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The Development of Flash Movie Learning Media with a SETS Vision to Improve Critical Thinking Skills and Learning Outcomes on Environmental Pollution Material

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Abstract: This research aims to determine: the feasibility of flash movie learning media with a SETS vision for use in biology learning, the influence of flash movie learning media with a SETS vision on improving student's critical thinking skills, and the influence of flash movie learning media with a SETS vision on improving student learning outcomes. The development procedure in this research refers to steps adapted from the Borg & Gall Model which include: collecting information, planning, developing an initial product form, conducting limited trials, carrying out revisions, conducting field trials, and carrying out revisions. The data analysis techniques used are descriptive statistics and inferential statistics using multivariate tests (MANOVA). The results of the research are as follows: The flash movie learning media has a SETS vision, from the media and material aspect it is in the "Very Good" category and has a significant influence on improving the critical thinking skills of class X F MAN Yogyakarta III students, this is proven by the MANOVA test which shows significance value (Sig.) = 6 x 10-9 with a confidence level of 95%. Flash movie learning media with the SETS vision has a significant influence on improving the learning outcomes of class X F MAN Yogyakarta III students, this is proven by the MANOVA test which shows a significance value (Sig.) = 0.001 with a confidence level of 95%.

Keywords: Flash Movie Learning Media; SETS; Critical Thinking Skills; Learning Outcomes

Introduction

Learning media are tools, methods and techniques used to make communication and interaction between teachers and students more effective in the learning process at school. Therefore, learning media is an integration in the learning process and one of the important aspects that every teacher must comprehend in carrying out their professional functions (Haryoko, 2009). The quality of learning, as elucidated by Newby et al. (2000), encompasses three aspects: methods, media, and materials. Muller et al. (2008), assert that student's difficulties in constructing highly complex scientific concepts can be alleviated through the utilization of instructional media.

The use of learning media can foster student's interest and motivation in participating in learning (Ossai-Ugbah, et al., 2012). Learning media can encourage student's activity in learning. Furthermore, this media is applicable for all intelligence level of students and also increase student concentration during learning (Kaur, 2012). The development and application of learning media is not merely positioned as a supporter of the learning process, but rather as an integral and inseparable part of supporting the achievement of better student learning outcomes. One of the instructional media that can captivate student's

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interest and motivation is the implementation of flash movie. The use and application of relevant flash movie learning media in the classroom can optimize the learning process.

According to Winarno et al. (2009), instructional media can be evaluated based on nine aspects. (1) Subject matter, which is related to the content or subject of instructional media. (2) Auxiliary information, such as additional information like introductions, instructions, aids, and conclusions. (3) Affective considerations, addressing how multimedia can influence students' attitudes to motivate them for learning. (4) Interface, referring to the multimedia presentation that is relevant to the material, including graphic displays, animations, audio, and video. (5) Navigation, the way users navigate through pages in instructional media. Navigation is considered good if it is consistent in terms of location and format. (6) Pedagogy, concerning aspects of teaching methods related to the appropriateness of the methodology used, alignment with students' intellectual levels, student interactivity, cooperative learning support, alignment with learning strategies, user control, educative questions, and how to answer them, and the quality of feedback from instructional media. (7) Invisible features, which are features that are not visible when the program is running and are usually rarely used in instructional media, such as user logs and progress reports. (8) Robustness, referring to the product's resilience that minimizes multimedia errors when used, both in terms of software and when the instructional media is run on different computer operating systems. (9) Supplementary materials, including additional materials in instructional media, such as adding a dictionary for language learning.

The use of flash movie learning media can be done well if the teacher knows the learning needs as well as the various problems faced by students regarding the material to be taught. Teachers can act as creators and learning organizers, one of which is by using flash movie learning media appropriately, efficiently, and fun for students. In the media display, questions can also be presented that direct students to analyze the relationship between the material studied and its various applications in real life (Sari and Sugiyarto, 2015).

However, it needs to be emphasized that the use of learning media is directed at helping students be active in learning, in other words, it is the students who have to use the learning media more. Teachers can utilize learning media as supplementary materials to enhance the effectiveness of the learning process and to boost student's learning motivation (Shahzad, 2012). The utilization of instructional media plays a crucial role in the learning process, as students become more focused on the material presented by the teacher, thereby facilitating effective content delivery (Quarcoo-Nelson et al., 2012). Teachers are more in a position to guide and direct each stage of learning activities that students will carry out through effective interaction. With effective communication patterns, teachers and students can both exchange (share) a variety of information and knowledge so that the teaching and learning process becomes more meaningful.

