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DEVELOPMENT OF *STEM-PjBL* BASED WORKSHEET INTEGRATED ENTREPRENEUR CHARACTERISTICS TO IMPROVE CREATIVE THINKING SKILLS

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Abstract

The purpose of this development research is to produce an integrated STEM-PjBL-based worksheet product with entrepreneurial characteristics oriented towards students' creative thinking skills in the subject of energy in life. This research is a type of research and development using the 4D model which consists of 4 mutually continuous stages, namely: define, design, develop, and disseminate. STEM-PjBL based worksheet has been developed and validated by material expert validators and media expert validators. Then it was tested on class VII students at SMP N 1 Jambi City. The results of the analysis of science teachers' responses to worksheet obtained an average percentage score of 89.58% which was categorized as "very good". While the results of the student response questionnaire in the small group trial, an average percentage score of 90% was obtained. Then a large group trial was carried out to see the effectiveness of the worksheet. Obtained an average score of students' activity acquisition related to indicators of creative thinking ability experienced an increase. Based on the results obtained in this study it can be concluded that the worksheet developed is feasible to use.

Keywords: Creative Thinking, Development, Middle School, STEM-PjBL Based Worksheet.

INTRODUCTION

The pandemic, which has been running for two years, has caused millions of people to lose their jobs. More than 1.5 million workers were laid off, 10% of them were laid off (Hanoatubun, 2020). However, interestingly, several business fields are growing rapidly, such as creative businesses, goods delivery services, and digital marketing. Why is that? The pandemic caused changes to the order of life on Earth. Physical contact that must be kept to a minimum, limiting visits to certain places, distance learning, and so on. This causes entrepreneurs to see opportunities. Entrepreneur according to Suryana (2013) is someone who applies a process in an innovation and creativity to find answers to a problem. An entrepreneur has entrepreneurial values within him.

One of the attributes of entrepreneurship is creativity (Hill, 2016). This ability allows one to see various possibilities in solving a problem (Fatmawati, 2011). Meanwhile Siswono (2009) sees creativity as a process to produce something new from elements that have been formed by changing the arrangement of these elements. One of the main constituents forming creativity

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is the ability to think creatively. The ability to think creatively itself is composed of several components, namely fluency, originality, flexibility, and elaboracy.(Silver, 1997). This ability is needed in the formation of ideas or ideas in finding solutions to a problem. However, based on data from The Global Creativity Index for 2015, Indonesia is ranked 115th out of 139 countries.(Florida, Mellander, & King, 2015).

Based on the needs analysis conducted by the author at SMPN 1 Jambi City, both students and educators have several problems in developing creative thinking skills. Based on the analysis of lesson plans and test questions on energy in life as well as interviews with educators, information is obtained, namely: educators are still focused on developing low-level thinking skills (Low Order Thinking Skills) seen in the formulation of learning objectives and indicators of competency achievement using operational verbs C1 to C3, only 10% of test questions require C4 abilities and there are no questions with C6 criteria that require creative abilities, educators have not used teaching materials that can support students to develop their creativity. Meanwhile, based on the results of a questionnaire distributed to 20 students, information was obtained, namely: 80% of students could not provide 2 or more solutions to the problems given, 50% of students did not answer problems based on facts and 70% of students were used to being uniform in doing Duty. These things resulted in little variation in the tasks carried out by students to answer a problem given by the teacher. Most students replicate the examples presented. In terms of the *worksheet* used by students, the structure of *worksheet* is more focused on developing lower-level thinking skills, some activities in the form of attached performance are not accompanied by work procedures and students do not know the purpose of these activities. 80% of students cannot provide 2 or more solutions to a given problem, 50% of students do not answer problems based on facts and 70% of students are used to being uniform in doing assignments. These things resulted in little variation in the tasks carried out by students to answer a problem given by the teacher. Most students replicate the examples presented. In terms of the *worksheet* used by students, the structure of *worksheet* is more focused on developing lower-level thinking skills, some activities in the form of attached performance are not accompanied by work procedures and students do not know the purpose of these activities. 80% of students cannot provide 2 or more solutions to a given problem, 50% of students do not answer problems based on facts and 70% of students are used to being uniform in doing assignments. These things resulted in little variation in the tasks carried out by students to answer a problem given by the teacher. Most students replicate the examples presented. In terms of the *worksheet* used by students, the structure of *worksheet* is more focused on developing lower-level thinking skills, some activities in the form of attached performance are not accompanied by work procedures and students do not know the purpose of these activities. 50% of students do not answer problems based on facts and 70% of students are used to being uniform in doing assignments. These things resulted in little variation in the tasks carried out by students to answer a problem given by the teacher. Most students replicate the examples presented. In terms of the *worksheet* used by students, the structure of *worksheet* is more focused on developing lower-level thinking skills, some activities in the form of attached performance are not accompanied by work procedures and students do not know the purpose of these activities. 50% of students do not answer problems based on facts and 70% of students are used to being uniform in doing assignments. These things resulted in little variation in the tasks carried out by students to answer a problem given by the teacher. Most students

