Combination of CPS and SAVI on Biology Learning Media to Improve Student’s Understanding and Creativity on Environmental Change Topic

S. G. N. Sagita1* and T. Aminatun2

1Biology Education, Graduate Program, Yogyakarta State University, Colombo St. No.1, Karangmalang, Depok, Sleman, Yogyakarta, Indonesia
2Biology, Faculty of Mathematics and Natural Sciences, Yogyakarta State University, Colombo St. No.1, Karangmalang, Depok, Sleman, Yogyakarta, Indonesia

*Corresponding author e-mail: shintyagaluh94@gmail.com

Abstract. The purpose of this research is to determine the feasibility and effectiveness of biology learning media with a combination of CPS and SAVI to improve students’ understanding and creativity. This research was conducted on students of grade X MIPA program in SMA Negeri 7 Purworejo, the subject was selected using Purposive Sampling method. The research method used is Research and Development (R & D) by Dick and Carey's ADDIE (Analyze, Design, Development, Implementation, and Evaluation) model research. The instruments used were expert judgment feasibility questionnaires, multiple choice questions and student worksheets. Data of the feasibility was analyzed by using percentage. The results indicated that Biology Learning Media with a combination of CPS and SAVI is effective to use shown on (1) expert’s validity percentage which above 75 means that learning media is feasible to use, (2) user response on usability showed that the percentage is 89,02 means that the learning media is feasible to use, (3) effectiveness of media showed that the N-Gain result is 0,52 which included on middle category of improving students’ ability, and the results of the student worksheet assessment is 84,16 which categorized high on students’.

1. Introduction
The world of education this era has developed very rapidly, the use of science and technology is applied to the world of education as the times developed. Various types of media, models, and learning approaches have been used to improve students’ abilities, both affective, cognitive, and psychomotor. The selection of learning strategies is not easy, it must be adapted to the students needs. As time goes on globalization occurs, too many problems arises and students are required to have the ability to understand and be creative in their lives to solved problems and to survive, whether it is related to environmental issue or many other issues. This ability is included in the cognitive domain which can be improved through a learning system. From PISA (Programme for International Students Assessment) rank that published by OECD (Organisation for Economic Co-operation and Development) in 2015, shows that Indonesia is placed on 62 from 70 countries. This subjects of assessment is focussed on science, reading, and mathematics, it’s surveyed on 15 years old students around the world. Most importantly, Indonesia is not ranked on Collaborative Problem Solving assessment aspect (OECD, 2016). To improve this ability, using an appropriate learning media with learning model and learning approach is highly needed. Educators must find the best solution to solves
the problems of students based on student’s characteristics and other things to adjust the appropriate learning strategy.

Form of interactions between students, teachers, learning tools, and learning environments is called learning system. The success of the learning process is influenced by the methods and learning media used. The process of learning consists of five components: goals, material, methods, media and evaluation (Wina Sanjaya, 2006). Learning objectives are needed to find out how far students have learned what has been taught, this goal can be seen from the results of cognitive and knowledge tests, there are four dimensions of knowledge, it is factual knowledge; conceptual knowledge; procedural knowledge; and metacognitive knowledge. And there are six dimensions of cognitive, it is remember; understand; apply; analyze; evaluate; create (Anderson, 2001)(Krathwohl. 2002).

The basic cognitive ability is understand, one of cognitive dimentions as mentioned on Bloom’s Taxonomy (krathwohl, 2002). Understand means that someone already knows and absorbs the meaning of a thing or material that has been learned, on Cambridge dictionary, understand has meaning “know” or “realize”. Someone can be said understand if they know or realize about how and why something had happened. Understand has been categorized into three: 1) the lowest level is understanding translation, starting from translating into the true meaning, interpreting and applying principles; 2) the second level is the interpretation understanding, which can link the relationship between or from the lowest level to the next level, or connect parts of the graph with a real event, distinguish between the principal and the non-principal; 3) the third level is to interpret extrapolation (Sudjana, 2013).

After know or realize about how and why something had happened, the next level is how to solve problems using creativity. Creativity comes from the word “to create” which means “to make”. It is the ability to make things, whether in the form of ideas, steps, or products (Rahmat, 2014). Someone who is creative is someone who can think synthetically, who can see relationships where others cannot see, and can analyze his own ideas and evaluate the quality of his personal work, able to translate theories and also abstract things into practical ideas to be able to convince others of the ideas that are going to implement (Sternberg, 2003). Someone categorized creative if they have ability to developing their original ideas that useful, different, new and unusual (Simonton, 2012). Creativity is one part of meta knowledge. Meta Knowledge it self is knowledge about cognition or thoughts in general, especially self-cognition (Anderson, 2001). Metacognition, self-efficacy and self-regulation are the three main elements that can help student’s learning activities (Cera, 2013). Meta cognition has a relationship with Higher Order Thinking (HOT), which deals with cognitive processes in learning activities (Aguayo, 2010).

