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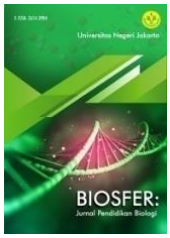

Effect of interactive media, make a match and lecture method on learning achievement of virus

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A B S T R A C T

The study investigates the effect of interactive media, make a match, and lecture method on learning achievement of virus. The research method used was quasi-experimental (quasi-experimental) with the pretest-posttest non-equivalent control group design. This research was conducted from September 2019 to November 2019 in High School A and High School T with a duration of learning ± 3 hours of study. The ANOVA test results on the average value of N-Gain showed the same results as the post-test. N-Gain in ICT learning media class, make a match learning model class and lecture learning method classes respectively amounted to 58.6 ± 13.6, 40.8 ± 17.6 and 40.5 ± 14.3. However, based on linear regression analysis, student learning outcomes are influenced by student perception factors and students' visual learning styles (P <0.05). The successful use of interactive ICT learning media is influenced by student perception factors and student visual learning style factors.

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INTRODUCTION

The most important factor when choosing media is to consider the number of students (Caspi & Gorsky, 2005). The choice of media for other biology is by video, the results of the study show that students respond positively when the teacher uses animated video media of the nervous system for class XI, with a percentage of 82.5%, they find out and compile the appropriateness of animated video media, which are linked to students'opinions, then measure their motivation (Utami & Wibowo, 2017). The learning characteristics of viral material are contained in the learning implementation plan with a time allocation of 3 x 45 minutes, including core and basic competencies, learning objectives, learning materials, learning methods, learning models, learning media, learning activity steps, assessments, and attachments. Media is said to be successful if students can complete group and individual assignments (Istiqomah, Akdiana, & Kartika, 2013). Information obtained from the media is complex and involves attention and understanding according to the stimuli provided (Linebarger, 2015). Learning media stimulates thoughts, feelings, attention, interest in learning (Aprilia & Suryadarma, 2020; Suparini, Rusdi, & Ristanto, 2020; Naz & Akbar, 2010). The development of learning media needs to be seen in terms of its effectiveness, as well as taking notes and understanding the impact of using instructional media (Pereira, Jorge, & Brites, 2017). The technology used in learning will maximize classrooms for collaboration (Suh, 2011).

Interactive media by utilizing science and technology is a challenge for educators to create high-quality and realistic learning (Islam, Ahmed, Islam, & Shamsuddin, 2014). Interactive learning can increase student interest (Muchamad, Mawarti, Santoso, & Kom, 2015). Interactive media eases the teacher's burden, because it makes the teacher act as a facilitator (Manny-Ikan, Dagan, Tikochinski, & Zorman, 2011). One way to achieve learning objectives is to use interactive media, because the use of learning media is often linked to learning outcomes and student development in understanding the subject matter (Kirkorian & Anderson, 2014). The results showed, the use of interactive multimedia to improve the concept of biology (nervous system material fairly), with a significant difference ($\alpha = 0.05$) between classical interactive multimedia and individual multimedia classes, student retention on both clases were quite high, 109.1% on individual interactive multimedia and 105.65% on classic interactive multimedia classes (Tapilouw & Juanda, 2017). The contextual learning model is used in achieving 3 educational competencies, because when a person studies diligently, behavior changes will be seen (Lotulung et al., 2018). The make a match learning model makes the teaching and learning process fun, because students look for pairs of answer cards or questions that are appropriate, while learning biology concepts, and training cooperation in goodness to solve problems and foster student creativity (Tampubolon et al., 2017). The student's perception factor is then followed by the visual learning style factor (vision) which is the main factor that affects the learning outcomes of viral material. The enthusiasm of students in participating in learning is enhanced using the make a match learning model, this is based on the percentage of student learning outcomes and activeness. Activities and student learning outcomes are improved using the make a match learning model, then 75% of students get learning outcomes above the minimum completeness criteria (Hidayah et al., 2016).

The lecture learning method has a weakness, namely the teaching and learning process becomes boring, the lecture method can have an impact on student motivation because students are passive in class, the material controlled by students depends on the material described by the teacher (Taurina, 2015). Satyaprakasha & Sudhanshu (2014) and Rosamsi, Miarsyah, & Ristanto, (2019) state that biology learning using multimedia learning media is significantly superior, it can improve biology learning outcomes compared to conventional learning methods. According to Tampubolon et al. (2017) professional teachers must have the following criteria: mastering subject matter, mastering learning models and methods, mastering the curriculum, showing skills in front of the class, making learning more interesting.

Students who have difficulty understanding biological material require appropriate learning media, methods, teaching aids, and often practice problem solving (Hasruddin & Putri, 2014). Students are bored when learning is centered on the teacher (Setyawati, Sukartiningsih, & Subroto, 2017). Learning methods, teaching aids and test questions are important but the use of learning media is more important because: students can understand the concept of biology correctly, students experience real learning experiences, students are motivated and concentrate on the core of the learning material, students who have difficulty understanding biological concepts can be projected in film and animation, media increase the length of time to keep biological material in mind, the problem of time and space in learning can be eliminated, and learning media saves energy and time for students (Satyaprakasha & Sudhanshu, 2014).

