



## The Influence of STEM Learning (Science, Technology, Engineering, Mathematics) Assisted with Android Media on Students' Learning Interest

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### ABSTRACT

This research aims to determine the significant influence of STEM learning assisted by Android media on students' interest in learning. This type of research is quantitative research, with a Quasi Experimental Design, Non Equivalent Control Group Design. The instruments used were learning outcomes tests and questionnaires, then analyzed using prerequisite tests in the form of normality tests, linearity tests and hypothesis tests using the t-test. The results of the research show that there is a significant influence of STEM learning assisted by Android media on students' interest in learning at X SMAN 2 Tabanan. This result can be seen from the results of the Independent sample t-test with  $t_{hitung} 2.720$  and  $t_{tabel} 2.211$  so that we get  $t_{hitung} > t_{tabel}$  with a significant value of 0.028 is smaller at the 5% significance level. The learning outcomes obtained by the experimental class were higher than those in the control class.

## **INTRODUCTION**

One could refer to the twenty-first century as the century of knowledge, since it saw a significant shift from an agrarian to an industrial and ultimately a knowledge society. The advent of globalization and the quickening flow of information have also brought about a number of social and cultural changes in society, which are indicative of this transformation process (Afandi et al., 2018). The fundamental changes that are occurring in human life in the 21st century set it apart from the lifestyle of the preceding century. One could argue that the 21st century expects excellence in all endeavors and outputs of human labor. (Etistika Yuni Wijaya, Dwi Agus Sudjimat, and Amat Nyoto 2020). So the role of teachers in this case plays a very important role in advancing the quality of students. Quality teachers in implementing learning will produce quality students. A student will determine the future of the nation, because students are the nation's next generation. This can be seen from how students gain knowledge through education (Sidik & Kartika, 2020). The knowledge that students gain can be seen from the students' understanding and can also be seen from their learning achievements. Judging from the teacher's teaching, the teacher only teaches students using conventional learning models and the way the teacher teaches mathematics only uses existing theoretical concepts, so that for the students themselves it is difficult to understand the theory of mathematics.

So, in order for children to get grades according to their abilities, students need an interest in learning so they can achieve satisfactory learning results. In determining students' understanding and interest in learning, a good teaching and learning activity process is needed. Student interest in learning is a very important factor in supporting the achievement of effective learning processes, which will ultimately influence student learning outcomes. Interest is the acceptance of a relationship between oneself and something outside oneself, this is a case where a person likes an object that he can see without coercion and creates a higher sense of interest in order to know more about the object (Muliani et al. , 2021). Because, a student's success is also seen from several factors that can influence it, namely environmental factors, teacher teaching factors, use of learning models and learning methods.

Difficulty in understanding mathematics learning is also caused by several factors. These factors include internal and external factors. Interest in learning is an internal factor that exists within students. Interest in learning will emerge if it is supported by external factors. Such as study rooms, textbooks and other learning devices to support the learning process. Learning media has developed very rapidly over time. This is also something researchers are highlighting that can be developed in learning to help attract student interest. As is known, every student nowadays is familiar with gadgets. Current use of gadgets is limited to playing and opening social media. Because students are highly interested in the gadgets they own, Android-based learning media was created to increase students' interest in learning. At least the gadgets they have are useful for studying, easy to use and can be opened anywhere.

One effort to prepare superior human resources (HR) in school education is to create learning that can be accepted by students, including by applying

various approaches or learning methods to improve the quality of students' abilities so they are able to overcome all kinds of problems of life on earth. One approach that has been widely developed to improve the quality of education amidst the rapid progress of science and technology in the 21st century is a Science, Technology, Engineering, and Mathematics (STEM) based learning approach (Firat, 2020). A STEM education combines science, technology, engineering, and math by having students solve real-world challenges in the workplace or in daily life. The goal of the STEM approach is in line with the requirements of 21st-century education, which include the need for students to possess scientific and technological literacy, which is demonstrated by their capacity to read, write, observe, conduct scientific experiments, and grow their competencies in order to address issues in the field on a daily basis. STEM fields (Sunardi & Hasanuddin, 2019).

