

## THE USE OF INTERACTIVE MULTIMEDIA (MACROMEDIA FLASH) TO INCREASE CREATIVE THINKING ABILITY OF STUDENTS IN BASIC PHYSICS SUBJECT

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### ABSTRACT

Students were intellectuals who should have the ability to think critically, one of which is the creative thinking skills. However, the students' limited ability in basic physics as well as the limitations of using a variety of multimedia resulted in basic physics final exam result was lower than 6 on average from maximum value of 10. This leads to the lower creative thinking skills of students in basic physics. This research was a Quasi Experiment research on students in the first semester of academic year 2014/2015 which amounted to 38 people. This research was expected to increase creative thinking skills as well as lecturers and students activities. Data obtained from this study was the data of creative thinking skills of students and data on the observation of activity of lecturers and students. The data were analysed by using formula percentage of completeness of learning outcomes, gain index and statistical t-test. Based on the results of data analysis it is showed that the use of interactive multimedia (Macromedia Flash) can improve creative thinking skills of students.

### ABSTRAK

Mahasiswa adalah kaum intelektual yang seharusnya memiliki kemampuan berpikir tingkat tinggi, yang salah satunya adalah keterampilan berpikir kreatif. Namun keterbatasan kemampuan dasar fisika mahasiswa serta keterbatasan penggunaan berbagai multimedia mengakibatkan hasil ujian final fisika dasar mereka rata-rata dibawah angka kriteria ketuntasan minimum. Hal ini mengindikasikan bahwa keterampilan berpikir kreatif mahasiswa pada mata kuliah fisika dasar rendah. Penelitian ini adalah penelitian Quasi Experiment Melalui penelitian ini diharapkan akan dapat meningkatkan keterampilan berpikir kreatif serta aktivitas dosen dan mahasiswa. Data yang diperoleh dari hasil penelitian ini adalah data keterampilan berpikir kreatif mahasiswa dan data hasil observasi aktivitas dosen dan mahasiswa. Setelah semua data terkumpul dianalisis dengan menggunakan rumus persentasi ketuntasan hasil belajar, indek gain dan statistik uji-t. Berdasarkan hasil analisis data diperoleh bahwa penggunaan multimedia interaktif (Macromedia Flash) dapat meningkatkan keterampilan berpikir kreatif mahasiswa.

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**Keywords:** Creative thinking skills; Interactive multimedia (Macromedia Flash)

### INTRODUCTION

Basic physics courses in physical education courses are the foundation for students to face and study other subjects in the following semester; therefore student of physics education is very important to thoroughly master the basic physics. The students' basic capabilities

related to mastery of concepts of physics is very important. Makrus and Hadiprayitno (2012) expressed his opinion about the science that science is not just made up of a collection of knowledge isolated from one another, rather than a collection of knowledge organized systematically. This opinion of Hadiprayitno and Makrus reinforces that the mastery of basic physics perfectly as a part of science plays an important role. Nevertheless, the results of experience as a lecturer of basic physics course

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during the last 3 years in the study of physics education, shows that the ability of the average student is still relatively low. It can be seen from the midterms and final exams results especially those of basic physics course which gain under 6 on average from maximum value of 10 and based on data from the service center KHS and KRS students information obtained that 55% of first semester students reprogram the subjects of Physics essentially is C or D.

Based on these findings followed by interview sessions, it is found that the lack of mastery of the physics is influenced by their habit while in high school that while they were studying physics they just applying physics equation without understanding the physics concept underlying. This is in line with that expressed by Sabella & Redish (2007) that one of the causes of low mastery of physics is that students learn only the surface pattern. Furthermore, Kristianingsih, Sukiswo & Khanafiah (2010) also says that due to the teachers are prone to give more lectures or simply delivering product, resulted the poorly trained students in developing the ability of thinking in order to develop application concept that has been learned in real life. Additionally, the learning activity should not be done only one way though the subject of the learners are the students. This is because the process of learning itself is a process that emphasizes providing direct experience to develop the competencies so that students are willing to explore and understand the universe around scientifically. Based on those direct experiences, all students' learning activities will be monitored by the lecturer.

In line with this statement, Subali, Sopyan, & Ellianawati (2015) argued that "the activity of the students is a real phenomenon that is evident in students and can be observed as well as be measured by students, in this case the most involved is lecturer. Based on this study, an improvement learning program was made in order to improve student's thinking skills. The improvement is important because physics is not a science which can only rely on mastery of concepts or rote alone. Thus, students should be able to understand a concept by relying with their thinking ability. The physics lesson is a lesson that requires learners more actively involved in classroom. This is in line with what was said by Yerigan (2008), which is active learning will be able to increase the level of interaction between students and higher level thinking.

