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Development of Integrated Science Worksheet with Immersed Model Based on Corncob Utilization Project to Improve Students' Creative Thinking Skills

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Abstract: This study aims to develop an Integrated Science Student Worksheet Immersed based on the use of corn cobs to improve the creative thinking skills of junior high school students. This study uses the ADDIE research and development method by Dick and Carry. The results obtained, namely expert validation, showed that the average percentage of the aspect of content conformity to basic competencies was 92.07% and the construction aspect of the student worksheet component was 100% with very high criteria. The effectiveness of student worksheets in terms of n-gain and effect size , respectively, is of 0.93 and 0.95 with large criteria. Based on this, the immersed integrated science student worksheet based on the corn cob processing project is effective for improving the creative thinking skills of junior high school students.

Keywords: student worksheets, project-based learning, creative thinking.

Abstrak: *Penelitian ini bertujuan untuk mengembangkan Lembar Kerja Peserta Didik IPA Terpadu model Immersed berbasis proyek pemanfaatan tongkol jagung untuk meningkatkan keterampilan berpikir kreatif siswa SMP. Penelitian ini menggunakan metode penelitian dan pengembangan ADDIE oleh Dick and Carry. Adapun hasil yang diperoleh yaitu Validasi ahli menunjukkan bahwa rata-rata persentase aspek kesesuaian isi terhadap kompetensi dasar sebesar 92,07 % dan aspek konstruksi terhadap komponen lembar kerja peserta didik sebesar 100 % dengan kriteria sangat tinggi. Keefektifan lembar kerja peserta didik ditinjau dari n-gain dan effect size berturut-turut sebesar sebesar 0,93 dan 0,95 dengan kriteria besar. Berdasarkan hal tersebut, lembar kerja peserta didik IPA terpadu immersed berbasis proyek pengolahan tongkol jagung efektif untuk meningkatkan keterampilan berpikir kreatif siswa SMP.*

Kata kunci: *lembar kerja peserta didik, pembelajaran berbasis proyek, berpikir kreatif.*

▪ INTRODUCTION

The new paradigm of 21st century learning states that the life and work environment of the digital era is so complex and highly competitive, that students need more than simple thinking skills (Sulistianingsih, 2019). 21st century learning is a real challenge for educators to be able to produce human resources who are able to take part in real life, creating a productive, creative, innovative generation and life skills (Wijaya, 2016; Andrini, 2016; Kabeel, 2016, Taghva, 2014).

One of the skills that must be trained to form a superior generation today is creative thinking skills. Creative thinking can teach students to be able to develop, find or create new constructive combinations based on existing data, information, or elements, with different perspectives, which appear as a manifestation of the problems they feel, so as to produce useful solutions (Diawati, Liliasari, Setiabudi, & Buchari, 2017; Al-Sulaeman, 2009). The indicators of creative thinking skills by Torrance in Al-Sulaeman (2009) are fluency, flexibility, originality and elaboration.

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To realize learning in practicing creative thinking skills, educators need to prepare appropriate learning models. One suitable learning model to improve students' creative thinking skills is project-based learning or PBP (Bell, 2010). Through PBP students will be directed to join the learning process actively and independently (Kokotsaki, 2016). PBP is also considered a suitable form of learning in the field of science studies (Movahedzadeh, 2012). Several studies have also stated that PBP has a positive impact on creative thinking skills (Antika, 2017; Rambely, 2013).

John Dewey and other progressive educators laid the curricular and psychological foundations for project-based learning, whose core values are child-centred learning, learning by doing, and implementing school learning at home (Diawati, Liliasari, Setiabudi, & Buchari, 2017) . This learning model provides a learning experience for students through project activities that lead to the creation of a product (Ardianti, Pratiwi, & Kanzunnudin, 2017). The existence of project activities will support the development of the potential of each student. This PBP is considered an alternative pedagogy to traditional student-centered teaching in primary, secondary, and higher education (Chen & Yang, 2019). Learners in PBP typically work in small groups and collaboratively explore projects with peers (Guo Pengyue, 2021; Chen & Yang, 2019). The PBP learning model has characteristics that are in accordance with the immersed integrated model Diawati , Fadiawati & Herlina, 2020).