Learning outcomes are written descriptions of students' understanding of knowledge at the end of learning and the things that are most expected by students (Taurina, 2015). Benefits of learning outcomes includes teachers are easier to design teaching materials and choose strategies that are effective and appropriate, save student learning time, increase student readiness, help in evaluating learning (Mahajan & Singh, 2017). Solutions are given for low biology learning outcomes to be improved using the latest learning media categories, one of which is: Multimedia Assisted Intruction, with the results of research that there is an increase in student achievement and attitudes towards biology (Kareem, 2018). Besides, the results of the preliminary questionnaire with the students about the biology subject of virus lessons problem include difficulties in understanding the abstract concepts, such as the shape of the virus, and replication of the virus, although the distinguishing features between diseases caused by viruses or bacteria (Prabowo, Surjono, & Prabowo, 2019). Most of the students, which were 74.12% in grade X, had difficulty in studying and comprehending the viruses and bacteria (Firmanshah, Jamaluddin, & Hadiprayitno, 2020). Virus material is closely related to life and everyday problems (Pradasti et al., 2019). The choice of the concept of Virus is because the main concept is taught to odd semesters following the time of research, and the lack of research on the development of student woksheet on this concept so that researchers take the initiative to research the concept of Viruses (Hadayati, Zaini, & Kapsul, 2020). Research examined the role of interesting details in learning about how a cold virus infects the human body (Moos, Marroquin, 2010). This Research objectives was knowing how students' biology learning outcomes in virus material are enhanced using ICT interactive learning media, make a match learning models and lecture learning methods in high schools. Learning outcomes of viral material can be improved using interactive learning media of Information and Communication Technology compared to the pair-making learning model and the lecture learning method at Ampel High School and Tengaran High School. The student's perception factor is then followed by the visual learning style factor (vision) which is the main factor that affects the learning outcomes of viral material.

METHODS

Research Design

The research method used was quasi-experimental (quasi-experimental) with the pretest-posttest non equivalent control group design seen (Sugiyono, 2012) in Table 1.

Table 1
Research design.

Treatment Classes	Pre-test	Treatment	Post-test
ICT interactive learning media treatment classes.	Q_1	X_1	Q_4
The treatment class of the learning model make a match.	Q_2	X_2	Q_5
Classroom treatment of lecture learning methods.	Q_3	X_3	Q_6

Note: Q_1: Pre-test of ICT interactive learning media class; Q_2: Pre-test of classroom treatment model to make a match learning; Q_3: Pre-test of lecture learning methods; X_1: Teaching and learning activities using ICT interactive learning media; X_2: Teaching and learning activities using the make a match learning model; X_3: Teaching and learning activities using lecture learning methods; Q_4: Post-test class of ICT interactive learning media treatment; Q_5: Post-test treatment class of learning model make a match; Q_6: Post-test class treatment of lecture learning methods.

Population and Samples

This research was conducted in Indonesia, Central Java province. Student of X grade on Mathematical Sciences and Natural Sciences of 1 Ampel Senior High School and 1 Tengaran Middle school as the research population. 90 students of 1 Ampel Senior High School and 103 students of 1 Tengaran Middle School were used as samples in this study.

Instrument

Test (Pre-test and Post-test).

Pre-test and post-test were carried out in each class of the experiment. Instruments (pre-test and post-test) used was in the form of reasonable multiple-choice questions.

Table 2
Tests That Were Filled Out by Students in This Study (Pre-test and Post-test)

Pre-test and Post-test question			
1	Viruses that consist of protein envelope are…	11	Viruses can be declared with inanimate objects because….
2	Viruses that consist of protein encelope are….	12	Viruses have the following characteristics….
3	Nucleic acids in viruses covered with capsids include….	13	Viruses can live as parasites to maintain them using a medium that is…..
4	Viruses can destroy stem cells after reproduction, the statement above is included in the infection by…	14	When the viral DNA enters the bacteria cell during reproduction, i.e when step….
5	The branches of biology related to viruses are….	15	Viruses produce enzymes that can break down bacterial cell walls called….
6	Bacteriofage, which is a virus that attacks….	16	Viruses can be considered as living creatures because they have….
7	The part that is not owned by the virus, namely….	17	The purpose of the virus to take over the function of bacteria DNA is….
8	Virus tails on the bacteria wall occur at this stage….	18	The virus envelope is composed of….
9	Viruses that infect bacteria are….	19	Viruses have properties one of which is….
10	Chickenpox disease is caused a virus….	20	The part that is not found in viruses is…

Questionnaire

Questionnaires are given to all biology teachers and students. The instrument used was an open question type questionnaire for biology teachers and a closed question type questionnaire for students. The aspects of the questions in the questionnaire filled out by class X Mathematics and Natural Sciences students were the objects in this study, in the treatment of the learning media class including: the level of student motivation towards biology, the level of student interest in biology, and so on.