Many of solutions can be performed by

a lecturer to create learning method that able to attract students, including the use of interactive multimedia (Macromedia Flash). Wahyudin, Sutikno, & Isa (2010) stated that interactive multimedia is a multimedia that allows the users to make an implementation and to receive feedback. Interactive multimedia with Macromedia Flash is one form of media that can be used to achieve the learning objectives. Through the medium, the students can be invited to view an animation of the concept that is being delivered. In connection with the use of interactive multimedia, other researcher has conducted similar research, Wiyono, Liliarsari, & Paulus (2012) with the title of his research "model-based interactive multimedia learning styles to improve the comprehension of the concept of introduction of solid-state physics". They concluded that the use of interactive multimedia-based learning style is more effective than conventional learning in increasing mastery of the concept of introduction to solid-state physics.

Arsyad (2007), gave his opinion regard to the learning media that can be characterized as follows: 1. Fixative feature, which describes the media's ability to record, store, preserve, and reconstruct an event or object; 2. Manipulative feature, which is media's ability to transform an object, event or process in addressing the problem of space and time; 3. Distributive feature, which describes the media's ability of transporting object or event through space, and simultaneously the incident served to a large number of students, in various places, with relatively same stimulus experience about the event.

Sadiman (2007) revealed that "media characteristics in terms of economic, target scope to be covered, and ease of control by the user. Characteristics of the media can also be seen by its ability to arouse entire sensory organs". In this case, knowledge of the characteristics of the medium of learning is very important for the grouping and selection of media, and can be adapted to the specific learning situation. Furthermore Wiyono, Liliarsari, & Paulus (2012) give their opinion regard to the use of interactive multimedia, namely interactive multimedia in teaching physics will greatly help students in understanding the concepts that are abstract. Therefore, it would be a very nice synergy to collaborate the appearance of interactive multimedia and continued with little investigation via existing practical equipment to enhance the creative thinking skills of students.

This is because the skills of creative thinking are one's ability to high level thinking skills and included various activities of process skills. According to Marnita (2013), high-level thinking skills such as self-process skills in students are a talent that should be developed in accordance with the nature of science teaching. As dictated by Chabalengula, Mumba & Mbewe (2012), there are two main abilities in thinking skills such as process skills, which are fundamental skills and integrity skills.

Furthermore Liliyasi (2000) mentions that the thinking skills is one of the necessary intellectual potential in many aspects of daily life of students. In this case Hassoubah (2002) stated that creative thinking ability is a process that aims to make sensible decisions about what is believed to be done. Furthermore Munandar (2009), also revealed that the skills of creative thinking consists of several indicators, namely (1) thinking smoothly (in which there are an act of generating many ideas that are relevant, smooth current of thinking, and always think that the answer of a problem is always more than one, (2) thinking flexibly (in which varied ideas/answers/questions were generated, toward a different idea, and is able to change the old-fashioned approach or thought), and (3) thinking in detail development, embellishment, and having an idea, breaking down the problems into details, and expand an idea). Learning process using Macromedia Flash and multimedia coupled with the implementation of a simple lab works, will make the students able to find the concept better, and will be able to generalize any findings into the example in the vicinity. Furthermore, Macromedia Flash multimedia animation also invited students to be directly involved in the process of observation through Macromedia Flash multimedia, followed by testing using simple equipment. These steps hopefully will be contribute to creative thinking construction of the students. Therefore, this study aims to determine whether the use of interactive multimedia (Macromedia Flash) can improve students' creative thinking skills in basic physics course.

**METHOD**

This research was conducted in the classroom of Physics Education Department, Faculty of Pedagogy and Education Almuslim University Bireuen districts of Aceh province. Samples in this study were 38 students of the first semester of academic year 2014/2015.

This study was conducted using Quasi experiment with quantitative approach. A quantitative approach was conducted to test the hypothesis by using some statistical equations corresponding to the data obtained in the field. Quasi experiment was chosen because it is difficult to obtain a control group. According to Sugiono (2009) if the researcher has chosen quasi experiment, the researchers need to do a pre-test as much as four times in order to obtain stability and circumstances of the group prior to treatment.