Integrated model is immersed designed to combine data from each field of science according to the interests of each student (Diawati, Liliasari, Setiabudi, & Buchari, 2017). The interest of students can be grown through the provision of problems that challenge students to find information that can be connected in solving the problem (Ardianti, 2017). This type can take place automatically because the integration process occurs internally from within the individual (Fogarty, 2009).model immersed useful when the learning activities carried out are really in accordance with the field of interest, so students will voluntarily organize themselves to work disciplined as if working in a project. This is in accordance with the National Science Teachers Association (NSTA) and Permendikbud No. 68 of 2013 recommends that science teachers at the SMP/MTs level must have integrated science interdisciplinary skills or integrated science to form a holistic (holistic) mindset of students who can used as a life skill in solving problems in their lives (NSTA, 2020; Noeraida, 2014; Wahyuni, 2016). In this case, researchers will develop an integrated science performance assessment instrument in junior high schools that can take advantage of regional potentials that are real problems in the environment, so as to improve creative thinking skills. The performance instrument developed was adjusted to the indicators of students' creative thinking skills in utilizing the potential of the area in South Lampung.

The real problem that occurs in South Lampung is the amount of corncob waste when the corn harvest season arrives. Corn cobs waste is usually just burned without any processing, causing environmental pollution. Integrated science materials related to solving the corncob waste problem are knowledge about environmental pollution, environmentally friendly products and biotechnology. Students are challenged to solve the corncob waste problem creatively by dipping their knowledge on environmental pollution, biotechnology, and environmentally friendly products. The abundance of corn cobs when the harvest season arrives that has not been utilized by the community can be used as a learning resource to improve students' creative thinking skills. Learning

resources that are needed to help students improve critical thinking skills are Student Worksheets (LKPD). LKPD is a student worksheet that can be done independently or in groups that contains a guide for learning activities. This LKPD aims to maximize students' understanding abilities in accordance with indicators in learning. Therefore, it is necessary to develop student worksheets based on corncob waste treatment projects.

▪ METHOD

The research method used is research and development of the ADDIE model. This model is one of the learning program design models that shows the basic stages of a simple and easy-to-learn learning system (Fadiawati & Syamsuri, 2018). The ADDIE model consists of five main stages, namely analysis, design, development, implementation, and evaluation. Performance analysis is an important point to find out the use of student worksheets that take advantage of regional potential in learning. This performance analysis uses a questionnaire given to teachers and students. Needs analysis at this stage analyzes basic competencies that can be taught in an integrated manner in project-based immersed integrated science learning. In addition, an analysis of the indicators of creative thinking skills was carried out which resulted in the tasks or skills to be measured in this study.

The indicators of creative thinking skills used according to Torrance are fluency, flexibility, originality, and elaboration. Creative thinking skills were measured using pretest and posttest questions consisting of 4 questions, each question representing an indicator of creative thinking skills. The pretest posttest question contains a discourse that contains problems regarding corncob waste which is underutilized by the people of Jati Agung and is simply burned, so that it can cause environmental pollution. One example of a question in the pretest and posttest is "Based on the above discourse, what problems are faced by the people of Jati Agung? Is there a way to solve this problem?". The sample questions are used to measure fluency indicators, students are able to come up with some ideas about the problems that occur and problem solving that is carried out. The second question contains questions about giving ideas in the form of ideas in overcoming the problem of corncob waste, this question assesses indicators of flexibility skills. The third question contains questions about the latest solutions/latest ideas made by students in tackling the corncob waste problem, this question assesses indicators of originality creative thinking skills. The last question contains explaining the workflow of using corn cobs in detail, this question assesses indicators of elaboration creative thinking skills.

