
IMPLEMENTATION OF THE STEM APPROACH TO IMPROVING THE UNDERSTANDING OF CONCEPTS AND CREATIVITY OF JAMBI 4TH JAMBI CLASS VII STUDENTS ON ACIDS, BASES AND SALTS MATERIALS

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ABSTRACT

To realize the Golden Generation of Indonesia and the challenges of a complex future, it is necessary to have a good and appropriate education pattern. Chemical materials integrated in science lessons at Madrasah Tsanawiyah (MTs) which are conceptual in nature make students more likely to memorize, for example; when students are faced with a natural event related to substances, they do not realize that the actual properties of acids, bases, and salts can be known naturally or artificially. The difficulty of students to understand substance materials in madrasah is also thought to be caused by the learning method used which focuses more on the completeness of the subject matter. The 2013 curriculum was designed by the government as a refinement of the previous curriculum (KTSP) which was deemed irrelevant to the demands of future generations. The development of this curriculum is designed using a scientific approach to improve higher-order, creative and critical thinking skills. One way to develop students' critical thinking skills in science learning is to develop the application of education with a STEM approach, students will be prepared to face the complex real world in order to be ready to face global competition. This is because Science, technology, engineering and mathematics are interrelated fields of science in human real life. These four fields must be mastered by students so that they can solve problems in the world of work, society, and in all aspects of life. In facing the era of global competition, Indonesia also needs to prepare reliable human resources in the STEM disciplines in quality and quantity.

Keywords : STEM, nature, chemistry, substances, acids, bases, salts, natural indicators, artificial indicators

INTRODUCTION

and competitiveness. To prepare quality and competitive human resources, education is a strategic tool. Education today must adapt to the characteristics of students who are required in the 21st century Framework for 21st century education, referring to Trilling and Fadel (2009) in his book entitled 21st Century Skills: Learning for Life in Our Times, there are some competence and / skills that must be possessed by 21st century human resources. In general, 21st century skills are divided into three skills, namely Learning and Innovation Skills , Information, Media, and Technology Skills (Information Technology and Media Skills) and Life and Career Skills (Life and Career Skills).

STEM education provides educators with the opportunity to show students how the concepts, principles, and techniques of STEM are used in an integrated manner in the development of products, processes, and systems

used in their daily lives. Therefore, the definition of STEM education is adopted as an interdisciplinary approach to learning (Reeve, 2013). In STEM-based learning students use science, technology, engineering, and mathematics in real contexts that connect schools, the world of work, and the global world to develop STEM literacy that allows students to be able to compete in the 21st century.

Based on preliminary observations made by researchers at MTsN 4 Jambi City, in class VII A science learning on August 20, 2019, it shows that learning carried out in class is still less effective. Most students pay less attention to the teacher at the front. When teaching they are busy with other activities. Activities -

learning activities designed by the teacher still less accentuate the creativity of students. Students do not seem to have great enthusiasm in taking science lessons. Students' enthusiasm for learning was also low, indicated by a minimal response when asked or asked to ask.

Problems in learning need to be fixed in order to increase student motivation. The resulting motivation will result in the formation of knowledge and skills which will lead to increased achievement. One alternative is to apply the approach Science Technology Engineering and Mathematics (STEM). Approach Science Technology Engineering and Mathematics (STEM) is a learning approach that integrates four disciplines

approach Science Technology Engineering and Mathematics (STEM) STEM stands for Science, Technology, Engineering and Mathematics. The word STEM was launched by the National Science Foundation US in the 1990s with SMET, but this word was not approved by some parties because it sounded like SMUT, so the term STEM appeared which represented each field of science in it. STEM is an approach that refers to the fields of science, technology, engineering and mathematics where the initiative to use the STEM approach was started as a way to advance education so that students will be ready to study science, technology, engineering and mathematics in higher education and can find future jobs in the STEM field.

