Development of Science Lesson Plan in *Pesawat Sederhana* Material with 5E Learning Cycle and Game to Improve Learning Outcome of Junior High School Students

Siti Wulandari[1] , Z.A Imam Supardi[2] , Tjipto Prastowo[2]
[1]Science Teacher of State Junior high school 47 Surabaya
[2]Post graduate program of Science department, State University of Surabaya

Abstract:- This study aims to improve appropriate (valid, practical, and effective) science learning devices using 5E cycle learning model and game to improve junior high school student learning outcomes in *pesawat sederhana*. The learning tool was tested on 38 eighth grade students of State Junior High School 47 Surabaya in academic year 2015/2016. This research is a development research by adapting the 4D model. Data analysis techniques use descriptive qualitative and quantitative. The results of the study show: (1) the validity of a valid category of learning devices; (2) lesson plan is implemented well; student activity shows student-centered learning; (3) positive student responses to the learning process, the class achieves learning outcomes completeness with increasing a high score. Based on the results and discussion of the study, it can be concluded that the junior high school science learning device with 5E cycle learning model and game are developed on *pesawat sederhana* material is appropriately (valid, practical, and effective) used in learning.

Keywords:- Learning Cycle 5E, Learning Outcomes.

I. INTRODUCTION

Based on the first Standard which is proposed by the National Education Standards Agency (BSNP), through the process of identification in science subject (IPA) to fill the need of life in daily need can be resolved well. Maintaining and keeping environmental sustainability is the application of science that is done wisely. The use and development of creativity and scientific attitudes learning emphasizes on junior high school / MTs level as a direct learning experience. (Ministry of Education and Culture, 2006).

The result in State Junior High School 47 where researcher did this research, the score of the National Examination of *pesawat sederhana* material, the average school grades was 52.11 under the average achievement score in academic year 2014/2015. The results of interviews with the students that the teachers rarely use science instrument when teaching *pesawat sederhana* material. The results of teachers' interview that the material must be delivered to the 8th grade students is too dense, so the teacher must quickly provide material so that all students can be learned on time.

All the results of the interview were concluded that *pesawat sederhana* material got low score scored because simple aircraft material was studied without using science instrument and was delivered quickly so that the entire material was completed on time.

In this millennial era, especially in computer technology is very influential and has an important role in the world of education nowadays, especially in the use of learning media, which is often referred to as computer assisted learning or Computer Assited Instructional (CAI). By using computer media, students get experience in independent learning process. The applications program included text, graphics, animation, video and sound that can attract students' attention in the teaching and learning process. (Rusman, 2012).

According to constructivist learning theory (Slavin, 2011), that learning is a process of forming knowledge. This formation must be done by students. The teacher constructivism approach has roles as a mediator and facilitator for students which includes activities to provide learning experiences, provide or give activities that stimulate student curiosity and help students express ideas, monitor and evaluate students' thinking. In terms of learning facilities, the constructivist approach emphasizes that the main function in learning activities is the activities of students in constructing their own knowledge through the environment, equipment, materials, media and other supporting facilities. In science subject, students are not only given theoretical explanations, but also given an explanation in the form of application in daily life, so students become more understand because what is learned is close to their life. The Examples of theoretical application can be taken from students' experienced at home or at school environment, or from equipment that has been used by students both in the home and school environment.

To improve the learning outcomes of science, teachers are required to be more professional by preparing learning devices that are adapted from the conditions and circumstances of the student environment, so that the material provided is easily understood by students. Learning tools that need to be prepared are learning media. According to Musfiqon (2012), the definition of learning media is an assisting devices in the form of physical and non-physical which is intentionally used between the teacher and students who are in mastering learning material to be more effective. Whereas Rusman argues that learning media makes it possible to combine or integrate various media including audio, graphics, text, moving images (video and animation), can reduce verbalism, increase students' attention and motivation, make students interested and motivated to learn, knowing limitations, energy, and helping students in creating illustrations for themselves. Learning media are designed with the aim of the student's interest optimally and it is not bored, so that learning process can be achieved (Rusman, 2012). In the current modern era, it is an obligation for students to mastering a technology, especially computer-based. Students live in the digital age and teachers also have to follow the development of these technologies, for example in making learning media based on Technology and Information (IT). One of them is a game, which has become a favorite game for both children and adults. (Rusman, 2012).