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To develop creative thinking skills, educators must provide opportunities for students through learning activities presented in class. One learning model that has a major influence on the ability to think creatively is project-based learning with the STEM approach (STEM-PjBL).(Kristiani, Mayasari, & Kurnadi, 2017). Apart from creativity, another advantage of using this model in learning according to Asri (2018) is that it can improve the ability to think logically, solve problems, and work in teams.

Based on the description put forward, the learning that is currently applied is experiencing problems in the form of students' creative thinking abilities which are still low. The lessons presented still focus on low-level thinking skills and there are no student worksheets available that can support students' ability to think creatively. So that causes educators have not been able to accommodate students in developing their creativity. Therefore the author intends to present learning that can give birth to students who are creative and innovative and can answer the problems around them through the development of STEM-PjBL-based worksheets that integrate entrepreneurial characteristics.

RESEARCH METHODS

This research is a development research (development research) which aims to develop a learning model on the subject of energy in life. This research focused on the development of student worksheets (LKPD) based on STEM that integrated the character of an entrepreneur for seventh grade students of junior high school on Energy in Life material.

This study was designed using the 4-D model development design developed by Thiagarajan and Semmel. The basis for using this model in development is because the 4-D model is a procedural model that is descriptive in nature with systematic and more detailed stages.

Procedures carried out in the development of *worksheet* on the materialEnergy in Living Systems has several stages as follows:

1. Defining Stage (Define)

This stage is carried out to establish and define development requirements, starting with an analysis of the objectives of the material boundaries being developed by the device. This stage includes: a) front end analysis, b) student analysis, c) task analysis, d) concept analysis, e) formulation of learning objectives.

2. Design Stage (Design)

The purpose of this stage is to elaborate on the STEM approach that integrates entrepreneurial characteristics into *worksheet* on the subject of energy in living systems. This stage consists of three steps, namely: preparation of test standards, selection of learning tools, and selection of formats.

3. Development Stage (Develop)

The development stage consists of two stages, namely expert validation and testing (Thiagarajan (1974) in Surani (2017)). Expert validation aims to assess the feasibility of the

designed product. The developed *worksheet* will receive an assessment from two validators, namely the media expert validator and the material expert validator. While the trial phase, the product developed is used by the actual research subject. The results at this stage will be used to revise the product. After the product was revised, the product was tested again on more subjects to obtain effective results.

4. Stage of Dissemination (Disseminate)

At the development stage the end result is a product that will be implemented on the real target. At this stage, an assessment of the achievement of goals will be carried out. This assessment aims to test the effectiveness of the product that has been developed. After the product is tested, the researcher can observe the results of achieving the goals. If there are development goals that have not been achieved, the researcher needs to explain the solution so that mistakes are not repeated after the product is deployed. The final stage of deployment is packaging. This is done so that the developed product can be utilized. Where in this study, the developer focuses on students' creative thinking abilities.