Difference with in general, creativity in science is called scientific creativity, because it is concerned with creative science experiment (Simonton, 2012). Scientific creativity is an ability to study science and to solve scientific problems (Wang & Yu, 2011). To study more about scientific creativity, Hu & Adey (2002) proposed Scientific Structure Creativity Model (SSCM). SSCM consist three dimensions, the process dimension, the trait dimension, and the product dimensions. The process dimension has two sub-dimension, that is thinking and imagination. The trait dimension has three sub-dimension, that is fluency; flexibility; and originality. The last is product dimension, has four sub-dimension that is technical product; science knowledge; science phenomena, science problem (Hu & Adey, 2002). The three-dimensional Scientific Structure Creativity Model (SSCM) has 24 cells contains components of scientific creativity, shown in Figure 1.
Figure 1. The Scientific Structure Creativity Model (SSCM) (Hu & Aden, 2002)

Biology is branch of science that study about living thing. Biology is study about the origins; histories; structures; functions and interaction between living things (Alton Bigs, 2004). Included in domain of biology is Ecosystem, in Ecosystem there is sub-domain namely Environmental Change, it is study about how Environment in Ecosystem has changed, what the consequence if it changes, what could we do to prevent the worst consequence, how to conserve the environment, and raise awareness about environmental change (Baharudin, 2009).

One of the method that can be use to improve understanding and creativity on environmental change is using Creative Problem Solving (CPS) learning model combined with Somatic Auditory Visual Intellectual (SAVI). CPS is learning model based on problem solving with systematic technique to provide creativity when solving the problems (Isaksen, 1995). Because someone creative is who could become good problem solver when solving the problem use different way more than using his knowledge only. Treffinger (2003) describe that “CPS is a model to help you solve problems and manage change creatively. It gives you a set of easy to use tools to help translate your goals and dreams into reality”, it means that CPS is a method that solve problem creatively and developing new result that useful to solve other problems. There is four steps of CPS learning model described by Treffinger 1). Understanding the challenge; 2). Generating ideas; 3). Preparing for actions; 4). Planning your approach (Treffinger, 2003).

Not only using learning model, but also using learning approach is highly needed. SAVI (Somatic Auditory Visual Intellectual) is a theory by Dave Meier from Accelerated Learning concept on his book “The Accelerated Learning Handbook”. SAVI learning approach is part of the accelerated learning theory, left/right brain theory; visual, auditorial, and kinesthetic; double intelectual theory; a thorough education; learning by experience; and learning by symbols. Four aspects in SAVI is: 1) Learning Somatic, is learning by moving and doing and learning process is involving the senses of touch, kinetic, physical, and move all the body; 2) Learning Auditory, is learning by talking and hearing; 3) Learning Visual, is learning by observing and picturing; 4) Learning intelectual, is learning by Problem Solving and reflecting. Learning process is optimal if four aspects in SAVI is used all together (Meier, 2000).

CPS and SAVI is combined in Learning Media based on Adobe Flash application on computer. If learning media designed creatively, it could make students learn much, increase students performance, and more understand about learning object (Nuryani, 2005). Using learning media based on Adobe Flash is caused by development of Information Communication and Technology (ICT), on 21st century, its development is greatly influencing the world of education, and the implementation on curriculum should encourage learning activities by using the technology (Linder, 2010). By combining
CPS and SAVI on learning media based on Adobe Flash, the student has expected to improve their understanding and their creativity about Environmental Change topic on Biology.

2. Methodology
The type of this research is Research and Development (R&D), by using ADDIE model, ADDIE model is a systematic instructional design model consisting of five phases: 1) Analysis; 2) Design; 3) Development; 4) Implementation; and 5) Evaluation (Dick and Carey, 1996). The implementation of this research is performed on students in SMA Negeri 7 Purworejo. The subject selection technique in this research was random sampling to decide the control-experiment group, one group of control group and one group of experiment group, on each group has 31 students. The treatment of experiment class is using Learning Media based on Adobe Flash with combination of CPS and SAVI, and the treatment of control class is using conventional Learning Media and PBL learning model which commonly used in Indonesia. The learning media is validated by experts on each fields: instrumens expert, medias expert, subjects expert, and user response. Before and after going through the improvement process in the implementation phase, pretest and postest is given to know the effectivity of learning media, the effectiveness can be seen on the result of the test using normalized gain (N-gain) score.