STEM learning is recommended to be applied as an integration in many scientific disciplines. It was also explained that in the international sphere both in the field of education, policy developers, and business organizations and even industry have now really highlighted the urgency of increasing STEM skills to be able to meet social and economic challenges in the present and also the future (Firat, 2020). STEM learning teaches students to become problem solvers, innovators, creators and collaborators who are essential for future generations in Indonesia. One aspect that requires more attention is the inclusion of engineering activities in compiling STEM learning materials. Numerous studies point out that these kinds of exercises can help students gain a better respect and comprehension of how engineering shapes society as well as how to contextualize science and math concepts to enhance their motivation, problem-solving skills, and achievement.

Engineering in STEM learning provides students with the opportunity to learn to make simple technology products through engineering activities as a form of problem solving by maximizing a concept that has been learned. Making simple technology products is also intended as motivation so that in the future students can develop their simple technology into modern technology products that continue to develop over time. Technology today is an inseparable part of human life. Technological developments are getting faster from time to time. One of the technology products owned by most people in the age range from teenagers to adults is cellphones. Almost all students use cellphones and most of them use the Android system (Ilmi et al., 2021). However, unfortunately, the use of Android in learning, especially learning in the classroom, is not optimal or even not used at all. Several studies on the use of Android system-based media in learning have shown positive results, such as those conducted by Rizki Suhendar Putra, et al. (2017) also shows that the use of Android application-based learning media has a significant influence on student learning outcomes. The use of this Android application media has a positive influence on the learning process, shown by questionnaire data which is included in the good category and received a positive response from students and fostered students' interest in learning.

Based on efforts to increase quality human resources in facing the challenges of the 21st century and the use of developing technology among students in the learning process, researchers conducted research entitled "The Influence of Science, Technology, Engineering, and Mathematics (STEM) Learning Assisted by Android Media on Interest Student Learning". Increasing learning outcomes, which are a measure of students' understanding of the material, is expected to be able to train and equip students with the STEM skills needed in the 21st century.

## **LITERATURE REVIEW**

### ***STEM***

The term STEM was first used and introduced by the National Science Foundation (NSF) to refer to programs related to science, technology, engineering and mathematics. STEM is an abbreviation of Science, Technology, Engineering and Mathematics in Indonesian which is translated as science, technology, engineering and mathematics. STEM-based learning is defined as an integration of science, technology, engineering and mathematics into interdisciplinary subjects at school. STEM education is designed with the aim of increasing global competitiveness in science and technological innovation and to increase understanding of the integration of STEM-based education throughout society (Capraro & Slough, 2013). In the world of education, STEM usually refers to courses related to those scientific disciplines. Each of these categories may include instruction in several areas of study (Dugger, 2010):

STEM-based education has the potential to bridge students' conceptual understanding between subjects and increase students' interest in STEM. Integrated STEM-based learning can be described as an approach that explores teaching and learning between two or more STEM areas and/or between one STEM component and other scientific disciplines (Syukri et al., 2013). The aim of STEM-based learning according to Bybee (2013) is for students to have scientific and technological literacy when they enter society in the future, they will be able to develop the competencies they already have to apply them in dealing with problems in everyday life related to the field of STEM sciences (Bybee, 2013). The development of STEM-based learning according to the National Research Council, (2010) and Subramaniam, et.al (2012) can occur if it is linked to the environment, so that learning can be realized that presents the real world experienced by students in everyday life. The characteristics of STEM-based learning include educating students to become problem solvers, logical thinkers, technology literate and able to connect their culture with learning. STEM-based learning is carried out with experiments, hands-on activities, and creating learning communities. Integrated STEM-based learning through project-based activities has the potential to improve the quality and motivation of learning (Gustiani et al., 2017).