The data obtained in this study are student learning outcomes data in the form of creative thinking skills, as measured by using the items creative thinking skills. The data were collected from paper documentation and test. The data that have been obtained subsequently processed using several statistical equations. To determine the thoroughness of students' learning outcomes in the form of creative thinking skills in using equation percentage of completeness as has been dictated by Trianto (2011), namely:

$$p = (\text{number of students who pass}) / (\text{total number of students}) \times 100\%$$

From equation percentage of completeness described above, it is known that each student is said to be complete in learning (individual completeness) if the correct answer  $\geq 65\%$ , and a class is said to be complete in learning (classical completeness) if there are  $\geq 85\%$  of students who has completed the study in a class (MONE).

As for knowing the increase in creative thinking skills Meltzer gain index equation (2002), as follows:

$$\text{Gain Index} = (\text{post test} - \text{pre test}) / (\text{maximum score} - \text{pre test})$$

**Table 1.** Gain Index Criteria

Gain Index	Category
$g \leq 0,3$	Low
$0,3 < g \leq 0,7$	Moderate
$0,70 < g \leq 1,00$	High

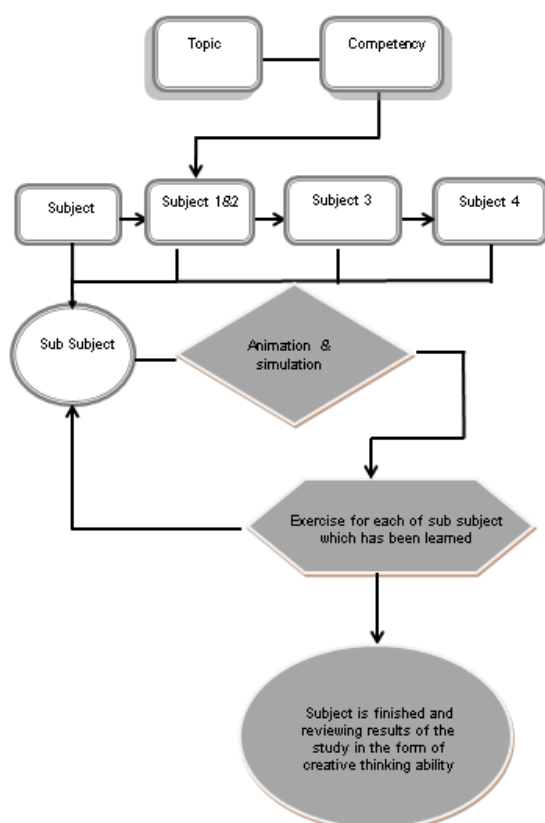
Furthermore, hypothesis testing was done by using t-test statistics dictated by Arikunto (2002), as follows:

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}}$$

## RESULTS AND DISCUSSION

### Research results

The study was conducted on subjects Physics, especially on the topic of motion. Prior to the discussion of the findings in this study, the following is a flowchart of specific material that has given treatment in the form of interactive multimedia.



**Figure 1.** The form of flowchart of the material

Before the data of this study are presented in the form of processed data, the researchers have tested the instrument on first semester students of Mathematic education program, Faculty of Pedagogy and Education that had been taking basic physics course. The calculations of the test results include validity, reliability, level of difficulty, and distinguishing features. The result of the calculation reliability of essays by using the formula has the alpha reliability coefficient of 0.66, which means that the reliability coefficient has high reliability. While the results of the calculation of validity of 13 items about the creative thinking skills, 7 of which have high validity criteria, 3 problems which have sufficient criteria, one matter of which have the low criteria and two questions of which have very low criteria. Further calcula-

tions about the difficulty level, 11 of which had moderate criteria, one matter of which have easy criteria, and 1 had a difficult criterion. Calculation of distinguishing features, 10 questions of which have good category, two problems of which have bad category, one question has sufficient categories. Based on test results, the writer decided that 3 out of 13 questions were decided to be discarded and three problems were decided suitable to be used as questions for assessing creative thinking skills.

Based on the results of the initial test results of data processing and final tests that have been done then the whole purpose of this research has been achieved. The general descriptions of the results that have been achieved are as follows:

**Table 2.** General Overview of Research Results on First Semester Students of Physics Education Program on Motion Subject

Value	Pre-test	Post-test
Highest	66.00	97.00
Lowest	20.00	52.00
Mean	29.21	71.00
Variance	24.45	92.34
Standard deviation	4.94	9.60

### Analysis of Creative Thinking Skills completeness

The research principle conducted on students of the first semester, particularly on the motion subject of matter, as a basic step to improve students creative thinking. It is done since the basic ability is still low, then for subsequent materials in the following semester, students will find it hard to master physics that correspond to physical education course curriculum. Based on this fact the analysis of creative thinking skills completeness of students were performed, which standardize the completeness refers to the standards stipulated by the Ministry of National Education that learners are considered complete on an individual basis if the score obtained is over 65% of the determined maximum score. The classical completeness is achieved if 85% of the students are able to achieve score above 65%.