3. Result and Discussion
The following steps of developing the understanding and creativity of students on Environmental Change is according to the ADDIE model by Dick and Carey’s the Systematic Design of Instruction (Dick and Carey, 1996). The result of this research are:

3.1. Expert Validity
Expert validity is one of the ADDIE steps on the development stage (Dick and Carey, 2015). Development phase is the actual creation of the content and learning materials based on the Design phase. Validation is carried out by one material expert, one media expert, one instrument expert, and one biology teacher. Revisions stage are done before implementation is carried out based on advice from experts (Dick and Carey, 2015).

All the instrument of validation was the result of adapting and modifying the research instrument by Kurniawan Aji Sutardi (2012) with the title “Pengembangan Multimedia Pembelajaran Interaktif (MPI) IPA dengan Tema Air Menggunakan Metode Webbed Berbasis Adobe Flash CS4 Kelas VII SMP RSBI” and Azhar Arsyad (2011). Instrument used to measure validity using rating scale with a scale of 0 to 4 per item, the final result is showed on percentage for each aspect. Percentage category division based on: 0-25 is very unfeasible, 25-50 is not feasible, 50-75 is feasible, 75-100 is very feasible (Azhar, 2011).

| Assessment Aspect          | Assessment Results (%) | Category Feasibility |
|----------------------------|------------------------|----------------------|
| Aspect of Concept Truth    | 90                     | Very Feasible        |
| Language Accuracy Aspects  | 81.25                  | Very Feasible        |
| Display Aspects            | 85                     | Very Feasible        |
| Software Aspects           | 100                    | Very Feasible        |
| Interaction Aspects        | 81.25                  | Very Feasible        |
| Implementation aspects     | 100                    | Very Feasible        |
| Average Percentage         | 87.4                   | Very Feasible        |

The validity result of Media Expert shows that all the aspect is very feasible, and also can be seen on the average of all the percentage aspects is 87.4%, above 75% means that the learning media is very feasible based on media expert validation.
### Table 2. The Material Expert’s Validation Result

| Assessment Aspect                             | Assessment Results (%) | Category Feasibility |
|-----------------------------------------------|------------------------|----------------------|
| Aspect of Concept Truth                       | 85                     | Very Feasible        |
| Language Accuracy Aspects                     | 81.25                  | Very Feasible        |
| Display Aspects                               | 79.54                  | Very Feasible        |
| Average Percentage                            | 82                     | Very Feasible        |

The validity result of Material Expert shows that all the aspect is very feasible, and also can be seen on the average of all the percentage aspects is 82%, above 75% means that the learning media is very feasible based on material expert validation.

### 3.2. User Response on Usability

The user response on usability is done by Biology Teacher, this response is one of the result on development stage (Dick and Carey, 1996). The teacher is the one who teaches Biology more than five years and be able to use multimedia learning.

### Table 3. The Biology Teacher’s Validation Result

| Assessment Aspect                             | Assessment Results (%) | Category Feasibility |
|-----------------------------------------------|------------------------|----------------------|
| Aspect of Concept Truth                       | 90                     | Very Feasible        |
| Language Accuracy Aspects                     | 75                     | Very Feasible        |
| Completeness of Material Aspects              | 87.5                   | Very Feasible        |
| Technical aspects of material presentation    | 93.75                  | Very Feasible        |
| Display Aspects                               | 82.5                   | Very Feasible        |
| Interaction Aspects                           | 100                    | Very Feasible        |
| Implementation aspects                        | 100                    | Very Feasible        |
| Average Percentage                            | 89.02                  | Very Feasible        |

The validity result of Biology Teacher shows that all the aspect is very feasible, and also can be seen on the average of all the percentage aspects is 82%, above 75% means that the learning media is very feasible based on biology teacher validation.

### 3.3. Effectiveness of Biology Learning Media

Biology learning media about Environmental Change material are used in learning activities, the combination of CPS and SAVI learning models are used to improve students’ understanding and creativity. The implementation was carried out in SMA Negeri 7 Purworejo, using the control class and experimental class to compare the final results at the evaluation stage. The control class is consisting of 31 students, and the experimental class in this study consisting of 31 students.

