The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational & Social Sciences (EPESS), 2024

Volume 34, Pages 42-51

IConSED 2024: International Conference on Special Education and Diversity

Processing Regional Typical Food with a STEM Approach for Craft and Entrepreneurship Subjects: The Education for Sustainable Development Project in School

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Abstract: Graduate Competency Standards (SKL) in educational units at the general high school level, based on Permendikbud Ristek Number 5 of 2022, one of which is focused on knowledge to develop students' competence so that they may live independently and seek further education. According to graduation statistics from SMAN 2 Padalarang in 2022, 45% of education participants continued their studies to the tertiary level, 25% employed, and the balance were married, jobless, or other. This implies that students at SMAN 2 Padalarang show an intense need to work, even if they are expected to carry out their study at the university level. There are strategies for tackling these challenges, including: (1) selecting regional food processing materials that are close to students' daily lives and to achieve sustainable development goals. (2) Applying PjBL STEM learning to engage in active and meaningful learning. The findings are as follows: (1) The STEM approach can be applied as an alternative to PKWU learning to get students inspired and involved in cooking dishes from their region. (2) The average student performance score is 80.3, indicating that students are able to create and promote locally sourced distinctive foods to rapidly and creatively solve food supply concerns and promote sustainable development.

Keywords: Regional food, STEM, Sustainable development, Entrepreneurship

Introduction

Graduate Competency Standards (SKL) in educational units at the general high school level, based on Permendikbud Ristek Number 5 of 2022, one of which is focused on knowledge to develop students' competence so that they may live independently and seek further education. According to graduation statistics from SMAN 2 Padalarang in 2022, 45% of education participants continued their studies to the tertiary level, 25% employed, and the balance were married, jobless, or other. This implies that students at SMAN 2 Padalarang show an intense need to work, even if they are expected to carry out their study at the university level. One of the factors causing the high interest of students at SMAN 2 Padalarang to work is the environmental conditions of Padalarang area which is an industrial area. Based on the profile data of Padalarang Sub-district in 2021, there are 392 industries with large, medium, and small categories, and 330 small and medium industries.

Adlim et al. (2014) stated that only 29% of high school students in Indonesia continue to college and the remaining 71% return to society without life skills. Therefore, it is necessary to have a programme that can accommodate these students in order to have the knowledge and skills to enter the world of work and even be expected to be able to open jobs, among others, through Craft and Entrepreneurship (PKWU) subjects. Based on Permen No. 59 of 2014, Craft and Entrepreneurship subjects consist of four aspects, namely engineering, crafts, cultivation, and processing, and can be classified into knowledge that develops knowledge and trains life skills

based on economically based arts and technology (Wati, 2018) or can be classified into transcience-knowledge (Chusuma, 2017).

The abilities developed in PKWU subjects include developing creativity through creating, designing, modifying, and reconstructing based on basic technology education, entrepreneurship, and local wisdom, and fostering a technological and aesthetic mindset: dexterous, economical, and practical (Wati, 2018). There are several obstacles in the implementation of PKWU learning, namely (1) the absence of professional teachers who teach specifically PKWU subjects so that schools appoint teachers with educational backgrounds in biology, physics, economics to teach it; (2) the lack of teacher creativity in developing PKWU learning methods; and (3) low motivation and curiosity of students in PKWU learning, and tend to put PKWU aside compared to other subjects (Chusuma, 2017).

The existence of the Science Technology Engineering and Mathematics (STEM) approach can be used to overcome the obstacles in PKWU learning and meet the challenges in developing these students' abilities. This is in line with the statement of Quang (Rahmawati et al., 2021) that the STEM approach makes students experience learning actively and meaningfully. The STEM approach is built from various disciplines, namely Science Technology Engineering and Mathematics to develop students' skills in solving problems in everyday life (National STEM Education Centre in Herliani, 2021). One of the PKWU fields, namely processing, is very close to everyday life, starting from food processing to production and business opportunities. Students are challenged to be able to produce a food product and then market it. Thus, in learning PKWU in the field of processing, a STEM integrated project-based learning model can be used or known as STEM-PjBL according to Laboy-Rush. The application of the STEM-PjBL model gives students the experience to solve problems in everyday life through practical, meaningful learning activities that support the essential skills needed for future careers (Rahmawati et al., 2021).