Table 3
Indicators in the Virus Material Learning Implementation Plan

Basic Competencies		Learning Indicators	
3.3	Applying an understanding of viruses related to their characteristics, replication, and role of viruses in public health aspects	3.3.1	Describe the characteristics of the virus: structure and reproduction
		3.3.2	Classifying the role of viruses that are harmful and beneficial in everyday life
4.3	Presenting data on the characteristics, replication and role of the virus in the health aspect in the form of a model / chart / presentation media	4.3.1	Present simple models of the structure and lytic and lysogenic life cycles of viruses
		4.3.2	Presenting data or images (posters or articles, etc.) relating to efforts to minimize the impact of viral infections in everyday life

Procedure

Teaching in the treatment class in this study was to select three classes in the research area to be treated according to the chapter of biology material which students felt difficult so that student learning outcomes were low. The first class was the treatment using ICT interactive learning media for viral material. Then the second class used the make a match viral learning model and the third class used the viral material lecture learning method. The process in the treatment class can be seen in the flow of the research chart below.
The process flow in this research is as follows:

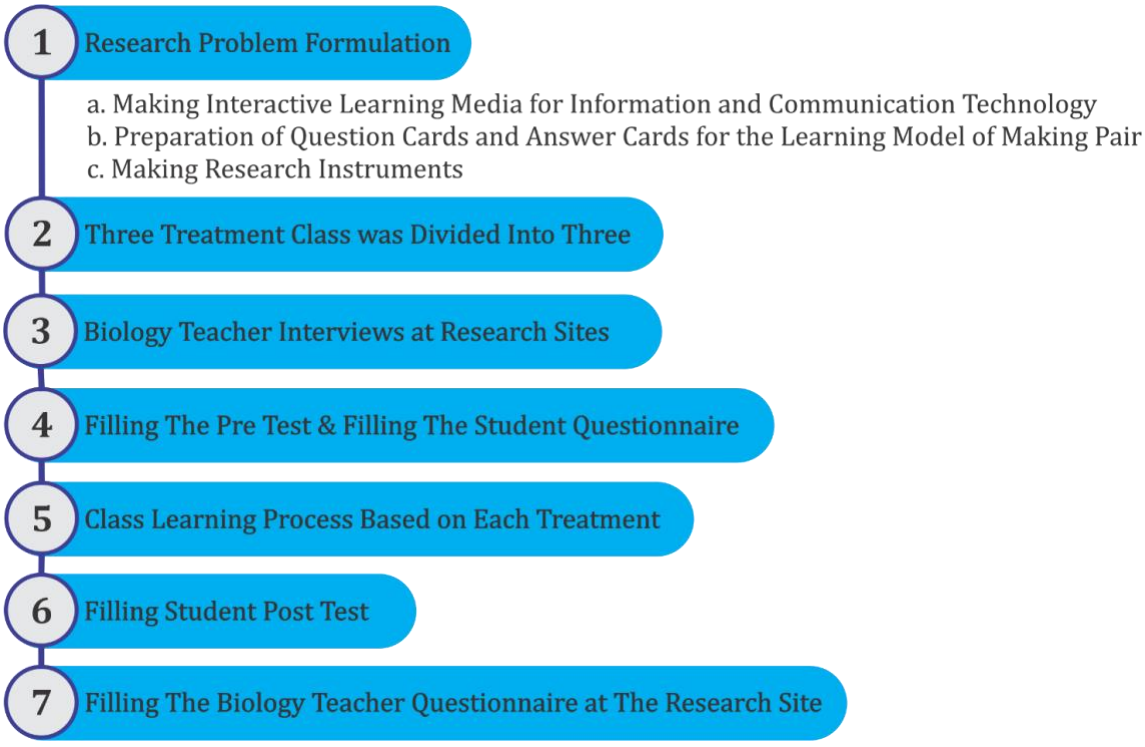

Figure 1. Research Procedure

Data Collection Instruments

The independent variable (independent) of this research is X1: ICT interactive learning media, X2: make a match learning model and X3: learning method (lecture method), the dependent variable (dependent) is Y the student learning outcomes of viral material (X Mathematical Sciences and Natural Sciences). The validity and reliability test of this research

data used the SPSS program, then the supervisor also provides input regarding the improvement of the research article manuscript so that it is better and according to the objectives, including research articles can be published in the intended journal.

Table 4
Results of the reliability of research data

Reliability Statistics		Reliability Statistics		Reliability Statistics	
Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items	Cronbach's Alpha	N of Items
.688	21	.799	21	.650	21

Data Analysis Techniques

Research data was tested by descriptive and inferential analysis. The normality and homogeneity test of the data was carried out using the Test (Pre-test and Post-test). Pre-test and post-test were carried out in each class of the experiment. Instruments (pre-test and post-test) were in the form of reasonable multiple-choice questions. There were 20 reasoned multiple choice questions that are equipped with a CRI (Certainly of Response Index) on each question, so that the level of student confidence in answering the questions can be identified. The validity and reliability of this question is that the researcher answers the research question by using brainly and confirming it with the supervisor. One example of the questions he posed to X Mathematical Sciences and Natural Sciences students in this study was virulogy which is a branch of biology related to viruses. Interactive learning media for information and communication technology are made using software for making a computer simulation learning model make a match using question cards and answer cards, while learning using the lecture learning method is dominated by speaking viral material orally and writing viral material on the blackboard. The sample in this study were students from high school "A" with a total of 90 students and high school "T" with a total of 103 students. The research method used was a quasi-experimental (quasi-experimental) with a pretest-posttest non equivalent control group design. This research was conducted from September 2019 to November 2019 in high school "A" and high school "T" with a duration of ± 3 lesson hours. The N-gain value is calculated using the following formula:

$$\text{N} - \text{Gain} = \frac{\text{Post Test Score} - \text{Pre Test Score}}{\text{Ideal Score} - \text{Pre Test Score}}$$