The analysis result of pre-test and post-tests shows that the pre-test or initial test, student who achieve complete category is only one student, while the rest have not yet reached complete category. The result indicate that while in junior high school and high

**Table 3.** Level of Students Creative Thinking Skills in Motion Subject

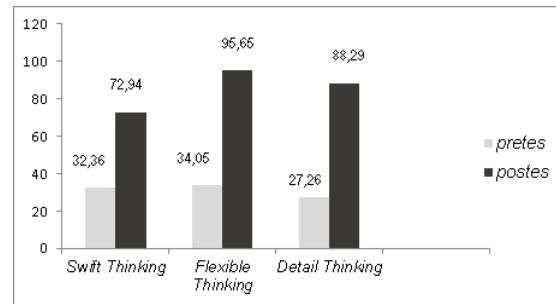
No.	Category	Pretest		Post-test	
		Number of Students	Percentage	Number of Students	Percentage
1	Pass	1	1%	32	93,61%
2	Fail	34	99%	3	6,39%
Total		35	100%	35	100%

school, the students studied physics only on the surface pattern so that mastery of physics is still very low. This is consistent with what has been revealed by Sabella & Redish (2007) who said that one of the causes of weak mastery of physics is that students learn only the surface pattern. Here is the percentage of students at the level of completeness of pre-test and post-tests.

The Table 3 shows that because previously the student in high school studied physics only on the surface pattern, the students were only invited to learn conceptually without involving them in a scientific investigation, the results obtained from the pre-test showed the students' lack of basic knowledge in physics, especially on the concept of motion. It can be seen from the test results that the pre-test showed only 1% of students who completed the test while on post-tests there are 93.61% or 32 students who completed the test or possessed the creative thinking skills ability. This significant difference shows that learning by using interactive multimedia (Macromedia Flash) is further coupled with practical implementation by using a few simple tools provide significant impact for first semester student of physical education program.

The impact can be seen from the completion of the indicators of learning, especially in the form of creative thinking skills. The indicator of creative thinking skills is swift thinking, supple thinking (flexible), and detailed thinking (elaboration). Overall, it can be seen that the average student 's creative thinking skills are higher on the post-test or the final test compared to pre-test or initial tests. The table below illustrates the average level of creative thinking skills of students from each of the indicators of pre-test and post-test.

The graph above is an illustration of average achievement of students' creative thinking skills, which shows that the average achievement indicators were better in post-test compared with pre-test (Figure 2).

**Figure 2.** Average of Student's Creative Thinking Levels on Each Indicator

#### Analysis of Creative Thinking Skills Improvement

The results of the analysis of creative thinking skills of students who have done with some similarities statistics show an increase in creative thinking skills of students on each indicator. Here is a graphic presentation of an increase in critical thinking skills of students which is calculated by using the N-gain formula.

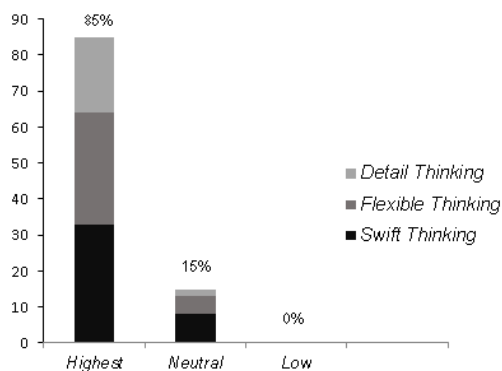
**Table 4.** N-Gain Criteria for Each Creative Thinking Skills Indicators

Indicator	N-Gain	Criteria
Thinking Swiftly	0,55	Moderate
Thinking Flexibly	0,95	High
Thinking in detail	0,72	High

Table 2 shows that there are two indicators of creative thinking which has increased in high criteria namely think flexible and think in detail, while the indicator of swift thinking increased in moderate criteria. Thus, the increase in creative thinking skills of students in general is high. This shows that after the learning process by using Macromedia Flash and multimedia coupled with the implementation of a simple lab works, students have been able to find the concept of motion well. Students no longer think on the surface pattern but have been able to generalize any findings into the example in the vicinity. This is because through the Macromedia Flash multimedia animation students have been invited to be directly in-

involved in the process of observation through Macromedia Flash multimedia, followed by testing using simple equipment.

