

DEVELOPMENT OF STEAM-BASED SCIENCE LEARNING MODEL TO IMPROVE CREATIVE THINKING SKILLS AND STUDENT LEARNING OUTCOMES AT SMP NEGERI 01 SAJAD

Tiya Juliani

Universitas Sultan Muhammad Syafiuddin Sambas

tiyajuliani31@gmail.com

Abstract

The purpose of this study is to determine the level of validity of learning tools and learning tools that can be used as a reference in the STEAM-based integrated science learning process (Science, Technology, Engineering, Art and Mathematics). The subject of this research is an education practitioner at SMP Negeri 01 Sajad. This type of research is Research and Development using the Borg and Gorkl model of 6-step modification to the practitioner evaluation stage. The data collection technique is with unstructured interviews, questionnaire sheets and documentation. The data analysis technique used consists of two techniques, the first is quantitative in the form of the results of the validation percentage of learning tools and the second technique is qualitative which comes from the comments and suggestions of validators. The results of the research on the development of an integrated science learning model based on STEAM have the potential to improve the creative thinking skills and learning outcomes of grade VIII students, showing that the results of the validation of experts and education practitioners are as follows: Syllabus 84.37%, RPP 80.10%, Module 84.63%, LKPD 82.50%. While the validation results from the education practitioner validators as follows the syllabus has a validation of 90.87%, the category is very valid with a small revision, the RPP has a validation of 93.16%, the category is very valid used with a small revision, for LKPD it has a validation of 89.75%, the category is very valid and with a small revision, while for the module it has a validation of 94.22% with a small revision. Based on the results of the research, it can be concluded that the learning tools developed have a high level of validation with very feasible categories and can be used as a reference for STEAM-based learning (Science, Technology, Engineering, Art and Mathematics).

Keywords: Learning Tools, STEAM, Creative Thinking Skills and Learning Outcomes

INTRODUCTION

Awareness of the importance of education can provide hope and better possibilities in the future. This awareness is able to encourage various efforts and attention by the entire community to every step and development of the world of education (Eriyanto, 2019; Gemnafle & Batlolona, 2021). The essence of this goal is that education is a very important capital in living a social life. Indonesia itself through education everyone can gain a lot of knowledge such as morals, religion, discipline and many others (Ardini et al., 2021).

Various problems arise not only in the problem of education concepts, regulations, and budgets, with the implementation of education from various aspects also adding to the

complexity of education problems in Indonesia. This is certainly a common concern, not only for the government but also for educational institutions and academics. Therefore, there needs to be development in learning. Not only in the form of materials but also adequate knowledge and skills should be possessed by the current young generation (Ricardo & Meilani, 2017). The level of thinking of students is still relatively low, especially in the field of science. Therefore, the application of science learning development needs to be carried out to improve creative thinking skills and student learning outcomes. The same is the case with students' critical and creative thinking skills at SMP Nergi 01 Sajad.

The results of the initial observation carried out at SMP Negri 01 Sajad show that the level of students' academic ability is very diverse. This diversity can be seen from students' ability to work on questions and mastery of the material is still relatively low with an average score of 60. The results of interviews with science subject teachers who said that during the current pandemic it is difficult to carry out learning that involves practice. Just giving questions to students is also ineffective. Some of the factors that cause the low level of students' ability include the application of conventional learning. Where the learning process in general only trains the process of convergent thinking, so that when faced with a problem, students will have difficulty solving the problem creatively (Budi Utama & Rohmadi, 2022).

The creative thinking ability of students in science learning at the school is still relatively low, as can be seen from the results of studies conducted with students and interviews with teachers. In working on the questions given by the researcher, there are still students who do not understand and still have difficulty in doing them. In this case, it is difficult for students to develop their creative thinking skills and improve student learning outcomes, especially in the field of science.

Based on the problems of these problems in accordance with the function of educational development, learning is very important to be improved in order to improve the quality of learning, especially in science subjects and creative thinking skills and student learning outcomes. A teacher needs to use an integrated science learning approach that combines simple airplane material with motion system material. Integrated science learning is more relevant, one of the approaches that is considered relevant is the learning approach with the STEAM model. According to Zubaidah (2019), the learning approach with the STEAM model is a response to the need to increase students' interests and skills in the fields of *Science, Technology, Engineering, Art and Mathematics* (STEAM).