### ***Mathematics Learning***

Mathematics is a branch of knowledge that has an important role in the development of science and technology, both as a tool and in the development of

mathematics (Siagian, 2012). Mathematics focuses more on reasoning and logic, not just learning to count or learning numbers. Meanwhile, the opinion of (Liberna, 2018) states that mathematics is one of the compulsory subjects at every level of education from elementary school. Mathematics subjects mean subjects with material that is full of problems, so they require expertise and calmness in solving them (Marliani & Hakim, 2015). According to (Maryati & Priatna, 2018), mathematics is a deductive science because in the process of searching for truth it must be proven by theorems, properties and postulates after being proven. Mathematics is also a science obtained by reasoning which uses definitional terms carefully, clearly and accurately. Based on the definitions of mathematics according to the experts above, it can be concluded that learning mathematics is one of the mandatory sciences because mathematics is a deductive science whose learning leads to reasoning and logic.

### *Android Learning Media*

In general, media has several uses, including: first, clarifying the message so that it is not too verbalistic. Second, overcome limitations of space, time, energy and sensory power. Third, it creates enthusiasm for learning, more direct interaction between students and learning resources. Fourth, it allows children to learn independently according to their visual, auditory and kinesthetic talents and abilities. Fifth, provide the same stimulation, equalize experiences, and give rise to the same perceptions. Mobile learning (m-learning) is a learning paradigm utilizing technology and mobile devices which is predicted to experience rapid and potential development along with the development of mobile technology itself (Buchori et al., 2015). Electronic Learning (e-learning), which also includes m-learning, has a very important function in learning activities, namely as a supplement, complement, and substitute.

Android is a Linux-based operating system designed for touch-screen mobile devices such as smartphones and tablet computers. The term Android in English means "robot that resembles a human". This can be clearly seen in the Android icon which depicts a green robot that has a pair of arms and legs. As an operating system, Android functions as a link (device) between the user and the hardware on a smartphone or certain electronic devices so that it allows users to interact with the device and run various kinds of mobile applications. Android has several advantages over its competitors, including user friendly, which means it is very easy to operate, generally people will be able to operate it in a short time. Apart from that, Android is also open source, meaning anyone can develop and modify Android without having to pay because it is built on the Linux kernel. STEM learning assisted by Android media in this research is the independent variable or variable Variable X (STEM learning assisted by Android media) is a variable that influences the dependent variable, namely students' understanding.

### *Interest in Learning*

Interest is one of the main factors in achieving goals, because the interest that arises in a person will give rise to attention to carry out an activity

enthusiastically in the learning process. Interest is the driving force of the learning process in order to achieve the desired goals. If there is no interest then there will be difficulty in achieving a learning goal. Interest itself means a person's tendency to focus attention and act with feelings of pleasure towards the person, situation or activity that is the focus of that interest. In this discussion there is an understanding that in interest there is a focus of attention, there is an effort to master, know, approach, have an object with a feeling of pleasure. Sansone and Harackiewicz stated that "Interest as a psychological state involves focused attention, increased cognitive functioning, persistence, and affective involvement" or interest is defined as a person's psychological state that involves focused attention, increased cognitive function, persistence, and attitudinal or affective involvement ( Rahmadhani & Wahyuni, 2018).

From several definitions of interest, researchers conclude that interest is increasing attention and focusing an individual's mental activities on an object related to him. In other words, interest can increase an individual's strength or drive to focus attention on their desires. The definition of learning, according to Rohmalina Wahab in her book psychology, learning is an activity carried out consciously by a person which produces changes in behavior in himself, both in the form of knowledge.

### ***Research Framework***

In the process of teaching activities at school, the learning model is the most important plan that must be prepared. The selection and use of learning models by teachers is one of the factors for student success. Student interest in learning can be seen or measured by student interest in learning and understanding. A diversity of learning models is an alternative that can be used by teachers so that they can be adapted to the material to be delivered. STEM learning is a learning model that teaches students to become problem solvers, innovators, creators and collaborators who are essential for future generations in Indonesia. One aspect that requires more attention is the inclusion of engineering activities in compiling STEM learning materials. Several studies note that these activities can develop students' appreciation and understanding of the role of engineering in shaping society and how they can contextualize mathematics and science principles to increase achievement, motivation, interest in learning and problem solving.