Science, Technology, Engineering and Mathematics (STEM) as an integrative approach investigates the teaching and learning process between two or more STEM subject areas. STEM is said to be an integrative approach because it is built from several disciplines so that it becomes a unified whole. The amalgamation of several disciplines is caused by increasingly complex educational problems that cannot be solved using only one discipline. Learning using the STEM approach will provide students with preparation to be ready to face global challenges in the future. Education that uses the STEM approach will make students ready to work in an era full of competition and technological advances. The STEM approach is very effective learning to engage students in higher (critical) thinking and problem-solving skills by placing mathematics and science in a technological and engineering or engineering context. The learning objective uses the STEM approach, which is to develop prospective engineers and scientists who focus on science, technology, engineering and mathematics.

Students who learn using the STEM approach are expected to be:

- a. Problem solvers, able to solve complex problems and then be able to apply understanding and learning to new situations.
2. Reformers, have the ability to investigate a problem.
- b. Inventor, capable and creative in creating something according to the needs of the world.
- c. Confident, independent and able to organize and develop themselves to gain confidence and work within a certain period of time.
- d. Think logically, able to provide logical thinking mathematically and can be used for all professions around the world, able to make connections in understanding a natural phenomenon.
- e. People who understand technology, understand technology related to nature and are able to apply it appropriately
- f. Participants in STEM education who become the link between STEM education at school and in the workplace.
- g. People who are able to connect culture and history in education.

Benefits of STEM

Students need education with a solid foundation in the STEM field so that they are ready for two things,

namely work and live in the 21st century. The 2014 workforce estimate by the Department of Manpower shows that 15 of the 20 fastest growing jobs require science or mathematics to successfully compete for jobs. Students who study with this STEM approach will be able to compete in two ways of employment and STEM graduates will have the ability to serve the community because of the knowledge they have.

Since science, technology, engineering and mathematics will greatly contribute to future careers, it is very important for teachers to be involved in preparing students through the STEM approach in the learning process. The benefits of the approach to STEM gives students the chance to use the knowledge and keterampilan more than one kind of disciplines to identify and mengatasi o masalah, collaborate with peers to organize and menstampaai tujuan, develop skills and attitudes that are useful for menghadapi future and participate in masyarakat. Dewi Robiatun Muharomah (2017).

Step - Step Pembelajaran STEM

Education STEM has a lima stages of implementation in the classroom that is observe, new idea, innovation creativity, dan society be described asrikut (Muhammad Syukri, et al: 2013):

- h. Observation in this stage students are motivated to make observations on various phenomena I issues that exist in the environment of everyday life that have a connection with the concept of the subjects being taught.
- i. New ideas, in this stage students observe and seek additional information about various phenomena or issues related to the subject matter discussed, then, students design new ideas. Students are asked to look for new ideas from existing information, at this step, students need skills to analyze and think hard.
- j. Third, the Innovation Step. In this innovation step, students are asked to describe what things must be done so that the ideas that have been generated in the previous new idea steps can be applied. Innovation in this research refers to efforts to add or improve something to an idea or product for the better. To produce this innovation, students should discuss and explain all the ideas in their respective groups. In order for the resulting innovation to be more meaningful, the following points should be considered and discussed together, such as; Is the idea produced is something new? Is the idea realistic to be applied? What is the advantage of this idea with the previous idea or product ?, and so on. For this reason, it is hoped that all group members can actively provide creative responses.
- k. Fourth, the Creative Step. So the fourth step in this action research is the creative step. This step is the implementation of all suggestions and views from the discussion regarding the idea of a new product that you want to apply. Of course the application by these students is not in the form of an actual product, but in the form of sketches and pictures. One of the group members who is good at drawing is chosen to translate all the innovative ideas that have been discussed previously into a scientific product image. Students can apply it in miniature or sketches and drawings. The resulting image or sketch creation should be depicted in its entirety from various positions, especially in the part where the idea is innovated, be it front, side or top view.
- l. Fifth, the Value Step. (Society). The final step that students must take in this action research is the value step. The value referred to here is the value possessed by the product idea produced by students for real social life (society). In this step, students are asked to carry out two activities, namely gathering people's views on product ideas. This step should be used as home work for students after school. Students are asked to find at least five neighbors to answer several questions such as; how do they think about the product, whether this product can be sold, whether it can be useful for the community, and what is the most appropriate price for the product. All answers from the correspondent for all these questions, then in a simple analysis concluded by the student. Finally, students will present the product and also the results of the analysis of people's views on the product to all students in front of the class.