RESULTS AND DISCUSSION

The results obtained from this development research are (1) STEM-PjBL-based student worksheets integrated with entrepreneurial character in the material on Energy in life (2) Assessment of the material and design of *worksheet* by material experts and design experts, (3) Response science teachers and students on the developed *worksheet*, (4) Observation sheets for students' creative thinking abilities when using the developed *worksheet*.

The stages that have been carried out in this *worksheet* development research are as follows:

1. Defining Stage (Define)

Judging from the teaching materials used, teachers more often use *worksheet* when presenting learning. This *worksheet* contains material and assignments that will be done by students. Most of the questions contained in the *worksheet* still lead to low-level thinking skills, only 10% lead to analytical abilities and none of the questions lead to creative thinking abilities. The *worksheet* structure is more focused on developing low-level thinking skills because it is textual in nature, some of the performance activities attached are not accompanied by work procedures and students do not know the purpose of these activities.

2. Design Stage (Design)

After the defining stage, the design stage for the developed worksheet is carried out. There are two integrations that will be mixed into this worksheet, namely STEM-PjBL based and entrepreneur character. The defining stage aims to produce an initial draft in the form of a storyboard for the developed worksheet. The design stage is the design activity for making teaching materials. The first step begins with compiling a framework for making worksheet teaching materials. The reference in preparing worksheet teaching materials is the product specifications that have been made. The next step is to design a storyboard to collect material about heat and its transfer. After that, make a product design worksheet, then do an assessment by experts. Assessment instruments for worksheet teaching material validation activities are material expert instruments and media experts. The validation sheets developed were material expert validation sheets, media expert validation sheets, teacher assessment questionnaires and

student response questionnaires. These four instruments are used to assess teaching materials that have been developed.

3. Development Stage (Develop)

a. Worksheet Material Validation

Material validation and learning design for the developed worksheet were carried out by Dr. Tanti, S.Si., M.Si. The purpose of this step is to see the compatibility between the material presented in the worksheet and the design of the STEM-PjBL learning model. The results of the assessment of the material in the worksheet are as follows.

