Effectiveness of Macromedia Flash digital module

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Abstract. In the 21st century, digital media is very important in life. With the development of technology, teachers must be able to develop multimedia-based learning systems. Modules are teaching materials that can be arranged in certain forms and can help learning activities. Modules can be made in various forms, one of them is a digital module. Macromedia Flash is an application for creating animations that are widely used by animators. The purpose of this study was to determine the effectiveness of the digital Macromedia Flash module in mathematics learning. This study uses descriptive statistical analysis. Based on the results of the author's research, it can be concluded that the Macromedia Flash digital module is very effective on mathematics learning. Digital modules can increase student’s motivation on mathematics learning and increase the activity of students in the learning process.

1. Introduction
In 2018 researchers have observed the high school junior in Surakarta city. In these observations, researchers found that there were still many teachers who used conventional learning models that could reduce student activity and also reduce students’ interest in participating in mathematics learning. This is also seen in mathematics learning, especially in straight line equations. The results of the observation stated that the motivation and interest of students in mathematics learning especially in the sub-subject of straight-line equations was very low. It can result in low student achievement. The low student achievement is indicated by the results of the SMP 2016/2017 academic year showing the average UN score in the straight-line equation material of Surakarta city only 57, 80. Based on the PAMER UN data shows that the absorption of material is a straight-line equation at the Surakarta city only 51.25%. The data shows that straight line equation material is classified as difficult material for students. Often teachers only use the lecture method in teaching, without combining with interesting learning models that fit the 2013 curriculum. and it is difficult to understand mathematics. This method makes students tend to be passive.

In the learning process, the use of learning media is also still minimal. With the lack of media use, the students' interest in mathematics was very low. This can be seen during the learning process; students are lazy and feel bored following learning. The use of media in mathematics learning can also improve students ‘memory and students’ understanding of the material being studied. At present, many schools already have computers or projectors, but are not properly utilized by mathematics teachers. Learning is a process of mutual influence between educators and learners in the learning process. The learning process is said to succeed if most learners are involved actively, whether physical, mental or social in the learning process. Mathematics education is very useful to develop the creativity thinking and self-confident habit of students and it also helps to develop the problem-solving habit [1]. However, many
students do not like mathematics. They feel afraid of math problems. Mathematics is considered very
difficult to understand and do. Therefore, many students do not care about the importance of
mathematics in life.

Modules can be used as an alternative form of presentation of materials used in learning, including
learning Research Methodology. A learning module is a self-contained, formally structured learning
experience with a coherent and explicit set of learning outcomes and assessment criteria [2]. The module
is one type of teaching materials that are presented systematically, so that the user can learn with or
without a facilitator or teacher [3]. The form of modules is not only in book form, but can also be in
digital form. Digital modules can improve thinking skills for students. However, the study only focused
on Geometer’s Sketch Pad (GSP). Teachers might have to spend hours constructing materials using this
software but in the long run, it might save them a lot of time [4]. This research reveals that the innovation
of mathematics, location, gender and technology influences students' academic performance in
mathematics [5]. Whether or not a module depends on the presentation of the material in the module.
Modules must be made as good as possible so students can easily understand them [6]. Mathematical
modules are very effective for students, helping to facilitate students in learning mathematics
independently [7].

Technology is very important in the world of education. The use of technology and animation in
mathematics learning can increase student motivation in following the learning process. This is because
the majority of students are more interested in technology, animation than reading printed books. The
development of computer-based modules is one way to increase student motivation. In this 21st century,
the term “technology” is an important issue in many fields including education. This is because
technology has become the knowledge transfer highway in most countries [8]. Technology can play an
important role in detecting and resolving mathematical misconceptions [9]. The electronic technology
can be used to assist students in comprehending the visual images of mathematical ideas, it also
facilitates students in organizing and analysing data, and helps students to calculate in a quick and
accurate way. Multimedia Technology can help to create high quality learning environments especially
for students through, different medias like texts, graphics, sound, animation etc [10]. Multimedia refers
to any computer-mediated software or interactive application that integrates text, colour, graphical
images, animation, audio sound, and full motion video in a single application. One of the learning media
that can attract students' interest in learning mathematics is Macromedia Flash. The application of
Macromedia Flash in the development of mathematical modules in the world of education is a solution
to help students and teachers in mathematics learning that aims to improve students' ability to understand
material. With the development of technology, teachers must be able to develop multimedia-based
learning systems. This software is a program to design animated graphics are very popular and widely
used graphic designers [7]. The usage of Macromedia Flash program is expected to increase the activity
of learning in class, so it can increase the interest and learning achievement of learners [11]. In addition,
other purposes of the Macromedia Flash program usage can provide new variations in learning methods
so that learners are not saturated with the presented view and able to answer questions that have been
prepared correctly [12].