Student worksheets are designed by determining learning objectives, and the steps in learning are in accordance with the project learning model. Next, develop student worksheets according to the designs that have been made. After the product was finished, it was then validated by 2 experts and the responses of 2 science teachers in South Lampung. The next stage is applying student worksheets in class 9 SMP Negeri 2 Jati Agung as many as 25 students. The last stage is evaluating learning outcomes in order to determine the effectiveness of student worksheets. The effectiveness of student worksheets can be seen from the value of n-gain and effect size.

▪ RESULT AND DISSCUSSION

This research was conducted through research and development steps of the ADDIE model (namely analysis, design, development, implementation, and evaluation). The

results obtained are at the analysis stage, performance analysis and needs analysis are carried out. The results of the performance analysis with science teachers and students at SMP Lampung Selatan showed that 80% of teachers had never designed learning projects that could improve creative thinking skills and 100% of teachers had not designed student worksheets based on corncob waste treatment projects to improve students' creative thinking skills. The results of the needs analysis show that in preparing student worksheets, theories regarding project-based learning are needed, indicators of creative thinking skills and the use of corncob waste.

The learning steps in the student worksheets are made at the design stage according to the project-based learning syntax according to Colley (2008), with 6 stages of learning. Each learning stage is designed to improve creative thinking skills such as identifying problems (Fluency), at the project planning stage, namely writing down ideas about the importance of the project (flexibility), writing down details of the project implementation steps (elaboration) and documenting each stage of project implementation (originality).

The stage of identifying and determining the project presents a discourse on the problems that exist in the surrounding environment related to the underutilized potential of the area. The potential areas discussed are corn cobs waste when the corn harvest season arrives. Local people just burn it or throw it away. In addition to the discourse on the problem, pictures of corncobs that are burned and corncobs that are just piled are also given. Then from the discourse students can identify 3 problems that occur. The discourse on the problems in the student worksheets can be seen in Figure 1.

Mengidentifikasi dan Menentukan Proyek

Bacalah wacana berikut ini!

Limbah Tongkol Jagung di kabupaten Lampung Selatan

Gambar 1. Tumpukan tongkol jagung

Gambar 2. Pembakaran tongkol jagung

Tumpukan tongkol jagung banyak ditemukan di lingkungan kabupaten Lampung Selatan ketika musim panen jagung tiba. Tongkol jagung diperoleh dari hasil penggilingan jagung yang barusaja dipanen dengan memisahkan biji jagung dari tongkolnya. Masyarakat sekitar tidak ada yang memanfaatkan tongkol jagung, sehingga tongkol jagung hanya dibakar begitu saja. Sehingga banyak warga yang mengeluhkan kondisi ini karena asap hasil pembakaran tongkol jagung menyebabkan beberapa warga batuk. Namun, jika tongkol jagung dibiarkan menumpuk akan membusuk dan mencemari tanah di daerah tersebut. Sehingga butuh ide-ide untuk menanggulangi limbah tongkol jagung yang dihasilkan setiap musim panen tiba.

Figure 1. Discourse on corncob waste problems

According to Lala, Prabowo & Suryanti (2018), integrated learning immersed is learning that uses an interdisciplinary approach, where students can combine all data from each field of science and generate ideas according to their area of interest to be applied in everyday life. This is given at the next stage, namely the planning stage, where the LKPD is given historical root to find out about previously known information and unknown information and how to find that information. At this stage, students can look for sources of information from various sources, such as books or journals and the internet. After finding the information needed, students are able to solve existing problems by combining all existing data. Then the LKPD is given a table to plan the project to be carried out. The table contains the project title, project date, problem formulation, project objectives, project importance, details of material tools in general and those to be used, procedures in general and those to be used, tool design drawings and descriptions and project implementation schedules.

