DEVELOPMENT OF STUDENT WORKSHEETS (LKS) BASED LEARNING CYCLE 5E ON MAIN MATERIAL ELASTICITY AND HOOKE'S LAW CLASS X HIGH SCHOOL

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Abstract

Has successfully developed the student worksheets (LKS) 5E learning cycle based on the subject matter and Hooke's law of elasticity class X SMA valid and practical. The process of developing student worksheet (LKS) through the steps of research development model based product development Rowntree, include: (1) the planning stage of the needs analysis worksheets, requirements analysis learning cycle 5E, analysis of material needs elasticity and Hooke's law (2) stage the development of the formulation of learning objectives, development topics, the drafting, production prototypes, and (3) the evaluation stage. At this stage of the evaluation, researchers used a model formative evaluation Tessmer and tailored to the needs of researchers, namely: (1) self-evaluation; (2) The expert review; (3) one-to-one; and (4) small group. Data collection techniques used in the form walkthrough (validation expert lecturer and teacher of physics), the questionnaire responses of students, and student activity observation. The results of the research development of student worksheet (LKS) showed that the results of the validation stage of expert reviews, the average ratings of 88.20 validator (category very valid), meaning the student worksheet (LKS) product developed by the researchers included in the category of very valid. The results of the questionnaire responses of students at the stage of one-to-one shows the average percentage of 82.37% (practical categories), and at the stage of a small group showed that average percentage of 90.88% (the category of very practical), means the student worksheet (LKS)product had a very practical according to student responses. The average percentage of student activity by 90% (the excellent category), meaning the student worksheet (LKS)product is excellent when used in learning physics. Based on the results of the study concluded that the student work product sheet (LKS) 5E learning cycle based on the subject matter and Hooke's law of elasticity class X SMA developed was valid and practical.

Key Words : research development, student activity sheet, 5E learning cycle, elasticity and Hooke's law

1. Introduction

Physics is one branch of science, and a science that was born and developed through the steps of observation, problem formulation, formulation of hypotheses, testing hypotheses through experimentation, drawing conclusions, as well as the discovery of the theory and concepts (Trianto, 2010: 137). Understanding of the concept of physics is not enough just to provision of material or information from the teacher, but the students are also expected to construct their own understanding of the concept. According to the theory of constructivism learning, teachers cannot just provide knowledge to students. Students had to build their own knowledge in his mind. Teachers can provide convenience to this process, by giving students the opportunity to find and implement their own ideas for learning (Dahar, 2006: 165). To help students construct understanding, it is necessary teaching materials appropriate for the learning process is running as desired.

Instructional materials are divided into four kinds, including printed teaching materials, teaching materials hear, hear viewpoint of teaching materials, and interactive teaching materials (Prastowo, 2011: 40).Teaching materials are often used in the learning process is printed teaching materials include student worksheets (LKS). The advantage of using worksheets in the learning process is easier for teachers in implementing the learning, and for the students can be used independently to understand and execute a task (Majid, 2009: 177).

Curriculum implementation in 2013 in the lesson can be done with a variety of approaches. Such approaches include constructivist approach (constructivism teaching and learning). Constructivism learning approach emphasizes the process of building (to construct) the student's knowledge. One model of learning with a constructivist approach is the learning cycle phase 5 or 5E learning cycle.

The learning model, most have seen a strategic role in the effort to boost the success of the learning process. Since he moved to see the condition of the needs of students, so the teacher is expected to deliver material accurately without causing students experience boredom. The learning model learning cycle developed by J.

Myron Atkin, Robert Karplus and SCIs Group (Science Curriculum Improvement Study), at the University of California, Berkeley, United States since 1967 (Zolman, 1998).

Basic competencies that must be achieved in learning physics class X the second half of which is KD 3.6 Analyze the elasticity properties of materials in everyday life, KD 4.6 Process and analyze the results of experiments on the properties of elasticity of a material. To be able to understand the material elasticity and Hooke's law, is necessary to understand the concept of previous material relating, so that knowledge can be awakened early students. In addition, the material elasticity and Hooke's law there are many applications of everyday life. This is in line with the learning cycle model of learning where learning with this model emphasizes the process of building the student's knowledge. Knowledge is built within the students independently through interaction with the environment that will be processed through learning experiences to acquire new knowledge (Ngalimun, 2016: 174). With the LKS based 5E learning cycle is expected that students can explore their ideas to gain new knowledge by itself, as well as familiarize students to think independently and critically. It is expected that students can easily construct their understanding of the material and the success of the implementation of the curriculum in 2013 can be realized.

Based on the background described above, then the researchers intend to conduct research with the title "Development of Student Worksheet (LKS) Based 5E Learning Cycle on Main Material Elasticity and Hooke's Law Class X High School". The aim is to develop the student worksheet (LKS) 5E learning cycle based on the subject matter Hooke's law of elasticity and class X SMA valid and practical.

2. Method

The method used in this research is the development of research. In this development study, researchers used a model of development Rowntree. Rowntree development model is a model-oriented products, in particular for producing an instructional materials. Subjects in this study were students of class X SMAN 2 Palembang. The study was conducted in March and April in SMA N 2 Palembang in the second semester of the 2015/2016 academic year.