One of the characteristics of learning with the STEM approach is the Engineering Design Process (EDP). Students design a product and then redesign it so that students are able to produce their best product (Nurfaijah, 2021). The variety of processes and products produced illustrates differentiated learning as an implementation of the Merdeka Curriculum. In the 2022-2023 school year, SMA Negeri 2 Padalarang began implementing the Merdeka Curriculum at the Independent Sharing level. The Merdeka Curriculum is a government policy as an option for restoring learning in Indonesia. According to Dr Rizqi in the event of Utilising Merdeka Mengajar Platform in Implementing Merdeka Curriculum Independently in East Java Province Wave 2 Year 2022, the choice of Mandiri Berbagi means that the school is very ready and has carried out many good practices related to the development of teaching tools and so on. In addition, the school has the readiness of facilities and infrastructure, human resources, and can already work or innovate, not only on the Merdeka Mengajar platform but also can share with other schools in the form of innovative works and still follow the principles of the Merdeka Curriculum.

Schools that choose Mandiri Berbagi can share their work not only with neighbouring schools, but also with teachers or principals in Indonesia. This is certainly a challenge for the author, starting from compiling and developing teaching tools, to the differentiated learning process that suits the needs of students at SMA Negeri 2 Padalarang. Differentiated learning is a form of effort in a series of learning that considers the needs of students in terms of learning readiness, student learning profiles, interests, and talents. There are three approaches to differentiated learning: content, process, and product. Content differentiation is what students learn in terms of curriculum and learning materials. Process differentiation is how students process ideas and information, which includes how students choose their learning style. Product differentiation is where students show what they have learnt. (Wasih et al., 2022).

Regional food processing as one of the areas in PKWU subject can be learnt through differentiated learning process. Students can choose food processing with different techniques. It also shows the connection between learning and sustainable development. Since 2015, Indonesia along with other developed and developing countries are committed to the welfare of the people through 17 global goals and targets of sustainable development. Based on the Implementation Report on the Achievement of Sustainable Development Goals in 2023, the prevalence of inadequate food consumption has increased from 8.49% in 2021 to 10.21% in 2022. Therefore, Indonesia needs to increase domestic food production capacity and diversify community food production and consumption as a step to anticipate the global food crisis and as an effort to improve people's food consumption. This anticipation step can be achieved through PKWU learning in the field of regional typical food processing.

Method

This study develops the process of processing regional typical foods through STEM integrated project-based learning model or known as STEM-PjBL according to Laboy-Rush. The syntax of this learning model consists of 5 steps, namely: reflection, research, discovery, application, and communication (Agnestia, 2023). This learning model was applied to 36 students of class XI in the odd semester of the 2022/2023 academic year at SMAN 2 Padalarang. This study used a pre-experimental design of one shot case study model in a group that was given treatment and then observed the results (Herdani et al., 2020). The instruments used included student project reports, questionnaires, interviews, and project-based summative tests. The data obtained in the form of student responses in the form of both written and oral, work performance, and observations documented through photos and videos are then analysed through simple mathematical calculations such as determining the average value of the project test, the percentage of questionnaire answers and described to answer the research problems that have been presented in the previous section.

Results and Discussion

The strategies implemented to overcome the problems described in the introduction include:

Selection of Types and Processing of Regional Typical Foods

Regional typical foods are foods commonly consumed in an area that reflect the character of the community, for example in mountainous areas usually produce dishes from vegetables, and generally the dishes are all hot and spicy to warm the body because of the cold mountain climate (Latifah, 2020). Regional typical foods can be made from plant-based foods, which are ingredients derived from plants, such as fruits, vegetables, nuts, and tubers, and animal-based foods, which are ingredients derived from animals, including fish, meat eggs, and milk. Some examples of regional typical foods made from plant-based ingredients include gudeg (Central Java), pickles (West Java), while examples of regional typical foods made from animal-based ingredients include rujak cingur (East Java), rendang (West Sumatra), and Coto Makasar (Sulawesi).

The average food calorie energy requirement for each individual in Indonesia is recommended at 2100 kcal/capita/year and has been met and even improved the quality of food consumption based on the Pola Pangan Harapan (PPH) score in the Implementation Report on Achieving the Sustainable Development Goals in 2023. However, food consumption in the form of tubers, nuts, and vegetables and fruits still needs to be increased. One of the strategies that can be applied to increase the consumption of these foodstuffs is through PKWU learning in the field of regional typical food processing made from vegetable food ingredients. In general, vegetable food is less perishable and has a higher durability than animal food. In addition, vegetable food tends to be more resistant to pressure, has specific material properties but is easier to generalise than animal food.

