Designing Plant Material Learning for 5th Grade Elementary School Using STEM Autonomous Learning City Map Apps: A Preliminary Study

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Abstract. This study aims to develop student worksheets using the STEM Autonomous Learning City Map application with plant material for fifth-grade students of State Elementary School 192 Pekanbaru. The material to be developed refers to the 2013 curriculum with ten practice questions given to students. In answering the exercise, students will answer using an application and a student worksheet that is filled out manually. Students who use the application must follow the direction of the location according to the coordinates presented in the application. Derived from the results found in the field, students became more active and enthusiastic when answering the questions given using the STEM Autonomous Learning City Map application compared to filling out student worksheets done manually. This is because students can directly see the conditions in the field so that learning becomes fun without boredom.

Keywords: STEM · Autonomous Learning · City Map

1 Introduction

Education is the basis for a person to construct a better personality. Through education, each individual will form their personality such as better attitudes, behavior, morals and empathy, with a good personality that may affect the development of a nation [1]. Education in Indonesia is a bridge for the nation's generation. Education may significantly help the nation's generation achieve and realize their goals. In 21st-century learning, especially in the 2013 curriculum, students learn the material through examples, applications, and real-world experiences inside and outside the classroom [2]. The methods

and techniques used during learning must be considered to achieve the objectives of learning. Teachers must be creative and innovative in delivering learning, one of which can be by utilizing learning media acquired from technology, information and communication (ICT). Literally, the word media can be interpreted as middle, introduction or intermediary [3]. Media can be defined as an introduction or intermediary applied to forward messages and stimulate students' critical thinking to motivate them in the learning process [4]. Information and Communication Technology (ICT) learning media as an instrument in the form of physical and non-physical that is used as an intermediary between teachers and students in understanding subject matter more effectively and efficiently [2, 5].

The integration of ICT in learning is a component of 21st-century learning. Science and technology continuously develop rapidly from time to time. This technology combines the world to become borderless even though they are geographically separated [2, 6]. One of the learning models that can be studied with the help of ICT media is STEM. STEM learning is an abbreviation of (Science, Mathematics, Engineering and Technology). STEM education was encouraged to grow and develop by several historical events, including World War II and the launch of the Soviet Union's Sputnik [7]. STEM learning can affect students' motivation to study an object and requires students to undertake the creative process while getting direct experience of what they are learning [8, 9]. STEM education is gleaned from skills that generally use the left half of the brain and are driven by logic, while research shows that art expands the brain's right hemisphere, where creativity and innovation are fostered [10]. In implementing STEM learning, teachers need to identify the characteristics of students, the learning approach to be used, and the delivery of methods in STEM learning STEM [11].

This study proposes a learning media application that can be accessed via a smartphone called the STEM Autonomous Learning City Map. This application will direct students to complete the exercise by exploring the surrounding environment according to the coordinates found on the map in the application. To complete the exercise, students must follow the steps and coordinate points on the map in the order set by the teacher. After completing the questions, students will know the overall score they got. The questions presented in the Autonomous STEM application can be in the form of essays, short entries, and multiple choice. This application will help teachers provide variety in learning that is different from usual. Teachers can invite students to be active by exploring the surrounding environment while learning new things for students. The use of this application is able to increase student interest in learning. Students are able to complete the exercise through a direct experience they undertake.

2 Research Method

The research method used is research and development with a 4D development model. This method is used to produce scientifically developed research products. The research stages consist of define (definition), design (design), development (development), and dissemination (dissemination). However, in this paper, we only focus on the first three stages, which are described as follows:

2.1 Define

At this stage, an analysis of the curriculum \which contains material about plants, is done. In the 2013 curriculum, plant material is contained in theme 8 in the fifth grade of elementary school. The learning objectives to be achieved are: 1) students can name the parts of plants, 2) students can mention the shape of the leaf bone, leaf shape, root shape, and stem shape, 3) students can know the function of the parts of the plant, 4) students can use the application according to the instructions given.

2.2 Design

The next stage is to design questions based on the material and objectives that have been set. The question design process is carried out in the Microsoft Word application, which is then revised jointly by the research team in order to produce quality questions. Next, the problem design is carried out in the STEM Autonomous Learning City Map application by determining the coordinates of the object specified in the designed problem.