The use of flash movie learning media will be more optimal if it is equipped with an appropriate learning vision. One vision of learning that can be used as a basis for development is the vision of the relationship between Science, Environment, Technology, and Society (SETS). SETS's vision is oriented towards applying and developing scientific concepts by paying attention to the use of technology, while accompanied by an analysis of the impact on the environment and society. The SETS vision has stages that can train student's scientific literacy. This is because SETS's vision is problem-oriented where scientific literacy is also linked to natural science problems (Widiastuti & Purnawijaya, 2021)

Science, Environment, Technology, and Society (SETS) is a learning vision that connects science, environment, technology and society. In the context of education with a SETS vision, the summary sequence of SETS carries the message that to use science (S-first) to form technology (T) in meeting the needs of society (S-second) requires thinking about the various implications on the environment (E) physically and mentally. With the SETS vision in learning, it is hoped that ideas will be obtained about the technological form of scientific transformation produced, without having to damage or harm the environment and society (Ministry of National Education, 2007). Binadja (2005), explains the characteristics of learning with a SETS vision, so flash movie learning media with a SETS vision must also be able to accommodate these characteristics and characteristics, namely: (1) Emphasizing science as a learning subject. (2) Flash movie learning media can bring students to specific situations to understand the benefits of science and technology concepts for the benefit of society. (3) Flash movie learning media can direct students to think analytically about possible causes and effects of transferring science to technology. (4) Flash movie learning media can direct students to consider the benefits or disadvantages of using scientific concepts in a technological context. (5) Flash movie learning media can stimulate students to look for alternative solutions to the various losses that can arise from applying science to technology, especially the impact on the environment and society. (6) In constructivism, flash movie learning media can direct students to discuss issues raised in the context of SETS from various directions and points of view according to the student's basic knowledge. Therefore, the essence of implementing learning with the SETS vision is to train

student's thinking comprehensively in interpreting every reality and environmental problem that occurs in society so that an applicable literacy foundation can be formed. Learning with a SETS vision requires educators and students to explore all the possibilities that can occur in the interrelationship between the concepts being studied and their influence on the learning process (Yulistiana, 2015)

The use of flash movie learning media with the SETS vision provides awareness to students regarding the existence of scientific problems that must be developed or even resolved using technology for the benefit of society and environmental sustainability. For example, plastic production which is carried out by applying science to technology will have various impacts, both positive and negative, for humans as part of society. On the one hand, plastic has many uses in everyday life, but on the other hand, plastic waste, which is increasingly accumulating has the potential to cause environmental pollution considering that the decomposition process takes a long time. One possible solution is to use recycled bags or environmentally friendly bags which are widely available. This method is seen as being able to reduce the use of plastic in society so that the opportunity for environmental damage due to plastic waste pollution can be reduced. The SETS vision guides students to learn contextually, oriented towards developing life skills so that students can produce new, innovative thoughts or ideas.

The SETS vision of flash movie learning media is to condition students to be willing and able to know and understand the principles of science to produce technological works (simple or more complex) accompanied by thoughts to reduce or prevent possible negative impacts that may arise from the emergence of a technological product on the environment and society. In a research, Frank & Barzilai (2006) shows that from the majority of student's standpoint, if the SETS concept is included in the learning process, it will give them the opportunity to gain knowledge and increase their understanding of the various branches of science.

In general, the SETS vision in learning has two characteristics, namely learning based on actual problems in everyday life and learning by linking the four elements of SETS, namely science, environment, technology, and society (Firdaus, 2017). The inseparable link between science, environment, technology, and society is a two-way reciprocal relationship that can be studied for the benefits and losses that result. In the end, students can answer and overcome every problem related to environmental components as well as social issues and global issues, until ultimately it leads to an attitude and character that cares about the environment.

Technological advances and human desire to control nature which are not balanced with concern regarding conservation measures have the potential to disrupt the balance of the environment and ecosystem. For this reason, through learning that applies flash movie learning media with the SETS vision, it is hoped that students will be able to know directly the consequences of the various activities they carry out on nature and the surrounding environment so that they can synthesize various policies that are very important for their future.

