



Involvement of Elementary School Students Through the Application of the STEAM with Project-Base Learning

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Abstract. Student learning involvement in schools should be of particular concern because student learning involvement is an essential factor in the success of students' learning and academic processes at school. This study aims to determine student learning involved in the classroom and describe student activity by applying the STEAM Project-based learning model. This research uses a descriptive method. The validity of the data is done by triangulation of sources and techniques. They are using qualitative descriptive data analysis. Data analysis is done by calculating the percentage of student involvement in behavior, cognitive, and emotional. The results of this study indicate that student learning involvement is divided into three components, namely the results of behavioral component 81.05%, cognitive 75%, and emotional 93%. The total average percentage of student involvement components is 83% are suitable criteria. Based on these data, the STEAM Project-based learning model proves students are well involved.

Keywords: STEAM · Project-based learning · Involvement · Students

1 Introduction

The implementation of education has a crucial role in human life. Education is held with the intent and purpose so humans can develop abilities and add insight and knowledge. The role of education is crucial for the development of Indonesia. It is essential in shaping humans to be better and able to benefit oneself, others, religion, nation, and state [11]. So the development of Indonesia must be connected to the role of education itself, based on the Indonesian formula of national education goals in the third article of the national education system law number 20 of 2003, Namely: the development of students to become human beings who believe in and fear God Almighty, have a noble character, are healthy, knowledgeable, capable, creative, independent, and become democratic and responsible citizens [14]. In the formulation of the educational objectives above, there are student characteristics that must be possessed after the implementation of education, including making students creative and independent.

There is another point of view which is the same as saying that independent character is one of the most important aspects that students must have. According to the views

of realistic humanists and critical realism [16], the purpose of holding education is to help everyone achieve optimal development in intellectual abilities, master knowledge and affective abilities, have an independent personality, and perform productive work. Characters that are independent, creative, innovative, and productive are indeed essential for students at this time. Development of the times is getting faster with all the technology and information that continues to be updated daily. The importance of preparing the next generation of this nation by having a character that is by the objectives of implementing education. Students who have completed their education will return and become part of the community in their environment, faced with various complex challenges in modern society. Modern society has characteristics including rational, forward-looking, open, respecting time, creative, independent, and innovative [17]. So an excellent educational process is needed to form the character of independent students.

The learning process is one of the main components in implementing education. In educational activities, six primary components of education can form patterns of influencing interactions. These components include goals, educators, students, content or materials, methods or implementation of learning, and the environment [24]. In the learning process, selecting and using appropriate learning methods and models in presenting material can help students know and understand the material. Learning will be more effective if teaching and learning activities are under student development [1]. Student involvement in class is crucial because it affects student success in learning achievement and student character formation [4].

Student learning involvement in schools should be of particular concern because student learning involvement is an essential factor in the success of students' learning and educational processes in schools [7]. Implementing learning in the classroom prepares students to face the challenges of the future, an era where the world is increasingly complex, and information comes so fast. The challenges of the 21st century are marked by the existence of science, knowledge-based society (knowledge-based society), and future competencies [12]. In 21st-century learning, students no longer depend on the teacher's detailed explanations of each material. However, students are expected to be able to create their learning activities to achieve learning goals [25]. Through the active involvement of students in learning, students are no longer dependent on explanations from the teacher, and students will be able to learn independently.

Student involvement is a form of meta-construction that includes emotional, behavioral, and cognitive involvement [5]. Garvin in [6] explains that teachers guide students in their roles and responsibilities by managing balanced interactions with students by involving students and guiding the process of achieving meaningful learning outcomes together with learning so that they can achieve learning goals. Relate the material to the daily life of students so that students are easier to understand. [22] explains that to form a conducive learning situation to form students' independent character by making students a learning center (student center). The teacher seeks for all students to participate or be directly involved to create a vibrant learning atmosphere. In this case, the teacher acts as a facilitator and mediator.

Based on the researchers' findings through direct observation and observation at MIM Paseban at fifth-grade, several teachers apply the learning model with the lecture and assignment method approach. Because of that, students are still very dependent on

the teacher because the teacher dominates in learning, and students still do not have the character of independence in learning. In carrying out their learning in the classroom, many teachers still need to involve students in learning actively. Students tend to be passive and bored in the class, as seen by some excellent students who talk alone with their friends. From the description of the problems above, applying a learning model that actively involves students during learning that is not teacher-centered is necessary. Jennifer Nichols suggests four 21st-century learning principles: instruction should be student-centered, education should be collaborative, learning should have context, and schools should be integrated with society [16]. The learning model should be student-centered so that students do more than sit and listen to the teacher explain. However, students try to understand the material by building understanding independently and collaborating with their friends. The learning carried out will be varied and varied. Designing varied learning will create fun and meaningful learning so that students will grow a sense of being able to learn independently [21].