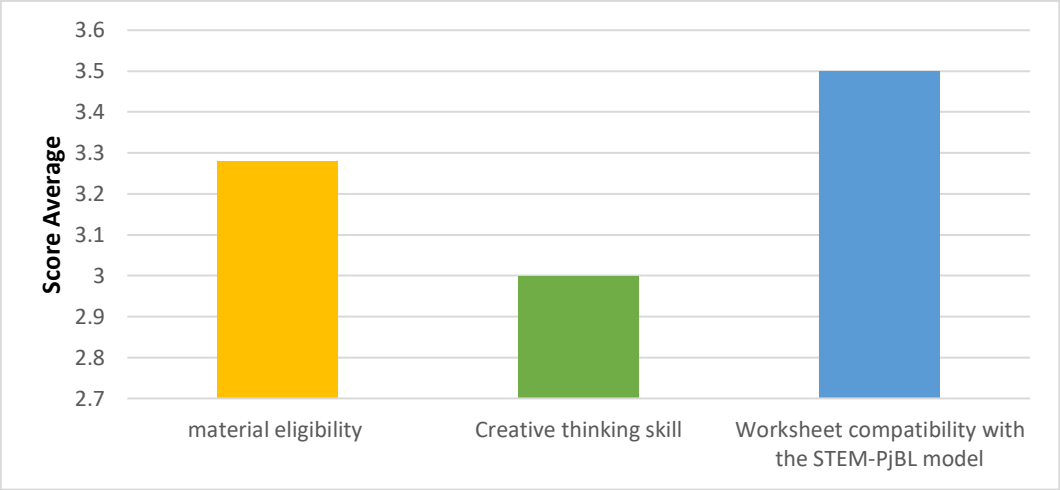

Figure 1. Graph of Material Expert Assessment Results and Learning Design

Through the graph, it is obtained an indicator that has the highest average score on the aspect of conformity of worksheet with the STEM-PjBL model. This is because the developed worksheet adopts activities in the STEM-PjBL syntax. Conversely, the aspect with the lowest score is the ability to think creatively. Based on the suggestions from the validator, the activities that are packaged in should be emphasized again on the creative and innovative process. However, overall worksheet has met the criteria both in terms of material and learning design.

b. Worksheet Design Validation

Design validation of the product being developed was carried out by Prof. Damris MMSc., Ph.D. The purpose of this step is to see the suitability of product development based on the principles of worksheet development. The results of the assessment of the media design are as follows.

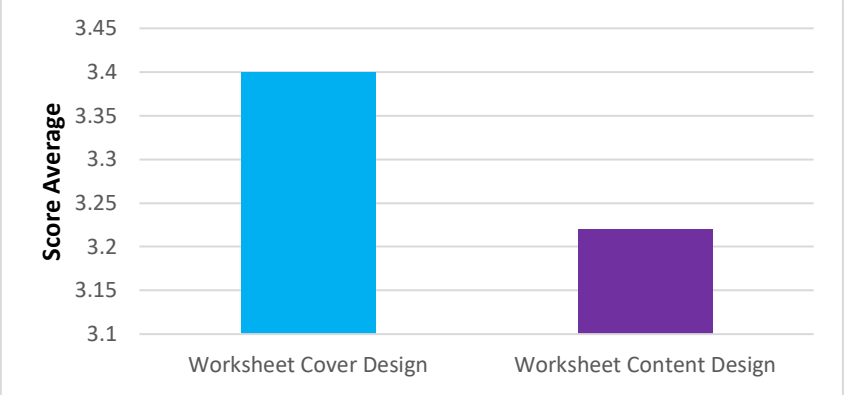

Figure 2. Graph of Media Design Expert Assessment Results

Through the media design expert's assessment, an average score of 3.4 was obtained for the worksheet cover design. This is the highest achievement in the assessment because the cover design meets the good criteria in every aspect of the indicator. On the other hand, content design gets an average score of 3.2 based on expert judgment. Even so, the two indicators met the good criteria for the overall assessment.

c. Individual Trial

After the worksheet was declared feasible by the material expert validator and the design expert validator, individual trials were carried out on worksheet users. The trial was conducted on two science teachers using a teacher response questionnaire. Based on the results of the teacher's response questionnaire analysis, a percentage score of 89.58% was obtained which was categorized as "very good". So that in terms of the feasibility aspect, STEM-PjBL-based worksheets integrated with entrepreneurial characteristics are suitable for use in the learning process.

d. Small Group Trial

After the worksheet was declared feasible by the validation team and the teacher, a small group trial was conducted on 16 students. This is done to obtain information about the weaknesses and shortcomings of the developed worksheet. The selected respondents have various levels of understanding seen from their learning outcomes, namely: high, medium, and low. Based on the results of the student response questionnaire, a percentage score of 90% was obtained which was categorized as "strongly agree". So it can be concluded that the respondents strongly agree that the STEM-PjBL-based worksheet is integrated with entrepreneurial characteristics. This is interesting and easy for students to understand.