The course materials used in Flash Movie Learning Media with SETS Vision are on the topic of environmental pollution. The theme of environmental pollution is a concept that is close to everyday life and presents many problems related to the environment, including water, land, and urban air pollution. Water pollution is caused by the addition of specific elements or organisms to the water, disrupting its utilization. The measurement of the quality of aquatic ecosystems can be conducted through chemical parameters of water, such as measuring dissolved oxygen (DO) and biological oxygen demand (BOD), as well as biological parameters using the organism *Euchema spinosum*, sp (Salmin, 2005) Land contamination refers to contamination of soil which can be caused by waste or heavy metals (Junaidi et al., 2013). Global climate change, thinning of the ozone layer, contamination by radioactive substances, and so on. Meanwhile, based on pollutant causing it, there are three kinds of environmental pollution include physical, biological and chemical pollution (Kahpi, 2012). One material that can raise problems for students is environmental pollution. Events and problems that occur in an environment will encourage students to make observations and investigations so that by thinking critically students can gain new knowledge (Iswanto, 2017)

The definition of thinking has a broad scope and is interpreted differently by experts, although it shares a nearly similar context and reference. Moore (2009) states that "thinking is problem solving, its decision making, reading, reflecting, making predictions about what might happen". Critical thinking skills require someone to have skills in thinking about solving problems rationally. Fisher (2009) explains that critical thinking skills are evaluative thinking abilities that are specifically related to the quality of thoughts or arguments to be able to measure problem-solving actions taken. According to Ennis (Nitko & Brookhart, 2011), critical thinking is defined as reasonable and reflective thinking, namely focusing on deciding what to believe and do. Llyod & Bahr (2010) state that one of the primary objectives of education today is the development of critical thinking skills.

Critical thinking skills are included in metacognitive skills that must be developed in students in addition to cognitive abilities (Anelly, 2023). The

results of the study conducted by Wiyono et al. (2009) reveal a significant difference in the improvement of critical thinking between the experimental class and the control class. The improvement in critical thinking skills in the experimental class is superior to that of the control class. Critical thinking skills not only enable students to understand concepts and use these concepts to solve exam questions, but students can apply developments in science and technology in everyday life. Critical thinking skills can change the learning paradigm which only emphasizes textual mastery of concepts and without including real-life applications into more contextual and meaningful learning. This skills can be optimize with learning motivation (Fahim & Hajimaghsoodi, 2014).

The research findings by Rahma (2012) indicate that the chemistry learning process using the SETS-oriented inquiry model to foster critical thinking skills is marked by an increase in the average scores of pretest and post-test in each critical thinking indicator, from 29.45 to 77.08. Students who have carried out the learning process will be evaluated to determine the level of achievement of their learning outcomes. Learning outcomes are a barometer of student success in participating in learning (Mulyati et al., 2013). The results of Triyanti's study (2012) indicate a significant improvement in student's learning outcomes through audiovisual media-assisted instruction. This is evidenced by a 68.79% increase in posttest scores compared to pretest scores. These findings are further supported by a gain score of 0.42, categorizing it as a moderate improvement. Suprijono (2009), states that learning outcomes are patterns of actions, values, understandings, attitudes, appreciation, and skills. Learning outcomes are a process of effort undertaken by an individual to acquire an overall new behavior as a result of personal experience or interaction with the environment (Slameto, 2010). Learning outcomes (achievement) are viewed as the realization or expansion of the potential skills or capacities that an individual already possesses (Kafit, 2009).

Based on Bloom's taxonomy (Rupani & Buto, 2011; Yamin & Maisah, 2009) learning outcomes are broadly divided into three domains, namely the cognitive domain, affective domain, and psychomotor domain. In this research, learning outcomes are limited to the cognitive domain. The assessment of cognitive competence achievement is conducted using reference criteria. (Trianto, 2009) states that the completeness of learning can be determined by each school by establishing a standard known as the Minimum Completeness Criteria (KKM). Trianto also explains that the determination of KKM is made by considering several factors, namely the level of essentiality (importance), the level of complexity (difficulty and intricacy), the level of student's abilities (intake), and school support resources. According to Krathwohl (2002), Bloom's revised taxonomy, intellectual abilities include six levels (cognitive levels C1 to C6), which include remembering, understanding, applying, analyzing, evaluating, and creating. The results of the study conducted by Setiyono (2011) indicate an improvement in student's critical and creative thinking abilities after participating in learning using instructional tools with the SETS approach. The existence of the flash movie instructional media is expected to contribute to the enhancement of critical thinking skills and student learning outcomes.

