Design Action in Primary School Students Class V for High and Medium Group Related Food Themes

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Abstract—**This study aims to determine the role of design action adapted from design thinking with project-based learning on the scientific literacy of elementary school students related to the theme of food. The subjects of the study were elementary school students from grade V of several State schools in Bandung District, West Java – Indonesia, consisting of 70 students who were then divided into 20 high-scoring students and 50 average-scoring students. The research method used was quasi-experiment with design one group pretest-posttest design. Instruments used include questions of scientific literacy tests, observation guidelines, attitude scales, and questionnaires. The results showed that there was a significant increase in the scientific literacy of high-scoring and average-scoring students based on the results of the test seen from the statistical calculations through t-test, where p-value (2-tailed) = 0,000 <0.05. However, in term of attitude, although there was an increase, the difference between two groups was not significant.**

Index Terms—**design action, food themes, literacy**

I. Introduction

The progress of science and technology which is rapidly increasing will have an impact on various aspects of human life in various parts of the world, including Indonesia. The influence can be direct or indirect, positive or negative. One way to adjust to the progress is through improving the quality of education.

Indonesia is a country with a very large population and large human resources. However, the quality of education in Indonesia generally is still below other countries in the world. This can be seen from Indonesia's ranking which is far from ideal. The results of the research conducted by the OECD PISA [1] put Indonesia at the 62nd position out of 69 PISA member countries. The results of research conducted by survey institutions in Indonesia, namely the Indonesian National Assessment Program (INAP) also showed the same results.

One effort to boost Indonesia's position in the rank is through improving the quality of learning. Learning is the interaction of active communication between teachers, students, and teaching materials [2], [3]. Learning done by teachers in elementary school is very important because it is the foundation for the next level. Therefore, the learning done by the teacher must be really designed so that it will be more meaningful. One of the subjects given to elementary students is natural science or science.

Learning science in elementary school is still not satisfactory whereas science teaching is learning fun and full of research activities and experiments that require high capabilities in accordance with the 21st Learning Skills of this Century. The facts show that the learning done in elementary school still focuses on the teacher (teacher centered) which is only limited to transferring the knowledge needed by the teacher or from teaching materials to students. Fewer students are involved in different learning activities, especially those which are related to manipulating the experiment tools and materials (hands-on activities). This thing happens because not all elementary school teachers have an educational background in science, so they find it difficult to teach science to their students. The results of research conducted by Carrier [4] showed that many elementary school teachers were less qualified to teach science compared to other fields of study. This situation was released and left to be very dangerous for students, so it was feared they could not compete with other students.

Science is one of the disciplines that studies the universe and its contents. Science is one of the subjects given starting from elementary school (SD) to college (PT) students. One of the factors that led to the teaching of science since elementary school is because science learning in elementary students has the potential to trigger students' interest in learning science at the next level, also on other knowledge [5].

The scope of science learning material in elementary school includes several things, one of which is food. Food is an energy source needed by the body to carry out various activities in daily life. Good food is a portion of clean, healthy and nutritious food. Nutritious food is a food that contains carbohydrates, protein, fat, vitamins and minerals in balance.

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Lack of nutritious food intake for the body will have an impact on various aspects including lack of energy to carry out various activities, weak thinking ability, susceptibility to disease, and stunted growth of the body. Conversely, excessive food intake is also not good for health, since it can cause the emergence of various diseases and obesity. Therefore, for the body to be healthy, the food intake in the body must be balanced, especially for elementary students, which becomes the golden stage in human growth.

Given the importance of food material for students, the process of science learning must be adapted to the characteristics of the students, the characteristics of the food material, and should be related to daily life. Various models, methods and approaches can be used by the teacher in implementing learning related to food material, one of which is design action learning adapted from design thinking with project-based learning.