Based on the advantages of plant-based food ingredients, plant-based food ingredients are easier to create with various food processing techniques. According to Latifah (2020), there are three (3) regional typical food processing techniques, namely:

1. Wet cooking techniques consist of boiling, stewing, braising, steaming, simmering, and blanching.
2. Dry cooking techniques consist of grilling, baking, and roasting.
3. Oil cooking techniques consist of sautéing (shallow frying) and frying (frying).

In addition to the cooking techniques that have been described, there are several terms in food processing including fileting, larding, barding, glazing, thickening, clarifying, whisking, marinating, stuffing, and coating.
Plant-based foods also contain carbohydrates, vitamins, and minerals, as well as protein and fat (Latifah, 2020). Thus, processing typical foods made from plant-based foods can also anticipate the food crisis and become one of the strategies to improve food consumption in order to achieve Sustainable Development Goal (SDGs) number 2, namely Zero Hunger.

Application of PjBL-STEM Model in PKWU Learning

It has been explained in the introduction that the STEM approach can be applied in PKWU learning because PKWU is classified as knowledge that develops knowledge and trains economic-based art and technology-based

life skills. The following are the Basic Competencies (KD) to be achieved from processing regional specialities, namely:

Knowledge Domain

3.1. Understand the planning of an original food processing business from plant-based food ingredients including business ideas and opportunities, resources, administration, and marketing.
3.2. Analyse the processing system of local typical food (original) from plant-based food ingredients based on the carrying capacity of the local area.

Skill Domain

4.1. Make a business plan for processing local specialities (original) from plant-based food ingredients including business ideas and opportunities, resources, administration, and marketing.
4.2. Process, package and preserve original food from plant-based food based on the concept of work with local and other cultural approaches.

Based on the Basic Competencies (KD), the STEM analysis is carried out as in the following diagram:

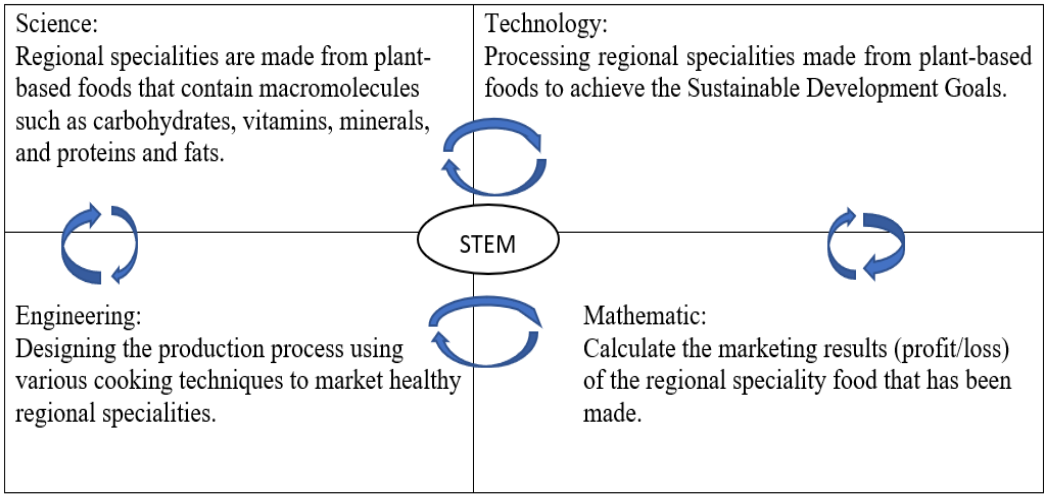


Figure 1. Diagram analysis of STEM

The following are the learning steps carried out by students with the PjBL-STEM model according to Laboy-Rush in PKWU learning in the field of processing regional typical foods from vegetable food ingredients as shown in Table 1.