Based on the results of observations at MAN Yogyakarta III, information was obtained that learning methods were still dominated by conventional methods because they were used to the culture of lecturing in front of students. The learning support facilities provided at the school include LCD projectors in the classroom and a computer laboratory. In the implementation of learning, the available facilities are underutilized so that students only focus on the teacher's explanation.

Based on the background of this problem, it is necessary to develop learning so that it becomes more varied by using learning media. The media used can be flash movie learning media with the SETS vision which is packaged in the form of exposure to problems related to the application of material in everyday life.

This research aims to determine: the feasibility of using flash movie learning media with the SETS vision in biology learning; the influence of flash movie learning media with a SETS vision on improving student's critical thinking skills, and the influence of flash movie learning media with a SETS vision on improving student learning outcomes.

This research uses procedures modified from Borg & Gall, namely: gathering information; carrying out planning; developing products; limited trials; major product revisions; conducting field trials, and making revisions based on field trials. The trial of the product being developed consists of three stages, namely, testing the validity of experts, practitioners (teachers), and peers; both limited trials at SMA N 2 Wonosari; and the third field trials at MAN Yogyakarta III. The trial was expanded using a quasi-experiment method using Randomized Control Group Pretest-Posttest Design (Sugiyono, 2011).

Method

Research Type

The type of research carried out is research and development which refers to the Borg & Gall (1983) model. This research is directed at developing products in the form of flash movie learning media with the SETS

vision. The learning tools used include a syllabus, Learning Implementation Plan (RPP), Student Worksheets (LKS), learning observation sheets, critical thinking skills tests, and learning outcomes tests. Before being tested, the product is first validated internally and externally, both through qualitative and quantitative analysis.

Time and Place of Study

This research was carried out at MAN Yogyakarta III, the academic year 2013/2014 on May 10, 2014.

Population and Sample of Study

The population of this study were all class X students at MAN Yogyakarta III and class XI IA3 students at SMA N 2 Wonosari. The research samples used in the trial were 15 students of class XI IA3 SMA N 2 Wonosari (for limited trials); 29 students of class X F MAN Yogyakarta III (experimental class); 30 students of class X G MAN Yogyakarta III (control class).

Procedure

This research uses procedures modified from Borg & Gall, namely: gathering information; carrying out planning; developing products; limited trials; major product revisions; conducting field trials, and making revisions based on field trials. The trial of the product being developed consists of three first stages, namely testing the validity of experts, practitioners (teachers), and peers; both limited trials at SMA N 2 Wonosari; and the third field trials at MAN Yogyakarta III. The trial was expanded using a quasi-experiment method using Randomized Control Group Pretest-Posttest Design (Sugiyono, 2011).

Data Analysis Technique

Techniques and instruments for collecting student data include data on student's critical thinking skills collected using test questions; data on student learning outcomes collected using test questions; and data on the implementation of the learning process collected through observation sheets. The overall data analysis technique includes analysis of the validity and reliability of the product/instrument, using qualitative and quantitative descriptive analysis (empirical testing). Empirical testing using the Rasch model with the help of the Winstep program (Sumintono & Widhiarso, 2013); analysis of product assessment data developed, using qualitative and quantitative descriptive analysis (criteria techniques as in Table 1); analysis of the implementation of the learning process, using categorization (table 2); and (4) analysis of the influence of flash movie learning media with a SETS vision on improving critical thinking skills and student learning outcomes, using the MANOVA test with the help of the SPSS 16.0 program with a significance level of 5%.

Table 1. Product Validity Assessment Criteria

Score Range	Criteria
$Mi+1,5SDi \leq \overline{M} \leq Mi+3,0SDi$	Very Good
$Mi+0SDi \leq \overline{M} < Mi+1,5SDi$	Good
$Mi-1,5SDi \leq \overline{M} < Mi+0SDi$	Enough
$Mi-3,0SDi \leq \overline{M} < Mi-1,5SDi$	Low

Table 2. Learning Process Implementation Category

Percentage Range	Category
81% -100%	High Implementability
61% - 80%	Sufficient Implementability
40% - 60%	Lack of Implementation
< 40%	Low Implementability

(Kemendikbud, 2010)

Results and Discussion

The data obtained in this research are: (1) results of the validity and reliability of flash movie learning media with the SETS vision; (2) limited trial results; and (3) results of field trials. The value of the validity/feasibility of flash movie learning media with the SETS vision was obtained from expert lecturers, teachers, and colleagues. Media expert lecturers and material experts assessed the "very good" category (table 3), high school biology teachers gave a "very good" assessment on the media and material aspects (Table 4), and a "very good" assessment on the media and material aspects as well. given by colleagues (Table 5). Meanwhile, the results of media validity and reliability tests empirically state that they are valid and reliable (Table 6). This shows that the flash movie learning media with the SETS vision that has been developed has received "very good" appreciation and has been tested for validity and reliability.