The animation in multimedia interactive learning gave a positive effect in improving students’
learning [13]. Animation is a technical process that, in general, produces motion illusion in the viewer
by sequencing the still images produced in the analogue or digital environment in sequence [14].
Animation is playing a more and more important role in the classroom with the advent of computers
[15]. Animation appears to provide a change in teaching methods. Conventional teaching that is teacher-
oriented learning as the transfer of knowledge tend to rely on faculty interests rather than the needs of
learners, resulting in learning activities less attractive and elusive student. Learning to use technology is
a change in the learning process of migrating to the student oriented. Animated Learning math can affect
students in how to think creatively to build mathematical concepts [16]. The researcher used Macromedia
Flash animation to attract students' interest in mathematics learning. By using Macromedia Flash, it is
expected to increase students' motivation in learning mathematics, especially in the subject of straight-
line equations. In addition to increasing student motivation, it is expected that the Macromedia Flash
module can improve students' understanding of the subject matter of straight-line equations. With the increase in student understanding of the equation of a straight line, it will also increase student learning achievement.

Mathematics learning with Macromedia Flash is very effective and can improve student learning achievement. Macromedia Flash is very effective when used in mathematics learning for 4th grade students [7]. Flash animation can be used for students to learn by observing, doing, thinking about, and connecting with all kinds of problems. Flash animations make students motivated, especially when used to understand difficult concepts in mathematics [5]. The use of the Macromedia Flash module is expected to improve student understanding and can improve critical thinking skills.

2. Method
The type of this research is experimental researches. This study involved two classes (grade 8) consisting of 30 students in each class. Classes are selected using the sample random sampling method by carrying out prerequisites before they are tested for normality and homogeneity. The treatment and control class groups were given achievement tests after learning using the Macromedia Flash module with the subject of straight-line equations. The experimental class is a class that is subject to learning with a Macromedia Flash digital module. While the control class is a class that does not use the digital module. After experimentation, a post test was conducted. From the results of the experiment and post-test, it can be analysed the effectiveness of the digital Macromedia Flash module in mathematics learning.

3. Result and discussion
The research was conducted in SMP N 9 Surakarta with a random sampling technique. From the results of the sampling obtained two classes consisting of one experimental class and one control class. Before conducting the experiment, initial tests were carried out, namely the normality test and the homogeneity test of the experimental class and the control class. The preliminary data is obtained from the results of the assessment data for the second semester of the class. The following are the results of the normality test from the initial data of the experimental class and the control class.

3.1. Preliminary data analysis
The initial data to be analysed is the final semester assessment data for 2017/2018. The following will be presented in table 1 about the results of the normality test of the experimental class and the control class using the Lilliefors method.

| Group            | $L_{obs}$ | N   | $L_{0.05;30}$ |
|------------------|-----------|-----|---------------|
| Experimental Class | 0.090324  | 30  | 0.160665      |
| Control Class    | 0.067442  | 30  | 0.160665      |

Based on the table above, the experimental class have $L_{obs} = 0.0903 < 0.160665$ which means that the class is normally distributed. In the control class shows the $L_{obs} = 0.067442 < 0.160665$ which means the control class is normally distributed. After testing the normality of the two classes, then the homogeneity test of the two classes was carried out. The experimental class and the control class are homogeneous samples.

After the two classes have proven to be normal and homogeneous, the research can be done in both classes. The experimental class is a class that uses a digital Macromedia Flash module in mathematics learning. While the control class is a class that does not use the digital Macromedia Flash module during mathematics learning. Before the module and learning achievement, tests are used, experts validate it first. Module validation is carried out by media experts and material experts. Validation of learning achievement tests, carried out by material experts. Digital modules have been declared suitable for use in learning after revisions. Learning achievement test questions have been declared appropriate to be
used to test student achievement. In addition to experts who conducted validation, researchers used as many as 30 students to give their opinions about the module. Revisions are made based on advice from experts and respondents. The next stage is a small class trial conducted on 5 students. After the trial was conducted, the module was revised again, then a large class trial was conducted. The large class trial is a trial conducted in the experimental class consisting of 30 students. After these trials, a learning achievement test was conducted in both classes namely the experimental class and the control class. If the results of the learning achievement test show that more than 80% of students get a value above the minimum completeness criteria, then the module is said to be effective to be used in mathematics learning.

The next step is to do a t-test which aims to show whether two samples are independent. Table 2 below shows whether there are differences between the experimental class and the control class.

| Group            | N  | Mean | DS        | $t_{obs}$     | $t_{0.05;60}$ |
|------------------|----|------|-----------|---------------|---------------|
| Experimental Class | 30 | 63   | 10.58415  | -11.43979     | 1.699126      |
| Control Class    | 30 | 57   | 12.05371  |               |               |

Based on t-test, it can be seen that the result of $t_{obs} = -11.43979 < t_{0.05;60} = 1.699126$. It’s means that there is no difference between the experimental class and the control class. So, it can be concluded that the two classes have the same ability. After it is known that both classes have the same ability and are normally distributed, experiment can be carried out.