Several studies on the use of Android system-based media in learning have shown positive results, such as those conducted by Rizki Suhendar Putra, et al. (2017) also shows that the use of Android application-based learning media has a significant influence on student learning outcomes. The use of this Android application media has a positive influence on the learning process, shown by questionnaire data which is included in the good category and received a positive response from students and fostered students' interest in learning. To compare the level of effectiveness of this learning, in the research the researchers used 2 classes as research objects, 1 class as the experimental class and 1 class as the control class. With the different treatment of these two classes, it is hoped that students' interest in learning from the experimental class will be better than the

control class. The framework of thinking in this research can be described as follows.

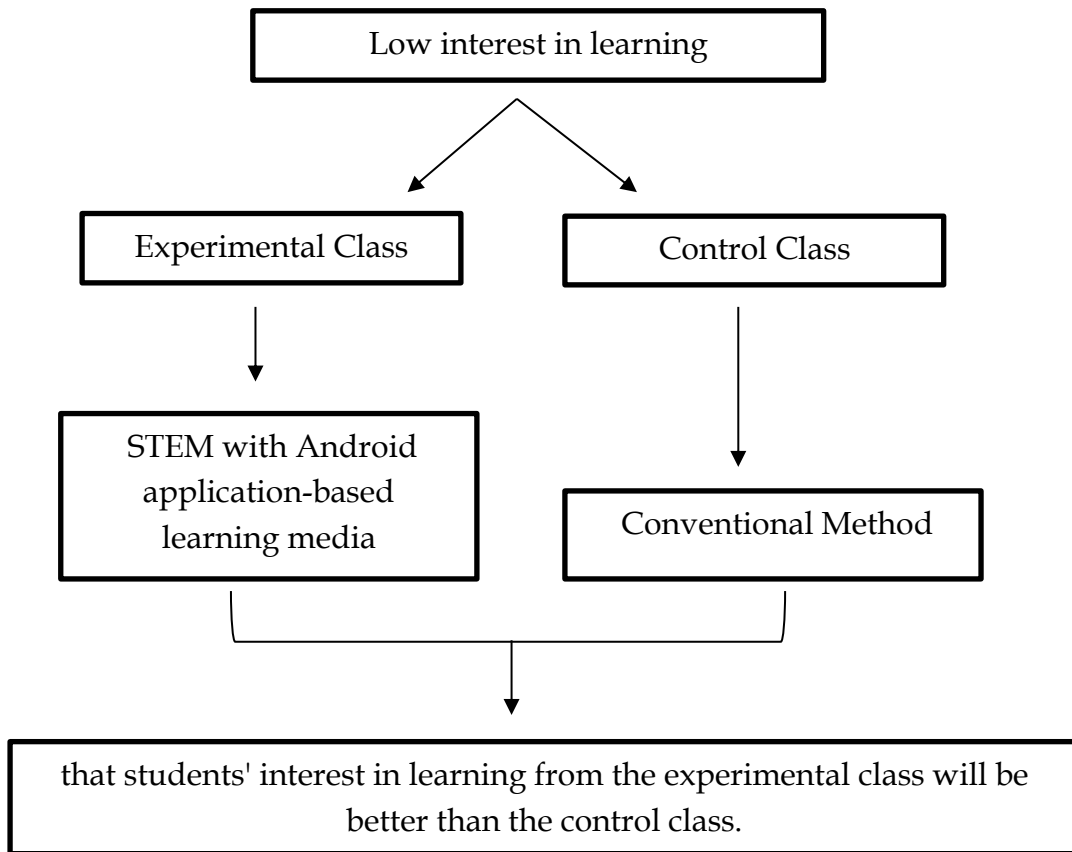


Figure 1 Research Framework For The Influence of STEM Learning Assisted With Android Media On Students' Learning Interest