The game is a computer-based game with an animation application. Animation, often referred to as animated film, is a film that produce from hand painting become 4D animation. Media animation is a form of media relation between teachers and students through 4D images that are similar to the real situation, and the purpose of learning being effective. Media games are easier for students to understand because they see clearly not only images from their imagination. The use of this method is considered effective but needs expensive and technically complicated costs. Basically, the animation media can be used to improve learning outcomes (Harsono, 2009).

According to the Minister of Education and Culture on Process Standards (Permendikbud no. 103, 2014), it is stated that in educational units, the learning process is carried out as fun, interactive, inspirational, challenging, motivating the student to be active, and provide sufficient space for ideas, creativity, and independence in accordance with physical development of the students, talents, and interests of students. So that teachers are required to develop their creativity in the application and development of learning models with the aim of improving thinking skills, analytical power, and student learning outcomes. One learning model that is relevant to the Process Standard is 5E Learning Cycle model. This model was firstly developed by J. Myron Atkin and Robert Karplus, who have five stages, that is engagement, exploration, explanation, elaboration, and evaluation. (Trowbridge, Bybee, & Powell, 2004).

The success of this learning cycle has been observed by Kamaluddin (2014) who developed a learning device with 5E learning cycle model in *Kalor* material which get a result in the completeness of student learning outcomes and it increases students' motivation during learning process. Likewise, research by Özgür Anil and Veli Batdi (2015) on students who received 5E learning cycle, it had a positive effect on academic achievement, absorption, values and attitudes of the students. The same results were obtained from research from Madu and Amaechi C.C (2012) that there was an increasing point in understanding of the concept of applying 5E learning cycle.

The use of computer-assisted media turned out to produce more efficient results than classes that only applied 5E learning cycle such as the results of the similar research from Rasha Mohammad Qawasmeh and Ahmad Ali Al. Syouf (2017). The same results are from Tshewang Namgyel and Khajornsak Buaraphan (2017) that the application of 5E learning cycles and applied simulations and games had an increasing result in understanding of photoelectric material. H Piyayodilokchai and friends (2013) conducted a study on second-year students of the science faculty using 5E and multimedia learning cycles which were given to increase the ability for implementing SQL and its implementation in databases compared to those without treatment.

Based on the findings above, the researcher will apply the 5E Learning Cycle model and will use game learning media to teach science material and to achieve learning completeness so this study entitles "Development of science lesson plan in *Pesawat Sederhana* material with 5E learning cycle and game to improve learning outcome of junior high school students"

II.   METHOD

The subjects were 38 students of 8A class of 47 state junior high school Surabaya in academic year 2015/2016 who participated in science learning of *Pesawat Sederhana* material for 3 meetings. The procedure of this study is divided into 2 stages; the first stage of the development of learning devices and the second stage is the application of learning devices in the classroom.

The implementation in the class used *One Group pretest-Posttest Design* which is described as follows:

O1 X O2

Information:

O_1 = Initial test (pretest), to determine the ability of students' knowledge before learning takes place
X   = Treatment using 5E learning cycle models and games
O_2 = Final test (posttest), to determine the ability of students' knowledge after learning takes place

❖ *The research instrument used based on this follow:*

➢ Validation Sheet used to assess the feasibility of science learning devices that have been developed. This validation sheet is given to lecturers in their fields. This validation sheet is in the form of a validation sheet for lesson plan, students work sheet, learning outcome tests, and game media.
➢ Observation Sheet for the Implementation of the Teaching and Learning Process is used to collect the data about the implementation stages of learning through the 5E learning cycle model as stated in the lesson plan. Filling out the observation sheet is done by giving a check mark (√) in the column to the stages of learning which carried out by the teacher, and giving the score based on the range of 1-4.
➢ Student Observation Sheet is used to observe student activities while applying science using development learning tools developed.
➢ Learning Outcomes Test made in the form of essays or descriptions. This test was developed by researchers with developing the cognitive and psychomotor indicators.
➢ Observation Sheet in learning process which is in the form of obstacles found during teaching learning process and being alternative solutions which is used to overcome these obstacles. This instrument is filled by observers.
➢ Student Questionnaire Response used to find out the opinions of students on learning devices used in learning activities.

