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**STUDENTS' PERCEPTION AND PERCEIVED EFFECTIVENESS TOWARD
e-AV BIOLOGY COURSEWARE FOR LEARNING ABOUT RENEWABLE ENERGY**

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ABSTRACT

The teaching media namely e-AV Biology, was developed with the main features of video lessons in supporting the students' learning process. Some video lessons describe the production process of Bio-fuel or Renewable Energy on the field of Biotechnology Industrial, which is one of the subjects that students and teachers find it difficult to learn and explain. The design and development of a Courseware for Biology in senior high schools in Indonesia is described in this paper.

The context of Biology education in Indonesia shows that the students' motivation in learning this subject is considered low. Moreover, students have difficulties in learning Biology and have no interest in the lesson due to the subject irrelevant with the daily experiences, and Biology teachers in Indonesia were still using the monotonous teaching method, teachers are the focal point of learning in the classroom.

The methodology used in this study was quasi experimental research. There were two groups involved in this experiment, namely: T0 and T1. The first group (T0) was assigned as the control group and the second group (T1) was assigned to the experiment group.

Two objectives were identified, firstly to design and develop the e-AV Biology Courseware that can be used as a teaching medium. Secondly, it examined the impact on students' perception and perceived effectiveness of high and low academic achievement when the e-AV Biology Courseware is used. The findings of study indicated that the e-AV Biology Courseware was able to help students to understand more about the Biology subject compared to the conventional ways of teaching. The students who learn Biology using the e-AV Biology Courseware have more interest, better perception and perceived effectiveness toward the subject. Most of the students who participated in this experiment responded positively and suggested that the video lesson should be added to their Biology subject in their schools.

The study suggested two key contributions to the Senior High Schools across Indonesia and to Indonesian educators, particularly teaching Biology. The first contribution was the design and development of an e-Learning Courseware for Indonesian senior high schools. Next, the provision of the e-AV Biology Courseware as a medium, it can be used by educators in the teaching and learning process.

KEYWORDS e-AV Biology, Courseware, Perception, Perceived Effectiveness, Renewable Energy

INTRODUCTION

Over the last decade, information and communication technology (ICT) has influenced various aspects of human daily life such as access to information, communication, and education, among others. The quality of teaching and learning can be enhanced by using ICT in [3]. The impact of ICT on the teaching and learning process depends on how it is used. The impact of a specific ICT application or device depends on the capacity of the teacher to exploit it efficiently.

Since ICT can enhance teaching and improve the teaching and learning process, it is important that all students receive training in ICT [5].

Many learning approaches can be explored through ICT such as project-based learning, learning object-orientation, self-directed learning, online discussion, multimedia-based learning, and more. In Biology, multimedia-based learning can be used to transform abstract concepts, such as the blood

circulatory system, into more concrete ones; and to overcome limitations of space, time and energy in the teaching of complicated processes such as the production of biodiesel, thereby enabling subjects to be taught by teachers and understood by students more easily.

Many students in Indonesia have difficulties in learning Biology, and they think that Biology learning simply involves memorizing certain facts [6]. There are some topics in Biology that students have particular difficulty in learning, such as cell division, chromosomes and the concept of energy [8]. The main reasons for this are the nature of the topic itself, the teacher's style of teaching, the students' styles of learning and study habits, the negative feelings and attitudes of students toward the topic, and a lack of resources. To overcome these difficulties and make students' Biology learning more attractive, it has been suggested that teachers adopt various strategies such as teaching Biology through the use of visual aids, which is believed to be one way of making Biology learning more attractive. However, students find it difficult to learn Biology and have no interest in the lessons because the subject is irrelevant to their daily experiences [2].

THE TEACHING AND LEARNING CONTEXT IN INDONESIAN SENIOR HIGH SCHOOLS

Currently, the teaching and learning system in Indonesia is still classic or traditional. In Indonesian senior high schools, many teachers are still using the conventional methods for teaching and learning, i.e. teachers are the focal point of learning in the classroom. According to [6], Biology teachers in Indonesia are still using a monotonous teaching method, namely, the lecture, which is followed by giving students some examples and exercises, or some assignments.