METHODS

This research uses a *Research and Development approach*. The product developed in this study is an integrated STEAM-based science learning model to improve students' critical thinking skills and creative thinking skills. The main target in this study is to obtain a prototype of a STEAM-based learning model that is ready to be tested at the design

validation stage by experts and practitioners. At this stage, other model tools are also prepared such as Learning Implementation Plans (RPP), Student Activity Sheets (LKPD), Modules summarized in the STEAM-based learning implementation guidebook. In the final stage, it is hoped that a Prototype Design/Model can be obtained as a result of revision from practitioners. The place where this research was carried out was at SMP Negeri 01 Sajad, the research instruments consisted of validation sheets, question sheets for creative thinking tests and learning outcomes, interview sheets, learning model tools such as lesson plans, syllabus, and modules. Data collection techniques with interviews, documentation, and questionnaires. Meanwhile, data analysis techniques with validity.

RESULTS AND DISCUSSION

The results of the study show that the development of an integrated science learning model based on STEAM produced a number of learning tools which include the syllabus, Learning Implementation Plan (RPP), modules, and Student Worksheets (LKPD). The tool was developed to support science learning on a simple plane concept by integrating elements of Science, Technology, Engineering, Arts, and Mathematics (STEAM). The product was then developed through the validation stage by expert validators and education practitioners before being used as a learning prototype. This is in accordance with the purpose of development research which is directed to produce learning tools that are suitable for use in the science learning process.

Based on the results of expert validation, the percentage of syllabus validity was 84.37%, the RPP was 80.1%, the module was 84.63%, and the LKPD was 82.5%. Meanwhile, the results of the validation of education practitioners showed that the syllabus obtained a percentage of 90.87%, RPP 93.16%, LKPD 89.75%, and modules 94.22%. The results show that all the learning tools developed obtained a high level of validity and can be used by revision according to the validator's suggestions.

The high validation results show that the learning tools developed have a compatibility between the learning objectives, materials, learning activities, and characteristics of the STEAM approach. The syllabus serves as the basis for organizing learning, while the lesson plan provides a direction for implementing learning in a more operational manner. Modules and LKPD then provide a more structured learning experience to students through activities that direct them to understand concepts, solve problems, and produce a form of work or solution.

The difference in validation results between expert validators and practitioners can be understood as part of the product development process. Expert validators provide assessments based on conceptual and academic aspects, while practitioners provide assessments based on the feasibility of implementing the device in real learning conditions. The relatively high results of practitioner validation indicate that the developed device not

only has a theoretical foundation, but is also seen as applicable in learning in schools.

Creative Thinking

Creative is a term that is widely used in the school environment and outside of school. In general, people associate creativity with something new and interesting. In science learning, creative thinking skills are also needed to solve difficult science learning problems (Putra, 2017). Each student basically has the ability to think creatively, but at different levels. The definition of creative thinking according to Siswono is a process that is used when we bring in/come up with a new idea. Creative thinking is the ability to think that includes fluency, flexibility, originality and elaboration (detail) (Pisaba, 2018). Students need encouragement to create divergent products. Furthermore, Munandar explained that teachers play a role in providing encouragement and support to students through learning activities that can motivate students to produce creative works so that the enthusiasm and products produced are meaningful challenges for both students and teachers.

One of the main goals of developing this learning model is to support students' creative thinking skills. Based on the results of the research, the STEAM-based learning tools developed have the potential to develop students' creative thinking skills. This can be seen from the characteristics of the model that provides clear learning steps through modules and LKPD and provides space for students to produce solutions or works.

Creative thinking skills in science learning are needed because students are not always faced with problems that can be solved through one answer. Learning that provides opportunities to generate various ideas can help develop fluency, flexibility, originality, and elaboration in thinking. This article also refers to the view that creative thinking is related to the ability to come up with new ideas and includes aspects of fluency, flexibility, originality, and elaboration. The STEAM approach provides a wider space for students to develop ideas because learning activities do not only end with understanding concepts. Students are also directed to use the knowledge gained in designing, trying, developing, and presenting a solution. In the process, students can find more than one possible solution to a problem. Therefore, the characteristics of STEAM learning are related to the development of divergent thinking skills.

These findings are also relevant to the initial conditions of the research. The results of the initial observations show that students' academic abilities are still diverse, mastery of the material is relatively low with an average score of 60, and students experience difficulties when working on problems and developing creative thinking skills. The teacher also conveyed that there are obstacles in carrying out learning involving practical activities.