Design action is one of the learning models that changes the learning paradigm which was initially centered on the teacher (teacher centered) to be student-centered (student-centered). In design action, observation activities use all the human senses until the discovery of the problem to be resolved is the starting point in learning activities. Through this design action, all aspects of learning are expected to be achieved, especially related to scientific literacy, more specifically, food literacy. This is because learning is done by involving students to be actively engaged in analyzing the problems faced, looking for alternatives in solving problems, creating many ideas and ideas that are out of the box, and making prototypes and concluding the methods that are considered the most appropriate in overcoming the problem.

II. Theoretical Framework

A. Design Action Related to Food Themes

Food is one of the most important components in life needed by the human to survive. Food is everything that the body consumes and provides great benefits to the body. Food functions as a source of energy, repairing damaged body cells, maintaining body temperature, improving the process of growth and development, as well as becoming body's defense against attacks of various types of diseases [6]. Therefore, the type of food consumed by the body determines its health. Food consumed at any time by humans with certain nutrients plays a role in determining one's health.

To nourish the body, then the food consumed must be hygienic and contain the nutrients needed. The nutritious food contains various substances needed by the body such as carbohydrates, protein, fat, vitamins, minerals, and water. In addition to the types of food, regular diet patterns are also very important in improving the health of the human body. Therefore, even though eating habits for each person will change, good eating habits are the basis for teachers in elementary school students [7]. Thus, the role of teachers in schools is expected to increase students' knowledge in increasing knowledge about nutrition. [8] One effort that can be done is by applying design action in the process of teaching and learning.

Design action is an innovative learning model that was initially developed in the fields of business management, design, and marketing around the 2000s. However, over time, design action has been applied in various fields, one of which is in the field of education. Design action is one of the learning models which focuses on student activities and therefore the role of the teacher is only as a facilitator in facilitating students so that learning is more effective efficiently. Thus, learning with design action will provide opportunities for students in various learning activities to improve all of their abilities.

Design action is based on the constructivism paradigm which views that in learning activities, students acquire their knowledge through cognitive conflict as an ingredient for increased ability or cognition [9]. The same thing was stated by Barrows & Tamblyn; 1980 [10], [11] who explains that learning with design action results from the work process towards understanding or solving a problem and therefore it is crucial to meet it first in the learning process.

In design action, environmental analysis and problem activities are the most important things for the starting point in learning. Observation activities to environmental analysis and problems raised in learning with design action models must be in accordance with the facts, complex but in accordance with children's reasoning, real, and ill-structure so it will give the students the opportunity to develop various abilities that they needed to create prototypes communicated them to the audience. Learning through design action involves the knowledge that is already owned and new knowledge that will be obtained by students at the time of observation, so that it can help students in processing information and compile this knowledge by themselves about the social world and its surroundings [12]. In addition, through the design action, it will be easier for the teacher to manage students who have different learning experiences, different learning styles, and different abilities [13].

Learning through design action can be done in a classical way or in group. However, group learning is recommended since through learning in group, students will be more optimal in improving their abilities, including social interaction, helping students practice collaboration skills, cooperation, interpersonal, and communication between them and familiarizing them with their respective cultures. [14]

To make design action to be more meaningful, students characteristics and learning material characteristics should be taken into account. The characteristics of elementary school students differ from the characteristics of middle school students. Elementary school students are between the ages of 6-13 years, which according to cognitive theory is still in the concrete operational stage. Therefore, learning carried out by teachers should emphasize concrete objects that can be observed by students.

In addition to these characteristics, the level of thinking of elementary school students is also still simple, so that learning still requires the help of others, especially for low-grade elementary students (classes 1, 2 and grade 3). Assistance provided to elementary students is mainly in terms of motivating them in learning, so learning using the design action model implemented for elementary students will be simpler.