From the description above, it is necessary to make changes in the activities of the learning process to involve students in learning in class. One thing that can be done is to apply a STEAM Project-based model. Applying the project-based learning model will require students to solve problems in their daily lives through projects. It is in completing projects that students' creativity is seen [2]. Completing projects during learning through students' thinking processes requires a learning approach that can also be integrated into learning.

STEAM learning can encourage students to develop 21st-century skills [3]. The STEAM learning model (Science, Technology, Engineering, Art, and Mathematics) combines the five interrelated sciences, and problem-solving patterns are integrated into students' daily lives. Through the STEAM-Project-based learning model, student involvement in learning will increase because the STEAM-integrated Project-based learning model will involve students actively, involve practical activities, and be direct to situations in students' daily lives [19]. It will create exciting and fun learning for students because STEAM learning combines the five sciences and integrates problems into their daily lives. Learning will also be more meaningful for students.

Applying STEAM learning can train and develop students' skills to provide ideas so that students will become more creative [11]. Applying STEAM learning can also direct students to develop problem-solving skills, critical thinking, and collaboration with friends [14]. The STEAM-based learning model steps that can be applied according to [2] are planning, development, collaboration, and transfer. Using the Project Based Learning Model, each stage of learning will increase students' thinking and activeness about completing a given project, starting with essential questions, developing project plans, preparing schedules, monitoring students and project progress, testing and evaluating results, and evaluating experiences. The procedure in this study is an observation sheet based on indicators of student engagement according to [9] which includes three main components, namely behavioral, cognitive, and emotional. These three components are interrelated with each other. The first component is behavior, including student attendance, students doing assignments, paying attention to teacher explanations, actively asking questions, and participating in discussions. The second component is

cognitive, which includes students concentrating, paying attention to teacher explanations, self-regulation, and liking challenges. The third emotional component includes students who are enthusiastic about learning, students who are happy to participate in learning, and those who are enthusiastic about learning from beginning to end. Based on the above background, the purpose of this study is to determine student learning involved in the classroom and to describe student activity through the application of the STEAM project-based learning model to prepare an independent generation and be able to answer challenges in the 21st century.

2 Method

The descriptive method was used in this research. This research is in the form of best practice that describes the best experiences related to a teacher's success in solving problems when carrying out assignments. Data collection techniques in this study include observation through observation sheets based on assessment rubrics that have been determined during the learning process using the STEAM Project-Based Learning model, interviews with teachers, and documentation. This research was conducted at MIM Paseban Bayat. Observations have been made previously. The previous findings were described that the research was carried out with the research subject. The subjects of this research were 5th grader students, which consisted of seven girls, and twelve boys. The object of this research is student learning involvement through applying the STEAM Project-based learning model in the natural science subject matter of the earth and its environment.

Based on the observations and the data's consideration, this research uses two triangulations, namely technical and source triangulation. Technical triangulation means re-checking and comparing information on the validity of research findings from different data collection methods. In this study, the researcher validated the student learning engagement data using the observation sheet technique based on predetermined assessment rubrics, documentation, and interviews to determine student learning engagement through the STEAM Project-based learning model. At the time of the study, researchers conducted direct observations and interviews. Take some photos during the lesson as documentation material.

Source triangulation aims to explore the validity of information data by re-checking and comparing data from several sources with the same technique. The sources of triangulation in this study are students and the views of teachers and researchers. The results of the interviews were compared with existing documents. This study uses descriptive qualitative data analysis, which is an analysis that describes the facts following the data obtained and aims to determine the learning outcomes achieved by students and to obtain student responses to learning activities and activities and learning outcomes during the learning process. Data analysis was carried out by calculating the percentage of students' involvement in cognitive, behavioral, and emotional aspects. From these data, it is concluded whether the actions carried out were successful. The data analysis formula used by the researcher is the formula according to [25] with the following formula.

$$P = \frac{f}{n} \times 100\%$$

Table 1. Criteria Paper

NO	Percentage	Criteria
1	90%–100%	Very good
2	80%–89%	Good
3	65%–79%	Enough
4	55%–64%	Bad
5	0%–54%	Very bad

Index:

P: percentage

F: sum of students

N: frequency.

According to [23], to determine the success of the observation sheet, the observation sheet was processed with the following criteria (Table 1).