A. Data Collection Technique

The activities were planned in this data collection technique as follow:

➢ Validation of the Science learning tool with 5E learning cycle model which is conducted by the lecturer to get suggestion, improve the device, and produce learning devices that are being tested.
➢ Observation is used for two things, (1) observing the implementation of learning in accordance with the stages that have been designed by the teacher in the lesson plan, (2) obtaining and measuring data about activities and a set of student knowledge and skills for the entire set of activities to be measured in this research, (3) obtaining information about constraints during teaching and learning.
➢ Tests are made in the form of essays or descriptions. This test was developed by researcher related to cognitive, psychomotor and affective indicators. The initial test (pretest) is given before learning begins, while the final test (posttest) is given after the learning is carried out.
➢ Questionnaires are used to obtain data on the level of students' work sheet and student responses. Questionnaire is given after the learning process ends.

B. Data Analysis Technic

➢ *Validation of Lesson plan and student work sheet*

The technique used to analyze validation data is qualitative descriptive by looking at the feasibility assessment of learning devices from predetermined reviewers (validators). Analysis is done by calculating the average rating by the validator. Analysis the results of the validation data in learning devices is presented in the following rating scale.

Good: 4 (good quality, easy to understand, in accordance with the context of the explanation)

Good enough: 3 (good quality, easy to understand, need to be refined explanation)

Poor: 2 (good quality, difficult to understand, need to be improved in the explanation)

Bad: 1 (quality is not good, difficult to understand, need to be improved of explanation)

Furthermore, the results of the average score of the assessment are described as follows.

$1,0 \leq SV \leq 1,59$ = unusable and need consultation
$1,60 \leq SV \leq 2,59$ = usable and need more revision
$2,60 \leq SV \leq 3,59$ = usable and minor revision
$3,60 \leq SV \leq 4,00$ = usable with no revision
(adopted by Ratumanan dan Laurens, 2011)

➢ *Analysis of Reliability Instrument.*
To determine the reliability of instruments, a percentage of agreement formula is used:

Percentage of agreement $= 100\ \% \left[1 - \frac{A-B}{A+B}\right]$

Information:

A = the frequency aspects which is observed by the researcher in high frequency.
B = the frequency aspects which is observed by the researcher in low frequency
(Borich, 1994 dalam Ibrahim, 2005)

➢ *Implementation of Learning Analysis*
Observation sheet for lesson plan implementation in learning activities is used by observers to observe the implementation of the lesson plan steps. The implementation plan for the lesson plan contains some steps that the teacher must do it well, the observer gives a score based on the existing assessment instructions, the observer also writes suggestions. The reliability of the data for observing the implementation of this lesson plan is tested by the following formula:

Percentage of agreement $= 100\ \% \left[1 - \frac{A-B}{A+B}\right]$
(Borich, 1994: 385)

Information:

A = the frequency aspects which is observed by the researcher in high frequency.
B = the frequency aspects which is observed by the researcher in low frequency

➢ *Student Activities Analysis*

Student activity was observed by two observers during the learning activities by giving a sign according to the activity category. To calculate the percentage of student activities are as follows (Arikunto, 2009):

$$P = \Sigma R / \Sigma N \ x100\%$$

Information:

P = Student activities percentages
Σ R = the total number of students activities
Σ N = the whole number of students

The calculation of reliability level uses the Percentage of Agreement equation with the provisions of the instrument said to be reliable if the reliability obtained is ≥ 0.75 (75%). The formula is as follows:

Percentage of agreement = 100 % $[1 - \frac{A-B}{A+B}]$

Information:

A : the high frequency of observer
B : the low frequency of observer

➢ *Learning Outcome Analysis*

• *Individual Completeness*

Student learning completeness (individually) is calculated by using the following formula:

$$KB = \frac{T}{T_t} \ X \ 100\%$$

Information:

KB = learning completeness
T = the number of students score
Tt = the total number of score

Students are declared complete learning if the number of correct answers is ≥ 75% of students, referring to the minimum completeness criteria (KKM) in SMPN 47 Surabaya at 75, it means that students are called to be complete if they have reached a minimum of 75, and a class is called to be complete learning (classically) if the class is 85% of students who have completed their studies.

