STEAM (Science Technology Engineering Art Mathematic) Based Module for Building Student Soft Skill

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Abstract. The purpose of this research is to develop steam-based science learning modelus to improve the soft skill of grade IV elementary school students. This research uses research and development (R&D) methods. The resulting product is a STEAM-based science learning module. This research was carried out in grade IV elementary school in Jekulo Kaupaten Kudus sub-district which was established by cluster random sampling technique. Technical analysis of the data used in this study includes quantitative descriptive data analysis related to the validity and readability of modules, as well as to find out the effectiveness of learning modules used for normalized gain tests as well as t tests. The result of testing tc = 5.721 tought the degrees of significant 5.721 > 2.042 or tc > ttable and 0.000 < 0.005 or significance value < 0.05. The results of this study show that (1) the validation results performed on steam-based science learning modules have been valid to be tested in learning, (2) STEAM-based science learning modules are proven to improve the soft skills of grade IV elementary school students. From the description, it can be concluded that the development of steam-based learning models effectively improves the soft skills of grade IV elementary school students.

1. Introduction

Education in Indonesia is currently leading to the development of creative human resources that were included in the 2013 curriculum reform. In the 2013 curriculum, teachers innovated learning activities to explore and optimize the potential of students. Careful preparation is needed in planning and carrying out quality learning activities. In educating children, it is not enough for a teacher to master only learning materials, but also to master the method of delivery[1, hal. 48]

The learning process is oriented towards what students should do as subjects that play a role in building knowledge, while the teaching process is oriented towards what teachers should do as learning facilitators. The two aspects will occur simultaneously and collaborate in a unified way into an activity in the process of interaction between teachers and students, as well as between students and students during learning[2]. Teachers and students together play their respective roles in the learning process in order to achieve the purpose of the defensejaran that has been applied. The learning process carried out by the teacher is distinguished by the breadth of the scope, but in the context of teaching learning activities have the same task. So the task of teaching is not only to pour the material of the lesson, teaching can not only be judged by the results of mastery of the subject, but the most important thing is the personal development of the child, even though
learning a good lesson and providing the experience evokes a variety of traits, attitudes and capacities that are constructive.

Thematic learning places more emphasis on students’ involvement in the process of actively learning, so that students can gain hands-on and trained experience to discover for themselves the knowledge they learn. Through firsthand experience students will understand the concepts they learn and connect them with other concepts they have understood. Thematic learning is also related to developmental psychology because the material content is based on the developmental stage of students in addition to learning psychology is also learned because it has a contribution [3].

Teachers as intercomponent learning students should be able to present thematic learning that brings the success of students to each teaching material with an active and pleasant atmosphere. Efforts to achieve success in every thematic learning material with an active and pleasant atmosphere can not all be easily achieved. Many of the obstacles that teachers face in conveying thematic learning. One example of an science charge on Energy material. Teachers must do real work through science practicum. Praktikum is done because science is a science that is expected to be a student's vehicle to study themselves and the environment and its development prospects in daily life. The science learning process emphasizes providing first-hand experience to develop the competencies of students exploring and understanding the environment scientifically.

The main key point in the science learning process is to reduce students' curiosity and facilitate students to actively engage in learning so that students' curiosity can be missed with their own discoveries. Teachers act as facilitators providing explanations and guidance when giving answers to students. Teachers are more open and well supportive of each student's questions to direct students in understanding knowledge.

Based on the results of observations and information that in the study of science in SD 6 Bulungkulon found several problems, including learning activities in grade IV SD 6 Bulungkulon less held practice activities, observations and experiments directly on Energy materials so that students impressed passively so that soft skills students less developed. Teachers still use conventional learning models so that students are less able to explain the answers related to learning that teachers have explained over and over again. In addition, students in low social activities are shown with attitude, disrespect for friends who are reading their work in front of the class, low student care, students are less responsible with their group work.

Looking at the basics above, steam-based learning model is a learning model that is suitable to be applied to improve students' soft skills. One of the learning approaches that can integrate several disciplines of science is steam learning approach (Science, Technology, Engineering, Arts, and Mathematics).