3 Result and Discussion

Student learning involvement was seen in the learning process and project results. Students were divided into two groups consisting of nine students in first group and ten students in second group. Student involvement in learning is assessed based on the criteria set in the rubric for assessing student engagement. Based on the results of research on student learning engagement through the application of the STEAM Project-based learning model, the results can be made as shown in Table 2 and Fig. 1.

3.1 Results of Involvement in Behavioral

Student learning involvement is described into three components. According to [24], the first component is the behavioral component. The behavioral component leads directly to student involvement in academic learning activities such as attendance, doing assignments, paying attention to the teacher explaining, asking questions, and participating in discussions. The study results show that the behavioral component of students actively involved during class learning can be seen from the average percentage of indicator A, which is 81.05% with suitable criteria. The total number of students in the class is 19, and all students are present. Seventeen students do assignments, namely writing down the characteristics of the ecosystem in the fields and beaches in a notebook.

The other two students are just playing alone and drawing. Sixteen students pay attention to the teacher when explaining the material. Three other students play with friends next to the bench. A total of 10 students actively ask questions, ask questions related to the material or the relevance of the material to their daily lives. In group discussion activities, as many as 15 students actively participated in group discussions, which were shown by students working together to complete ecosystem replica projects, discussing finding group names, dividing tasks evenly with some cutting paper, designing layouts, and making picture captions. From the explanation above, it can be seen in Fig. 2.

Table 2. Result of Students' Learning Involvement in Elementary School Through The Application of The STEAM Project-based Learning Model

No	Indicators of student's involvement	Results
A	Involvement in behavioral	
1	Students are present	100% (19 rsp)
2	Doing assignment	89.47% (17 rsp)
3	Listening to teacher	84.21% (16 rsp)
4	Asking	52.63% (10 rsp)
5	Participate in discussion	78.94% (15 rsp)
	Average in indicator A	81.05%
B	Involvement in cognitive	
1	Student's focus while learning	78.94% (15 rsp)
2	Student's focus in teacher	73.68% (14 rsp)
3	Student's Positive Participation	68.42% (13 rsp)
4	Student's cooperation	78.94% (15 rsp)
	Average in indicator B	75%
C	Involvement in emotion	
1	Students are enthusiastic in learning	89.47% (17 rsp)
2	Students are happy in learning	100% (19 rsp)
3	Students are eager to follow the learning from beginning to end	89.47% (17 rsp)
	Average in indicator C	93%
	Average score (A + B + C)	83.01%

3.2 Result of Involvement in Cognitive

The second component focuses on the quality of cognitive processes and student learning strategies for school assignments, for example students concentrate on listening to teacher explanations by not joking with their friends, focus, self-regulation and likes challenges. The cognitive component is one component that shows that in the learning process in the classroom students not only present their bodies but also their minds [24]. The cognitive component looks at how the student's effort is needed to understand and master a material so that students achieve that ability. Based on the results of the study, it showed that students' involvement in the cognitive component obtained an average of 75% with quite good criteria. 15 students were fully concentrated during the learning process so that they followed the instruction well, 14 students focused on paying attention to the teacher's explanation, 13 students carried out positive participation, students positive participation is a conscious and active effort to intervene and to control one's thoughts, reactions and behavior [10]. 15 Students are actively involved in carrying out the challenging learning stages in completing the project with a time of 25 min.

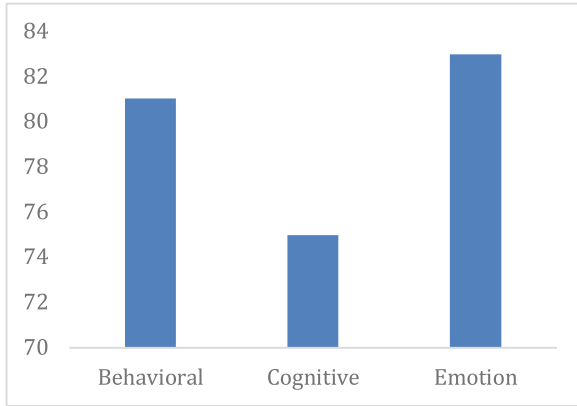


Fig. 1. The Indicators for Student Learning Involvement in Elementary Schools through The Application of The STEAM Project-based learning model



Fig. 2. Students are Active in Group Discussion

3.3 Results of Involvement in Emoticon

The third component is emotion. This component refers to students' sense of ownership of learning and interest in positive and negative reactions to teachers, friends, and learning activities. Emotional involvement describes students' positive emotions in the learning process and assignments obtained from the school. This involvement shows that enthusiastic students enjoy learning and are happy and satisfied with academic activities. The results showed that the average percentage acquisition of the emotional component was 93%, with excellent criteria. Seventeen students participated in the lesson enthusiastically when the new lesson started until the end of the group presentation. All students are happy to follow the lesson from beginning to end. It can be seen from the feedback they ask the teacher, and they focus on listening to the teacher's explanation. The other 17 students also seemed eager to follow the lesson. The students expressed their cheerful faces and were full of laughter (Fig. 3).