➢ *The sensitivity of Question Items*

To find out how far each item is measured and the effects of learning that have been given, it is necessary to calculate the sensitivity. The effective sensitivity index is

between 0.00 and 1.00. The equation for calculating the sensitivity of the item is as follows:

$$Sensitivity = \frac{Ra - Rb}{T}$$

Information:

Ra = The number of students who answered correctly in the final test
Rb = The number of students who answered correctly on the initial test
T = The number of students doing the test

According to Aiken (in Trianto, 2012), question items were stated to be sensitive if the sensitivity number was between 0 and 1, and the item was sensitive to learning if it obtained S ≥ 0.30.

➢ *Gain Score*

Testing the effectiveness of learning with 5E learning cycle model in improving student learning outcomes used normalized gain formula (Wiyanto, 2008) as follows:

$$< g > = \frac{< S_{post} > - < S_{pre} >}{100 - < S_{pre} >}$$

The Spost and Spre symbols represent the average score of each individual pre-test and post-test

Information:

g > 0,70 = high
0,30<g <70 = medium
g < 0,30 = low

➢ *The Obstacle Faced by the Researcher*

The obstacles faced are the description of various things such as time, supporting facilities / infrastructure, and other things that are not in accordance with the planning that are found to be obstacles to the smooth learning of each meeting, and the alternative solutions used to overcome various kinds of obstacles. The obstacles described from the researchers or information from the students, and information from observers.

III. RESULT AND DISCUSSION

A. Lesson Plan Assessment

If analysis that has been done, then the lesson plan developed and it is categorized as valid, then it can be used in learning with minor revision and has been ready to be tested in the school.
.
B. Students Worksheet Assessment

Student worksheet developed by researchers in the form of students' journal with 5E learning cycle models to improve student learning outcomes. Student work sheet consist of some activities to formulate problems, make hypotheses, identify variables, retrieve experimental data, analyze data, and make conclusions.

The results of the analysis state that the developed-worksheet is categorized as good and feasible to use with minor revisions. Some suggestions from validators can be used by researchers to improve Student worksheet

C. Game Media Assessment

Pesawat Sederhana game media developed by researchers to support the learning process. The material in the game refers to the learning indicators that have been compiled. The game media is validated by 2 validators who included the feasibility of media components, the quality of illustrations and animations, dialogic and interactive, and conformity with Indonesian language rules.

Validation results for game media provided by 2 validators are valid and appropriate categories for use in learning.

D. Implementation of Lesson Plan

All the steps listed in the lesson plan that have been developed can be carried out properly by the teacher. The aspects observed in the assessment of the implementation of the lesson plan with the 5E learning cycle model to improve student learning outcomes include preliminary activities, core activities, conclusions, class atmosphere, and time management.

The average value of the two observers to the lesson plan of 3.5 in good category with Percentages of Agreement is 94.04%. This shows that the teacher carried out all learning activities using the learning cycle 5E model is well implemented and students get an active role in learning activities.

E. Students Activities

The observations are made of activities and carried out by students, the frequency of student activities in learning reduces teacher dominance in the classroom. This can be seen from the activities and carried out by students at each meeting of 96.9%. The Percentages of Agreement assesses the student activity during learning at 94%.

F. Students Response

93% of students expressed interest in the way learning progresses, 100% of students want to take part in teaching and learning activities as they have been followed, 80% of students agree that the way of learning takes place in fosters a critical attitude, scientific thinking and collaboration, and all students (100%) states that the way learning has taken place, makes students like to study in groups, easy to do questions, love to learn and dare to ask questions.

The overall results of the response questionnaire given to students showed that students gave a positive response to the 5E learning cycle model. This positive response shows that students are enthusiastic during the learning process. This is supported by the conclusion of Muh Nasir (2014) in his research that the 5E learning cycle model can help students think critically and argue. The same results were stated by Matthew Cornelius (2012) that students feel happy while in the laboratory and study science and are able to make strategies and connections that are relevant between concepts and problems faced.

G. Student Learning Outcomes

➢ *Knowledge Learning Outcome*

The learning process begins with the pretest. The results obtained both individual and classical completeness are 0%. This is because 8A grade students have not got *pesawat sederhana* material. After the pretest, the next meeting was teaching and learning activities three times using a revised learning tool after receiving some suggestion from the validator. After the teaching learning process is completed, the next meeting is conducted posttest.