Thus, the development of STEAM-based learning tools can be seen as an alternative to provide a more active and contextual learning experience. However, the results of this research need to be understood according to the scope of the development research carried out. This research mainly produces prototypes and tests the validity of the device through

expert validators and practitioners, so claims about improving creative thinking skills and learning outcomes empirically still require testing through the implementation stage or wider effectiveness tests.

Learning Outcomes

Learning is an effort process carried out by individuals to obtain new behavioral changes as an experience of the individual itself. Individuals are said to learn or not very much depends on their needs and motivations. The needs and motivations of the individual/person are the goals of the individual/person in learning (Bahri, 2017). Meanwhile, motivation will arise if the individual has a great interest. According to Usman, an effective teaching and learning condition is the existence of students' interest and attention in learning (Usman, 2010). Interest is a trait that is relatively fixed in a person. Interest has a great influence on learning because with interest a person will do something that he is interested in. On the other hand, without interest a person cannot do something. Learning outcome indicators are tools to measure changes that occur in an event or activity. In order to measure learning outcomes, indicators are needed as a reference to assess the extent of development of a person's learning outcomes.

In addition to creative thinking skills, the learning model developed is directed to support students' learning outcomes. Learning outcomes basically show changes obtained by students after participating in the learning process. In this article, it is explained that learning is a process of individual efforts to obtain behavioral changes as a result of experience, while students' interest and attention are one of the factors related to the effectiveness of the learning process.

STEAM-based learning allows students to gain learning experience through activities that combine concept understanding with problem-solving activities. When students observe phenomena, understand simple aircraft concepts, carry out design activities, use tools or materials, and communicate the results, the learning process not only involves aspects of knowledge, but also skills and attitudes. This condition is important because science learning is essentially not only a collection of facts and concepts. Science is also related to scientific methods and scientific attitudes. Therefore, science learning that provides direct experience to students can help connect the knowledge learned with the phenomena that exist in the surrounding environment.

The use of modules and LKPD in the developed model also provides an activity structure that allows students to follow the learning process in stages. The tool is designed so that students get clear instructions in participating in learning activities. With this structure, teachers have guidelines in carrying out learning, while students have guidelines in carrying out learning activities.

Integrated IPA

Natural Sciences (IPA) is a part of science or science that originally came from the English word 'science'. The word 'science' comes from the Latin word 'Scientia' which means I know. Natural Sciences (IPA) is a collection of knowledge that is systematically arranged, and in its use is generally limited to natural phenomena. Its development is not only marked by the existence of a collection of facts but also the existence of scientific methods and scientific attitudes (Hartati, 2019). In general, Natural Sciences (IPA) in junior high schools/MTs, one of which is the field of simple aircraft studies, space earths, living things and life processes, and their actual materials and properties play a very important role in helping students to understand natural phenomena (Putra, 2017). Natural Sciences is scientific knowledge, namely knowledge that has undergone truth testing through scientific methods, with characteristics: objective, methodical, systematic, universal, and tentative. Natural Sciences is a science whose subject matter is nature and all its contents (curriculum center, IAARD of the Ministry of National Education).

STEAM (Science, Technology, Engineering, Arts, and Mathematics)

Entering the 21st Century and the Industrial Revolution 4.0 Era which is marked by the emergence of supercomputer technology, artificial intelligence (AI), and other digital technology devices, has made several countries such as the United States (US), the United Kingdom, and China emphasize *Science Technology Engineering Arts Mathematics* (STEAM)-based learning. In addition to being integrated into the curriculum, they also introduced STEAM clubs as extracurricular activities to strengthen students' skills, especially in the disciplines of science, crafts, arts, and mathematics (Astini, 2019).

STEAM (*Science, Technology, Engineering, Arts, and Mathematics*) learning is an integration of various disciplines, namely science, technology, engineering, art, and mathematics in one learning approach. Buinicontrol (2017) defines STEAM as the integration of art disciplines into the curriculum and learning in the areas of science, technology, engineering, and mathematics that were previously known as (STEM) (Leavy, 2023). STEAM is a discipline that integrates science, technology, engineering, art, and mathematics into an integrated approach that can be implemented in learning in schools. STEAM can be implemented in learning at every level of education.

The learning model developed integrates the five main elements of STEAM in science learning. Science is used to build students' understanding of science concepts and phenomena. Technology is used as part of the use of learning tools or resources that support the learning process. Engineering is directed at designing or finding solutions to problems. Arts provides space for students to develop creativity in producing or presenting products. Meanwhile, Mathematics is used to help students measure, calculate, or interpret data

related to the concepts being studied.