## METHODOLOGY

This type of research is quantitative research, the research design used in this research is Quasi Experimental Design. The form of quasi-experimental design used in this research is Non Equivalent Control Group Design. Based on the sampling technique, this research uses Non-Probability Sampling, Purposive Sampling Type. Purposive sampling is used to determine the experimental class and control class which can be seen based on student learning outcomes before being given treatment (pretest). The sample in this study amounted to 64 people, namely class X AK1 as the control class totaling 25 people and class X AK2 as the experimental class totaling 24 people. The instruments developed in this research are tests and questionnaires. Researchers use a type of test in the form of questions in the form of descriptions. Before testing the sample, a grid of questions is created, then a test is carried out to get good questions. The place where the test questions were tested was SMK Negeri 2 Tabanan class X. The test questions consisted of 10 essay questions. Scores from trial results are used to determine validity and reliability. Based on the results obtained, the analysis of 10 essay questions can be tested on the pretest and posttest in the research class. The data analysis technique in this research, before the prerequisite analysis test is carried out, can calculate individual student learning scores, average learning

outcomes and NGain scores. Analysis prerequisite tests were carried out using normality tests and linearity tests. After the test result data obtained is normal and linear, then proceed with hypothesis testing using the independent sample t-test.

## RESEARCH RESULT

In this research, it took place at SMK Negeri 2 Tabanan which was carried out from January 29 2024 to February 20 2024. In this research, researchers used a research sample in class X with a total of 49 people. Based on the results of the pretest that was carried out in both classes, X AK2 was chosen as the experimental class and class X AK1 as the control class. The two classes were given different treatment, the experimental class was taught using STEM learning assisted by Android media and the control class was taught using conventional learning. Based on the pretest and posttest in the experimental class and control class which were carried out from January 29 2024 to February 20 2024.

Table 1 Statistical Data on Pretest and Posttest Scores for Experimental and Control Classes

Centralization and distribution of data	Pretest		Posttest	
	Control	Experiment	Control	Experiment
<b>Lowest Value</b>	10	10	35	50
<b>The highest score</b>	78	76	80	90
<b>Average</b>	35,70	27,04	66,78	80,91
<b>Median</b>	36	31	66	78
<b>Mode</b>	35	33	78	81
<b>Variance</b>	222,917	191,540	273,773	264,093
<b>Standard Deviation</b>	14,930	13,840	16,564	16,251

Based on the following table, it shows that the average pretest score for the control class (35.70) is higher than the experimental class (27.04), while the average posttest score for the experimental class (80.91) is higher than the control class (66.78). . These results show that the scores of the control class and experimental class increased after being given different treatment. In the control class there was an increase with the difference between the average pretest and posttest scores being 31.08, while the difference in the experimental class was 53.87. The analysis prerequisite test is used to see conclusions from the data obtained from the test results. Before conducting a hypothesis test, a data normality test is first carried out. The normality test was carried out with the help of SPSS 24, the normality test data is presented as follows:

Table 2. Pretest and Posttest Normality Test Results for Control Class and Experimental Class

Statistic test	Pretest		Posttest	
	Control	Experiment	Control	Experiment
The $X^2$ value is calculated	4,28	4,08	9,47	5,06
$X^2$ Value Table	11,07	11,07	11,07	11,07
Decision	Data is normally distributed			

Based on the table above, it can be seen that the pretest and posttest data for the experimental class and control class have a value of  $X^2_{hitung} < X^2_{tabel}$ . So that  $H_0$  is accepted, meaning the data variance is normally distributed.

#### Hypothesis test

This research uses the t test to determine whether the variable (X) using Android-based mathematics learning media influences the variable (Y) learning outcomes or not. So it can be seen from the following SPSS 24 output.

Table 3. Hypothesis Test Posttest Experiment Class and Posttest Control Class

Class	Average	$t_{count}$	$t_{table}$	Sig.
Post-test Experiment	80,91	7,727	2,011	0,025
Control Post-test	66,78			

Based on the t test, it is known that the average experimental learning result is 80.91 and the average control class learning result is 66.78, so the difference in the average learning result for the experimental class and the control class is 14.13. From this table it is known that the t count is 7.727 with a significance of 0.025. The t table obtained from DB 49 at a significance level of 5% is 2.011. So the value of  $t_{hitung} > t_{tabel}$  ( $7.727 > 2.011$ ) and the sig value  $< 0.05$ .