38 students got experience in understanding of concepts, from an average of 45.25 at the pretest to 91.03 at the posttest. Student learning completeness reflected the increasing of student understanding. This was supported by Irma's research (2013); Ikhwan (2017); Mir'atu et al (2018); Ni Luh Murni (2013), that 5E learning cycle teaching model can improve student learning outcomes. Likewise, Tzu-Chien Liu's research, Hsinyi Peng, Wen-Hsuan Wu, and Ming-Sheng Lin (2009); İsmet Ergin, Uygar Kanli, and Yasin Unsal (2008); Ibrahim Bilgin, Hümeyra Coşkun, and Idris Aktaş (2013); Hüseyin Artun and Bayram Coştu (2012); Güner Tural, Ali Rıza Akdeniz, and Nedim Alev (2010); Fatma Ağgül Yalçın and Samih Bayrakçeken (2010); also concluded that the 5E Learning cycle model was effective for improving understanding concept and student academic achievement.

Whereas Hongsiri Piyayodilokchai1, Patcharin Panjaburee1, Laosinchai Parames, Watcharee Ketpichainarong and Pintip Ruenwongsa (2013) added multimedia in the 5E learning cycle model which would improve understanding teaching and learning understanding which were taught to students.

The individual and classical completeness showed that 5E learning cycle learning models on *pesawat sederhana* material can improve student learning outcomes. Increasing student learning outcomes is a positive influence of the Learning Implementation Plan and Student Worksheets which is used in the learning process. The use of media cannot be ignored; the media can motivate students in the learning process. This motivation is important for students to be involved in learning activities and absorb the information presented.

➢ *The Result of Spiritual and Social Learning*

In the learning process that is observed consists of admiring, honesty, thoroughness and curiosity. At the first meeting, the students carried out the experiment to calculate the mechanical advantage of the lever, in the experiment were still some students who did not realize their admiration with speech and were not thorough in conducting the experiment activities. At the second

meeting, the students carried out the experiment to calculate the mechanical advantage of the pulley and at the third meeting, the students carried out the experimental activities which is calculated the mechanical advantage of material, it was seen that the aspects observed during the activity increased. The results of the spiritual and social competence of students are the values obtained by students, where there is an increase in scores which obtained by students during carrying out experimental activities in three meetings. The same thing was obtained by Mir'atun (2018) that there was an increase in spiritual attitudes in a good category at several planned meetings.

H. Research Finding

Based on the research that has been done, with the testing of learning devices in *pesawat sederhana* material with 5E learning cycle model, there are several findings as follows:

➢ Science learning tools (Syllabus, lesson plan, student worksheet, Learning Outcomes Tests, media games) of 5E learning cycle models to improve learning outcomes of junior high school students who have been developed and it can be declared as valid and useable. The results of student assessment of the readability of LKS have a readability level of 80%.

➢ The effectiveness of science learning devices that have been developed can be seen from:

• Positive student responses to learning devices, 5E learning cycle models and game media.
• Student learning outcomes have increased with a high category <g>, as well as student learning completeness of 91.03% after following the learning process using 5E learning cycle model and the media of this game.

➢ The practicality of science learning devices that have been developed which can be seen from:

• The implementation of lesson plans in 8A grad of 47 State Junior high school Surabaya get averaged of 3.5, this shows that lesson plans can be implemented well.
• Student activity during the learning process reaches 96.9% and the most dominant activity is making observations and discussing.
• Student activity in following all the learning steps during the learning process reaches 96.9% and the most dominant activity is making observations and discussing.

IV. CONCLUSION

Based on data analysis, it can be concluded that learning devices in *pesawat sederhana* material with 5E learning cycle model and game media (lesson plan, students' work sheet, learning outcome tests, and game media) are suitable to use in Teaching and Learning Activities (KBM).

SUGGESTIONS

➢ Observation activities are important because they can improve students to be able to make hypotheses, formulate problems, and determine variables in observation activities.
➢ The phase of elaboration, that is connecting concepts which have been obtained to be applied to new things, and it can improve students to strengthen the concepts that have been obtained.
➢ Teachers who will use 5E learning cycle model, it should pay attention to the characteristics of students, the situation and conditions of the school, in this case the tools and experimental materials are united so that the process of implementing the learning run well and accordance with the time allocation planned.
➢ On difficult material, the teacher should emphasize more and repeat the material again if there is still time so students can receive the material properly.
➢ The teacher can understand the class situation quickly, so that if there are students who lack focus in learning, the teachers approached the student focus.
➢ The devices that have been developed need to be tested more, for example in all of 8A grade in this research or in the close relation to the research to obtain better results.