Generally, teaching and learning involves the transfer of knowledge from the teacher to the students. The methods used to acquire knowledge are listening, taking notes and doing assignments, which constitute a traditional teaching method that is popular in the Indonesian education system. Students may obtain lower learning outcomes due to a mismatch of teaching and learning styles in traditional teaching. For instance, one of the traditional teaching elements in the classroom is lecturing in a teacher-centered environment, in which students have to perform some activities such as listening to the teacher in the classroom and taking notes. However, sometimes students make mistakes because they are too busy

writing down the information that is presented by teacher.

This teaching and learning culture makes students passive and they can become bored because the subjects are not interesting. The participation, interest and motivation of Indonesia students in the teaching and learning process is low [6]. For enhancing students' motivation and interest on Biology subject, the teacher should change the way of teaching. The use of teaching media is one of the options that could be used to increase students' motivation and interest, also students' perception and perceived effectiveness.

Multimedia with Interactivity

Multimedia material has another distinctive characteristic, namely, possibilities for interaction. Students can interact with the information in different ways and they can access the information in multiple ways. Different items can be connected according students' interests and they can practice and simulate complex processes such as the production of biodiesel. [1] state that all these characteristics are the result of technological developments to promote self-learning among students, who should take a more active role in learning at their own pace and in their own time, to achieve a KBS.

It is important to define the concept of Audiovisual and multimedia in relation to education. Audiovisual are a form of multimedia that can be used in the teaching and learning process. Video or Audiovisual are able to give a more multisensory and emotional experience to students than textual information. On the other hand, paper-based pedagogical materials, such as book or articles, allow students to gain deeper knowledge of a topic and allow them to develop a more analytical approach toward the subject. However, the multimedia materials addressed in this study embody the characteristics of both types of material. Firstly, they allow the inclusion of AV content as educational material, and secondly, they allow the inclusion of textual information for reading [1].

AIM OF RESEARCH

The study will recommend an improved model of the e-AV Biology Courseware for Indonesian senior high schools.

RESEARCH QUESTIONS

This study addresses the following research questions, mainly concerning the impact of e-AV Biology

courseware on learning outcomes, namely perception and perceived effectiveness.

1. How is the impact in learning of high and low academic achievement when the e-AV Biology teaching media was used?
2. Does e-AV Biology Courseware able to improve the Students' Perception toward Biology of high academic achievement if compared with conventional teaching approach?
3. Does e-AV Biology Courseware able to improve the Students' Perceived Effectiveness toward Biology of high academic achievement if compared with conventional teaching approach?

THE OBJECTIVES OF RESEARCH

Teaching Biology through media is designed and developed by the researcher, namely e-Audiovisual Biology media as one of the alternatives in teaching innovation. Audiovisual teaching media is chosen because of the strength of audiovisual media. In facts that the researcher is able to stimulate motion effects, modify sound and color, and also learners do not need any special prerequisites to operate it. By combination of various elements in teaching and learning process, teacher can realize that learning atmosphere which use audiovisual media can attract students' interest in learning [4].

Based on these reasons, the design and development of e-Audiovisual Biology (the e-AV Biology) teaching media for senior high school students in Indonesia are needed. The researcher cooperated with teachers to make the Biology instructional design and to create the e-AV Biology teaching media which appropriate with Indonesian science curriculum, supported by multimedia learning theory, so that the teachers can teach Biology subject effectively and improve students' perception, perceived effectiveness and interest in Biology. Besides that, it is also enhancing their learning outcomes. The e-AV Biology is one of the alternative teaching media to explain Biology course. Hence, the teaching and learning process in Indonesian senior high schools will improve.

Renewable energy is a current topic of Biology education in Indonesia, which should be educated to students and improved their understanding and awareness of bio energy such as biomass, biodiesel and bio-fuel. This area of contents was concluded in Biology curriculum of Indonesian senior high school in the fifth competency standard about Biotechnology. Biotechnology as a part of Biology subject is learned

in the tenth grade of senior high school, it is determined by the fifth Competency Standard, which states that: "The Students are able to explain about Biotechnology - the principles, roles and its implications for sciences, environment, technology and society", and renewable energy has gained much attention from the green scientists.

