understanding the concept.

Thus the title of this study is: " The Effect of Using Electric Circuit Props Based on Bruner's Thinking Stage of Concept Understanding Mathematics on Conjunctions and Disjunctions"

Materials and Methods

This research uses quantitative research methods. This research includes experimental type research is quasi experimental which aims to find out the large Influence of the Use of Electrical Circuit Props Based on Bruner's Thinking Stage On Understanding Mathematical Concepts on Conjunction and Disjunction Materials In Class X Semester II Of SMA Negeri 1 Tarutung. This research design uses the **one-shot case study**, this research involves an experimental class that is given treatment using electric circuit props

The population of this study is all students of class X semester II of SMA Negeri 1 Tarutung, which amounted to 7 parallel classes where the

total number of students amounted to 245 people. This study sample consists of one class taken randomly (random sampling) which is class X_1 which numbers 30 students and is referred to as an experimental class. The reason we chose X_1 as an experimental class, which is because the X_1 to X_7 classes have the same ability, so whichever class I make as an experimental class then the results obtained are the same.

Data collection techniques are carried out in accordance with systematic and standardized procedures for obtaining the necessary data. Determination of relevant research data collection tools and considering practicality, efficiency and valid.

Researchers gave post-tests to learners to measure the ability to understand the mathematical concepts of learners after doing learning treatment using electrical circuit props, so that student observation data (variable X) and post-test data measured the ability to understand the mathematical concepts of learners (variable Y) that had been tested. In the preparation of data collection tools (post-test) has been piloted first to find out the validity, reliability, differentiating power of the problem and the level of difficulty.

Furthermore, the data obtained is analyzed using the Ms. Excel program, to obtain average values, variances and standard deviations. Furthermore, data analysis is carried out to find out whether the difference in observation data and post-test data is significant or not. For that, the data normality test is carried out using the Liliefors test first to find out the next test steps. If the data is normally distributed then it can then perform a simple linear regression test. The regression equation is $\hat{Y} = a + bX$ (Sudjana, 2005). Furthermore, to find out the range and meaning, a variant analysis test will be conducted. Next will be conducted a coefficient of determination test using the correlation technique product moment to see the relationship of electrical circuit props to the ability to understand the concept of students. After that will be conducted a determination test to see the large influence of electrical circuit props on the ability to understand the student's concept on the material of conjunction and disjunction.

Results and Discussion

Of the 8 questions tested there are 6 questions that are declared valid and reliable, so 6 questions are obtained as a post test. Based on the results of the data analysis obtained a description of data understanding the mathematical concepts of students who are given treatment by using electrical circuit props that can be seen in the Table 1.

Table 1. Description of Research Results.

Parameter	Electrical Circuit Props (Observation)	Understanding mathematical concepts (Post-test)
N	30	30
$\bar{X}$	83,58	82
S_D	5,97	7,38

Furthermore, statistical analysis of data to find out the difference between the two groups is significant or not. The next step is to test normality using the lilifors test. From the results of the test the normality of the student observation data obtained $L_{\text{count}} = 0.1385 < L_{\text{table}} = 0.1610$, while for post-test data obtained $L_{\text{count}} = 0.1289 < L_{\text{table}} = 0.161$, this indicates that the sample came from a normal distributed population. Because the data is normally distributed, a simple regression test is performed.

Based on the calculation of regression analysis obtained the regression equation $\hat{Y} = (-8.27) + 1.08X$. In the equation the coefficient of linear regression direction $b = 1.08$ is positive, which means that both variables have a positive linear relationship. Understanding the concept will increase with the effect of the use of electrical circuit props by 1.08 times.

Based on the linear regression equation calculated the correlation coefficient of $r = 0.8735$. The results showed a strong relationship between the use of electrical circuit props to the understanding of mathematical concepts. Then from the results of the calculation obtained the coefficient of determination $r^2 = 76.30\%$ means the influence between the use of electrical circuit props on the understanding of mathematical concepts of

76.30%, and the rest is influenced by other variables or factors.

Conclusions

From data analysis and hypothesis testing, as a conclusion in this study, there is an influence on the use of electrical circuit props on the understanding of mathematical concepts of students of grade X of SMA Negeri 1 Tarutung. Thus the use of real electrical circuit props can affect the understanding of a student's mathematical concepts by 76.30% which can be explained through linear relationships $\hat{Y} = 1.08X - 8.27$

Conflict of Interest. The authors declare that there are no conflicts of interest concerning the publication of this article.

References

- Abdurrahman, Mulyono. 2009. *Pendidikan Bagi Anak Berkesulitan Belajar*. Cetakan II. Jakarta: Rineka Cipta.
- Bruner, Jerome, S. 2007. *Discovery Learning at Learning Theories*. Retrieved June 10th, 2007
- Hamalik, Oemar. 2008. *Kurikulum dan Pembelajaran*. P.T. Bumi Aksara. Jakarta.
- Sudjana. 2000. *Metode Statistik*. P.T. Tarsito Bandung. Bandung.
- Sudjana. 2002. *Metode Statistik*. P.T. Tarsito Bandung. Bandung.
- Sudjana. 2005. *Metode Statistik*. P.T. Tarsito Bandung. Bandung
- Sukarjo. 2009. *Landasan Pendidikan Konsep dan Aplikasinya*. P.T. Rajagrafindo Persada. Depok.
- Sulistiyono. 2012. *SPM Matematika SMA dan MA*. P.T. Gelora Aksara Pratama. Jakarta.
- Syah, Darwyan. 2009. *Pengantar Statistik Pendidikan*. Gaong Persada Pres. Jakarta.
- Syah, Muhibbinsyah. 2010. *Psikologi Pendidikan*. Remaja Rosdakarya. Bandung.
- Trianto. 2010. *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: Kencana Prenada Media Group.
- Wahyudin. 2008. *Pembelajaran dan Model-model Pembelajaran*. Jakarta: CV. Ipa Abong.