REFERENCES

[1]. Artun, H., & Costu, B. (2013). Effect oe The 5E Model on Prospective teachers' Conceptual Understanding Diffusion and Osmosis : A mixed Methode Approach. Journal os Science Education and Technology, 1-10.

[2]. Balci, S., Cakiroglus, J., & Tekkayas, C. (2006). Engagement, Exploration, Explanation, Extension, and Evaluation (5E) Learning Cycle and Conceptual Change Text as Learning Tools. Biochemistry And Molecular Biology Education, 199-203.

[3]. Bilgin, I., Coskun, H., & Aktas, I. (2013). The Effect Of 5E Learning Cycle On Mental Ability Of Elementary Students. Journal of Baltic Science Education, 592-607.

[4]. Borich, G. (1994). Observation Skill For Effective Teaching. Englewood Cliffs: Merril Publisher.

[5]. Cardak, O., Dikmenli, M., & Saritas, O. (2008). Effect of 5E instructional model in student success in primary school 6th year circulatory system topic . Asia-Pacific Forum on Science Learning and Teaching, 1-11.

[6]. Cepni, S., & Sahin, C. (2012). Effect of Different Teaching Methods and Techniques Embedded in the 5E Instructional Model on Students' Learning about Buoyancy Force . Eurasian J. Phys. & Chem. Educ, 92-127.

[7]. Cornelius, M. (2012). The 5e Learning Cycle And Students Understanding Of The Nature Of Science. Montana : Montana State University.

[8]. Dimyati, & Mudjiono. (2006). Belajar dan Pembelajaran. Jakarta: PT. Rineka Cipta.

[9]. Ergin, I., Kanli, U., & Unsal, Y. (2008). An Example for the Effect of 5E Model on the Academic Success and Attitude Levels of Students': "Inclined Projectile Motion" . Journal of Turkish Science Education, 47-59.

[10]. Groundlund, N. (1982). Constructing Achievement Tests. Third edition. New York: Prentice Hall Inc.

[11]. Hamdani. (2011). Strategi Belajar Mengajar. Bandung: Pustaka Setia.

[12]. Harsono, B., Soesanto, & Samsudi. (2009). Perbedaan Hasil Belajar Natara Metode Ceramah Konvensional Dengan Ceramah Berbantuan Media Animasi Pada Pembelajaran Kompetensi Perakitan Dan Pemasangan Sistem Rem. Jurnal Pendidikan Tehnik Mesin Universitas Negeri Malang, 71-79.

[13]. Ibrahim, M. (2002). Pengembangan perangkat pembelajaran. Surabaya: UniPress.

[14]. Indriyani, I. (2013). Pengembangan Lks Fisika Berbasis Siklus Belajar (Learning Cycle) 7e Untuk Meningkatkan Hasil Belajar Dan Mengembangkan Kemampuan Berpikir Kritis Pada Siswa Sma Kelas X Pokok Bahasan Elektromagnetik. Tesis. Yogyakarta: Universitas Ahmad Dahlan.

[15]. Kamaludin. (2014). Pengembangan Perangkat Pembelajaran dengan Model Siklus Belajar 5E pada Materi Kalor untuk Meningkatkan Hasil Belajar Siswa. Tesis. Surabaya: Universitas Negeri Surabaya.

[16]. Karim, S. (2008). Belajar IPA membuka cakrawala alam sekitar untuk kelas VIII SMP dan MTs. Jakarta: Pusat Perbukuan.

[17]. Kementrian Pendidikan dan Kebudayaan. (2014). Ilmu Pengetahuan Alam untuk SMP/MTs Kelas VIII semester 1. Jakarta: Pusat Perbukuan.

[18]. Kemp, J., Morrison, G., & Ross, S. (1994). Designing Effective Instruction. New York: Macmillan College Publishing Company.

[19]. Kusuma, F. (2013). Penerapan Model Pembelajaran Learning Cycle (Lc) "5e" Berbantuan Lks Interaktif Berbasis Blog Untuk Meningkatkan Hasil Belajar Tik Siswa Kelas Xi Ipa 3 Sma Negeri 2 Singaraja Tahun Ajaran 2012/2013. Jurnal Karmapati Vol. 2, No. 1, 168-180.