STEAM is the development of STEM education by adding elements of art (Arts) in its learning activities [4]. STEAM stimulates students' curiosity and motivation about high-level thinking skills that include problem solving, cooperation, self-learning, project-based learning, challenge-based learning, and research [5, hal. 20]. STEAM (Science, Technology, Engineering, Art and Mathematic) is a learning approach that gives students the opportunity to expand knowledge and science and the humanities and at the same time develop skills to thrive in the 21st century such as communication skills, critical thinking skills, leadership, teamwork, creativity, toughness and other skills [6, hal. 66]. In this study, researchers applied the learning approach of Science, Technology, Engineering, Arts, and Mathematics (STEAM) in an effort to develop the soft skills of students in energy materials. In addition to using the right learning model, the use of teaching materials must also be appropriate for students' thinking skills to be trained. One of the early activities in improving learning is designing teaching materials that refer to a development model to make learning easier. Bahana ajar is indispensable by a teacher so that students have positive learning outcomes in accordance with
the existing curriculum, the development of learning needs as well as the development of information technology [7, hal. 2]. In this case the researcher selects the module.

Modules are one of the printed teaching materials used by students as a tool to learn independently and used by a teacher to provide materials to students in a retail way [8]. Modules also play a role in training students to learn actively and can also maintain the effectiveness of achieving learning goals. The use of modules in the teaching learning process aims to ensure that learning goals can be achieved effectively and efficiently (Sudjana, 2007).

STEAM (Science, Technology, Engineering, Art and Mathematic) empowers teachers for project-based learning involving five disciplines (science, technology, engineering, art and mathematics) and fosters an inclusive learning environment in which all students involved contribute. In line with that steam approach according to Quigley et al [4, hal. 7] it appears as a response to the need to increase students’ interest and skills in the fields of Science, Technology, Engineering, and Mathematics (STEM). STEAM combines "arts" with STEM learning with the goal of increasing student engagement, creativity, innovation, problem solving skills, and other cognitive benefits.

STEAM was defined by Buinicontro as the integration of arts disciplines into the curriculum and learning in the areas of science, technology, engineering and mathematics (STEM) [9]. STEAM is a meta discipline at the school level where teachers of science, technology, engineering and mathematics teach an integrated approach and each discipline material is not divided but handled and treated as a dynamic unit [10]. Therefore it can be said that STEAM is a meta discipline that integrates science, technology, engineering, art and mathematics into an integrated approach that can be implemented in learning in schools.

Soft skill as a simple term for complex systems on the properties and habits that are generally needed by the company [11]. He exemplifies some of the soft skills that someone should have such as; trust, flexibility, honesty, and integrity, the ability to see things from different perspectives, optimism and common sense. The soft skills aspects used in this study include cooperation, responsibility, confidence, leadership, communication skills, and problem solving skills [12]. The most sought-after and popular soft skills are problem solving, inventive thinking, the ability to compromise, negotiate and persuade, the ability to guide, teach, communicate, network and perform other public speaking skills including the ability to follow directions – even when they are uns spoken., understanding what needs to be done and doing it, having manners and being polite, looking for opportunities to continue education, doing the job thoroughly and properly and the ability to acknowledge and correct mistakes.

Character education is expected to answer these challenges. Education governance and educational institutions at the macro and micro management system through the implementation of curriculum and learning management are both driven to support the strengthening of national character in Indonesia [13].

Based on the background above, the STEAM-based module is a teaching material in which it explores the abilities students have that can improve soft skills. The STEAM-based module contains material and student activity steps that are in accordance with the steps of the STEAM approach. Where in the learning process students interact with friends in a group so as to improve students' soft skills.

2. Research Methods

Research is oriented towards developing STEAM-based thematic learning to increase student soft skills stance on the science of Energi material lesson. The design of the development adapted the
development model according to [3]. Research and development measures there are ten stages in arranging the product shown in Figure 1.

![Diagram of product development model]

Fig 1. Research Design

The two groups were given pre-test before treatment with the same test to measure the initial conditions. Experimental groups are given a learning treatment using the android media treatment thematic Learning (X) the control group is not given treatment (X1), after the learning process, the two classes are tested again with the same test as the final test (post-test) [14].

The study was conducted in the first half of January-June of 2020 in elementary school in Kudus in the year 2019/2020 with a sample of class IV research amounting to 203 students. Both groups carry out learning activities through pretests and posttest activities, the pretests activity is used to know the basic ability of students on STEAM-based thematic learning increase student soft skills stance before being held learning, while the posttest is used to learn students learning outcomes after the study. Group experiments during the learning process using STEAM-based thematic learning, while in the learning control group are conventionally. The role of the STEAM-based thematic learning in this case is as a teaching medium that can help students during the learning process to make it easier for students to understand thematic learning. The achievement of the pre-test and post-test scores of both groups was tested for effectiveness to determine the achievement of the learning outcomes of the experimental and control group.