## DISCUSSION

It can be concluded that there is a significant influence of STEM learning assisted by Android media on students' interest in learning. Based on the research conducted in this study, the aim is to determine the effect of using STEM learning assisted by Android media on students' interest in learning. At the beginning of learning, to determine students' initial abilities, researchers gave an initial test (pretest) in the form of essay questions. After that, each class was given different treatment, namely class X AK2 (experimental class) using STEM learning assisted by Android media and class X AK1 (control class) using lecture or conventional methods. Finally, give an evaluation test (posttest) to determine students' learning outcomes and interest in learning after being given different treatment, then compare the results.

Based on the results of the pretest and posttest for the experimental class, it is known that the average pretest score for the experimental class is 27.04 and the average posttest is 80.91. The data was then analyzed and the results obtained were normally distributed and the two data had a linear relationship, then the regression model for the experimental class explained the relationship between initial abilities and learning outcomes as well as learning interest taught using STEM learning assisted by Android media with the regression model obtained.  $Y = 57.60 + 0.53X$ . From the results of the significance test analysis, the regression model is meaningful or significant.

Based on the results of the pretest and posttest for the control class, it is known that the average score for the pretest was 35.70 and the posttest for the control class was 66.78. The data was then analyzed and the results were normally distributed and the two data had a linear relationship, then the regression model for the control class which explained the relationship between initial abilities and learning outcomes taught using the lecture method with the regression model obtained was  $Y=42.73+0.56X$ . From the results of the significance test analysis, the regression model is meaningful or significant.

Based on the known results, the average posttest score for the experimental class was 80.91 with a variance of 16.251, and the average posttest score for the control class was 66.78 with a variance of 16.564. The data was then analyzed and the results obtained were normally distributed and the relationship between the pretest and posttest in the experimental class, pretest and posttest in the control class was linear. Thus, hypothesis testing was carried out using parametric statistics, namely the independent sample t-test (t-test) that  $t_{count} > t_{tabel}$  with a value of  $t_{count} = 7.727$  and  $t_{tabel} = 2.011$  or a sig value.  $< 0.05$  ( $0.025 < 0.05$ ). This means that  $H_0$  is accepted which states that there is a significant influence of STEM learning assisted by Android media on students' interest in learning in class X students at SMK Negeri 2 Tabanan.

Descriptively, it can be seen that there is a difference in the average learning outcomes between the experimental class and the control class. These results are the same as the research results obtained by Nurrita (2018) with the title "Development of Learning Media to Improve Student Learning Outcomes" which shows that there is a significant influence from the use of learning media in increasing students' motivation and interest in learning so that students can think and analyze the lesson material. provided by the teacher well with a pleasant learning situation and students can understand the lesson material easily. Apart from that, research from Masruroh & Agustina (2021) entitled "Android-based E-module as a support for online learning and efforts to improve student learning outcomes" which shows that the Android-based E-module developed has been tested for its feasibility, based on validation tests by media experts. The overall average score was 99.05% and in the validation test the material expert obtained an overall average score of 96.47%. It can be said to have met the criteria of being very valid and very effective for use as a learning resource for students. Apart from that, research conducted by Bakhtiar (2020), the results obtained by STEM-based learning media have several advantages: (1) an interesting way of learning for students, (2) the STEM approach has a more

effective impact on student learning achievement, and (3) ) Students who use STEM learning have a good understanding of concepts because at the stage of making props they are asked to express their ideas.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the research and processing of the data obtained during the research, the conclusion of this research is that Based on the results of the  $t_{count} > t_{tabel}$  analysis of the data, it is known that  $t_{count} = 7.727$  and  $t_{tabel} = 2.011$  or the sig value.  $< 0.05$  ( $0.025 < 0.05$ ), it can be interpreted as accepting  $H_0$  which states that there is a significant influence of STEM learning assisted by Android media on students' interest in learning.

Suggestions that researchers can give are:

1. For teachers, teachers should continue to train their students so that they have a high enough interest in learning by using existing learning media according to their era.
2. For research to be able to develop other materials and complement the materials that have been created in this research.

## ADVANCED RESEARCH

For further research, I hope to be able to see or analyze students' learning interests better so that they can take steps by adding learning media during the learning process, and this research can still be carried out as further research using different techniques and analysis methods so that good results are obtained. variety was found for this study.

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