MACROMEDIA FLASH-BASED LEARNING MEDIA AND LEARNING MOTIVATION ON MATHEMATICS LEARNING OUTCOMES

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Abstract: The development of technology, especially Information and Communication Technology (ICT) has influenced all aspects of life including education. Learning mathematics requires a tool (media) to explain mathematical material that is abstract in nature and fosters student learning motivation. Macromedia flash is a vector-based animation program and is used to create animated objects and text. This study aims to determine the effect of macromedia flash-based learning media and learning motivation on learning outcomes of class X IPA students at SMAN 1 Asembagus. The population is 180 students of class X IPA which consists of 5 classes, while the sample taken is 124 students of class X IPA. Data collection techniques used questionnaire and documentation techniques, while data analysis in this study used multiple regression analysis. The results of this study indicate that simultaneously learning media based on macromedia flash and learning motivation towards mathematics learning outcomes is 6,2%. While partially macromedia flash based learning media has an effect of 0,0027% and learning motivation has an effect of 0,059%. Based on the results of the study, it can be concluded that there is the influence of macromedia flash based learning media and learning motivation on the mathematics learning outcomes of class X IPA at SMAN 1 Asembagus both simultaneously and partially.

Keywords: Learning Media, Macromedia Flash, Learning Motivation, And Learning Outcomes

INTRODUCTION

The development of the world of education today cannot be separated from the development of science and technology. Education is the main capital in building young people who are ready to face the world of work. The world of education is required to always move along with the development of global technology (Taharuddin, 2012). The demands of the world of work today are increasingly difficult, because the world of work requires prospective workers who have competency advantages in their respective fields. Mathematics is a science that underlies the development of modern technology which has an important role in various disciplines and can develop human thinking power. Knowledge mathematics will be better if students are able to construct it through the experiences they have had before. Learning mathematics is a mental activity to understand meaning, relationships and symbols which are then applied to real situations. Abdulrahman, et al. (2011) said "as managers of student activities, teachers are expected to be mentors and assistants to students". The role of teachers in schools is very much needed in achieving the goals of learning mathematics and teaching and learning processes to help students achieve optimal learning outcomes. Learning outcomes are very important in education and can be viewed as one measure of student success in education at school (Hasanah, 2022).

In the problem of learning motivation, it is generally assumed that if the other factors that influence learning outcomes are the same, then individuals who have higher motivation will

achieve higher learning outcomes as well. This can be proven from the results of research conducted by Kusnanang, (2015) with the title "The Influence of Learning Motivation on Learning Outcomes of Class VII-I Students of SMPN 13 Surabaya on Material Production, Consumption and Distribution" which states that learning motivation has a significant effect on results learning class VII-I students of SMPN 13 Surabaya, the influence is 88,8% and the remaining 11,2% is influenced by other factors. The purpose of learning motivation is the overall driving force that gives rise to learning activities, which guarantees the continuity of learning and provides direction for learning activities, so that goals can be achieved (Shah, 2016).

Given the importance of knowledge of motivation, it is deemed necessary to discuss the motivation to learn. There are many ways for a teacher to convey learning material that will motivate students to improve learning outcomes, including by using strategies, appropriate methods and assisted by media that support learning activities. Departing from the problems above, the author then conducted a discussion with one of the mathematics teachers at SMAN 1 Asembagus. In this discussion, the teacher gave suggestions for using computer-based learning media in the learning process. The selected learning media is made with *Macromedia Flash Software*. Puspitasari, (2019) said "*Macromedia Flash* is a program that is currently popular for creating and manipulating graphics and animation".