The following are the objectives of research to support the aim:

1. To examine the impact in learning when the e-AV Biology Courseware was used.
2. To examine the impact in learning of high and low academic achievement, when the e-AV Biology Courseware was used.

SIGNIFICANCE OF THE STUDY

Significance of the study can be formulated as follows:

1. Providing e-Learning (the e-AV Biology Courseware) as a tool to enhance students' perception and perceived effectiveness toward e-AV Biology Courseware, particularly in Renewable Energy topic.
2. Providing an alternative teaching and learning tool (teaching media) for educators.

METHODS

The study was carried out at three International schools by government in Semarang, a district in Indonesia which has connections to Jardiknas (The Educational Network had developed by Indonesian Government). One school had been selected as a pilot study, and two schools have been selected for the main research. An experimental design research was applied in two selective International schools of year 2011. Those schools were selected because they were equipped with computer laboratory and internet access. The first step of the experiment was to seek approval from school science teachers and the headmaster. The next step was to provide lessons to the intended group of students in two ways of teaching strategies, normal teaching and learning through the e-AV Biology Courseware.

RESULTS AND DISCUSSIONS

The dimensions of Perception and Perceived Effectiveness were tested of normality, which indicated normal and its graph were normally distributed. The findings of the impact of e-AV Biology Courseware for Perception and Perceived Effectiveness in Renewable Energy were presented and explained in the following sections:

Students' Perception of e-AV-Biology Courseware for Teaching and Learning Biology of High-Low Academic Achievement between The Experiment and Control Group.

The e-AV Biology Courseware, which uses an individual learning strategy for the teaching and learning of Biology, was able to improve the students' perception of AV Media or Video in the experiment group of high and low academic achievement when compared with the conventional teaching approach. According to the research on students' perception of online learning which was carried out by [7] reveals that students exhibit greater perception and motivation when course content interests them and when they perceive some personal relevance with the content.

Impact of Students' Perception Toward e-AV Biology Courseware of High Academic Achievement

Table 1. shows the mean scores of students' academic high achievers in perception in the pre-test for the

experiment and control group. Their mean scores were 3.59. Descriptively, the experiment group has equal mean scores with control group in the pre-test. However, there is no significant difference on the mean scores in the pre-test between the two groups as the p-value = .992 ($p > .05$).

Table 1. also shows the mean scores of high achievers of students' perception in the post-test for the experiment and control group. Their mean scores were 4.36 and 4.10, respectively. Descriptively, the experiment group has a higher mean score in the post-test compared to the control group. The result shows that there is a significant difference on students' perception in the post-test between the two groups as the p-value = .000 ($p < .05$). Thus, there is an indication that the e-AV Biology teaching strategy has beneficial for perception of the experiment group of students' academic high achievers.

Table 1: Independent Samples t-Test of High Achievers of Students' Perception toward AV Media or Video for Teaching and Learning Biology

	Group	Mean	SD	t-Test for Equality of Means		
				t	Df	Sig.(2-tailed)
Perception pre-test	experiment high ^a	3.59	.28655	.011	194.96	.992
	control high ^b	3.59	.44197			
Perception post-test	experiment high ^a	4.36	.31293	5.537	215.38	.000*
	control high ^b	4.10	.40131			

Note :^an = 117, ^bn = 115

Likert Scale 1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree

* Significant at $p < .05$

Figure 1. depicts the graph of the interaction of the means of perception of AV Media or Video between students' academic high achievers of the experiment and control group. It shows that there is an interaction between the level of perception high achievers of the experimental group and that of the control group. It illustrates that the control and experiment group have equal mean score in the pre-test, it indicated that perception score of AV Media or Video in the pre-test of the control group is not significant difference from the experiment group as shown in Table 1.