(Situmorang et al., 2015)

The following index formula (%) is used to calculate the value of the percentage of students' statements on filling out questionnaires by students at the research place. The N-gain values are categorized as follows:

Table 5
The N-gain values category

Percent	Classification
N-Gain > 70	High
30 ≤ N-Gain ≤ 70	Moderate
N-Gain < 30	Low

$$\text{Index (\%)} = \frac{\text{Total Score}}{\text{Y}} \text{X } 100$$

(Ali, Toriman, & Gasim, 2014)

Information Y = highest score of Likert x number of respondents (highest number 5) "by paying attention to the weight of the assessment".

RESULTS AND DISCUSSION

Learning Outcomes of High School Student Virus Material.

The successful use of interactive ICT learning media is influenced by student perception factors and student visual learning style factors. The pre-test questions, the post-test questions that were answered by students and the student questionnaires that were filled in for the research data so that the way to see the differences and / or real comparisons was one of them by knowing the average n-gain. The average pre-test results of virus material in the two schools used in this study ranged from 28 to 33. Homogeneity test on pre-test results in both schools showed homogeneous results (P> 0.05). Therefore, data from the two schools were combined into one and further analyzed to answer the objectives of this study. ANOVA test results on the average value of the pre-test results showed significantly different results (P> 0.05). The mean pre-test scores in the ICT learning media class (27.3 ± 12.0) and the make a match learning model class (32.0 ± 12.8) were not significantly different (P> 0.05). However, the pre-test mean scores of lecture classes (33.2 ± 12.0) were higher (P <0.05) compared to ICT learning media classes and make a match learning model class.

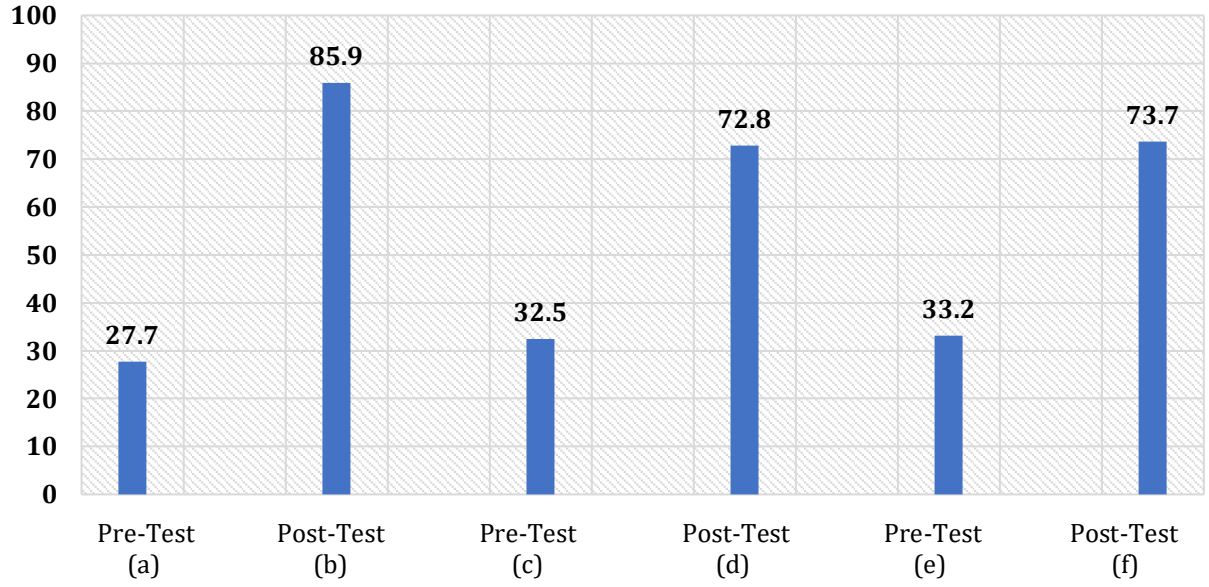

Figure 2. Comparison of the mean score of students' pre-test and post-test virus material; **2a**. The pre-test average value of ICT interactive learning media; **2b.** The post-test average value of information and communication technology interactive learning media; **2c.** The pre-test average value of the pairing learning model; **2d.** The post-test average score the test model of learning made pairs of; **2e**. The pre-test means value of the lecture learning method; **2f.** the post-test mean value of the lecture learning method.

The difference in letters above the standard deviation showed significant differences (P <0.05). Explanation of Figure 3. is the average pre-test result of student learning outcomes virus material in the treatment class ICT interactive learning media has the lowest average learning outcomes compared to other treatment classes, while the average post test value after treatment using interactive learning media ICT has an average value The highest compared to the treatment class is the pair making learning model and the learning method.