4. Stage of Dissemination (Disseminate)

The final stage of the 4D development model is disseminate. At this stage, validation testing or large group trials are carried out which aim to test the effectiveness of the product against development goals. The experimental testing design was carried out using the one-shot case study design. This design does not require the existence of a control group in testing a product(Rusdi, 2018). The developer uses observational data using the previous worksheet as a substitute for the pretest. Then the developer tested the developed worksheet and made

observations as a posttest. The tryout was carried out on 24 students at SMP Negeri 1 Jambi City through observing creative thinking skills before and after using worksheet. The results obtained through this large-stage trial are as follows:

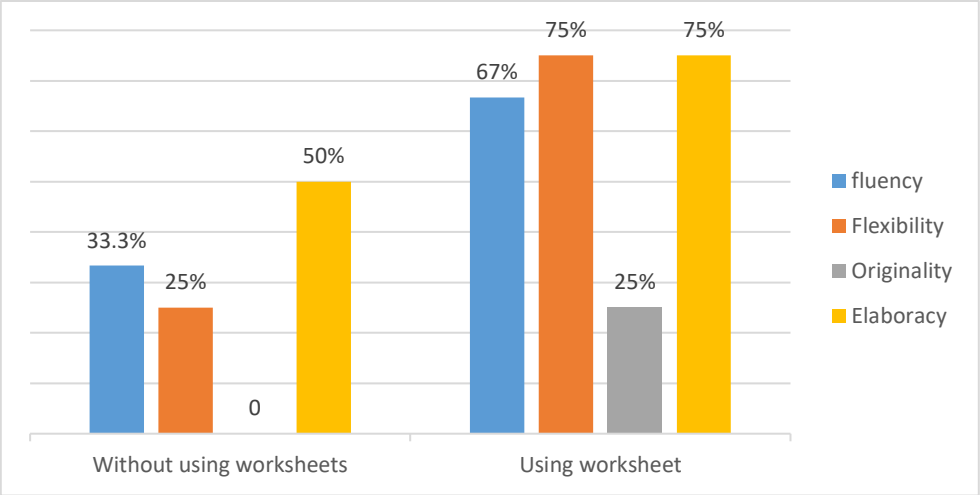

Figure 3. Observation Results of Creative Thinking Ability

Through the graph, it can be seen that there is an increase in each indicator of creative thinking when students use the worksheet developed for learning. The most significant increase occurred in the flexibility indicator, which was 50%. According to Siswono T (2009) flexibility is the ability of students to solve problems in various ways. This is in accordance with the observer's notes, students showed various ways to make a solar oven, both in terms of tools and materials as well as how it works. Another indicator that shows improvement when using worksheet is novelty. Students succeed in asking several unique questions, ideas, and ideas related to the problem to be solved.

Overall, each indicator on students' creative thinking skills has increased. This is in accordance with research conducted by Ani Ismayani (2016), where STEM-PjBL learning is effective in increasing students' creative thinking abilities. This is because STEM-PjBL learning activities in worksheet make students learn to solve problems using their own ideas and ideas and integrate entrepreneurial characteristics into motivation for students in developing their creativity.

CONCLUSION

Based on the results of the developer's research and discussion on the development of student worksheet based on STEM-PjBL on energy in life for class VII junior high school students, it was concluded that the feasibility of the product was carried out by an expert validator and from the results of the product validation it was stated that it was feasible to be tested. After being declared feasible by experts, the next step is to try out the worksheet products in the field by teachers and students. In the teacher's assessment, it was found that the percentage of the total score of the two teachers was 89.58% in the "strongly agree" category with integrated STEM-PjBL-based worksheets. These entrepreneurial characteristics are interesting and easy for students to understand. In addition, student assessments were also carried out in small group tests, it was found that the overall average percentage was 84% in the "very decent" category. Then a large group trial was carried out by comparing the activities

of students related to the ability to think creatively when not using the developed worksheet and when using the developed worksheet. The trial results show an increase in each indicator of creative thinking when students use the WORKSHEET developed for learning. The most significant increase occurred in the flexibility indicator. The trial results show an increase in each indicator of creative thinking when students use the worksheet developed for learning. The most significant increase occurred in the flexibility indicator. The trial results show an increase in each indicator of creative thinking when students use the worksheet developed for learning. The most significant increase occurred in the flexibility indicator.

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