The research conducted Rosa, (2011) entitled "The Influence of Using *Macromedia Flash* on Motivation and Learning Achievement in Manual Arc Welding Training Subjects at SMKN 2 Pengasih" concluded that there is an effect of using *Macromedia Flash* on the learning motivation of students who receive Manual Arc Welding training courses in practice making a welding line in the underhand position at SMKN 2 Pengasih. This can be seen from the results of research in the experimental class which was treated using *Macromedia Flash* which had a higher motivation score than the control class which was given conventional learning. In the experimental class, the average student learning motivation score was 73,53. Whereas in the control class the average score was lower, namely 68,82 (Hasanah, et al., 2022). Research conducted by Shah, (2016) entitled "The Effect of Using *Macromedia Flash 8 Software* on Students' Mathematics Learning Outcomes in Grade VIII" concluded that the use of *Macromedia Flash* as a learning medium can attract students' interest and attention, while learning that does not use *Macromedia Flash* can be considered by students as boring learning. This is based on the results of hypothesis testing obtained $t_{hitung} = 2{,}910 > 2{,}002 = t_{(0{,}975;(58))}$.

Provision of *Macromedia Flash* in the teaching and learning process help students in learning mathematics (exposition). This can be seen in its effect on the mathematics learning outcomes of students who were taught using the *Macromedia Flash* learning media as the experimental class and the mathematics learning outcomes in the control class without using *Macromedia Flash*. Based on the help of this media the teacher can make the learning design as attractive as possible and it is hoped that students will find it easier to understand the subject matter and student learning motivation will increase, so that it has a positive impact on student learning outcomes. Therefore, the author wants to conduct research on "The Effect of *Macromedia Flash-Based Learning Media* and Learning Motivation on Student Learning Outcomes in Mathematics Class X IPA at SMAN 1 Asembagus".

METHOD

This study uses a quantitative approach, because researchers assume that the observed symptoms can be measured and expressed in numbers. To describe this research, several

statistical formulas were used, so that this research is known as quantitative research. The research subjects in this study were students of class X IPA at SMAN 1 Asembagus. Class X IPA consists of 5 classes with 36 students in each class. The total number of students in class X IPA is 180, but not all students in class X IPA are used as research subjects. Researchers chose 124 students to be used as research samples.

The instruments used in this study include (1) Questionnaire sheets. The questionnaire used was a structured questionnaire in which the respondent only gave the answers provided in the questionnaire and the form of the answer was closed, meaning that alternative answers were available for each item. There are five alternative answers to the questionnaire, namely, Always (SL) with 5 points, Often (SR) with 4 points, Sometimes (KD) with 3 points, Rarely (JR) with 2 points and Never (TP) with 1 point. The questionnaire that was previously given was validated by three validators. After the questionnaire has been completed, the respondent's next step is to test the collected data to find out whether the questionnaire is valid and reliable, using the following formula.

1. Validity Test

   A research instrument is said to be valid if the instrument can measure something exactly what it wants to measure. According to Rosa, (2011), the product moment formula is used to determine the validity of the research instrument, namely:

$$r_{xy} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)\}}}$$

   Where:
   r_{xy} = Product moment correlation
   X = Total score of each item
   Y = Score/value of each item
   N = Number of samples

   In this study, the significance level used to find r_{table} is 5%. In the calculation if $r_{count} > r_{table}$, then the instrument item is said to be valid.

2. Reliability Test

   The purpose of holding reliability is to find out whether the data that has been collected can be trusted or not. According to Abdulrahman, et al. (2011: 56) a measurement instrument is said to be reliable if its measurements are consistent and accurate. The reliability test is carried out using the Alpha Cronbach Technique, the formula is as follows:

$$r_{11} = \left[\frac{k}{(k-1)}\right]\left[1 - \frac{\sum \sigma b^2}{\sigma t^2}\right]$$

   Where;
   r_{11} = instrument reliability
   k = the number of questions
   $\sum \sigma b^2$ = the number of item variances
   σt^2 = total variance

   In this study, the significance level used to find r_{table} is 5%. In the calculation if $r_{count} > r_{table}$, then the instrument is said to be reliable. The second instrument is the Documentation

Sheet. The documentation sheet contains school profiles, lists of student names, and student knowledge scores. The analysis technique used in this study is a multiple regression technique. Following are some of the formulas used in multiple regression analysis.