Improvement in creative thinking skills of students overall has reached high and medium categories. More specifically the percentage of each category is evident from the results of pre-test and post-test as well as N-Gain value from each student that has been done. The number of students who achieve increased creative thinking skills categories of high, moderate and low are 0%, respectively. Here is a specific chart based on the percentage of high, medium, and low to the increasing of students' creative thinking skills (Figure 3).



**Figure 3.** Percentage of N-Gain Score of Each Indicator Of Students' Creative Thinking

#### Overview on the Hypothesis Data Distribution Normality Test

Normality test is principally conducted to determine whether the data are normal or randomly distributed. Testing data normality will involve some statistic methods. The following is a presentation table containing the results

processed data of pre-test and post-test to determine the normality of the data distribution. The results obtained are as Table 5.

Based on Table 5, it appears that the test result data pre-test and post-test from students of the first semester of Physics education department obtained on value  $\chi^2_{count} = 4.98$ , while  $\chi^2_{table} = 16.9$  for 95% level of confidence, with degree of freedom (df) = k-1. These data show that the calculated value < table which means the pre-test result data are distributed normally. List of table value for each df can be seen on the table H statistics. Similarly for post-test results data the same test were performed. Post-test scores obtained count value = 5.94, while the table values = 16.9 for 95% level of confidence and degree of freedom df = 3. This result also shows that the calculated value < table which means that data on post-test results also distributed normally.

#### Statistical Analysis t-test

To determine the significance of differences in pre-test and post-tests results, then the data should be statistically analysed with different test statistic, the t-test. The t-test can be performed after both data distribution were found to be normally distributed. The results of the t-test for experimental class, that is first semester students of Physical education department after have been taught using interactive multimedia (Macromedia Flash) is as follows:

The results of the statistical calculation that has been recapitulated in the table above shows that the obtained value t count is 23.21, while the obtained value of t table is 1.72 t that is considered by the degrees of freedom (df) = N-1 and the significant level  $\alpha = 0,05$ . These

**Table 5.** Normality Test Results of Pretest and Posttest Data

Class	n	df	$\chi^2_{count}$	$\chi^2_{table}$	Criteria		Information
					Accept $H_a$	Reject $H_a$	
Pretest	35	9	4.81	16.9	$\chi^2_{count} < \chi^2_{table}$	$\chi^2_{count} > \chi^2_{table}$	Normal
Posttest	35	9	5.94	16.9	$\chi^2_{count} < \chi^2_{table}$	$\chi^2_{count} > \chi^2_{table}$	Normal

$$\alpha = 0,05$$

**Table 6.** T-test of Pre-test and Post-test Score

Gain Amount ( $\sum d$ )	Xd <sup>2</sup>	Median	df	T <sub>count</sub>	t <sub>table</sub>	Criteria		Information
						Reject $H_o$	Accept $H_a$	
972	1689.86	42.26	22	23.21	1.72	$T_{count} < t_{table}$	$T_{count} > t_{table}$	Accept $H_a$ and Reject $H_o$

figures indicate that the value of  $t_{count} > t_{table}$  which means that the hypothesis is accepted or  $H_0$  is rejected and  $H_a$  is accepted at significance level  $\alpha = 0.05$ . This significantly shows that the use of interactive multimedia (*Macromedia Flash*) can improve creative thinking skills of students in basic physics course. The use of interactive multimedia is also accompanied by experimental activity directly done by students after observing the display of multimedia which has been set by the lecturers. The result of these findings, shows that high-level thinking skills of students, one of which is the ability to think creatively can be developed through the media and direct practice test. Results obtained after learning by using interactive multimedia is very different from the data obtained prior to the treatment. These findings provide a conclusion to the author that learning by involving the entire area of intelligence and motor skills of the students can make students recognize each of the concepts of physics better.