METHODOLOGY

This research was conducted in class VII A MTsN 4 Jambi City, conducted starting on October 11, 2019

with 32 students. The topics of science material are acids, bases and salts in KD 4.3 in which there are learning activities about: The practice of conducting investigations of acids, bases and salts using artificial and natural indicators. The learning design acid, base and salt is designed using the STEM Project Based Learning model with a research pretest-posttest design.

RESEARCH RESULTS AND DISCUSSION

CONDITIONS OF LEARNING FACILITIES

STEM education eliminates the boundaries between science, mathematics, technology, and engineering subjects and connects the knowledge gained by students with real-life problems. By contextualizing the various scientific knowledge learned by students with problems in real life, STEM education can improve scientific literacy competencies.

Before entering the material, teachers are required to be able to make a STEM analysis in their learning. STEM analysis is what becomes a reference in learning activities with the STEM approach. This section identifies the appropriate learning process in the four domains, namely science, technology, engineering, and mathematics, which need to be developed.

STEM analysis on the topic of acids, bases and salts

Science	Technology
<ul style="list-style-type: none"> • Factual: Substance properties can be identified through natural and artificial indicators. • Conceptual: acids, bases and salts Arrhenius theory • Procedural: determine the properties of substances through natural and artificial indicators 	<ul style="list-style-type: none"> • Use litmus paper and natural indicators • Use computers for data analysis
Engineering	Mathematics
<ul style="list-style-type: none"> • Create natural indicators by smoothing hibiscus flowers 	<ul style="list-style-type: none"> • Observing the change in the color of the litmus paper or solution.

After the STEM analysis is made, the next step is to carry out learning that goes through 5 phases / stages, as follows:

Stage 1. Reflection

The purpose of the first stage is to bring students into the context of the problem and inspire students to immediately start investigating / investigating. This phase is also intended to link what is known and what needs to be learned. As a teacher (while distributing worksheets to students) I did apperception by asking questions about acids, bases, salts, and svante arrhenius, a Nobel-winning scientist. Students are asked to observe various solutions dipped in litmus paper. Then the teacher asks another question: why can a solution be said to be acid, alkaline, and salt. And what is our purpose in knowing that solutions are acidic, alkaline, and salt.

Stage 2. Research

The second stage is a form of student research. The teacher provides science learning, selecting readings, or other methods to collect relevant sources of information. At this stage,, as a teacher I demonstrated about natural ingredients that exist in nature, then asked the students: "Why can these natural ingredients be classified as acids, bases, and salts? This is done to direct students to the law of svante arrhenius regarding compounds that move or break down into ions in solution. He explained how the strength of an acid and aqueous solution depends on the concentration of hydrogen ions in it. Finally, the students presented the results of the discussion and shared perceptions.

Stage 3. Discovery

The discovery stage generally involves a process that bridges research and known information in project

preparation. Here students begin to study independently and determine what is still unknown, for this PjBL STEM model students are divided into small groups to present possible solutions to problems, collaborate, and build collaboration between friends in other groups. Other models use this step in developing student abilities in establishing a habit of mind from designing to designing.

At the Discovery stage, I as a teacher asked students to make a design model for a tool to prove acidic, alkaline, and salt solutions through natural and artificial indicators using litmus paper and natural indicators, which they thought was an effective design. At this stage, students are assessed for their creativity using the creativity rubric.