The integration of these five elements makes science learning not only oriented to mastering concepts. Students get the opportunity to connect science concepts with daily life through contextual activities. This is in line with the description in the article that STEAM is an approach that integrates science, technology, engineering, art, and mathematics in one learning unit. In the concept of a simple plane, STEAM integration can be realized through activities that connect the concepts of levers, pulleys, inclined planes, and pivoted wheels with the use of objects contained in daily life. Students not only receive an explanation of the concept, but are directed to understand its functions, working principles, and applications. Thus, learning becomes closer to the student's experience.

CONCLUSION

Based on the results of the research entitled "Development of a STEAM-Based Integrated Science Learning Model to Improve Creative Thinking Skills and Student Learning Outcomes on the Concept of a Simple Plane at SMPN 01 Sajad for the 2022-2023 Academic Year" which has been carried out, it can be concluded that: The validity of the STEAM-based integrated science learning model to improve creative thinking skills and student learning outcomes on the concept of a simple plane at SMP Negeri 01 Sajad for the 2022-2023 school year, through the creation of learning tools in the form of Syllabus, RPP, Modules and LKPD that have been designed by researchers consisting of pulley devices, levers, inclined planes and pivoted wheels. Validation results from expert validators and practitioner validation. The results of the expert validation are as follows: 1) Syllabus 84.37%, 2) RPP 80.10%, 3) Module 84.63%, 4) LKPD 82.50%. Meanwhile, the validation results from the educational practice validator are as follows: 1). Syllabus 90.87%, 2). RPP 93.16%, 3). LKPD 89.75%, 4). Module 94.22%. The characteristic of the STEAM-based integrated science model is to foster a mindset that is easy and understood by students, equipped with clear steps in the modules and LKPD. This STEAM-based learning tool also has the potential to develop students' creative thinking skills and learning outcomes.

REFERENCES

- Ardini, S. N., Jayanti, I. D., Ulfah, M., & Saputro, B. A. (2021). Implementation of the Independent Learning Program at Universitas PGRI Semarang in 2020-2021: Problems and Solutions. *JP3 (Journal of Education and Educator Profession)*, 7(2), 163–179.
- Astini, N. K. S. (2019). The Importance of Information and Communication Technology Literacy for Elementary School Teachers to Prepare the Millennial Generation. *Proceedings of the 1st National Seminar of Dharma Acarya STAHN Mpu Kuturan*, 113–121, 113–120.
- Bahri, S. (2017). The Conditioning Learning Paradigm in the Perspective of Islamic Education Samsul Bahri. *Tadris*, 12(2), 196–213.
- Budi Utama, B., & Rohmadi, Y. (2022). Curriculum Management and Learning Development

- Based on Multicultural Values at MTs N 15 Boyolali. *Fikrah : Journal of Islamic Education*, 6(1), 72.
- Eriyanto. (2019). Effective Madrasah Management: Answering the Challenges of Islamic Education in the Industrial Era 4. o. *Indonesian Journal of Islamic Education*, 4(1), 74–88.
- Gemnafle, M., & Batlolona, J. R. (2021). Learning Management. *Journal of Indonesian Teacher Professional Education (Jppgi)*, 1(1), 28–42.
- Hartati, M. S. (2019). Development of Learning Methods in Facing the Industrial Revolution 4.0. *Global Citizen Journal: Scientific Journal of Civic Education Studies*, 7(1), 125–134.
- Leavy, A. (2023). The prevalence and use of emerging technologies in STEAM education: A systematic review of the literature. In *Journal of Computer Assisted Learning* (Vol. 39, Issue 4, pp. 1061–1082).
- Pisaba, M. D. (2018). *The Influence of the Problem Solving method on the problem-solving ability and creative thinking skills of SMK SMTI Bandar Lampung students*. UIN Raden Intan Lampung.
- Putra, P. (2017). Application of Inquiry Approach in Science Subjects to Develop Students' Character at SDN 01 Kota Bangun. *Muallimuna*, 3(1), 28–47.
- Ricardo, R., & Meilani, R. I. (2017). The Impact of Learning Interest and Motivation on Outcomes. Student Learning. *Journal of Office Management Education*, 2(2).
- Usman, M. U. (2010). *Becoming a Professional Teacher*. Rosdakarya Teenager.