### Discussion

In studying physics it is important to note the appropriate model or learning strategies when starting the learning process, because the right-on-target model or learning strategy and in accordance with the desired competencies will facilitate the students to master a particular concept. Models and strategies will also contribute to the success of achieving the learning objectives. The learning model is presented by an educator does not merely have to be glued in the form of innovative learning model that lately has been offered to fix a learning process. Learning model can also be a product of a media that is able to bring the learners to enjoy the learning process. As well as the use of interactive multimedia (*Macromedia Flash*) is also accompanied by the simple practical activity turned out to give a different colour on the increased ability of creative thinking of first semester students of physical education department. Live demo in the form of a simple lab work are performed using simple equipment such as cars kids, baseball, and others. The use of a simple apparatus, intended by the researchers so that student as a candidate teacher can understand, that in order to encourage students to learn physics, they do not always have to deal with expensive equipment and sophisticate as it is available in the laboratory of physics. Expensive and hard to get equipment is often used as an excuse

by many teachers to teach physics only on the surface patterns or concepts that are actually just an activity of memorizing and counting. Related to the findings on success through simple practical tools media and interactive multimedia has confirmed the findings which has been done previously in 2015, Marnita (2016) found that the application of problem-based learning assisted simple hydraulic pump can improve students' critical thinking, and further the activities of teachers in managing learning by using problem-based learning-assisted simple hydraulic pump classified as very good.

The use of interactive multimedia (*Macromedia Flash*) as has been done can be used as a reference for teacher candidates at the Al-muslim University when they are about to do their final research assignment. For a teacher any interactive multimedia (*Macromedia Flash*) which is accompanied with simple lab works can be used as a solution to the application of appropriate learning models while teaching. Interactive multimedia (*Macromedia Flash*) can invite a learner, in this case is the first semester students of Physics education department to directly engage fully in learning. The involvement began with the use of the senses to observe directly any movement or animation displayed, which animated the movements that generally they encounter in their environment. Furthermore, the involvement of students also occurs when the entire motor, the left brain and right brain has to be able to use and apply the simple equipment that exists into a variety of styles and effects form the style of Newton's laws. This causes students to think actively to resolve any responsibility given to them in the learning process.

Based on the research that has been conducted by researchers at the first semester students of Physic education department, it can be conclude that the use of interactive multimedia (*Macromedia Flash*) can improve creative thinking skills of students, namely ability to think fluently, flexible thinking and detailed thinking. These findings suggest that the ability for reflection of the students when confronted with learning activity by using interactive multimedia have triggered them to use their mind in order to develop their creative thinking abilities. In line with it, Hipkins (2006) stated that the development of generic skills in the students themselves needs to be facilitated so that they can reflect themselves. Based on the findings, the use of interactive multimedia (*Macromedia Flash*) can improve creative

thinking skills of students. It can be said that the findings are consistent with the study conducted by Sumarni, Sudarmin, & Kadarwati (2013) entitled "Improving multimedia-based learning for mastery of chemistry concepts and thinking skills students". The study found that the application of interactive multimedia based MPK (Model Pembelajaran Kimia = Chemistry Learning Model) able to improve the mastery of chemistry concepts, integrated high-level thinking skills of chemistry teacher candidates to the level of N-Gain high category for the ability of critical thinking, creativity, the ability to decide and problem solving".

The success of this research can also be seen from the two indicators of creative thinking that has increased in high criteria, namely think flexible and think in detail. While the indicator of thinking swiftly increase in moderate criteria. On the criteria of thinking swiftly, the student is required to pour new ideas or new ideas that are relevant to the concept of Newton's laws which are being discussed. These demands make the most of the students who only study physics at the surface pattern in previous secondary school, have difficulty in exploring their ideas. Thus, an increase in creative thinking skills of students in general is high. In addition the results of t-test statistical calculations also show that the value  $t_{count} > t_{table}$  which means that the hypothesis is accepted or  $H_0$  is rejected and  $H_a$  is accepted at significance level  $\alpha = 0.05$ . Increased students' creative thinking skills which on average is in the high category indicates that student enthusiasm for learning is very high. During the learning process the students are excited, passionate and highly motivated to understand and apply the concept of Newton's laws which are being discussed. The results of the research that has been found by this writer, reinforces the findings of a study conducted by Widodo et al (2010) who found that MMI has given students the opportunity to skilfully use the framework of logic, logical consistency, and the law of cause and effect.

## CONCLUSION

From the results of this study it is concluded that the use of interactive multimedia (*Macromedia Flash*) can improve creative thinking skills of students. It can be seen from the indicators of creative thinking, namely thinking flexibly and thinking with detail that increased in

high criteria, while the indicator thinking swiftly has increased in moderate criteria. In addition, the results of t-test statistical calculations also show that  $t_{count} > t_{table}$  which means that the hypothesis is accepted or  $H_0$  is rejected and  $H_a$  is accepted at significance level  $\alpha = 0.05$ .

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