Table 1. Syntax and activities of the PjBL-STEM learning model for processing regional typical foods

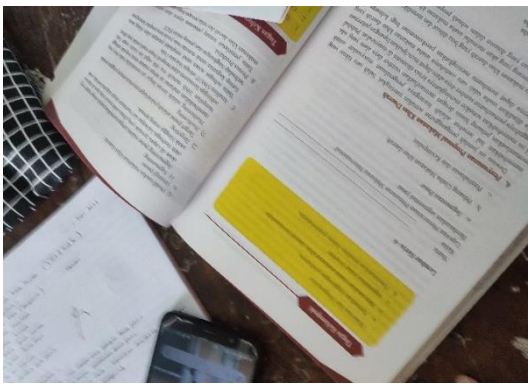
No.	Syntax of Learning Model	Learning activities
1.	Reflection	a. The teacher conveys the condition of students' nutritional intake that is sometimes lacking attention and the various types of food around the students' neighbourhood. b. Students observe various types of West Java regional typical foods sold around their neighbourhood and share their observations.
2.	Research	a. Students observe a video presented by the teacher on vegan restaurant business opportunities in Bandung and try to interpret it. b. Students write and ask some questions related to plant-based foods and regional typical foods of West Java.
3.	Discovery	Students are formed into groups to: a. Discuss Students with guidance from the teacher discuss the design of STEM projects in groups including formulating problem formulation, making research hypotheses, making methods and work steps, and compiling a research project schedule in

No.	Syntax of Learning Model	Learning activities
		the form of a project proposal. b. Collect information Record all information about plant-based foods and regional typical foods that have been obtained through various sources in notebooks and LMS (Google Classroom) with neat writing and using good and correct Indonesian language. c. Present the project proposal Students communicate orally with confidence about the plan for processing plant-based food ingredients into healthy West Java regional specialities. d. Make improvements to the project proposal based on the results of the discussion at the proposal presentation.
4.	Application	a. Students carry out STEM projects inside and outside learning hours for 7 x meetings. b. Teachers monitor learning project work in class and LMS based (Google Classroom). c. Teacher facilitates students' project activities by providing input related to the progress and obstacles faced through class discussions or on the LMS. d. The teacher assesses the production of the West Java regional typical food samples. e. Students improve the typical food products according to the teacher's suggestions and continue to the packaging and sales stages.
5.	Communication	a. Students present the results of the project on making West Java regional typical foods made from plant-based foods. b. The teacher conducts performance-based summative assessment and provides reflection and reinforcement to avoid students' misconceptions. c. The teacher provides opportunities for students to express their experiences during the research project activities.

The documentation of learning with the PjBL-STEM model on processing regional typical foods made from vegetable food is shown in the following figure.

a

b



c

d

e

Figure 2. Documentation of PKWU learning with PjBL-STEM model a) Reflection b) Research c) Discovery d) Application e) Communication

In PKWU learning in the field of regional typical food processing with the PjBL-STEM model, students are grouped into six (6) groups. Based on the results of observations of various types of typical food around their environment and the results of discussions about food business opportunities made from vegetable food, then each group designs a typical West Java food production project by determining the type of food and analysing its business opportunities. The typical food project proposal was presented first and then improved according to the suggestions from the discussion. Students then carry out the project by making samples of the typical food and then testing it (tester) to several teachers. The shortcomings of the typical food that are known based on the results of the tester are improved and produce typical food products that are ready to be marketed. The typical food was then promoted and sold in the school environment and the neighbourhood around the students' homes for 2 weeks. The project report was communicated and assessed. The following table summarises the results of the West Java regional typical food processing project made from plant-based foods carried out by the 6 groups.

Table 2. Project results of processing typical West Java food made from plant-based foods

Group	Type of West Java Regional Typical Food	Cooking Technique	Sales Result
1	Misro	Pan fying	Profit Rp 10500
2	Getuk	Boiling and Steaming	Profit Rp 9500
3	Comro	Pan fying	Profit Rp 23000
4	Surabi	Baking	Profit Rp 92000
5	Nasi Tutug Oncom	Stir frying	Profit Rp 120000
6	Dadar Gulung with Natural Colouring	Sauteing	Profit Rp 102000

In learning the processing of typical West Java regional foods with the PjBL-STEM model, it can be seen that students have been able to make typical foods from vegetable food ingredients which generally come from tubers and nuts, including misro, getuk, and comro which are made from cassava and oncom which comes from

soya beans. These ingredients should not be processed carelessly so that the nutritional content is not damaged (Atmoko, 2017). The frying process causes a very significant decrease in nutritional content because frying uses high temperatures so that nutrients such as protein are damaged (Lamid, 2015). The use of high temperatures causes thermal degradation of the compounds in the ingredients resulting in a decrease in the quality of food ingredients (Koeswardhani, 2014).