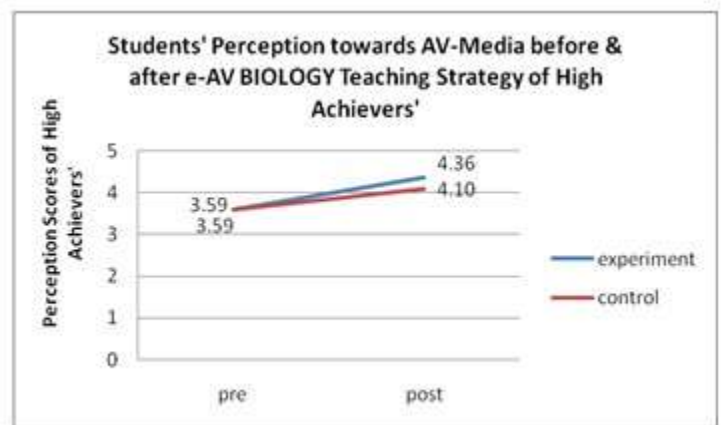


Figure 1: High Achievers of Students' Perception of AV-Media or Video for Teaching and Learning Biology

Impact of Students' Perception toward e-AV Biology Courseware of Low Academic Achievement

Table 2. shows the mean scores of students' academic low achievers in perception in the pre-test for the experiment and the control group. Their mean scores were 3.44 and 3.33, respectively. Descriptively, the experiment group has a higher mean scores in the pre-test compared to the control group. However, there is no significant difference on the mean scores in the pre-test between the two groups as the p-value = .349 ($p > .05$).

Table 2. also shows the mean scores of students' academic low achievers of perception in the post-test

for the experiment and control group. Their mean scores were 4.47 and 3.71, respectively. Descriptively, the experiment group has a higher mean score in the post-test compared to the control group. The result shows that there is a significant difference on students' perception in the post-test between the two groups as the p-value = .000 ($p < .05$). Thus, there is an indication that the e-AV Biology teaching strategy has beneficial for perception of the experiment group of low achievers.

Table 2: Independent Samples t-Test of Low Achievers of Students' Perception of AV-Media or Video for Teaching and Learning Biology

	Group	Mean	SD	t-Test for Equality of Means		
				t	Df	Sig.(2-tailed)
Perception pre-test	experiment low ^a	3.44	.20951	.957	22	.349
	control low ^b	3.33	.34850			
Perception post-test	experiment low ^a	4.47	.15934	7.451	18.082	.000*
	control low ^b	3.71	.32356			

Note : ^an = 11, ^bn = 13

Likert Scale 1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree

* Significant at $p < .05$

Figure 2. depicts the graph of the interaction of the means of perception of AV Media or Video between students' academic low achievers of the experiment and control group. It shows that there is an interaction between the level of perception low achievers of the experimental group and that of the control group. It illustrates that the control group with a lower mean score of perception of AV Media or Video in the pre-test, also had a lower mean perception score of AV Media or Video in the post-test compared to the experimental group. However, the lower perception score of AV Media or Video in the pre-test of the control group is not significant difference from the experiment group as shown in Table 2.

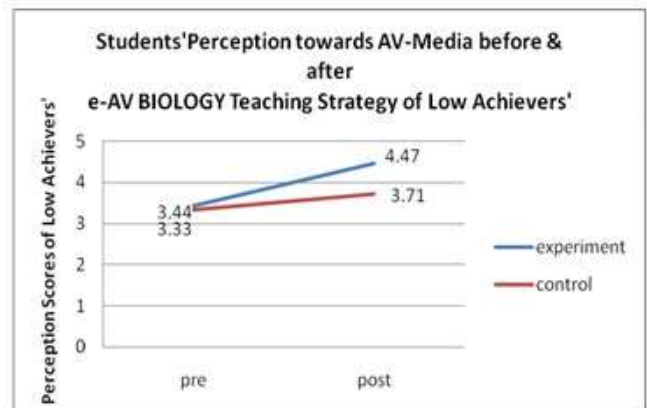


Figure 2: Low Achievers of Students' Perception of AV Media or Video for Teaching and Learning Biology

Students' Perceived Effectiveness of e-AV-Biology Courseware for Teaching and Learning Biology of High-Low Academic Achievement between The Experiment and Control Group.