Procedure development research was conducted in three stages, namely the planning stage, the stage of development, and evaluation phase. The planning stage includes needs analysis, the BLM needs analysis, requirements analysis 5E learning cycle and analysis of material needs and Hooke's law of elasticity. Stages of development, including the formulation of learning objectives, development topics, the drafting, prototyping and production. Formulation of learning objectives aims to determine the necessary competence possessed by the student after a learning program, formulated learning objectives of core competence and basic competence in the syllabus which refers to the curriculum of 2013. Development of the topic conducted to determine the subject of the subject matter and Hooke's law of elasticity that will explained to students through the student worksheet (LKS). The drafting of the student worksheets (LKS) was conducted to determine the sequence of learning which will follow the phases of learning activities in the learning model 5E learning cycle. Production of the prototype is done by completing and editing the draft that has been prepared. At this stage of the evaluation, researchers used a model formative evaluation Tessmer and tailored to the needs of research, namely: (1) self-evaluation; (2) The expert review; (3) one-to-one; (4) small group.

Data collected by using sheets of validation given to experts, a questionnaire used to determine the opinion of learners against the practicality of the use of student worksheet (LKS), as well as the observation sheet to retrieve the data by looking at the activity of students during learning using student worksheet (LKS).

3. Result and Discussion

Research result

The result of the development of generating student worksheet (LKS) 5E learning cycle based on the subject matter Hooke's law of elasticity and class X SMA. Student worksheet (LKS) is divided into three sessions, namely: first meeting with the material elasticity of the material; 2 meeting with the subject matter of the meeting 3 Hooke's law with the subject matter of a spring arrangement. At each meeting developed by following the phases of learning model 5E learning cycle. The descriotion of several phases in the learning model 5E learning cycle in the student worksheet (LKS) is as follows:

Table 1. Description of Phase - Phase Learning Cycle 5E in LKS

Phases of Learning Cycle 5E	Information
Engagement Phase	In this phase there are illustrations of everyday life problems related material and Hooke's law of elasticity. Expected by the illustrations beginning students to gain knowledge and their ideas, interests and curiosity about the topics that will be taught. Then proceed with the questions related to the events that had just observed.
Exploration Phase	Students experiment with the prior knowledge that has been owned by the students. At this stage the teacher acts as a facilitator and motivator.
ExplanationPhase	Students try to explain a concept with a sentence or his own thinking. Later plus a discussion of activities to strengthen students' understanding.
Elaboration Phase	Students apply the concepts and skills they have learned in new situations and different contexts.
Evaluation Phase	Students perform a self-evaluation, understand the shortcomings and advantages.

The elements in the student worksheet (LKS) based learning cycle 5E developed by researchers is part of the front page (cover), preface, table of contents,

concept maps, learning objectives, basic competence, indicators of learning, lesson plans, learning materials, to summarize, the journal study and answer keys, learning material presented in three meetings and each meeting is presented phases correspond to the phases of the learning model 5E learning cycle and independent journal.

The results of the evaluation of the student worksheets (LKS) is based on the validation sheet and questionnaire responses of students is as follows:

Table 2. Results of Validation Student Worksheet (LKS)

No.	aspects Rating	Average Every Aspect	Category
1	Contents	87%	Very Valid
2	Language	93.33%	Very Valid
3	Design	84.28%	Valid
Average Rate Validator		**88.20%**	**Very Valid**

Table 3. Summary of Assessment Score Questionnaire One-to-one

Statement	scores of Respondents		
	MGS	**MIM**	**BO**
point 1	5	5	4
point 2	5	4	4
point 3	4	4	4
point 4	4	4	4
point 5	4	4	5
point 6	5	4	4
point 7	4	4	4
point 8	4	3	3
point 9	5	4	3
point 10	4	5	3
point 11	4	4	4
point 12	4	4	4
point 13	4	4	4
point 14	5	5	4
total score	61	58	54
Practicalities Value (%)	87.14	82.85	77.14
Category	Very Practical	Practical	Practical

Table 4. Summary of Assessment Questionnaire Score Small Group

Statement	Scores of Respondents								
	DS	**DG**	**TC**	**TA**	**SMC**	**GAP**	**AY**	**AFS**	**MR**
point 1	5	5	4	4	5	5	5	5	4
point 2	5	4	4	5	5	5	5	5	4
point 3	4	4	4	5	4	4	5	4	4
point 4	5	4	5	5	4	4	5	5	5
point 5	5	4	4	4	5	5	5	5	3
point 6	4	4	3	5	5	4	5	5	3
point 7	5	3	3	4	4	5	5	5	4
point 8	5	4	4	5	5	5	3	5	4
point 9	5	4	4	5	5	5	4	5	4
point 10	5	5	3	5	5	5	5	5	5
point 11	5	5	4	5	5	5	5	5	5
point 12	5	5	4	4	5	5	5	5	5
point 13	5	4	4	5	5	5	5	5	4
point 14	5	4	4	4	5	4	5	5	4
Total Score	68	59	54	65	67	66	67	69	58
Practicalities Value (%)	97.14	84.28	77.14	92.85	95.17	94.28	95.71	98.57	82.85
Criteria	very Practical	Practical	Practical	very Practical	very Practical	very Practical	very Practical	very Practical	Practical

At the stage of a small group, each student studying student worksheet (LKS). During the learning takes place, the observer observing the activity of students using observation sheet that has been provided. Based on observations obtained by the average percentage of student activity by 90% and is in excellent condition.