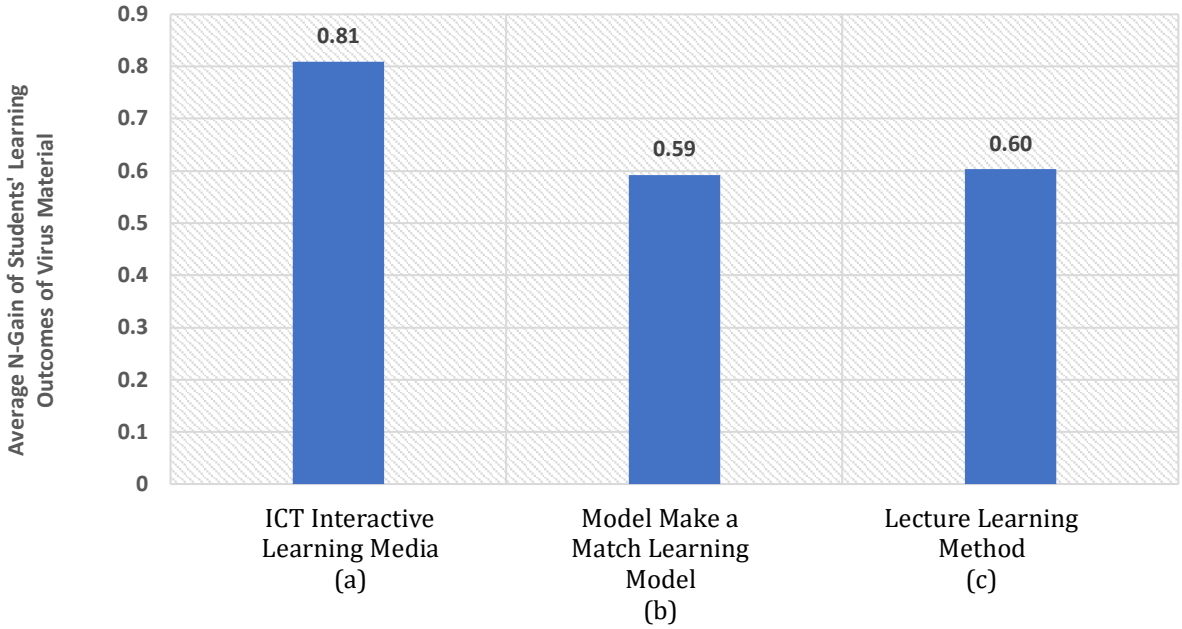

Figure 3. Average students' N-gain learning outcomes of viral material; **3a**. Average N-gain ICT interactive learning media; **3b**. Average N-gain learning model make a match; **3c.** Average N-gain lecture learning method.

Different letters above the standard deviation of each learning show significant differences (P <0.05). Explanation of Figure 3. is the average n-gain value of student learning outcomes, virus material in the interactive learning media treatment class, ICT has the highest average n-gain compared to the average n-gain in the treatment class, the learning model makes pairs and the n-gain average of the treatment class method learning. Then multimedia-based learning can increase student motivation and learning outcomes (Priyambodo & Sulistyani, 2014).