Table 3. Validation Results of Flash Movie Learning Media with a SETS Vision by Expert Lecturers

Media Expert	Material Expert	Average	Category
52	67	5.5	Very Good

Table 4. Results of Validation of Flash Movie Learning Media with SETS Vision by High School Teachers

Teachers on Media Aspects	Teachers on Material Aspects	Average	Category
47.33	61	54.25	Very Good

Table 5. Results of Validation of Flash Movie Learning Media with a SETS Vision by Colleagues

Friends on Media Aspects	Friends on Material Aspects	Average	Category
50.33	61	54.67	Very Good

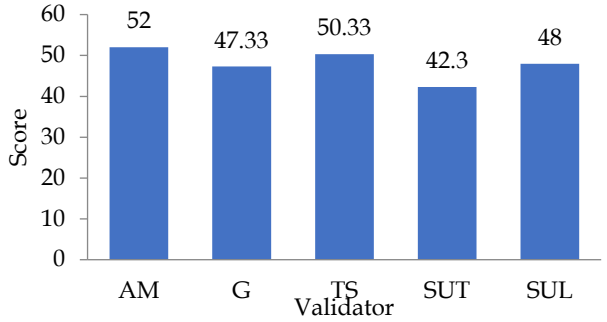

Figure 1. Diagram of Flash Movie Learning Media Assessment Results for Media Aspects

Figure 1 shows that the flash movie learning media with a SETS vision from media experts (AM) obtained a total score for media aspects of 52, which according to the assessment scale was "very good", from the biology teacher (G) a total score of 47.33 was obtained, from colleagues (TS) obtained a total score of 50.33, from students during limited trials (SUT) obtained a total score of 42.33, and from students during field trials (SUL) obtained a total score of 48. Based on Table 1 regarding the assessment scale, it can be stated that media Flash film learning with a SETS vision from the media aspect received assessment results from media experts, biology teachers, colleagues, and students in the "very good" category.

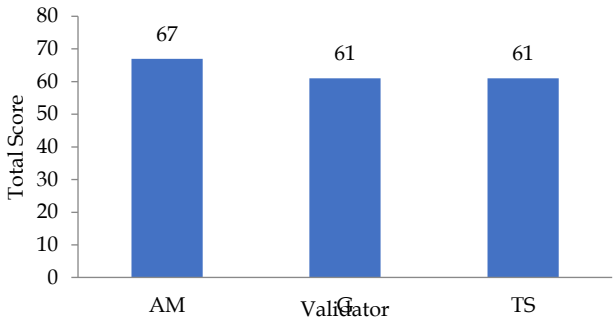

Figure 2. Diagram of Flash Movie Learning Media Assessment Results for Material Aspects

Figure 2 shows that the flash movie learning media with a SETS vision from the media expert (AM) obtained a total score for material aspects of 67, the biology teacher (G) obtained a total score of 61, and colleagues (TS) obtained a total score of 61. Based on Table 1 about The assessment scale can be stated that flash movie learning media with a SETS vision from the material aspect received assessment results from media experts, biology teachers, colleagues, and students in the "very good" category.

Table 6. Empirical Validity and Reliability Results of Flash Movie Learning Media with a SETS Vision

MNSQ	ZSTD	PMC	Information
0.74	0.3	0.25	Valid
0.56	-0.1	0.52	Valid
0.56	-0.1	0.52	Valid
1.04	0.4	0.21	Valid
0.74	-0.1	0.49	Valid
0.74	0.3	0.25	Valid
Alpha Cronbach		0.83	Reliable

The results of the empirical validation of the critical thinking skills test instrument using the Rasch model are shown in Table 7 and the empirical validation of the learning outcomes test instrument is shown in table 8. Statistical validity and reliability testing using the Rasch model with the help of the Winstep program shows that the critical thinking skills test instrument and learning outcomes are valid and reliable with a Cronbach's Alpha value of 0.77 for the critical thinking skills test and 0.85 for the learning outcomes test.