Discussion

The curriculum developed by the government at the moment is the curriculum of 2013. The process of learning to the curriculum in 2013 for all levels implemented using a variety of approaches, including constructivism approach. Constructivist approach emphasizes the process of building (to construct) the student's knowledge. One model of learning with a constructivist approach is the learning cycle 5fase or 5E

learning cycle. To cultivate learning by using phases contained in the learning model 5E learning cycle in accordance with the demands of the curriculum in 2013 can be done by developing teaching materials namely student worksheet (LKS). Development of student worksheet (LKS) aims to help students to learn continuously, directed, and more systematic. Student worksheet (LKS) is required as a companion book or supplement supporting student handbook that allows students to learn actively and independently.

Student worksheet (LKS) is divided in three meetings with the subject matter of the material elasticity, Hooke's law, and the arrangement of the spring. At each meeting the student worksheet (LKS) developed by following the phases contained in the learning model 5E learning cycle the engagement phase, the phase of exploration, explanation phase, the phase of elaboration and evaluation phase. Student worksheet (LKS) developed covering the front page (cover), preface, and table of contents, concept maps, learning objectives, basic competencies, and indicators of learning, learning plans, learning materials, summaries, learning journal and an answer key.

Evaluation of student worksheet (LKS) first performed by the researchers themselves, in consultation with the thesis supervisor. After that the student activity sheet (LKS) validated by 2 people physics professor, one lecturer Indonesian and three subject teachers of physics. Validator provide comments and suggestions to the student worksheet (LKS) lies on the cover, grammar, spelling writing, tables and graphs as well as in the example problems to be reproduced again. Then the researchers improve student worksheet (LKS) is based on the advice of some experts, researchers also added quick info or additional information in accordance with the material elasticity and Hooke's law so that students know the real application of the material elasticity and Hooke's law, researchers add more example problems where examples of questions on the student worksheet (LKS) is equal to "come on sharpening your ability!" added the elaboration phase. The tests showed that the student worksheet (LKS) is otherwise very valid after being repaired.

At the stage of one-to-one, student worksheet (LKS) tested to 3 students. Based on the observations of researchers for ongoing trials activities, students' difficulties in answering sample questions with a reduction formula, while in answering questions related to the daily life they are very enthusiastic. According to all three students at the stage of one-to-one, student worksheet (LKS) researchers have developed an interesting but an explanation would be a decrease in the formula is still deemed less. The results of the questionnaire responses of students to the student worksheet (LKS) on the stage of one-to-one, indicating that the student worksheet (LKS) otherwise practical with some improvements. Based on the observations of investigators during the course of one-to-one and the comments of students, researchers improve student worksheet (LKS) by adding the sample questions along with a decrease in the formula and fix the distance between the posts. In addition, researchers also improve the sentences in student worksheets (LKS), especially in sub material Hooke's law with clear and concise sentences and adding images so that students can better understand the questions in the student worksheet (LKS) and answer them.

At the stage of a small group, student worksheet (LKS) tested to 9 students. During the learning process, student activities were observed and assessed using observation sheet by an observer. Results of student activity observation and questionnaire responses of students to the student worksheet (LKS) on the stage of a small group, indicating that the student worksheet (LKS) which has been developed by researchers stated very practical with some revisions. The revision of the researchers improve the layout of the image and add a caption on an image, enlarge the size of the formula contained in the student worksheets (LKS) and correct the spelling of writing.

4. Conclusion and Remark

Based on the results, it can be summed up as follows:

1. Student worksheet (LKS) 5E learning cycle based on the subject matter and Hooke's law of elasticity class X SMA developed by researchers declared invalid based on the results of validation with experts. It can be seen from the average assessment of the results of expert validation of 88.20% with a very valid category.
2. Student worksheet (LKS) 5E learning cycle based on the subject matter and Hooke's law of elasticity class X SMA developed by researchers stated practical. It can be known based on the observation of student activity at the stage of a small group with a mean percentage of student activity by 90% with very good categories and the results of the questionnaire responses of students to the student worksheet (LKS) with an average percentage of 90.88% with a very practical category. Thus the student worksheet (LKS) based 5E learning cycle developed has been tested practicality.

Remark

Based on the research that has been done, researchers gave some suggestions as follows:

1. Products LKS results of this research can be used by teachers and students in learning physics at school
2. Limitations of this study is based LKS 5E learning cycle only tested up to small groups. It is therefore suggested the next researcher to conduct similar studies to conduct field trials or actual class test.
3. LKS need to be developed based on 5E learning cycle for other fine materials physics in junior high or high school.
4. LKS subject Hooke's law of elasticity and can be developed with a base or model of learning.

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