3. Regression Line Equation

To find the equation of the regression line, the values of the predictor coefficients and their constant numbers can be found from the data investigated. The formula used in finding the regression line equation.

$$Y = a + bX_1 + cX_2$$

Where;
Y = Criterion
X_1 = Predictor 1
X_2 = Predictor 2
a = Intercept
b and c = Regression coefficient

Meanwhile, to calculate the intercept (*a*), the regression (*b* and *c*) use the following formulas.

$$b = \frac{(\sum x_2^2)(\sum x_1 y) - (\sum x_1 x_2)(\sum x_2 y)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$

$$c = \frac{(\sum x_1^2)(\sum x_2 y) - (\sum x_1 x_2)(\sum x_1 y)}{(\sum x_1^2)(\sum x_2^2) - (\sum x_1 x_2)^2}$$

To get the elements at values *a*, *b* and *c*, the following generally applies.

$$Y = \frac{\sum Y}{N}$$

$$X = \frac{\sum X}{N}$$

$$\sum y^2 = \sum Y^2 - \frac{(\sum Y)^2}{N}$$

$$\sum x^2 = \sum X^2 - \frac{(\sum X)^2}{N}$$

$$\sum x_i y = \sum X_i Y - \frac{(\sum X_i)(\sum Y)}{N}$$

$$\sum x_i x_j = \sum X_i X_j - \frac{(\sum X_i)(\sum X_j)}{N}$$

Where;
Y = Criteria
X = Predictor
N = Number of Respondents

4. Calculating the Coefficient of Determination (R^2)

To calculate the precession (accuracy) of the regression line as the basis for predicting research variables by finding the magnitude of the coefficient of deteremination.

$$R^2 = \frac{(b \cdot \sum x_1 y) + (c \cdot \sum x_2 y)}{\sum y^2}$$

5. Calculating Residue or Forecast Error (Res)

To calculate the forecast error (Residue), the following formula is used.

$$Res = (1 - R^2)\left(\sum y^2\right)$$

6. Calculating the Correlation Level (r)
   a. Calculating the multiple correlation between X_1 and X_2 against Y, with the formula:

   $$r = \sqrt{R^2}$$

   From calculations with a significance level of 5%, if $r_{count} > r_{table}$ it is significant. Meanwhile, if $r_{count} > r_{table}$, then it is not significant.
   b. Calculates the partial correlation between X_1, X_2, and Y.
   To determine the level of partial correlation between X_1, X_2, and Y, first determine the simple correlation coefficient as follows.

$$r_{y_1} = \frac{(\sum x_1 y)}{(\sum x_1^2)(y^2)}$$
$$r_{y_2} = \frac{(\sum x_2 y)}{(\sum x_2^2)(y^2)}$$
$$r_{y_{12}} = \frac{(\sum x_1 x_2)}{(\sum x_1^2)(\sum x_2^2)}$$

After obtaining each simple correlation coefficient, the next step is to determine the partial correlation as follows.

1. Calculating the Partial Correlation Coefficient between X_1 and Y with the control variable X_2

$$r_{y_{1.2}} = \frac{ry_1 - (ry_2)(ry_{12})}{\sqrt{(1 - (ry_2)^2)(1 - (ry_{12})^2)}}$$

2. Calculating the Partial Correlation Coefficient between X_2 and Y with the control variable X_1

$$r_{y_{2.1}} = \frac{ry_2 - (ry_1)(ry_{12})}{\sqrt{(1 - (ry_1)^2)(1 - (ry_{12})^2)}}$$

7. Significance Test

To test the significance of the regression equation, it is done by calculating the value of the regression F through the formula:

$$F_{reg} = \frac{Rk_{reg}}{Rk_{res}}$$

To complete the prices contained in the formula, the following things must be found first.

$$Jk_{reg} = R^2 \cdot \left(\sum y^2\right)$$
$$Jk_{res} = (1 - R^2) \cdot \left(\sum y^2\right)$$
$$db_{reg} = \text{m (number of predictors)}$$
$$db_{reg} = \text{N} - \text{m} - 1$$
$$Rk_{reg} = \frac{Jk_{reg}}{db_{reg}}$$

$$Rk_{res} = \frac{Jk_{res}}{db_{res}}$$

From the calculation with a significance level of 5%, if $F_{count} > F_{table}$, then it is significant. Meanwhile, if $F_{count} > F_{table}$, then it is not significant.