Stage 4. Application

At the application stage the goal is to test the product / solution in solving problems. In some cases, students test products made from predetermined conditions, the results obtained are used to correct previous steps. In other models, at this stage students learn a broader context outside of STEM or linking STEM field disciplines. At this stage, I as a teacher ask students to arrange experimental tools according to the designs they have made. Each group that tested the design was asked about changes in the color of the litmus paper or solution in the experiments they tested. . This is done so that there is no misconception about acids, bases and salts. At this stage students are also assessed for their level of creativity.

Stage 5. Communication

The final stage in each project in making a product / solution by communicating between friends and class scope. Presentations are an important step in the learning process for developing communication and collaboration skills as well as the ability to receive and apply constructive feedback. Often the assessment is based on the completion of the final steps of this phase.

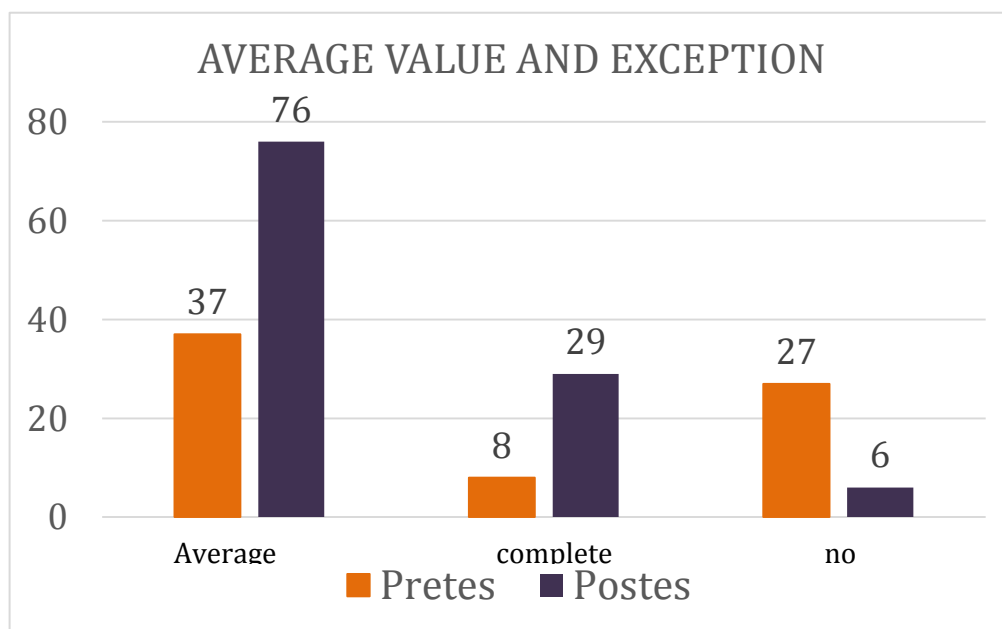
At this stage, I as the teacher asked each group to present the results of the practicum test of the solution they had tested. Then the teacher guides students to conclude about acid, base, and salt solutions, factors that affect the classification of the solution, as well as the effective design of each design.

The obstacles that arise in the implementation of learning with the STEM approach are:

1. The time allocation is not in accordance with the plan.
2. Chemicals in this electrolyte solution are not sold freely.
3. Lack of student knowledge about learning with the STEM approach.

The solutions taken to overcome barriers to learning with the STEM approach are:

1. The use of video viewing (youtube) from the teacher can minimize the use of time.
2. Using solutions available in the laboratory
3. To stimulate literacy and to gather information from various reading



1. Students begin to increase activity in science learning, especially acid, alkaline, and salt materials seen from their enthusiasm for the experimental process.
2. There is an increase in students' understanding of chemistry, especially about acids, bases, and salts seen from the results of the pretest and posttest.

CONCLUSION

Based on the description above, it can be concluded:

1. Implementation of learning with the STEM approach can improve conceptual understanding of class VII A students of MTsN 4 Jambi City.
2. Implementation of learning with the STEM approach can increase the creativity of class VII A students of MTsN 4 Jambi City.

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