The results of the development of student worksheets and then the draft validation test was carried out by 2 experts in their fields. The results of the validation carried out by the validator to assess the suitability of the content and construction aspects to measure students' creative thinking skills. The number of questions in the content suitability validation aspect consists of 6 items and the construction aspect consists of 12 questions. Aspects of content suitability include conformity to project learning stages, phenomena according to learning outcomes in improving creative thinking skills, and stages in student worksheets that can help students understand the material easily. Aspects of construction include the presence of identity, basic competence, achievement indicators, learning objectives, instructions for use, discourse on problems according to the material, there are 6 stages of project learning. Then the validator assesses by putting a check mark in the column provided for each question and writing suggestions for improving the student worksheets that have been developed.

The content suitability aspect has an average percentage of 83.3% with very high criteria. In this aspect, the validator does not provide suggestions, meaning that the student worksheets have a very good content suitability, making them suitable for improving students' creative thinking skills. In the aspect of construction, the average percentage is 100% with very high criteria. In this aspect the validator does not provide suggestions, meaning that the student worksheets already have the appropriate construction. After being validated by experts, the next step is a limited trial by knowing the teacher's response to the developed student worksheets. This limited trial was carried out in 2 schools in South Lampung Junior High School. The limited trial process carried out on the teacher was the same as in the expert validation process, namely by asking the teacher's response questions about aspects of content suitability and construction suitability. Each question item contained in the teacher's response questionnaire is the same as the questions contained in the expert validation instrument.

The results of expert validation on the aspect of content suitability have an average percentage of 91.70% with very high criteria. In this aspect, the validator does not provide suggestions, meaning that student worksheets are suitable for improving students' creative thinking skills. In the aspect of construction, the average percentage is 100% with very high criteria. In this aspect the validator does not provide suggestions, so that the student

worksheets already have the appropriate construction. Examples of learning stages in student worksheets can be seen in Figure 1.

The results of expert validation show that the average percentage of aspects of conformity of content to project-based learning stages and indicators of creative thinking skills is 83.3% with very high criteria, while sheet construction aspects student work is 100% with very high criteria. The average percentage of teacher responses to the aspect of conformity to the content with project-based learning stages and indicators of creative thinking skills and student worksheet construction are 91.70% and 100%, respectively, with very high criteria. Based on these results, the student worksheets produced from this study are valid and feasible to improve creative thinking skills in project-based learning using corn cobs waste.

Next is the application of student worksheets. The application of student worksheets was carried out in grade 9 at SMP Negeri 2 Jati Agung. On the first day of application, students were given a pretest to measure students' creative thinking skills. Then, students are given learning using the student worksheets that have been developed. After learning, students are then given a post-test to measure creative thinking skills after learning using the developed student worksheets.

The last stage is evaluation, at this stage an analysis of the results of the application of learning is carried out using the developed product. The purpose at this stage is to determine the effectiveness of the student worksheets developed to improve creative thinking skills. The effectiveness of student worksheets is seen based on the results of n-gain and effect size. The results of n-gain and effect size were obtained from the students' pretest and posttest scores. The results of the pretest and posttest scores for each indicator of creative thinking skills are in Figure 1.