8. Calculating Relative Contribution (SR) and Effective Contribution (SE)

Relative Contribution (SR) and Effective Contribution (SE) are a measure of how much the predictors in the regression have a contribution or contribution to the criterion variable. By calculating SR and SE, it will be known about which predictor has the greatest contribution to the formation of variation in the regression criteria units.

The procedure for calculating SR and SE is to use the following formula.

$$SR_{x_1} = \frac{b(\sum x_1 y)}{Jk_{reg}}$$

$$SR_{x_2} = \frac{c(\sum x_2 y)}{Jk_{reg}}$$

$$SE_{x_1} = (SR_{x_1})(R^2)$$

$$SE_{x_2} = (SR_{x_2})(R^2)$$

RESULT

Data about *Macromedia Flash-Based Media* and Learning Motivation

Collecting data for independent variables using a questionnaire technique which consists of 30 statements, namely:

a. Number 1-15 statement items regarding the use of *macromedia flash based media* (X_1).
b. Number 16-30 statement items about learning motivation (X_2).

Each statement item has five alternative answers as follows:

a. Always (SL) with a score of 5
b. Often (SR) with a score of 4
c. Sometimes (KD) with a score of 3
d. Rarely (JR) with a score of 2
e. Never (TP) with a score of 1

So, the maximum score for each variable is formulated as follows.

Highest score = 5
Number of items = 15
Number of Respondents = 124

Maximum score $= 5 \times 15 \times 124$
$= 9.300$

To find out the high and low scores obtained from the results of the questionnaire, the researcher created the following categories.

Table 1. Maximum Score Category

Total score	Category
$\mathbf{1.860} \leq x \leq 3.720$	Very low
$\mathbf{3.720} < x \leq 5.580$	Low
$\mathbf{5.580} < x \leq 7.440$	Tall
$\mathbf{7.440} < x \leq 9.300$	Very high

Meanwhile, from the results of scoring and tabulation, it can be seen the results and conditions of students in terms of *macromedia flash*-based learning media and learning motivation as follows.

1) *Macromedia Flash*-based learning media

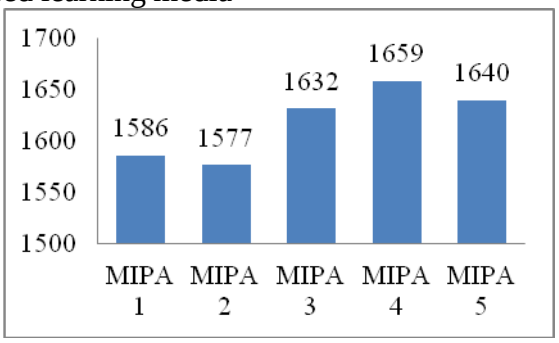

Figure 1. *Macromedia Flash*-Based Learning Media

From the graph, the maximum score is 8,094. The value of 8,094 is included in the very high category.

2) Motivation to Learn

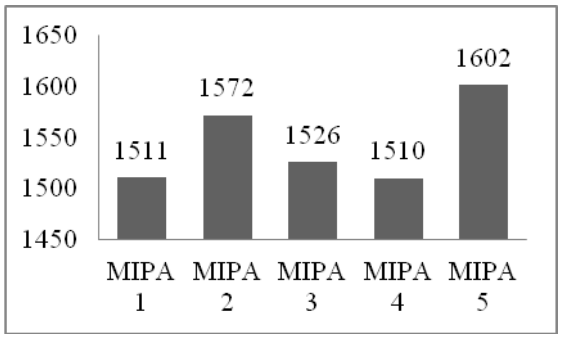

Figure 2. Motivation to Learn

From the graph, the maximum score is 7,721. The value of 7,721 is included in the very high category.