The e-AV Biology Courseware, which uses an individual learning strategy for the teaching and learning of Biology, was able to enhance the students' perceived effectiveness of AV Media or Video (Biology Teaching Media) in the experiment high and low achievers' group when compared with the conventional teaching approach.

Impact of Students’ Perceived Effectiveness toward e-AV Biology Courseware of High Academic Achievement

Table 3. shows the mean scores of students’ academic high achievers in the level of perceived effectiveness in the pre-test for the experiment and control group. Their mean scores were 3.50. Descriptively, the

experiment group has equal mean scores with the control group in the pre-test. However, there is no significant difference on the mean scores in the pre-test between the two groups as the p-value = .884 ($p > .05$).

Table 3: Independent Samples t-Test of High Achievers of Students’ Perceived Effectiveness toward AV Media or Video for Teaching and Learning Biology

	Group	Mean	SD	t-Test for Equality of Means		
				t	df	Sig.(2-tailed)
Perceived Effectiveness pre-test	experiment high ^a	3.50	.31789	.146	230	.884
	control high ^b	3.50	.35720			
Perceived Effectiveness post-test	experiment high ^a	4.25	.35549	4.716	220.47	.000*
	control high ^b	4.01	.43128			

Note :^an = 117, ^bn = 115, * Significant at $p < .05$
Likert Scale 1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree

Table 3. also shows the mean scores of students’ academic high achievers of the level of perceived effectiveness in the post-test for the experiment and control group. Their mean scores were 4.25 and 4.01, respectively. Descriptively, the experiment group has a higher mean score in the post-test compared to the control group. The result shows that there is a significant difference on students’ perceived effectiveness in the post-test between the two groups as the p-value = .000 ($p < .05$). Thus, there is an indication that the e-AV Biology teaching strategy has beneficial for perceived effectiveness of the experiment group of students’ academic high achievers.

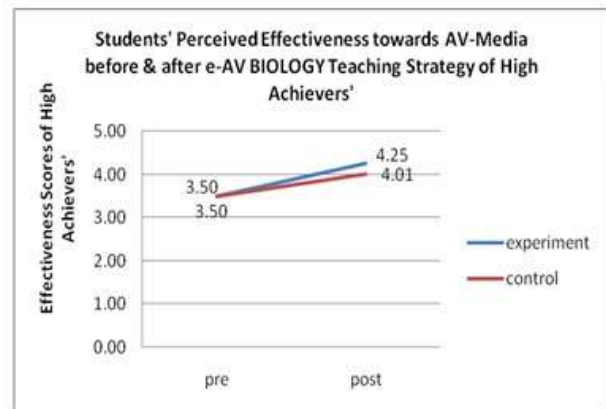


Figure 3: High Achievers of Students’ Perceived Effectiveness of AV Media or Video for Teaching and Learning Biology

Figure 3. depicts the graph of the interaction of the means of perceived effectiveness of AV Media or Video between students’ academic high achievers of the experiment and control group. It shows that there is an interaction between the level of perceived effectiveness high achievers of the experimental group and that of the control group. It illustrates that the control and experiment group have equal mean score in the pre-test, it indicated that perceived effectiveness score of AV Media or Video in the pre-test of the control group is not significant difference from the experiment group as shown in Table 3.

Impact of Students’ Perceived Effectiveness toward e-AV Biology Courseware of Low Academic Achievement

Table 4. shows the mean scores of students’ academic low achievers of perceived effectiveness in the pre-test for the experiment and control group. Their mean scores were 3.53 and 3.31, respectively. Descriptively, the experiment group has a higher mean scores in the pre-test compared to the control group. However, there is no significant difference in the mean scores in the pre-test between the two groups as the p-value = .125 ($p > .05$).

Table 4. also shows the mean scores of students’ academic low achievers of perceived effectiveness in the post-test for the experiment and control group. Their mean scores were 4.49 and 3.53, respectively.