In making omelette rolls, the cooking technique is called Sauteing, which is a method of cooking food using a small amount of oil or fat that only sticks to the surface of the pan or heating device (Atmoko, 2017). Rolled omelette skin is moulded using a flat pan (Teflon) quickly with one turn using a little oil so that the nutritional content inside is not lost. In the process of making surabi, the dough is baked using earthenware without adding oil, while getuk is made by boiling cassava first. The boiling process can cause the dissolution of vitamins into the cooking water. All cooking or food processing methods can also reduce the nutritional content of food. The degree to which the nutritional content of a food is reduced due to cooking depends on the type of food, the temperature used and the length of the cooking process (Lamid, 2015). Therefore, during the processing of regional specialities, it is necessary to pay attention to the temperature and duration of the cooking process so that the nutritional content of the food ingredients is not completely lost.

Based on the data in Table 2, the sales results of all groups made a profit. The profit varied from Rp 9500 to Rp 120000 even though the selling time for all groups was the same, namely for 2 weeks. This is due to the variation in the selling price of food and the amount of food sold. The frequency of sales was also an obstacle for the groups, as students had to organise their selling time in between school and study. However, this experience provides knowledge and skills about business opportunities in the culinary field, so that it can be used as a provision for students after graduating from school. Thus, the processing of regional typical foods made from plant foods can be learned with the PjBL-STEM model and can equip students with entrepreneurial skills. In addition, cooking techniques applied to the production of regional typical foods and their marketing are one of the efforts to diversify food production and consumption so as to achieve the Sustainable Development Goal of Zero Hunger.

The innovation applied with the use of natural food colouring from leaves and fruits as well as menu variations on surabi, getuk and nasi tutug oncom show a variety of regional food production processes. This reflects the differentiated learning process which is further assessed in the performance-based summative assessment of project implementation. The rubric and results of the project assessment are shown in the following table.

Table 3. Rubric for Project Implementation Performance Assessment

No.	INDICATORS	SCORE				
		1	2	3	4	5
A	Determine the type of regional typical food (original) from plant-based food ingredients					
B	Plan an original regional typical food business from plant-based food ingredients based on business opportunities and the carrying capacity of the local area.					
C	Communicating ideas/ideas for business planning of regional typical food (original) from plant-based food ingredients.					
D	Processing regional (original) typical food from plant-based food ingredients.					
E	Marketing regional (original) typical food from plant-based food ingredients.					
F	Analyse marketing results based on break-even point (BEP).					
G	Innovate business development and marketing of regional typical foods (original) from plant-based food ingredients					
H	Evaluate the constraints of the regional typical food business (original) from plant-based food ingredients					
I	Present the results of analyses and conclusions in various forms of media					
J	Communicating a report on the results of a regional typical food business (original) from plant-based food ingredients					

Score Gradation:
5 : Students are very capable of achieving the set indicators
4 : Students are able to achieve the set indicators
3 : Students are quite capable of achieving the set indicators
2 : Students are less able to achieve the set indicators
1 : Students have not been able to achieve the set indicators

$$final\ score = \frac{score\ acquisition}{maximum\ score} \times 100$$

Table 4. Student project implementation performance-based summative test results

STUDENTS	INDICATORS										SCORE
	A	B	C	D	E	F	G	H	I	J	
1	5	5	3	3	3	3	3	4	3	3	70
2	3	4	3	3	5	4	4	4	3	3	72
3	3	4	4	4	4	4	5	4	4	4	80
4	5	5	4	5	5	4	5	4	5	5	94
5	3	4	4	4	4	4	5	4	4	4	80
6	5	4	3	4	4	4	4	4	4	4	80
7	5	5	3	3	3	4	3	4	4	4	76
8	5	4	3	3	3	4	4	3	3	3	70
9	5	5	4	4	4	4	3	4	5	5	86
10	4	5	4	3	5	5	5	4	4	4	86
11	4	5	4	3	5	5	5	4	3	3	82
12	5	5	4	5	5	4	5	4	5	5	94
13	3	4	3	4	5	4	4	4	4	4	78
14	3	4	3	3	3	4	5	4	4	3	72
15	5	4	3	4	4	4	4	4	4	4	80
16	4	5	4	3	5	5	5	4	4	4	86
17	5	5	4	5	5	4	5	4	3	3	86
18	3	4	3	3	3	4	5	4	4	3	72
19	3	4	4	4	4	4	5	4	4	4	80
20	4	4	3	3	3	4	4	3	3	3	68
21	5	5	3	3	3	3	3	4	3	3	70
22	3	4	3	3	5	4	4	4	3	3	72
23	4	5	2	3	3	3	4	4	3	3	68
24	5	5	3	3	3	4	3	4	4	4	76
25	3	4	3	4	5	4	4	4	4	4	78
26	5	4	3	4	4	4	4	4	4	4	80
27	4	5	4	3	5	5	5	4	4	4	86
28	5	5	4	3	3	4	3	3	5	5	80
29	3	4	4	4	4	4	5	4	4	4	80
30	5	5	4	4	4	5	3	4	5	5	88
31	3	4	3	4	5	4	4	4	5	5	82
32	5	4	3	4	4	4	4	4	4	4	80
33	5	5	4	5	5	4	5	4	5	5	94
34	4	5	4	3	5	5	5	4	5	5	90
35	3	4	3	5	5	4	5	4	4	4	82
36	5	5	4	5	5	4	5	4	5	5	94