Fig. 3. Student are Happy During Class

3.4 Result of Project Based Learning

The results of project-based learning on the lessons implemented are replica boards of the food chain in the rice field ecosystem and river ecosystem. Assessment of project-based learning results is carried out by filling out an assessment sheet according to the assessment rubric determined by the researcher. The results of the teacher council's assessment of student project results can be seen in Table 3.

The results of project-based learning in the implemented class are replica boards of the food chain field ecosystem and river ecosystems. The group that achieves the highest average score is group one. In terms of the results completed by group one, the suitability of the information on the river ecosystem replica board is relatively straightforward, as well as written descriptions of animals that act as producers, consumers, and decomposers. Creativity is shown by placing the image layout that has been provided. In this case, group two is superior. The neatness of group one was shown by the cleanness of the replica boards they finished without any dirty stains attached. The cleanliness of group one is supported by neatness and the type of image they added by decorating manually using color markers. The first group got an average score of 93.75%. For the second

Table 3. Results of Teachers for Project-based Learning Model Results (food chain replica boards of rice and river ecosystems) based on STEAM

Assessment Aspect	Group		Avg.
	1	2	
Suitability of the Information	95	85	90
Creativity	90	95	92.5
Cleanliness	95	90	92.5
Fineness	95	90	92.5
Sum	375	360	367.5
Score	93.75	90	91.87



Fig. 4. Group One Is The Best Group During Class Learning

group, it was 90%, and for the overall competition activities, an average of 91.87% was obtained. From the overall average score, it was excellent (Fig. 4).

Based on the data analysis of the treatment results, the application of the STEAM project-based learning model is to analyze the relationship between ecosystem components and food webs in the surrounding environment. It is known that the average percentage of students' learning engagement indicators in the classroom is divided into three components, namely the behavioral component 81.05%, the cognitive component 75%, and the emotional component 93%. The total average percentage of student involvement components is 83%, with suitable criteria. The steam approach in this learning process is viewed from science first as a basis for knowledge about the essential competencies studied, namely the relationship between ecosystem components and food webs. Engineering technology is found in the delivery of material using power points, and during the process of making replicas of the ecosystem, art or existing art is seen from the beauty and creativity of students in compiling pictures and decorating the ecosystem replica boards, mathematics plays a role in the process of counting the number of animals used in presentation activities in front of the class and students' ways of dividing the time available to complete projects.

STEAM-based classroom learning has good potential for students to be more involved when learning through mutual discussion, collaboration, and creative and critical thinking activities. Similar to the opinion from [7], the final result of the STEAM approach makes students dare in taking risks with considering making more mature decisions, being directly involved in shaping the learning experience, persistent in finding problem solutions, and active in collaborating and collaborating with the creative process. The project-based model has more value when implemented because it contains real problems, an appreciation of student work, and supports the learning process based on learning by doing [20]. Based on the state and condition of the class during the science learning process using the Project-based learning model based on STEAM, the formation of an active classroom climate and students are more involved. From the results of research [2] from the application of the STEAM Project-based model, the creation of cooperation, communication between students, students have problem-solving skills, self-management, and collaboration with each other. [7], added that by applying

the Project-based model based on STEAM, students' motivation was further increased, and students were more actively involved during the learning process in fun and more meaningful atmosphere.

4 Conclusion

From the discussion above, the STEAM Project-based learning model is quite effectively applied to involve students' learning roles during the learning process. In this study, student learning involvement was proven by the average percentage of students' learning engagement indicators in the classroom, which was divided into three components: the behavioral component 81.05%, the cognitive component 75%, and the emotional component 93%. The total average percentage of student involvement components is 83%, with suitable criteria.

Acknowledgments. The authors would like to thank the Muhammadiyah University of Surakarta for providing funds for the publication of articles that the authors have compiled. The researcher would like to thank all the lecturers of primary school teacher education at the University of Muhammadiyah Surakarta who have always provided suggestion for the researcher to complete this article. The researchers also thank the Paseban MIM school for allowing researchers to conduct research.

Authors' Contributions. The first author is in charge of conducting research and processing research data. Meanwhile, the second author is in charge of reviewing the result of the article and providing input to the first author.

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