Design action that is applied to elementary students does not necessarily make the teacher has nothing to do since elementary students still need guidance. The theme given to elementary school students must also be a simple and well-known problem for students. The role of the teacher is not totally as a facilitator, but he or she helps students in solving problems faced through an active coaching process during learning activities. In addition, a unique and appropriate student worksheet (LKS) is needed as a guideline for them to solve the problems faced step by step. Through learning with design action models, all abilities possessed by students can increase. The implementation of design action related to food material is carried out following the stages shown in the picture below (Fig. 1.):

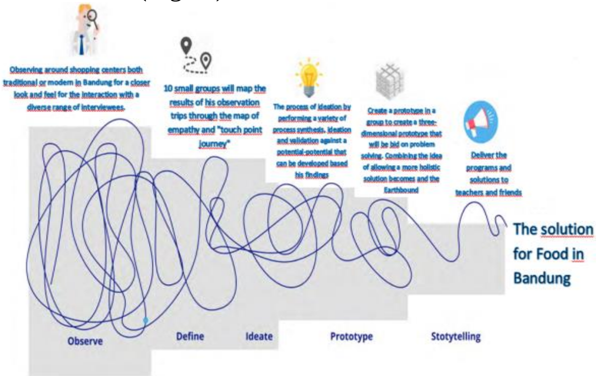

Figure 1. Implementation of design action learning [15]

B. *Science Literacy*

Science literacy is someone's ability to analyze problems related to science, to find alternative solutions to problems, to conduct testing related to efforts to overcome the problems faced, and to communicate the efforts to overcome these problems for everyone. Although scientific literacy is a goal in science learning internationally, but the definition of scientific literacy put forward by experts since the beginning of its development in 1950 still creates differences from one another. Literacy of science can be seen as human nature, which is essentially characterized by someone's ability to acquire scientific knowledge and apply that knowledge to solve problems faced, both individually and socially [16].

The definition of science literacy that is common in the OECD PISA [17], is a person's ability to use scientific knowledge to identify questions, to acquire new knowledge, to explain phenomena scientifically and to draw conclusions on issues based on scientific evidence. PISA also assesses students' understanding of the characteristics of science as a scientific investigation, awareness of science and technology that shapes the environment materially, intellectually, culturally and desires to be involved in scientific issues.

PISA also establishes the domain of scientific literacy which consists of four types, namely science content, science context, scientific competence, and science attitude. Science content or knowledge about science is related to material that must be studied in science which includes physical systems, living systems, earth and space, and technological systems. The science context is related to the application of science in life such as health, natural resources, environment, and technology. Science competencies include the mental processes involved in dealing with problems faced and the attitude of science related to how to respond to scientific issues that occur in science. Meanwhile, Coll and Taylor [18] categorize scientific literacy into knowledge and understanding of scientific concepts and processes needed for personal decision making, participating in community and cultural issues, and economic productivity.

To find out all aspects of scientific literacy, a scientific literacy assessment is carried out that includes those components. Assessment of the context and content of science is carried out by presenting events or other matters related to science in the form of stories or articles of events in everyday life that can come from newspapers, advertising leaflets, information leaflets, scientific articles, books, and so forth. Other contexts can be industrial processes, environmental problems, problems in daily life, food problems that are served by traders in schools, and other problems.

To find out competencies in scientific literacy related to the theme of food is done by identifying several scientific processes such as recognizing questions in scientific inquiry, identifying evidence in scientific investigations, communicating the results of scientific investigations, and demonstrating understanding of scientific concepts, either through experiments or observations from the field on a phenomenon related to the theme of food. Whereas to find out attitudes, an assessment is used using the attitude scale.

III. Research Methods

This research was conducted to determine the role of design action with project-based learning in improving the scientific literacy of elementary school students regarding food themes. The research method used was pre-experimental design with the design of one posttest pretest design group. The subjects in this study were grade V elementary school students from several schools in Bandung Regency, consisting of 20 high-scoring students and 50 average-scoring students.

The instruments used in the study included tests to measure students' scientific literacy related to food themes in the form of descriptions consisting of 15 items, observations used to determine the implementation of design action with project-based learning related to food themes, and interviews used to explore things that have not been explored through tests and observation.

IV. Results and Discussion

This study aims to determine the role of design action on student scientific literacy related to food themes to high-scoring and average-scoring students. Furthermore, this study is aimed at finding out whether the design thinking model is more effective for high-scoring student and average-scoring students, or equally effective for both the groups. To find out the impact of the design thinking model, the two groups were given the initial test (pretest), as well as the final test (posttest) conducted after the implementation of the design action model related to food themes. The results of the pretest and posttest data on high-scoring students obtained are shown in Table I.