Data collection techniques are conducted by angket, tests, observations, and documentation [3]. Pre-Test and post-test Data from the control group and experiment Group are analyzed using the N-Gain formula:

\[ N - gain < g > = \frac{Skor \ posttest - Skor \ pretest}{Skor \ maksimum - Skor \ pretest} \]

3. Results and Discussion

3.1 Learning Module Characteristics

Module is a learning tool or tool that contains material, methods, limitations and ways of evaluating which are designed systematically and attractively to achieve the expected competencies according to the level of complexity. A module is said to be good and interesting if there are the following characteristics: a) Self Instructional That is, through this module a person or learners are able to teach themselves, independent of other parties. b) Self Contained That is all learning material from one competency unit or sub competency studied is contained in one module as a whole. The purpose of this concept is to give learners the opportunity to study the learning material thoroughly, because the material is packaged into one complete unit. c) Stand Alone (stand alone) Namely the developed module does not depend on other media or does not have to
be used together with other learning media. d). Adaptive Module should have high adaptive power to developments in science and technology. It is said to be adaptive if the module can adapt to developments in science and technology, and is flexible to use. e) User Friendly Module should be friendly to the wearer. The use of simple, easy to understand language and use commonly used terms is one form of user friendly. So, a good module must fulfill several characteristics so that students can easily learn independently, a good module must contain material that is written completely and be accompanied by a variety of helpful illustrations and written in language that is easy to understand [15].

3.2 Module Validity
Validation of class IV SD STEAM-based science modules is performed by 5 validators. The validation results of this module are presented in Table 1.

| No | Validator | Average Score | Category |
|----|-----------|---------------|----------|
| 1  | Validator 1 | 3,32          | Excellent|
| 2  | Validator 2 | 3,38          | Excellent|
| 3  | Validator 3 | 3,43          | Excellent|
| 4  | Validator 4 | 3,5           | Excellent|
| 5  | Validator 5 | 3,38          | Excellent|
|    | Average value | 3,40          | Excellent|

Validators assessing modules developed with success criteria (very valid) indicate that steam-based SCIENCE modules are feasible to be implemented in learning on energy materials. The assessment conducted by the validator of this developed module theoretically gives an idea that the module is in accordance with the content, material and basic competencies of the map material and the appearance of the environment because based on the theory, the learning device is said to be valid if it is in line with the content, materials and competencies. According to Yeni (2014) a form of learning implemented through a contextual approach that connects the content of academic subjects with the context of daily life to find meaning and methods that promote student involvement to be active in learning.

3.3 Readability of STEAM-based Learning Modules
The readability test uses readability polls on 32 students from grade IV who already use steam-based Learning Modules. Students of Grade IV Elementary School 6 Bulungkulon, with a total of 32 students as an experimental class were asked to fill out the readability questionnaire of steam-based Learning Module. This questionnaire is about the appariation, materials, and readability of steam-based Learning Modules. Details of the results of the STEAM-based Learning Module readability poll can be found in Table 2.

| No | Indicators       | Average Percentage |
|----|------------------|--------------------|
|    |                  | Ts | Ks | S  | Ss  |
| 1  | Interest         | -  | -  | 15%| 85% |
| 2  | Material Clarity | -  | -  | 18%| 82% |
| 3  | Readability      | -  | -  | 7% | 83% |
Description:
TS : Disagree
KS : Disagree
S : Agree
SS : Strongly agree

Judging by Table 2, it is known that 85% of students strongly agree that the STEAM-based Learning Modules that have been developed by these learners are interesting. They can say this STEAM-based Learning Module is interesting because this STEAM-based Learning Module has an interesting overall look. Steam-based Learning Modules are equipped with interesting colors and images so that students become more excited about learning. In terms of material clarity, 82% of students strongly agree that steam-based Learning Modules developed by researchers have a very clear material decomposition structure. The submission of materials in this STEAM-based Learning Module relates to daily life and the geographical environment around where students live, making it easier for students to provide a direct picture. In terms of the readability of steam-based Learning Modules, as many as 93% of students strongly agree that this steam-based Learning Module developed is easy to read. Students can say so because this STEAM-based Learning Module has the appropriate and interesting size and typeface of Comic Sans MS 12. The use of sentences in steam-based Learning Modules is not too long so it is easy for students to understand.

