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Developing Lesson Plan on the Healthier Local Snack STEM Education

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Abstract. The paper will clarify the healthier local snack STEM education. The STEM education learning activity will be developed based on Sutaphan and Yuenyong (2019) the context-based STEM education learning approach. The activity will start from identification of social issue - how we can make our Indonesia local snack become healthier. Then, the lesson plan will provide activities regarding on the 7 stages of Sutaphan and Yuenyong (2019) the context-based STEM education in order to scaffold students to practice knowledge for designing prototypes or products of the healthier local snack through engineer design process. Students, then, will be challenged to practice knowledge between healthy, nutrition, and existing capitals (physical: the shape of the snack, the interesting packaging, financial: using good but affordable local ingredient, social/technology: choosing the right cooking tools that suitable for the snack making, human: the safety of food and nutritional value of the food, culture and religious: culture of produce local snack and the way of living based on Islamic beliefs, and natural: the impact of developing this design/product toward the ecosystem and environment). This paper may have implications for designing STEM education learning activities.

Keywords: STEM education, cooking, snack, culture, religious, nutrition

1. Introduction

The new movement of education has affected globalization which motivated a massive engagement in other countries with STEM. Particularly, countries in Europe have been struggling to enhance their people in operating and creating technologies to boost their domestic production (Schwab and Martin, 2012). STEM is an initiative of the National Science Foundation, USA and now being implemented by several countries such as the USA, Japan, Finland, Australia, and Singapore. Today, it becomes one of the primary trends in global education. The implementation goal to make a major career choice for learners (Kapila and Iskander, 2014; Han et.al., 2014) STEM approach is greater emphasized on the quality of curricula and instruction. There is composed of four disciplines - science, technology, engineering, and mathematics- to applied approach. It

is also an important development of student skills like problem-solving, critical thinking, and reasoning skill are essential to life-long learning because of those skills allows them not only the effective outcome from learning in their classroom but also attitude process in different contexts. Nevertheless, in recent years, many countries are applied STEM to their education level regarding educational direction. These are seen as the generation of technological and scientifically literate citizens who necessary elements to prepare those employed in integrated fields such as medicine, computer science, agriculture, and others (Hayward and McComas, 2014; Chomphuphra et.al., 2019; Yuenyong, 2019).

Students in 21st century need to be successful in the effective workforce. Thus, tend to engage students to be a well-educated citizen is prepared greater education and focused on various life skills, workforce skills, applied skills, personal skills (curiosity, imagination, critical thinking, and problem-solving), interpersonal skills (cooperation and teamwork) (Saavedra and Opfer, 2012). These appropriated skills are also commonly referred to as higher-order thinking skills, deeper learning outcomes, and complex thinking and communication skills. Some skills are improved students learning also based on problem-based learning approach, especially basic problems in their local that lead students to aware fundamentally. Indonesia was implemented STEM and problem-based learning to make students have STEM literacy to improve student accomplishment of learning in previous skills and integrate science and mathematics that is basic knowledge to the complex knowledge. The perception of STEM users in the field of content and career not only illustrated positive reflections but also give consequence development of education in the STEM context, it can be said that STEM had the potential to solve problems about the quality of the learning process in the current era (Saavedra and Opfer, 2012; Christensen et.al., 2014; Duc et.al. 2019; Ebal et.al., 2019; Guarin et.al., 2019; Mordeno et.al., 2019; Suwono et.al., 2019; Tupsai et.al., 2019; Villaruz et.al., 2019).

Many active learning processes with teaching techniques for a variety of skills to children necessary in life that emphasize students learn from real practice and real-life situations in order to use thinking skills. There are conditions and rules for participating in activities, the learning activities that are organized focused on the students to practice group discussion to share their ideas from different contexts by the teacher plays a guiding role. Furthermore, the learning advocates the opinions, as well as communication skills. When considered essential and important for students learning, the researcher interested in problem-based learning (PBL) which is a learning process using active learning for preparing the citizen who has to face different problem contexts.

This study focused on problem-based learning combined with STEM education that provided students to concern about local snacks that in recent many people have more favored consuming snacks that low nutrients but high calories. Students can apply scientific knowledge or others to design the solution for making people tend to demand in food healthier.