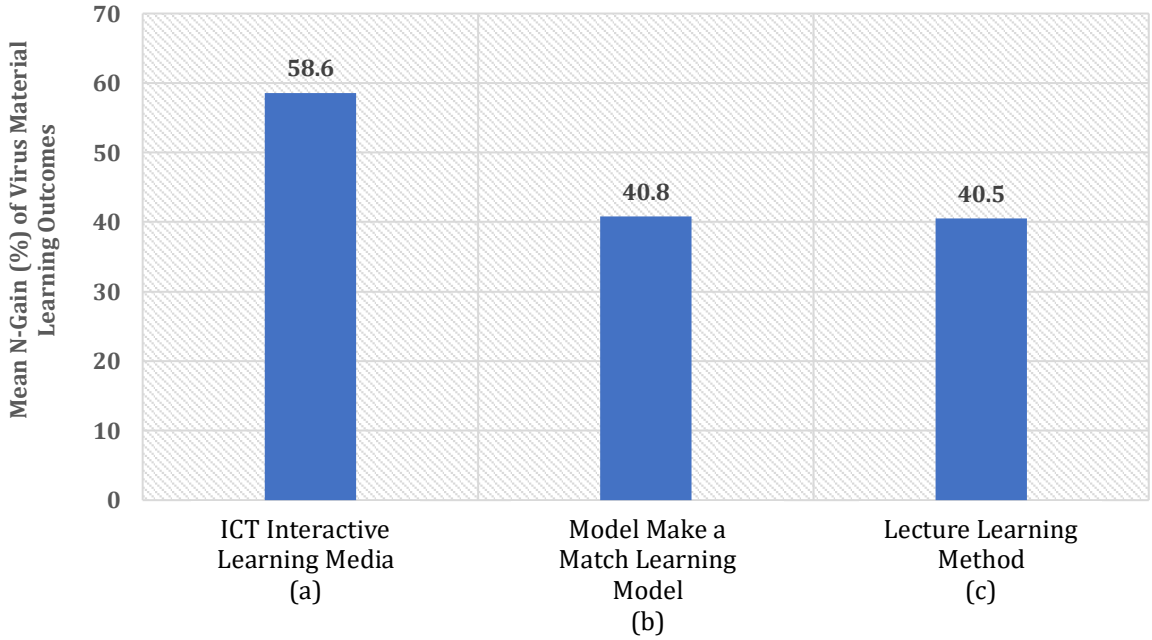

Figure 4. Average students' N-gain (%) learning outcomes of viral material; **4a**. Average N-gain ICT interactive learning media; **4b.** Average N-gain (%) learning model make a match; **4c.** Average N-gain (%) lecture learning method.

Different letters above the standard deviation of each learning show significant differences (P <0.05). Explanation of Figure 4. is the average n-gain value (%) of student learning outcomes of virus material in the interactive learning media treatment class ICT has the highest average n-gain (%) compared to the average n-gain (%) of the treatment class learning model making pairs and the average n-gain (%) of the learning method treatment class. The ANOVA test was used to determine the effect of the results of the class treatment test with interactive ICT learning media, the treatment of the learning model to make pairs and the treatment of the lecture learning method can be seen in Table 6.

Table 6
The ANOVA resullt

	Sum of Square	Df	Mean Square	F	Sig.
Between Groups	13803.88	2	6901.94	29.50	.00
Within Groups	44439.60	190	233.83		
Total	58243.48	192			

Based on the ANOVA output, the average n-gain value above shows that the sig. 0.000 <0.05 so it can be stated that the average n-gain of the three treatment classes, namely the treatment of the interactive instructional media class, ICT, the treatment of the learning model making pairs and the treatment of the lecture method were significantly different. High-quality learning media can be a powerful learning resource for students (Linebarger, 2015). ANOVA test results on the average value of the post-test results (Figure 4) also showed significantly different results (P <0.05). ICT learning media class (85.9 ± 11.8) gets the highest score (P <0.05) compared to make a match learning class model (72.8 ± 14.7) and lecture learning method class (73.3 ± 12.6). The make a match learning model class and the lecture learning method class were not significantly different (P> 0.05). ANOVA test results on the average value of N-Gain showed the same results as the ANOVA test results on the average value of the post-test results. N-Gain in ICT learning media class, make a match learning model class and lecture learning method classes respectively amounted to 58.6 ± 13.6, 40.8 ± 17.6 and 40.5 ± 14.3 (Figure 4). There was an increase in student learning outcomes on virus material after being treated in this study. Students agree that the biology teacher is the facilitator when learning biology. Learning outcomes of viral material can be improved using interactive learning media of Information and Communication Technology compared to the pair-making learning model and the lecture learning method at Ampel High School and Tengaran High School. The results showed that the use of interactive multimedia enhances the overall concept of biology (Priyambodo & Sulistyani, 2014).

Based on the results of interviews with biology teachers and students using a questionnaire (Table 4), biology teachers and students are of the opinion that the factors that influence learning outcomes are school environmental factors on virus material (68.60%), school environmental factors and biological material (70.98%), the level of student interest (73.16%), student's perception factor (assessment) (73.67%), student motivation factor (76.68%). Biological learning style factors when sorted from the smallest to the largest are: kinesthetic learning style (motion) 71.50%, auditory (hearing) 73.47% and visual (visual) 79.17%. Based on multiple correlation test auditory learning style factors and kinesthetic learning styles do not significantly influence in improving virus learning outcomes, but virus learning outcomes are influenced by perception factors and visual learning styles. The following table shows the percentage of student questionnaires.

Table 7
Percentage of questionnaire on closed questions filled out by students in the study area

No	Statement List (Student Questionnaire)	Percent
	Classification of Student Questionnaire (Learning Media Factor)	
1	Computer learning media increases motivation to study biology more actively.	77,18%
2	ICT interactive media improves biology learning outcomes more than lecture methods.	75,93%
	Average	**76,55%**
	Student Questionnaire Classification (Learning Model Factors)	
1	The make a match learning model increases the motivation to study more biologically.	75,07%
2	The make a match learning model makes biological material fun.	78,76%
3	The make a match learning model makes learning biology more effective and efficient.	72,61%
4	The make a match learning model enhances learning outcomes rather than the lecture method.	76,30%
	Average	**75,68%**
	Student Questionnaire Classification (Learning Method Factors)	
1	Learning methods improve learning outcomes in biology.	77,50%
2	Learning methods improve learning outcomes of viral material.	74,68%
3	The learning method used by the teacher makes students understand biology clearly.	78,75%
4	Learning methods increase student motivation to study biology material more actively.	78,12%
5	The method used by the teacher makes students more active in learning biology.	73,12%
6	Learning methods make students more clearly understand biology, without using learning media and or certain learning models.	68,75%
	Average	**75,15%**

Information:
a. 0 - 19,99% (Very Poor)
b. 20 - 39,99% (Not Good)
c. 40 - 59,99 % (Sufficient)
d. 60 – 79,99% (Good)
e. 80 – 100% (Very Good)

However, based on linear regression analysis, student learning outcomes are influenced by student perception factors and students' visual learning styles (P <0.05; Table 6). Student motivation factors, student interest, biological material school environment, and viral material school environment, auditory learning style and kinesthetic learning style had no significant effect (Table 8).