1. Learning Outcome Data

The learning outcomes used are learning outcomes in the cognitive domain of students, namely the Daily Deuteronomy. Researchers obtained learning outcome data from one of the mathematics teachers at SMAN 1 Asembagus named Mr. Fani Firmansyah, S.Si who had used learning media based on *Macromedia Flash* in learning mathematics in class. There are two daily test scores, namely Basic Competency (KD.3a) and Basic Competency (KD.3b).

2. Hypothesis Test

Hypothesis testing is a test based on statistical tests which included simultaneous testing and individual (partial) testing. The following will describe the results of the statistical test.

a) Minor Hypothesis X_1

1. Correlation coefficient (r) between X_1 and Y

Based on the calculation, the correlation coefficient is obtained $ry_{1\cdot2}$ of – 0,174. Because the correlation coefficient ($ry_{1\cdot2}$) is negative. The negative sign indicates that there is a negative relationship between *macromedia flash*-based learning media and student learning outcomes.

2. Effectiveness contribution X_1

Based on the calculation obtained SE_{X_1} by 0,0027%. This shows that the *macromedia flash*-based learning media variable has a contribution of influence on learning outcomes of 0,0027%.

Based on the analysis above, it can be concluded that there is an influence of *macromedia flash*-based learning media on student learning outcomes.

b) Minor Hypothesis X_2

1. Correlation coefficient (r) between X_2 and Y

Based on the calculation, the correlation coefficient is obtained $ry_{2\cdot1}$ equal to 0,248, the correlation coefficient ($ry_{2\cdot1}$) is positive. The positive sign indicates that there is a positive relationship between learning motivation and student learning outcomes.

2. Effectiveness contribution X_2

Based on the calculation obtained SE_{X_2} by 0,059%. This shows that the learning motivation variable has a contribution of influence on learning outcomes of 0,059%.

Based on the analysis above, it can be concluded that there is an influence of learning motivation on students learning outcomes.

c) Major Hypothesis Testing

1. The correlation coefficient (r) is multiple

Based on the calculation, a correlation coefficient of 0,25 is obtained which is a multiple correlation between the variable X_1 and X_2 the variable Y. It is called double because X_1 and X_2 together as a team of predictors it correlates with Y. r_{count} and r_{table} at 0,25 the 5% level of 0,176 it indicates that $r_{count} > r_{table}$, so the correlation between learning media based on *macromedia flash* (X_1) and learning motivation (X_2) with learning outcomes is significant.

2. Calculating the coefficient of determination (R^2)

Based on the calculation, the coefficient of determination is obtained R^2 = 0,062, which means that 6,2% of the variation that occurs in variable Y is caused by the influence of variables X_1 and X_2 together, while the remaining 93,8% is caused by the influence of other variables not examined or variables which are outside the research area are classified as residues. Thus, the size of the coefficient of determination will be a determinant of whether or not the precision of the regression line is a tool for the basis of forecasting research variables.

3. Significant test with the F test

Based on the calculation above, it is obtained F_{count} by 4,02 and F_{table} at the 5% level of 3,07. Meaning $F_{count} > F_{table}$. This indicates that there is influence of learning media and learning motivation on student learning outcomes.

Based on the F test, the F value is obtained as big as 4,02. A significance level of 5% and a total of 124 respondents, a value F_{table} of 3,07. This shows that $F_{count} > F_{table}$, based on the analysis above, it can be concluded that there is an influence of *macromedia flash*-based learning media and learning motivation on student learning outcomes.

DISCUSSION

The purpose of this study was to test whether there is an effect of *macromedia flash*-based learning media and learning motivation on student learning outcomes at SMAN 1

Asembagus. To discuss the research results of data from testing the following hypothesis, a summary of the results of data analysis is presented as follows:

1. *Macromedia flash*-based learning media on student learning outcomes in math class X IPA at SMAN 1 Asembagus

   The correlation coefficient value $ry_{1\cdot2}$ is – 0,174 in the form of a negative value. Arikunto, (2013) says that a negative correlation shows a relationship in the opposite direction, meaning that Y affects X_1. There are several factors that cause a negative correlation. One of them is the respondent answering the questionnaire is not in accordance with the existing conditions or answers at random. Based on the results of the analysis obtained SE_{X_1} by 0,0027%. This shows that the variables of *macromedia flash*-based learning media have an influence contribution on learning outcomes of 0,0027%, so that *macromedia flash*-based learning media has an affect on learning outcomes.