[20]. Madu, & Amaechi. (2012). Effect of Five-Step Learning Cycle Model on Students' Understanding of Concepts Related To Elasticity . Journal of Education and Practice , 173-181.

[21]. Musfiqon. (2012). Pengembangan Media dan Sumber Pembelajaran. Jakarta: Prestasi Pustaka.

[22]. Nana, S. (2009). Penilaian Hasil Proses Belajar Mengajar. Bandung: PT. Remaja Rosdakarya.

[23]. Nasir, M. (2014). Pengembangan Perangkat Pembelajaran Model 5e Pada Materi Ekologi Kelas X Sma. Oryza Jurnal Pendidikan Biologi Vol. 3, no. 2, 12-22.

[24]. Ngalimun. (2014). Strategi dan Model Pembelajaran. Yogyakarta: Aswaja Pressindo.

[25]. Nirom, M. (2009). Bahan Pendidikan Dan Latihan Profesi Guru Dalam Jabatan Pengawas Sertifikasi Guru Rayon 11 Universitas Negeri Yogyakarta. Yogyakarta: Departemen Pendidikan Nasional.

[26]. Novaliendry, D. (2013). Aplikasi Game Geografi Berbasis Multimedia Interaktif (Studi Kasus Siswa Kelas Ix Smpn 1 Rao). Jurnal Teknologi Informasi dan Pendidikan. ISSN : 2008 - 4981 Vol. 6 No. 2, 50-62.

[27]. Ozgir, A., & Batdi, V. (2015). A Comparative Meta-Analysis of 5E and Traditional Approaches in Turkey . Journal of Education and Training Studies , 212-219.

[28]. Pemerintah Republik Indonesia. (2003). Undang-Undang Republik Indonesia Nomor 20 Tahun 2003 Tentang Sistem Pendidikan Nasional. Jakarta: Sekretariat Negara.

[29]. Pemerintah Republik Indonesia. (2006). Standar Isi Untuk Satuan Pendidikan Dasar Dan Menengah. Jakarta: Sekretariat Negara.

[30]. Piyayodilokchai, H., Panjaburee, P., Laosinchai, P., Ketpichainarong, W., & Ruenwongsa, P. (2013). A 5E Learning Cycle Approach–Based, Multimedia-Supplemented Instructional Unit for Structured Query Language . Educational Technology & Society, 146-159.

[31]. Prastiwi, C., & Anggaryani, M. (2014). Penerapan Strategi Pembelajaran Learning Cycle Tiepe 5e Dengan Materi Pesawat Sederhana Sebagai Upaya Meningkatkan Hasil Belajar Siswa Smp Negeri 2 Gedangan Kelas Vii. Jurnal Inovasi Pendidikan Fisika Vol. 3 No. 2, 37-40.

[32]. Qawasmeh, R. M., & Al. Syouf, A. A. (2017). The Effect of Using Computerized 5E's Learning Cycle Model on Acquiring Scientific Concepts among Fourth Graders . American Journal of Educational Research, 579-587.

[33]. Rahmat, H. (2014). Penerapan Model Learning Cycle 5E Berbasis Guided Discovery pada Pembelajaran Biologi SMA. Tesis. Surabaya: Universitas Negeri Surabaya.

[34]. Ratumanan, T., & Laurens, T. (2011). Penilaian hasil belajar pada tingkat satuan pendidikan edisi 2. Surabaya: Unesa University Press.

[35]. Rusman. (2012). Belajar dan Pembelajaran Berbasis Komputer. Bandung: Alfabet.

[36]. Sa'dun, A. (2013). Instrument PErangkat Pembelajaran . Bandung: Rosdakarya.

[37]. Sanjaya, W. (2011). Penelitian Tindakan Kelas. Jakarta: Kencana Prenada Media Grup.

[38]. Sari, I., Fitrihidajati, H., & Kuntjoro, S. (2013). Pengembangan Lembar Kegiatan Siswa (Lks) Berorientasi Model Learning Cycle 5E Pada Materi Ekosistem. Jurnal Bioedu Vol. 2 No. 1, 99-101.

[39]. Sari, K., Saputro, S., & Hastuti, B. (2014). Pengembangan Game Edukasi Kimia Berbasis Role Playing Game (Rpg) Pada Materi Struktur Atom Sebagai Media Pembelajaran Mandiri Untuk Siswa Kelas X Sma Di Kabupaten Purworejo. Jurnal Pendidikan Kimia Vol. 3 No. 2, 23-37.