TABLE I. HIGH AND MEDIUM PRETEST AND POSTTEST RESULTS

No	Group	Test Type	*Lowest*	*Highest*	*Average*
1	High-Scoring	*Pretest*	37,40	85,80	60,50
		posttest	56.42	100	85.10
2	Average-Scoring	*Pretest*	32,43	73,80	55,80
		posttest	42.23	100	75,68

Table I shows that the results obtained from posttest for both groups were greater than the pretest. However, when viewed from the initial ability, they were relatively the same. Even the lowest value of the high-scoring group is smaller than the lowest value of the average-scoring group.

Furthermore, testing was carried out with the u-test (Mann-Whitney) in both groups to find out whether there was a difference in the increase in literacy or not [60]. The test results are listed in Table II.

TABLE II. HIGH AND MEDIUM PRETEST AND POSTTEST TEST RESULTS

	Groups	N	*Mean rank*	Sum of Ranks
Gain	High-scoring group	20	46.02	1150.50
	Average scoring group	50	28.74	1264.50
	Sum	70		

Table II shows p-value. Sig. (2-tailed) = 0.001, the value is less than α, meaning that there are significant differences between the two groups, where the mean of the high-scoring group is superior to average one.

In addition to the results of the written test, it was also seen the attitudes of students obtained through scalability assessment. The results of the groups' attitude scale are listed in Tabel III.

TABLE III. RESULTS OF ATTITUDES OF HIGH AND MEDIUM GROUP STUDENTS

No	**Group**	*Type group*	*Lowest*	*Highest*	*Average*
1	High-scoring students	Before applying the design action	65,00	98.3	84.7
		After applying the action design	66,70	98.3	86,50
2	Average-scoring students	Before applying design action	63.3	96.7	82,00
		After applying the action design	65,00	96.7	83.4

Table III shows that although there are differences before and after learning, the difference is very small. So it can be concluded that there is no significant difference in student attitudes before and after learning with design action related to food themes.

The increase in students' scientific literacy related to food themes, especially based on the results of written tests id seen as an impact of learning with design action. This is because in learning with design action, students are more active in analyzing problems and looking for alternative solutions to problems faced. Students are given the freedom to learn the problems faced with the help of the teacher who directs the activities carried out by students to be more directed, effective and efficient. In addition, for certain things that have not been fully understood by students, the teacher also provides reinforcement so that students will find it easier to understand it.

Learning that is done is also associated with the students' everyday activities, so that the problems faced are not new things for students and the problem is very demanding to be solved. This is because if the problem is not immediately solved, it will have an adverse effect on them. Student learning experience is also the main concern of the teacher because learning experience is an implicit part of the learning process, where students build knowledge from the experiences they have. [19]

To ascertain whether the increase in student scientific literacy related to the food theme is due to learning with design action or not, then interviews with students were conducted. The interview results show that design action made students more interested in learning, the process learning is more focused, and students were encouraged to be more active and more participative in learning. They also felt that they were given the freedom to solve problems with the various knowledge they had from various scientific disciplines.

The results of the observation also showed that students were actively involved in learning so that the learning carried out motivated students to obtain the most appropriate way to overcome the problems faced. This situation is very important because student activities in learning are a major part of conducting research, decision making, and writing down the results they get [19].

V. CONCLUSIONS

Design action with project-based learning is very influential on the learning of lesson with food as the theme for high-scoring and average scoring students of grade V. The effect can be seen from the increase in students' scientific literacy related to food themes after design action learning. The increase in scientific literacy is due to the learning that were carried out giving freedom to students in analyzing problems and finding alternatives that were considered the most appropriate in solving problems faced so that students' motivation in learning was higher.

In addition to the results of written tests, it is also seen about the attitude of students. The analysis results showed that there was a significant increase in students' scores before and after learning in both groups. However, there is no difference between high-scoring students and average-scoring students. This indicates that design action can be used in instilling attitudes in both groups.

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