3.4 Effectiveness of STEAM-based Learning Modules
The effectiveness of steam-based Learning Modules developed was measured using a comparison of pretest and posttest results using steam-based Learning Modules. The questions used are multiple choice questions and description questions. The number of questions used is 30 questions consisting of 20 multiple choice questions and 10 description questions. The validity of an item is calculated by correlating the item score with the total score, the valid criteria of the invalidity of a test instrument compared to \( r_{table} \), if \( r_{count} > r_{table} \) then the test item can be said to be valid (Suharsimi, 2006: 72). Furthermore, the reliability of the item of the multiple choice that obtains the test reliabilitas coefficient of 0.835 and the item of the description question that obtains the reliability coefficient 0.752 which means the reliability coefficient is high due to high reliability if \( 0.70 < r_{11} < 0.90 \). This indicates that the instrument is reliable.

Furthermore, the results of the calculation of normality of the question posttest data in the experiment class are presented in Table 3.

| Data                | Kolmogorov Smirnov | Sig.  | Criteria |
|---------------------|--------------------|-------|----------|
| Initial condition   | 0.724              | 0.032 | Normal   |

Based on Table 3 obtained a value of significance= 0.032. When compared to 0.05, the Sig > 10 value can be concluded that the results of the experiment class students come from a normal distributed population.

The average increase in science literacy of experimental students can be seen from the difference in pretest and posttest results. The improvement results were measured using a normalized gain test. Details of individual upgrade results can be found in Table 4.
Table 4. Improved Normalized Gain Index

| No | Category | Average Increased | Amount Increased | Students |
|----|----------|-------------------|------------------|----------|
| 1  | High     | 0.95              |                  | 22       |
| 2  | Are      | 0.68              |                  | 8        |
| 3  | Low      | 0.29              |                  | 2        |
|    | Overall average | 0.64 (medium category) | |         |

From these results it can be seen that 22 students experienced an increase with a high category that is an increase of more than 0.70 which means steam-based Learning Module is very effective. Then 8 students experienced a moderate category improvement with an increase of between 0.30 to 0.70 which means the STEAM-based Learning Module is effective for use. However, 2 students experienced an increase in the low category of less than 0.30 which means steam-based learning modules are less effective for both children. From the overall data can be taken the average increase in learning outcomes is 0.64 which means steam-based Learning Modules are developed effectively to improve students’ learning outcomes. Furthermore, to prove the effectiveness of steam-based Learning Modules, followed by t test.

In the hypothesis test, there are several provisions that should be used as guidelines. The provision is if $t_{count} < t_{table}$ or significance value > 0.05, then $H_0$ is accepted, and if $t_{count} > t_{table}$ or significance value < 0.0, then $H_0$ is rejected. In this study, researchers used a sample of 32 people, then the degree of freedom value ($df$) = n - 2 = 32 - 2 = 30 and error rate 5% for the 2-part test then can be known value = 2.042 (Priyatno, 2010: 113). The results of the hypothetical test calculation using the SPSS program version 23 independent sample t test results can be seen in Table 4.

Table 5. T-Test Analysis Results

| Q | Df | Sig (2-tailed) | Mean Difference | Std. Error Difference |
|---|----|----------------|-----------------|----------------------|
| Equal Variances Assumed | 5,721 | 30 | 0.000 | 14,642 | 2,455 |
| Equal Variances Assumed | 5,879 | 52,488 | 0.000 | 14,642 | 2,471 |

Table 5 It is known that the data in the study is homogeneous, so to find out the results of the hypothesis test can be seen in the column equal variances assumed. Conversely if not homogeneous, to find out the results of the hypothesis test can be seen in the equal variances column not assumed. Based on the calculation results with SPSS version 23 equal variances assumed column can be known that the value $t_{count} = 5.721$ and its significance is 0.000. From the result of the calculation can be known that $5.721 > 2.042$ or $t_{count} > t_{table}$ and 0.000 < 0.005 or significance value < 0.05. Based on the t-test that the researchers have shown above, $H_0$ was rejected and $H_a$ was accepted. So it can be concluded that steam-based learning modules are very effectively used in the science learning of grade IV elementary school students.
4. Conclusion

Based on the results of the research and discussion, it can be concluded that the STEAM-based learning module on Energy Science subjects to improve soft skills has met the criteria of being valid, effective, and practical. STEAM-based learning modules on Energy Science subjects to be used in each theme in elementary schools to improve soft skills. Through the STEAM-based learning module, an active, effective, efficient, and fun learning atmosphere will be created so that student activity and learning outcomes increase.

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