Combination was carried out at each stage of the learning model, the SAVI approach was applied at each stage of the CPS Treffinger (2003) model: 1). Understanding the challenge; 2). Generating ideas; 3). Preparing for actions; 4). Planning your approach. Each CPS stage has its sub-stages, the sub-stage if sorted again will be 6 stages and then combined with the SAVI approach becomes: 1). Constructing Opportunities (SAVI-Somatic, Audio, Visual, Intelectual); 2). Exploring Data (SAVI-Somatic, Audio, Visual, Intelectual); 3). Framing Problem (SAVI-Somatic, Audio, Visual, Intelectual); 4). Generating Ideas (I-Intelectual); 5). Developing Solution (SVI-Somatic, Visual, Intelectual); 6). Building Acceptance (SAVI-Somatic, Audio, Visual, Intelectual).
3.4. Improvement of Students’ Understanding

To determine the effectiveness of learning media on student’s understanding and creativity, students are given a pretest and posttest to compare students' abilities before and after being given treatment. The results of the pretest and posttest were calculated using the Normalized Gain Score (N-gain) to determine the increase in students' abilities of understanding. The criteria for increasing N-gain are shown in the following table.

| Table 4. N-Gain Improvement Criteria (Hake, 1999) |
|-----------------------------------------------|
| Quantitative Value | Qualitative Value |
| g > 0.70 | High |
| 0.30 < g ≤ 0.70 | Medium |
| g ≤ 0.30 | Low |

From the results of N-gain we can see the difference in the increase of students’ ability in each treatment for the control class and the experimental class. The results of the pretest and posttest in the control class and experimental class were calculated using N-Gain with the results shown in the following table.

| Table 5. N-Gain Calculation Result |
|-----------------------------------|
| Criteria | Control Class | Experimental Class 1 |
|         | Pretest | Posttest | Pretest | Posttest |
| Min     | 46.60  | 53.30   | 46.40   | 66.60   |
| Max     | 86.60  | 93.30   | 86.60   | 100.00  |
| SD      | 8.68   | 8.68    | 1.04    | 7.31    |
| Average | 66.42  | 75.46   | 67.49   | 85.56   |
| N-Gain  | 0.26   |          | 0.52    |          |

Based on the Table 5. The average of Normalized Gain Score on the control class is 0.26 categorized Low, means that the improvement of control class students’ understanding and creativity using conventional learning media was in low effectiveness. The average of experimental class’ Normalized Gain Score is 0.52 categorized medium, means that using learning media based on Adobe Flash with combination CPS and SAVI is improving the students’ understanding and creativity in medium effectiveness (Hake, 1999).

3.5. Improvement of Students’ Creativity

To strengthen the effectiveness of learning media on student creativity, students are given a project using combination of CPS and SAVI on learning media. The students’ scientific creativity is categorized using SSCM by Hu and Adey (2002), the 24 cells of SSCM is simplified by Hu and Adey (2002) into seven category for aspect of the assessment. The results of the simplification is problem finding, problem solving, science experiment, creative imagination, unusual uses, product improvement, and product design. Comparisons were made between the control class and the experimental class to determine differences in creativity after the use of learning media, these results are shown in the following table.
Table 6. The Result of Students’ Creativity

| Aspect                  | Control Class | Experimental Class |
|-------------------------|---------------|--------------------|
| Problem Finding         | 2.13          | 3                  |
| Problem Solving         | 2.65          | 2.87               |
| Science Experiment      | 2.65          | 2.48               |
| Creative Imagination    | 2.16          | 2.87               |
| Unusual Uses            | 1.10          | 1.97               |
| Product Improvement     | 1.90          | 2.48               |
| Product Design          | 1.90          | 2.55               |
| Score All Aspect        | 14.48         | 18.23              |
| Mean                    | 2.07          | 2.60               |
| Percentage              | 66.88         | 84.16              |

From the Table 8, the students’ creativity of experimental class is higher than the control class, can be seen based on the mean of experimental class is higher than the control class, the mean of the control class is 2.07 and the mean of the experimental class is 2.60, the percentage of control class is 66.88 and experimental class is 84.16. From the result can be concluded that the use of Learning Media with combination CPS and SAVI is increasing the students creativity. This conclusion strengthened by the result of Independent Sample T-Test, the value of sig. (2-Tailed) is 0.000. The value of sig. (2-Tailed) < 0.05 is Ho rejected and Ha accepted, could be interpreted that there is a difference mean of learning result on control class and experimental class.

4. Conclusion

From the results of this research, can be concluded the learning media with a combination of CPS and SAVI are feasible and effective to be used to improve students' understanding and creativity about environmental change topic by the result of (1) the expert judgement showed that the percentage is more than 75 it means the learning media is feasible to use, (2) the user response on usability showed that the percentage is more than 75 it means the learning media is feasible to use, (3) effectiveness of media showed that the N-Gain result is 0.52 which included on middle category of improving students’ understanding, and the results of the student worksheet assessment is 84.16 which categorized high on students’ creativity.

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