Factors thought to influence virus learning outcomes are school environment factors, students' level of interest, student perception factors, student motivation factors, kinesthetic learning style factors, auditory learning styles and visual learning style factors. The successful use of interactive ICT learning media is influenced by student perception factors and student visual learning style factors. The feasibility standard for developing multimedia interactive animation, is included in the very good category, as evidenced by the average percentage of multimedia expert viability that is 85.55%, then the results of the material expert validation, the average percentage of viability is 90.84% and the average percentage of student eligibility is 96.38% (Wiana, 2017).

Table 8
Multiple correlation test factors influencing virus learning outcomes.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	40,710	9,859		4,129	,000		
	Student Motivation Factors (X1)	3,077	2,300	,132	1,338	,183	,502	1,991
	Students' Level of Interest Factors (X2)	-4,059	2,294	-,174	-1,769	,078	,501	1,994
	School Environment Factors_(Biology) (X3)	-2,729	1,975	-,133	-1,381	,169	,527	1,896
	School Environment Factors_(Virus) (X4)	-2,725	1,963	-,131	-1,388	,167	,544	1,839
	Student Perception Factors (X5)	5,998	1,828	,251	3,282	,001	,544	1,198
	Visual Learning Styles Factors (X6)	3,427	1,703	,159	2,012	,046	,778	1,286
	Auditory Learning Styles Factors (X7)	-1,375	1,627	-,066	-,845	,399	,809	1,237
	Kinesthetic Learning Styles Factors (X8)	-,747	1,350	-,040	-,553	,581	,930	1,075

a. Dependent Variable: The N-Gain Value

This study shows that the pre-test results of the ICT interactive learning model class and the make a match learning model class do not differ significantly, the effectiveness of the media, models and learning methods in this study are viewed based on the N-gain value. N-gain value is also used by other researchers to determine the effect of the use of computer-based learning media (multimedia) on learning outcomes and student achievement. According to Satyaprakasha (2014) in achieving good learning outcomes in biology learning can be seen from the value of N-gain. The N-gain value can be used to measure student understanding written between the experimental class and the control class for the concept test, namely the objective test and essay test (Tapilouw & Juanda, 2017). The results of this study indicate that ICT learning media can improve student learning outcomes on the subject of the virus significantly compared to the make a match learning model and lecture learning methods at A High Schools and T. Digital interactive learning media is used for more collaborative learning so that it can feel more fun and useful feedback occurs, by involving students in learning, through the dynamics that occur in groups so that discoveries occur through individual reflection, supported by tools that can be connected to the internet online and or student participation in class (Gan, Menkhoff, & Smith, 2015). The results of this study indicate that the visual learning style factor and the student's perception factor influence the improvement of student learning outcomes on virus material, this happens because there is a relationship between the treatment class and interactive learning media ICT with visual learning styles, because the learning material is projected with an LCD in front of the class, besides that there is an interaction between students and learning media, especially in answering questions. Whereas the treatment class with the learning model made student pairs actively look for pairs with question cards and answer cards so that they were more identical to the kinesthetic learning style factor. Student enthusiasm in participating in learning can be increased using the make a match learning model, this is based on the percentage of learning outcomes and student activeness (Fidiyanti & Ruhimat, 2015).

This is still adjusted between the questions, then the answers contained in the interactive ICT learning media, the make a match learning model, the pre test and post test, with the hope that there are no excess constraints, so that the section specifically the results and discussion in this research article has high level of trust. Satyaprakasha & Sudhanshu (2014) also get that

learning biology using multimedia on learning is significantly superior, it can improve learning outcomes in biology compared to conventional learning methods. The reason that this happens is because learning biology using LCD devices and computers is more likely to factor in visual learning styles. Learning outcomes are influenced by student motivation, good environment, level of student interest in subjects, and student perceptions (Taurina, 2015). As found in this study, visual learning styles significantly influence viral learning outcomes compared with auditory and kinesthetic learning styles. In addition, the majority (75.93%) of students also stated that ICT interactive learning media improved biology learning outcomes more than lecture learning methods. Most of the research conducted, agreed that learning media could improve student understanding and / or learning outcomes (Tabor, 2013). As the development of information and communication technology, computer-based learning media becomes one of the solutions in overcoming student learning difficulties in biology subjects. This study concludes that interactive media eases the burden on teachers, because the teacher acts as a facilitator (Manny-Ikan, Dagan, Berger Tikochinski, & Zorman, 2011). Information and communication technology can increase the value of N-gain because students are directly involved in learning biology, with learning related to visuals and the interaction between learning media with students. Teaching and learning processes using ICT interactive learning media make mastery of the concepts of students 'biological material better and overcome students' misconceptions in learning science including biology (Aina & Kola, 2013). This study indicated by an increase in the average N-gain learning outcomes of students with the highest viral material using ICT interactive learning media compared to the average N-gain learning outcomes of make a match learning models and lecture learning methods. The selection of appropriate and effective learning media for teaching and learning activities is an extraordinary task for educators because it is important in education (Satyaprakasha & Sudhanshu, 2014).