Descriptively, the experiment group has a higher mean score in the post-test compared to the control group. The result shows that there is a significant difference on students' perceived effectiveness in the post-test between the two groups as the p-value = .000 ($p < .05$). Thus, there is an indication that the e-AV Biology

teaching strategy has beneficial for perceived effectiveness of the experiment group of low achievers.

Table 4: Independent Samples t-Test of Low Achievers of Students' Perceived Effectiveness toward AV Media or Video for Teaching and Learning Biology

	Group	Mean	SD	t-Test for Equality of Means		
				t	df	Sig.(2-tailed)
Perceived Effectiveness pre-test	experiment low ^a	3.53	.39489	1.596	22	.125
	control low ^b	3.31	.28744			
Perceived Effectiveness post-test	experiment low ^a	4.49	.22808	7.593	22	.000*
	control low ^b	3.53	.36251			

Note : ^an = 11, ^bn = 13, * Significant at $p < .05$
 Likert Scale 1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree

Figure 4. shows the graph of an interaction for the means of perceived effectiveness of AV Media or Video between students' academic low achievers of the experiment and control group. It shows that there is an interaction between the level of perceived effectiveness low achievers of the experimental group and that of the control group. It shows the control group with a lower mean score for perceived effectiveness of AV Media or Video in the pre-test, also has a lower mean perceived effectiveness score of AV Media or Video in the post-test compared to the experimental group. However, the lower perceived effectiveness score of AV Media or Video in the pre-test of the control group is not significant difference from the experiment group as shown in Table 4.

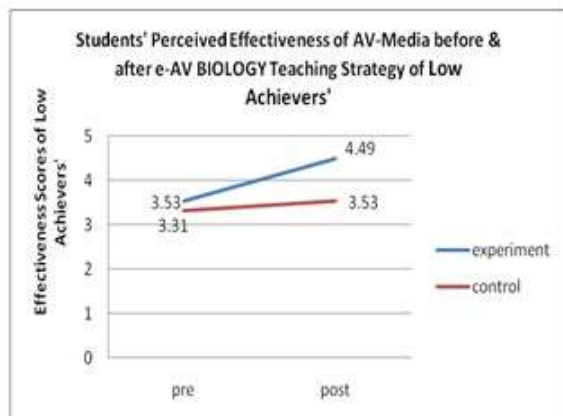


Figure 4: Low Achievers of Students' Perceived Effectiveness of AV Media or Video for Teaching and Learning Biology.

CONCLUSION

1. This study found that there was no significant difference in students' perception of AV Media or video for Biology teaching and learning before employing the e-AV Biology teaching strategy between the experiment and control groups. This was indicated by the fact that the students of both groups showed equal perception of AV Media for Biology in the pre-test. However, there was a significant difference in students' perception of AV Media or Video for Biology teaching and learning after employing the e-AV Biology teaching strategy between the experiment and control groups. This was indicated by the fact that the students of the experiment group showed significantly better perception of AV Media for Biology than the control group in the post-test.
2. This study found that there was no significant difference in the perceived effectiveness of AV Media or Video for Biology teaching and learning before the use of the e-AV Biology teaching strategy between the experiment and control groups. This was indicated by the fact that the students of both groups reported an equal perceived effectiveness for the AV Media for Biology in the pre-test. However, there was a significant difference in the perceived effectiveness of AV Media or video for Biology teaching and learning after the use of the e-AV Biology teaching strategy between the experiment and control groups. This was indicated by the fact that the students of the experiment group rated the perceived effectiveness of AV Media of

Biology significantly higher than the control group in the post-test.

3. Students who initially felt that the teaching and learning of Biology, and in particular renewable energy, was not effective, scored perceived effectiveness more highly after using the e-AV Biology Courseware for individual learning. This improvement is due to use of the e-AV Biology Courseware, particularly the video lessons on bio-energy, which were able to improve students' understanding of and knowledge about renewable energy, especially biodiesel. The video showed the sources of biodiesel, the process of making biodiesel and the use of biodiesel, which could not be explained well enough verbally by the teachers.

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