   Based on the results of the analysis above, it can be concluded that there is an influence of *macromedia flash*-based learning media on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus.

2. The influence of learning motivation on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus

   Correlation coefficient value $ry_{2\cdot1}$ equal to 0,248, the correlation coefficient ($ry_{2\cdot1}$) is positive. The positive sign indicates that there is a positive relationship between learning motivation and student learning outcomes. This can be interpreted that the higher the value of X_2, the higher the value of Y. Based on the results of the analysis obtained SE_{X_2} by 0,059%. This shows that the learning motivation variable has a contribution of influence on learning outcomes of 0,059%. So, that motivation to learn affects the learning outcomes. This is consistent with the results of research conducted by Kusuma, (2015) with the title "The Influence of Learning Motivation on Learning Outcomes of Class VII-I Students of SMPN 13 Surabaya on Material Production, Consumption and Distribution" which states that learning motivation influences significant to learning outcomes.

   Based on the results of the analysis above, it can be concluded that there is an influence of learning motivation on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus.

3. *Macromedia flash*-based learning media and motivation of student learning outcomes in X IPA class math at SMAN 1 Asembagus

   Based on the calculation, a correlation coefficient of 0,25 is obtained which is a multiple correlation between the variable X_1 and X_2 the variable Y. It is called double because X_1 and X_2 together as a team of predictors it correlates with Y. r_{count} and r_{table} at 0,25 the 5% level of 0,176 it indicates that $r_{count} > r_{table}$, so the correlation between learning media based on *macromedia flash* (X_1) and learning motivation (X_2) with learning outcomes is significant. Based on the calculation obtained the coefficient of determination R^2 = 0,062, it can be interpreted that 6,2% of the variation that occurs in variable Y is caused by the influence of variables X_1 and X_2 together, while the rest 93,8% is caused by the influence of other variables that are not examined or variables that are outside the research area which are classified as residuals. Thus, the size of the coefficient of determination will be a determinant of whether or not the precision of the regression line is a tool for the basis of forecasting research variables. Based on the calculation above, it is obtained that F_{count} is 4,02 and F_{table} at the 5% level of 3,07.

Meaning $F_{count} > F_{table}$. This indicates that there is an influence of *macromedia flash*-based learning media and learning motivation on student learning outcomes. In accordance with research conducted by (Taharuddin, 2012; Syafaruddin, 2019) which states that there is an effect of using *Macromedia Flash* and motivation on learning outcomes.

Based on the F test, the F value is obtained as big as 4,02. A significance level of 5% and a total of 124 respondents, a value F_{table} of 3,07. This shows that $F_{count} > F_{table}$, based on the analysis above, it can be concluded that there is an influence of *macromedia flash*-based learning media and learning motivation on student learning outcomes.

CONCLUSION

Based on the results, we can conclude that:

1. There is an influence of *macromedia flash*-based learning media on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus, as indicated by a correlation coefficient $ry_{1\cdot2}$ of – 0,174 with a contribution of influence on learning outcomes of 0,0027%.
2. There is an influence of learning motivation on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus, which is indicated by a correlation coefficient $ry_{2\cdot1}$ equal to 0,248 to the contribution of influence on learning outcomes of 0,059% and t_{count} equal to 2,815.
3. There is an influence of *macromedia flash*-based learning media and learning motivation on student learning outcomes in mathematics class X IPA at SMAN 1 Asembagus, which is indicated by a correlation coefficient r of 0,25. The contribution of influence on learning outcomes is 6,2% and F_{count} equal to 4,02.

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