2. Developing the healthier local snack STEM education learning activities

Nowadays, Indonesian local and popular snacks are in high demand. Many seller develop various snack depended on the market taste or preferences. Indonesian people tend to like spicy, fried, and flour-based food which is low in nutrient yet high in calories, for example *gorengan* (Fried food), *cilok, seblak, sempol* (tapioca and flour based snack), *etc.* In this lesson, the students are expected to be able to integrate the knowledge related to STEM to propose a solution.The developed lesson plan of the healthier local snack STEM education learning activities will be developed based on Sutaphan and Yuenyong (2019) the context-based STEM education learning approach. The context of Indonesian local snack (e.g. gorengan, cilok, cireng, seblak, and so on)

will be raised in order to enhance students to identify the problem of how to make healthy snack from Indonesian local snack.

Sutaphan and Yuenyong (2019) the context-based STEM education learning approach consists of 7 stages. These included (1) Identification of social issues, (2) Identification of potential solution, (3) Need for knowledge, (4) Decision-making, (5) Development of prototype or product, (6) Test and evaluation of the solution, and (7) Socialization and completion decision stage. The 7 stages of context based STEM education teaching approach, the activities may motivate students to practice knowledge for designing something related to produce healthy snack (e.g. process of making healthy snack, favor of snack, forms of snack, manual of eating the snack, label or packaging, advertising and so on).

Through designing those things, students will be challenged to practice knowledge between healthy, nutrition, and existing capitals (physical: the shape of the snack, the interesting packaging, financial: using good but affordable local ingredient, social/technology: choosing the right cooking tools that suitable for the snack making, human: the safety of food and nutritional value of the food, culture and religious: culture of produce local snack and the way of living based on Islamic beliefs, and natural: the impact of developing this design/product toward the ecosystem and environment). The highlight of learning activities could be viewed as showed in the table 1.

Table 1: highlight of the healthier local snack STEM education learning activities

Stage	Activity
1. Identification of social issues	1. Discussion with the students about their favorite local snack, why they like the snack, their opinion about health issue of the local snack. 2. Teachers raise the issue "how can we make our local snack become healthier?" (advertise, persuade, create new activities) The teacher raises the social issue that "people prefer affordable food also, people in this generation tend to give more attention to the nutrition content of the food ingredients than before. "If students are engineers how to design a healthier and economical version of local snack (gorengan/cilok/cireng/seblak)? "
2. Identification of potential solution	1. Students and teachers shared the analysis in the design of a healthier but still affordable version of local snack. 2. Students may discuss their possible designing of a healthier and economical version of local snack on the five capitals including physical, financial, social/technology, human, and natural capitals. For examples, students may come up with some ideas of capitals as following: Physical: The shape of the snack, the interesting packaging, Financial: using good but affordable local ingredient, and Social/technology: choosing the right cooking tools that suitable for the snack making Human: The safety of food and nutritional value of the food. Culture and religious: culture of produce local snack and the way of living based on Islamic beliefs Natural: The impact of developing this design/product toward the ecosystem and environment

Table 1 (Continued)

Stage	Activity
3. Need for knowledge	1. Developing concept of nutrition, students study the following activities to make sense of nutrition. (a) Explaining Nutrition, food, and the health of the body. Nutrition is how food affects the health of the body through the illustration activities. These included illustration of child running to depict energy, illustration of building blocks to depict protein and other nutrients, illustration of child flexing muscle to depict protein, illustration of healthy growth and development, illustration of "strong" blood to depict iron and other nutrients, and illustration of "happy" skeleton to depict calcium and other nutrients (b) Develop concept map of food and its composition of nutrients. Food is comprised of macronutrients including protein, carbohydrate and fat. Food also supplies micronutrients (vitamins and minerals) and phytochemicals (c) Clarify the role of nutrients and what kinds of food would be found that nutrients. (d) Survey the Indonesian local snack to clarify macronutrients or micronutrients probably is found in those snacks (Mahan et.al., 2012). 2. Problem Based Learning (PBL) on constructing idea of healthy and economical local snacks. Students have to form group of 4-5 people. Each group will have to gather information as following activities: (a) Collect data by asking students from another class/grade (limited 20 students for each group) about what kind of local snack they like, what the indicator of local snack is, and the range of price that included into affordable categories. (b) Review literatures to identify what criteria to identify healthy snack.
4. Decision-making	1.Discussing the possibility to make different kind of snacks in healthier version. They may also design something related to produce healthy snack (e.g. process of making healthy snack, favor of snack, forms of snack, manual of eating the snack, label or packaging, advertising and so on) 2.Students, which work in group of 4-5 people, will present their idea in front of the class and explain what snack that they will choose and what kind of modification they will do. Non presenter groups will ask, also give their comments to the idea. Presenter group will answer and note the comment to refine their idea.