[40]. Sayuti, I., Rosmaini, & Andayannhi, S. (2012). Penerapan Model Pembelajaran Learning Cycle Untuk Meningkatkan Sikap Ilmiah Dan Hasil Belajar Biologi Siswa Kelas Xi Ipa 4 Sma Negeri 5 Pekanbaru. Jurnal Pendidikan Vol. 3 No. 1, 1-11.

[41]. Seyhan, H. G., & Morgil, I. (2007). The Effect of 5E Learning model on eaching of acid-base topic in chemistry education. Journal of Science Education, 120-123.

[42]. Slavin, R. (2011). Psikologi Pendidikan Teori dan Praktek Edisi kesembilan. Jakarta: PT. Indeks.

[43]. Sudjana. (2001). Penilaian Hasil Proses Belajar Mengajar. Jakarta: PT. Remaja Rusdakarya.

[44]. Sudjana, N. (2005). Penilaian Hasil Proses Belajar Mengajar. Bandung: PT. Remaja Rosdakarya.

[45]. Sugiyono. (2010). Metode Penelitian Belajar Mengajar. Bandung: Alfabeta.

[46]. Suharsimi, A. (2009). Dasar-Dasar Evaluasi Pendidikan. Jakarta: Bumi Aksara.

[47]. Suhendar, A., & Prasetiawan, I. (2015). Perancangan Game Edukasi Pada Smpn Cidahu Kelas Vii Berbasis Multimedia. Jurnal Protekinfo Vol. 2 September 2015, 1-4.

[48]. Suprijono, A. (2012). Cooperative Learning: Teori Dan Aplikasi Pakem. Yogyakarta: Pustaka Pelajar.

[49]. Susanto, A. (2013). Teori Belajar dan Pembelajaran di Sekolah Dasar. Jakarta: Kencana Prenadamedia Group.

[50]. Susanto, A. (2014). Teori Belajar dan Pembelajaran di Sekolah Dasar. Jakarta: Kencana.

[51]. Syah, M. (2011). Psikologi Pendidikan dengan Pendekatan Baru. Bandung: Remaja Rosdakarya.

[52]. Thiagarajan, S., Semmel, D., & Semmel, M. (1974). Instructional Development for Training Teachers of Exceptional Children a Sourcebook . Indiana: Indiana University.

[53]. Trianto. (2012). Mendesain Model Pembelajaran Inovatif-Progresif: Konsep, Landasan, Dan Implementasinya Pada Kurikulum Tingkat Satuan Pendidikan (Ktsp). Jakarta: Kencana.

[54]. Trowbridge, L., Bybee, R., & Powell, J. C. (2004). Teaching Secondary School Science:Strategies for Developing Scientific Literacy. New Jersey: Merrill Publisher.

[55]. Tuna, A., & Kacar, A. (2013). The Effect Of 5e Learning Cycle Model In Teaching Trigonometry On Students' Academic Achievement And The Permanence Of Their Knowledge . International Journal on New Trends in Education and Their Implications , 73-87.

[56]. Tural, G., Akdeniz, A. R., & Alev, N. (2010). Effect of 5E Teaching Model on Student Teachers' Understanding of Weightlessness. Journal of Science Education and Technology, 470-488.

[57]. Tzu-Chien, L., Peng, H., Wu, W.-H., & Lin, M.-S. (2009). The Effect of Mobile Natural-Science Learning Based 5E Learning Cycle:A Case Study. Educational Technology & Society, 344-358.

[58]. Usman, M. (2010). Menjadi Guru Profesional. Bandung: Remaja Rosdakarya.

[59]. Wasis, & Irianto, S. (2008). Buku Ilmu Pengetahuan Alam SMP dan MTs kelas VIII. Jakarta: PT. Sekawan Cipta Karya.

[60]. Wulandari, R., Sunardi, & Kurnia, I. (2014). Pengembangan Perangkat Pembelajaran BerbasisPembelajaran Matematika RealistikPokok Bahasan Kubus Dan Balok. Pancaran Vol. 3 No. 1 Februari, 131-140.

[61]. Yalcin, F. A., & Bayrakceken, S. (2010). The Effect of 5E Learning Model on Pre-Service Science Teachers' . International Online Journal of Educational Sciences, 508-531.