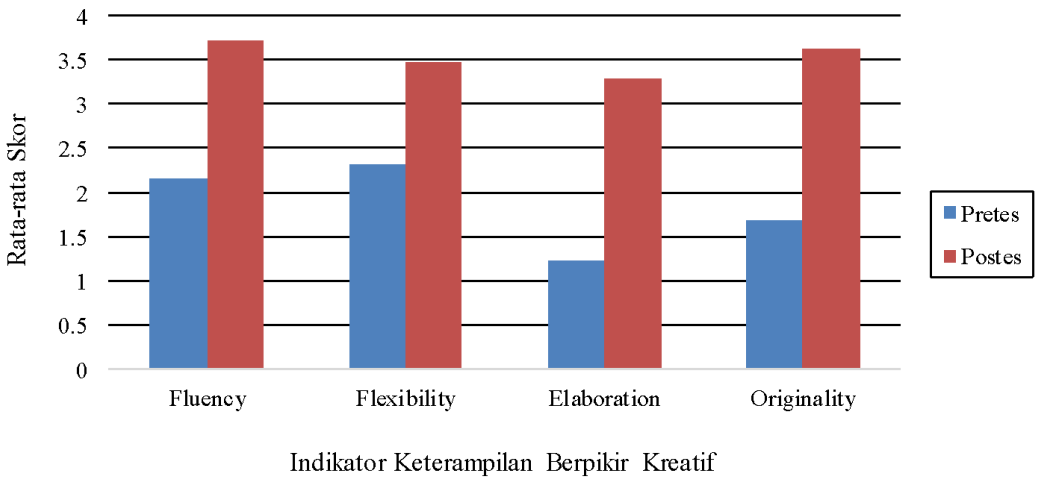

Figure 1. Results of pretest and posttest scores for each creative thinking skills indicator

Based on Figure 1, it can be seen that the average score of each indicator increased from pretest to posttest.indicator The fluency increased by 1.56;indicator flexibility there was an increase of 1.16;indicator elaboration there was an increase of 2.04;indicator originality increased by 1.96. Based on these results, the highest increase occurred in the

elaboration indicator. This can be interpreted those students are able to make ideas in detail compared to before learning with the developed program.

The average pretest score of students is 46.25 and the average post-test score of students is 88.25. These results indicate that the average post-test score is higher than the average pre-test score, so it can be stated that students' creative thinking skills have increased after learning has been carried out. The increase in students' creative thinking skills resulted in an average n-gain of 0.78. Based on the n-gain proposed by Hake, the n-gain obtained has high criteria.

The magnitude of the influence of the immersed integrated science student worksheet based on corncob waste treatment projects to improve students' creative thinking skills can be calculated based on the effect size results. The result of the effect size is 0.95. Based on Jahjouh's statement (2004), the effect size obtained shows that 95% of students' creative thinking skills are influenced by learning using immersed integrated science student worksheets based on corncob waste treatment projects.

Creative thinking skills students are able to develop are influenced because in project-based learning students are encouraged and guided to think about solving life problems that exist from various perspectives of each student (Siew and Ambo, 2020). Most students also learn to use different tools and materials in different ways to create new products. According to Savery (2015) states that the environment requires an interdisciplinary approach consisting of unique expertise by immersing various disciplines to develop possible solutions. Each group in the learning, is given the freedom to express opinions in making projects. Students are also given the freedom to try new things in order to create original products, so that the latest products from each group will be created with different components of tools and materials and students are also able to create detailed performance steps so that the desired product matches. Ramani and Brownell (2014) state that children who are involved in the problem-solving process while working together in peer groups are the key to generating more new solutions to a problem. Guo, Saab, Post, & Admiral (2020) argue that creating a product is important because it can help students to integrate and reconstruct their knowledge, discover and improve their professional skills, and increase their interest in the discipline and ability to work with others. In other words, the final product is a concentrated expression of the various competencies that students can develop during project-based learning.

Through productive interaction and communication among group members, students are able to produce products using the knowledge they already have. Students are better able to explain, and add more logical details in existing ideas, which in turn helps them to capture more information for their sketches or creations (Siew and Ambo, 2020). This effort indirectly helps students to improve their elaboration skills. This is in line with Vygotsky's (1986) social cognitive theory which argues that children can develop further in their zone of proximal development with the presence of peers or more competent adults. Based on this, the use of developed student worksheets can improve students' creative thinking skills.

▪ CONCLUSION

Based on the results of data analysis and discussions that have been carried out by the researcher, this development resulted in an integrated science student worksheet based on an immersed model *of* a corncob waste treatment project that has been valid, can be

used and is effective to improve students' creative thinking skills. The effectiveness of the developed student worksheets can be seen from the results of *n-gain* and *effect size* with high criteria. Suggestions to further researchers, should be able to take advantage of the potential of other areas in accordance with regional conditions. In addition, researchers should also pay attention to sources of information such as books or the internet that students will use to find additional information related to solving existing problems.

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