Table 1 (Continued)

Stage	Activity
5. Development of prototype or product	Students create sample/prototype related to the healthier snack at home. Those prototypes may include the process of making healthy snack, favor of snack, forms of snack, manual of eating the snack, label or packaging, advertising and so on. Then, they have to bring their prototypes/products to school on the next meeting. For each step, of their experiment they need take a documentation in the form of photo. They will also asked to bring the original snack to compare the appearance, taste and nutrional information.
6. Test and evaluation of the solution	1. Each group of students will present their criteria of identifying healthy snack and their existing capitals. 2. To test and evaluation of the solution, they need to clarify the following activities of developing prototypes or products regarding on the criteria of identifying healthy snack and their capitals. Those activities included the process and ingredients of making healthy snack, mention nutritional information of food, recipes for local snack, manual of eating the snack, label or packaging, advertising, and so on.
7. Socialization and completion decision	Students have present their prototypes or products that related to the healthy snack to the committee. Each group will have to: 1. Explain what their final product is. 2. How they develop and test their product. 3. Present physical, nutrional and economical value of their product to support their claim about being healthy and affordable. The last, convince audiences that their products are worth selling and profitable.

3. Conclusion

The paper clarified how to provide STEM education through Sutaphan and Yuenyong (2019) context based STEM education learning approach. It is possible to provide the context of Indonesian local snack (e.g. gorengan, cilok, cireng, seblak, and so on) will be raised in order to enhance students to identify the problem of how to make healthy snack from Indonesian local snack. That knowledge could be provided based on school curriculum.

According to the issues of the healthier local snack, the activities of 7 stages may motivate students to practice knowledge for designing something related to produce healthy snack (e.g. process of making healthy snack, favor of snack, forms of snack, manual of eating the snack, label or packaging, advertising and so on). To support student practicing knowledge, the classroom will move to the need for knowledge stage where students will develop concept of nutrition and do PBL on constructing idea of healthy and economical local snacks.

After students learn some more related knowledge, they could develop their prototypes or products which concurrent through knowledge based that could be provided on the decision making and development of prototype or product stage. Students will discuss about the possibility to make different kind of snacks in healthier version. They may also design something related to produce healthy snack (e.g. process

of making healthy snack, favor of snack, forms of snack, manual of eating the snack, label or packaging, advertising and so on). To develop a solution as real world solving problem, students will be challenged to develop their design regarding on existing capitals. These included physical capital (e.g. the shape of the snack, the interesting packaging), financial capital (e.g. using good but affordable local ingredient, social/technology capital (e.g. choosing the right cooking tools that suitable for the snack making), human capital (e.g. the safety of food and nutritional value of the food, culture of produce local snack and the way of living based on Islamic beliefs), and natural capital (e.g. the impact of developing this design/product toward the ecosystem and environment).

The test and evaluation of the solution stage, students' prototypes will be validated through students' explanation about activities of producing the healthier local snack to obtain the criteria of identifying healthy snack and their capitals. In the socialization and completion decision stage, students have present their prototypes or products that related to the healthy snack to the committee. Then, students will get the comments from committees in order to revising their prototypes and products. And, students will have also chance to apply their scientific and other knowledge for problem solving in context of engineers, technology, or entrepreneurship (Sutaphan and Yuenyong, 2019).

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