Based on the results of the project implementation performance assessment, the average score obtained by students is 80.3. Thus, students have achieved the competency of planning a regional speciality food business starting from selecting the type of regional speciality food, innovating vegetable food processing, serving, marketing, evaluating to communicating their products.

Based on the results of the questionnaire with a total of 35 respondents, it was found that most of the students 80% had just experienced PKWU learning with the STEM approach for the first time and 85.7% of students felt happy learning PKWU with the STEM approach. The learning also made students excited and able to solve problems (88.5%). As many as 91.5% of students think that PKWU learning in the field of regional speciality food processing is very close / in accordance with daily life, makes students actively cooperate in making

products, and is able to improve students' abilities in the field of entrepreneurship. However, 48.6% of students find it difficult to learn PKWU with the STEM approach. This is in line with the results of student interviews which stated that in the implementation of the project there were several obstacles including costs, equipment, communication, and cooperation in group members that were not optimal due to the location of the houses that were far apart between members. In addition, because this STEM approach was only known for the first time by students, students were not familiar with the syntax of the learning model (Agnestia, 2023).

The following are the results of interviews from several students:

The impression in learning Pkwu with this STEM approach is quite good because we can find out how to be a good entrepreneur and we are able to sell this tutug oncom rice well without any losses in selling it.

It's fun because it can make us learn how to be entrepreneurs, even if it's small. And can make us feel how to make the food because we know we just buy near the house. And how difficult it is to calculate the ingredients and determine the selling price.

When working in groups, because our houses are mostly far away, it is difficult to make the products.

Difficulty in cost, then for surabi, we should use a stove and then surabi must be warm and it's a little complicated, then for the surabi cooking pan is limited.

Conclusion

The field of regional typical food processing in the subject of Crafts and Entrepreneurship (PKWU) can be studied with a STEM approach so that there is a differentiation of processes in applying various cooking techniques to process vegetable food into typical West Java regional food. The average score of the project implementation performance-based summative test of 80.3 shows that students have been able to make and market typical West Java regional food as an effort to diversify food production and consumption so as to achieve the Sustainable Development Goal of No Hunger. In addition, students have also been able to develop knowledge and skills regarding business opportunities in the culinary field, so that they can be used as provisions for students after graduating from school.

Recommendations

The author recommends the STEM approach with the PjBL-STEM learning model according to Laboy-Rush to be applied in other PKWU fields (engineering, crafts, and cultivation) as well as in other subjects. In this study, there is still limited data on the nutritional content of food processing results with various cooking techniques. Therefore, further research needs to be done to determine the content contained in food ingredients after processing both qualitatively and quantitatively.

Scientific Ethics Declaration

The author(s) declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Special Education and Diversity (www.iconsed.net) held in Alanya/Turkey on May 02-05, 2024

*The researchers would like to express their deepest gratitude to the Beasiswa Pendidikan Indonesia (BPI) of the Kementerian Pendidikan, Kebudayaan, Riset dan Teknologi (Kemendikbudristek) and is implemented by the Balai Pembiayaan Pendidikan Tinggi (BPPT), which is a joint programme between the Kemendikbudristek and the Lembaga Pengelola Dana Pendidikan (LPDP) under the Kementerian Keuangan of the Republic of Indonesia as the sponsor for their master's studies, and the support for this paper and publication.

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To cite this article:

Agnestia, M.I. & Mudzakir, A. (2024). Processing regional typical food with a STEM approach for craft and entrepreneurship subjects: The education for sustaınable development project in school. *The Eurasia Proceedings of Educational & Social Sciences (EPESS)*, *34*, 42-51.