3.2. Result
In this section, a normality test will be presented after conducting research in the experimental class and the control class. Table 3 presents the normality test based on the results of the post-test material for straight line equations.

| Group            | $L_{obs}$ | N  | $L_{0.05;30}$ |
|------------------|-----------|----|---------------|
| Experimental Class | 0.143038  | 30 | 0.160665      |
| Control Class    | 0.067285  | 30 | 0.160665      |

Based on the table above, the experimental class have $L_{obs} = 0.104924 < 0.160665$ which means that the class is normally distributed. In the control class shows the $L_{obs} = 0.067285 < 0.160665$ which means the control class is normally distributed.

3.3. Effectiveness Macromedia Flash digital module in the equation of a straight line
The effectiveness of the Macromedia Flash digital module can be seen from 2 factors, among others: 1). Student responses to the Macromedia Flash digital module; 2). The result of post-test after experiment. The following shows the number of student responses to the module digital Macromedia Flash.

| No | Student’s comment                                                                 | Number of student’s |
|----|------------------------------------------------------------------------------------|---------------------|
| 1. | I can understand the material of straight-line equations using a Macromedia Flash digital module. | 6                   |
| 2. | I find it easier to learn with the Macromedia Flash module.                         | 4                   |
| 3. | I feel interested in using a Macromedia Flash digital module                        | 15                  |
| 4. | By using modules, I am more motivated to learn straight line equations.             | 20                  |
| 5. | The illustration of the problem of the real world at the beginning of each material makes me motivated to study every material. | 3                   |
| 6. | I can study more diligently independently with this module.                         | 8                   |
Table 4. Cont.

| No | Student’s comment                                                                 | Number of student’s |
|----|------------------------------------------------------------------------------------|---------------------|
| 7. | The animation on the Macromedia Flash digital module makes me not bored in learning straight line equations. | 8                   |
| 8. | I can get to know the animation application in mathematics learning.               | 4                   |
| 9. | I better understand operating Macromedia Flash animation applications using a computer. | 3                   |
| 10.| I can understand that computers and Macromedia Flash animation applications can be used to learn mathematics. | 3                   |

Based on the table above, it can be seen that, most students stated that they were happy and motivated in learning straight-line equations with the digital module Macromedia Flash. Students feel many other benefits while using the Macromedia Flash digital module. They can better understand the benefits of animation applications in mathematics learning. Students find it easier to learn and understand the material presented in the digital module. They do not feel bored in learning mathematics while using the Macromedia Flash digital module.

Table 5 is the post test results on the material of straight-line equations. From these results it can be seen the percentage of students who meet the minimum completeness criteria.

Table 5. Post Test after experiment.

| Control | Experiment |
|---------|------------|
|         | Value      | frequency | Value | frequency |
|         | 30         | 1         | 50    | 1         |
|         | 35         | 1         | 55    | 1         |
|         | 36         | 1         | 60    | 1         |
|         | 45         | 2         | 65    | 1         |
|         | 46         | 2         | 70    | 1         |
|         | 50         | 2         | 72    | 2         |
|         | 55         | 2         | 75    | 4         |
|         | 56         | 3         | 76    | 3         |
|         | 60         | 5         | 78    | 5         |
|         | 65         | 3         | 80    | 4         |
|         | 66         | 1         | 83    | 2         |
|         | 67         | 1         | 85    | 1         |
|         | 70         | 3         | 90    | 3         |
|         | 71         | 1         | 92    | 1         |
|         | 73         | 1         |       |           |
|         | 80         | 1         |       |           |

Based on the table, students who get a score of 70 on the results of the control class post-test as many as three students and in the experimental class as many as 1 student. Students who get more than 70 grades in the control class are 3 students, while in the experimental class there are 25 students. Its means in the control class students who get grades that meet the minimum completeness criteria are only 20%, while students who meet the completeness criteria are at least 90%. Based on the results of students' learning achievements prove that the use of Macromedia Flash in mathematics learning can improve student learning achievement.

4. Conclusion

Based on the results and analysis of this study, it can be concluded that the use of digital modules can improve student learning achievement. This can be seen from the percentage of students getting post
test results more than or equal to 70. Based on the table, it can be seen that there are 26 students getting a value greater than or equal to 70. This means that there are 90% of students pass the math test. More than 80 percent of students obtain grades above the minimum completeness criteria. In addition, student comments indicate that the Macromedia Flash digital module is very useful for increasing learning motivation and student understanding in learning mathematics, especially straight-line equations. So that it can be concluded that Macromedia Flash digital module is very effective if used in mathematics learning.

Based on the results of this researches, based on the results of the study, there is still an opportunity to conduct research on the development of the Macromedia Flash digital module with:

- a different sub-topic
- different levels
- different electronic media.

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