Table 7. Empirical Validation Test Results of Critical Thinking Skills Test Instruments (Description) Using the Rasch Model

MNSQ	ZSTD	PMC	Information
0.82	-0.7	0.51	Matter is accepted
1.17	0.7	0.62	Matter is accepted
0.78	-0.8	0.50	Matter is accepted
0.71	-1.1	0.42	Matter is accepted
1.18	0.8	0.60	Matter is accepted
1.21	0.8	0.52	Matter is accepted
Alpha Cronbach		0.77	Reliable

Field trials were carried out at MAN Yogyakarta III. From field trials in this school, data was obtained on the implementation of the learning process, critical thinking skills, and learning outcomes.

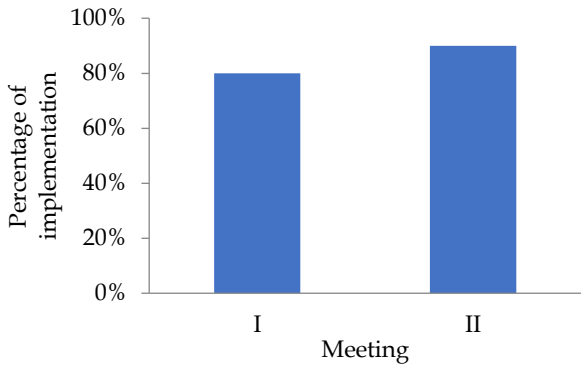

Figure 3. Bar diagram of learning implementation observation results

Figure 3 shows the results of the implementation of the learning process at MAN Yogyakarta III. From this picture, it is known that the implementation of student activities at the first meeting was 80% and at the second meeting was 90%. This shows that the two meetings were carried out well and student activities showed positive activity. Data on critical thinking skills and student learning outcomes were also searched for standard gain values. The standard gain assessment categories are in Table 9 (Hake, 1998).

Table 9. Standard Gain Assessment Categories

Interval Gain	Value	Category
$g \geq 0.7$	A	High
$0,7 > g \geq 0.3$	B	Medium
$g < 0.3$	C	Low

The experimental class for critical thinking skills obtained a standard gain value of 0.95 (high) while the control class obtained a standard gain value of 0.68 (medium). For learning outcomes, the experimental class obtained a standard gain value of 0.78 (high) while the control class obtained a standard gain value of 0.60 (medium). The standard gain value shows the increase between the pretest and posttest results. The gain value for the experimental class which is higher than the control class shows that the flash movie learning media with the SETS vision applied in the experimental class can improve critical thinking skills and student learning outcomes.

Hypothesis testing was carried out to determine whether or not there was an influence of flash movie learning media with a SETS vision on critical thinking skills and learning outcomes of class X MAN Yogyakarta III students. Before testing the hypothesis, a prerequisite test is first carried out which includes testing for normality and homogeneity of the data. From the prerequisite tests that have been carried out, the data in this study are normally distributed and homogeneous, so the hypothesis test carried out is a parametric statistical test, namely by multivariate analysis (MANOVA).

Table 10. MANOVA Test Results

	df	*Mean Square*	*F*	*Sig.*
Critical	1	1.242	46.686	0.000
Learning Outcomes	1	0.270	11.527	0.001

Based on Table 10, it can be seen that the significance value of the statistical test shows a value of 0.000 or less than 0.05 so H0 is rejected at the 5% significance level. This means that there is a difference between the critical thinking skills of students whose learning uses flash movie learning media with a SETS vision, compared to the critical thinking skills of students whose learning does not use flash movie learning media with a SETS vision at MAN Yogyakarta III. This can also be interpreted that the flash movie learning media with the SETS vision has a positive influence on improving critical thinking skills and biology learning outcomes for class X MAN Yogyakarta III students.

Conclusion

Based on the results of data analysis and discussion, the following conclusions can be drawn. First, the flash movie learning media with the SETS vision and the tools developed are empirically valid and reliable in the "Very Good" category, so this learning media is suitable for use as a support in the learning process. Second, the flash movie learning media with the SETS vision has a significant influence on improving the critical thinking skills of the class X MAN Yogyakarta III, this was proven by the MANOVA test which showed a significance value (Sig.) = 0.000 with a confidence level of 95%. Third, the flash movie learning media with the SETS vision has a significant influence on improving the learning outcomes of the class X MAN Yogyakarta III, this was proven by the MANOVA test which showed a significance value (Sig.) = 0.001 with a 95% confidence level.

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Author Contributions
Ahmad Faisal Amri: Conceptualization, methodology, writing research design, validation.
Kartono: Methodology, validation, data curation, analysis, reviewing.

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Conflict of Interest
The authors declare no conflict of interest

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