2.3 Development

The next stage is the development stage. This stage was executed by testing the use of the STEM Autonomous Learning City Map application for fifth-grade students at SDN 192 Pekanbaru. The trial phase was undertaken in 1 meeting with revisions: 1) stabilizing the application when the number of students entered so that errors did not occur in the application, 2) re-estimating the distance between one question and another, 3) presenting more varied questions so that students could explore more and more knowledge. After the development stage is complete, the next stage is a large-scale trial.

3 Result and Discussion

Learning teaching materials in grade 5 are plant materials which consist of 2 types, namely the first in the form of Student Worksheets, which are filled out manually by students and the second in the form of questions presented in the STEM Autonomous Learning City Map application. Learning and questions presented in the STEM Autonomous Learning City Map application provide opportunities for students to actively solve existing problems based on the coordinates given. The questions in the worksheets are done simultaneously with those presented in the STEM Autonomous Learning City Map application. The research team designed the questions in keeping with the results of the definition of the material studied by students in the even semester of the 2021/2022 academic year, namely the function of parts of the plant body. Before designing the questions, the researchers first looked for various kinds of plants used as questions, such as manga plants, *ketapang,* roses, hibiscus flowers, grass, taro flowers, and sugar apple plants. The plants are then photographed to be used as instructions for questions in the STEM Autonomous Learning City Map application.Next, the researcher designed the questions based on the plants that had been determined. After the questions have been designed, the research team makes revisions to the questions to get more meaningful questions. The problem can be noticed in Fig. 1.

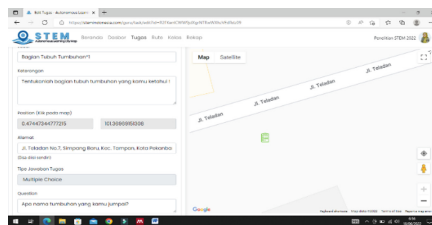**Fig. 1.** Problems with Plant Materials

Fig. 2. The Coordinate Point of the Problem in the Application

The next step is to input questions in the STEM Autonomous Learning City Map application and determine the selected plants' coordinates. The coordinates of one of the questions can be seen in Fig. 2.
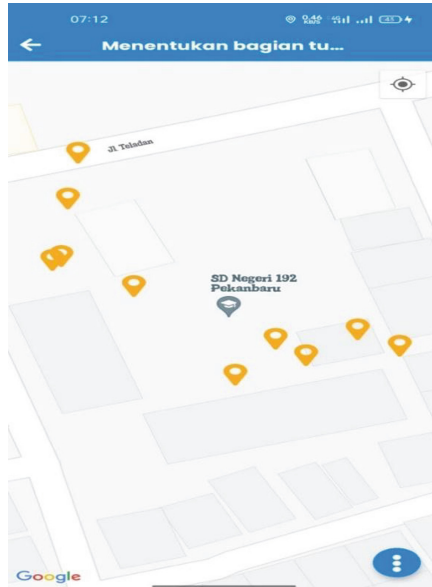
Fig. 3. Question Route

After all the questions have been successfully inputted, and the coordinates have been determined, the next step is to combine all the questions into one route that students will work on during the learning process, employing students walking according to the coordinates set with the help of GPS. The route that students will take on this plant material can be seen in Fig. 3. The route that students will take on this plant material can be seen in Fig. 3.

The routes presented are designed randomly, and students can work on any number of questions. This anticipates students piling up at the same point, which makes students not focus on finding answers. In line with working on the questions in the application, students also fill out the worksheets that have been given together in groups.

Plant material based on the STEM Autonomous Learning City Map application for class V students helps students solve problems they face directly. Students explore all plants and identify them together to get correct answers. The subject's responses to learning plant material applying the STEM Autonomous Learning City Map application are presented as follows:

1. MY Students: Learning with the STEM Autonomous Learning City Map app is fun. In operating, it is easy but sometimes slow due to an unstable network.
2. DP Student: I like to answer questions with this application because I can directly see the plants, pulling the grass to find out what kind of grassroots are.

From the responses given by the students above in answering questions about plant material, the researchers concluded that, in general, students seemed happy and active

in learning and answering questions by the STEM Autonomous Learning City Map application.

4 Result and Discussion

From the responses given by the students above in answering questions about plant material, the researchers inferred that, in general, students seemed pleased and active in learning and answering questions through the STEM Autonomous Learning City Map application. Through the results of interviews with students, it is known how students respond to learning with this application, and students respond positively by saying that they are happy with learning that goes directly to the field. Learning is easy to understand because students look for their answers by identifying existing plants. With this, we recommend that teachers use the STEM Autonomous Learning City Map application as a learning medium in formal and non-formal schools.

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