According Satyaprakasha & Sudhanshu (2014) learning biology use multimedia learning media in significan more than good can increase biology learning outcome compare convensional learning method. The weaknesses of the make a match learning model applied in the teaching and learning process include the effectiveness and lack of efficiency when applied in large classes, classes are somewhat difficult to manage rather difficult because of the large amount of teacher guidance in its implementation, requiring more teacher time and staff in applying the model make a match (Tampubolon et al., 2017). Students also feel bored when teacher-centered learning (Setyawati et al., 2017). The lecture learning method also has weaknesses, for example the teaching and learning process becomes boring, the lecture method can have an impact on student motivation because students are passive in class, the material controlled by students depends on the material explained by the teacher (Taurina, 2015). Taurina (2015) shows that motivation becomes a very significant factor in achieving and or improving student learning outcomes. In addition, the teacher's direct perception and student activity in class are strongly interrelated between emotions in learning, teacher satisfaction, students and motivation, the significance value of individual perceptions or feelings is one aspect of the importance of the work done by students in the classroom (Taurina, 2015). The sample in this study were students from 1 Ampel State Senior High School and 1 Tengaran State Senior High School (X Mathematical Sciences and Natural Sciences 1, X Mathematical Sciences and Natural Sciences 2 and X Mathematical Sciences and Natural Sciences 3) three classes each with 30 - 35 students. The treatment of learning using ICT interactive learning media, make a match learning models and learning methods (lecture method) is applied in each class at this research site. Learning outcomes of viral material can be improved using interactive learning media of Information and Communication Technology compared to the pair-making learning model and the lecture learning method. Multimedia is an interactive learning media that is used to improve student learning outcomes (Gunawardhana & Palanipun, 2016).

Table 9
Learning Step of ICT Interactive Learning Media and Make a Match Learning Model

Activity	ICT Interactive Learning Media	Make a Match Learning Model
Initial Activity	Greetings, pray.	Greetings, pray.
	Explain the purpose of learning.	Explain the purpose of learning.
	Pre test.	*Pre test.*
	Learning video display.	Cards are prepared with various biological concepts.
Core Activities	Students take turns pressing computer keys, getting the prescribed biology concepts.	Each student gets a question-and-answer card.
	Students summarize at least 1 paragraph related to the biological sub-chapter obtained.	Students think about answers and questions.
	Students understand the biology section summarized.	Students look for the appropriate pair of cards.
	Students who succeed in understanding the appropriate biological concepts are given points.	Students who find the right card are given points.
	The teacher continues learning computer-based biology.	The cards are shuffled again, and students get a different card.
	Summing up the learning material.	Summing up the learning material.
	Post test.	*Post test.*
Closing Activity	Closing, prayers and greetings.	Closing, prayers and greetings.

Educators can increase the effectiveness and student learning outcomes with student assessments, which include evidence, teaching style, methodology and instructor data assessments at higher education (Paolini, 2015). The use of information and communication technology replaces teaching and learning activities with conventional methods and can assist teachers in explaining learning material (Ghavifekr & Rosdy, 2015). ICT-based media stimulates the effectiveness of learning and encourages high-level interactivity in students (Sakat et al., 2012). Analyse data point out have signiffican correlation between bored and student confused in learning process. The data analysis shows that there is a significant relationship between boredom and student confusion in learning, the use of computer literacy is the right solution to guide students to understand learning material in language that is easy to understand (Craig, Graesser, Sullins, & Gholson, 2004). Researchers need to consider costs, time, and effort, with constant effort, trying and praying within one's abilities and environmental conditions. Learning media of the type of teleconferencing or information and communication technology require online networking to be a solution when the epidemic of the COVID 19 virus is rampant in various countries in the world (Rachmadtullah et al., 2020). The learning model of make a match, crosswords, scramble, word square becomes a fun and educational learning process in class. This is a biology module and provides educational games for the tenth grade including viral material (Suciyati & Adian, 2018)

CONCLUSION

Students strongly agree if the learning media based on information and communication technology are then applied by the teacher when learning biology. There was an increase in student learning outcomes on virus material after being treated in this study. Students agree that the biology teacher is the facilitator when learning biology. Learning outcomes of virus material can be improved using interactive learning media of Information and Communication Technology compared to the pair-making learning model and the lecture learning method at

Ampel High School and Tengaran High School. The student's perception factor is then followed by the visual learning style factor (vision) which is the main factor that affects the learning outcomes of viral material. Based on the multiple correlation test statistical analysis, factors that have not yet influenced the increase in learning outcomes of viral material include: kinesthetic learning style (motion), auditory learning style (hearing), student motivation level, school environment, student interest level. While the factors that significantly influence the improvement of learning outcomes are visual learning styles (vision) and student perceptions. The successful use of interactive ICT learning media is influenced by student perception factors and student visual learning style factors.

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