

PROJECT-BASED MATHEMATICS LEARNING: FRUIT SALAD RECIPES IN JUNIOR HIGH SCHOOL

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Abstract

Mathematics learning is associated with 21st-century skills such as communication, collaboration, critical thinking in problem-solving, creativity, and innovation. To help students obtain these skills, a learning project was developed through *Pendidikan Matematika Realistik Indonesia* (PMRI) approach by using fruit salad recipes and collaborative learning based on the Lesson Study for Learning Community (LSLC) system. The primary purpose of this study was to develop fruit salad recipes to assist junior high school students in solving problems using mean, social arithmetic, and data presentation. It employed design research type validation studies using photos, fruit salad products, and document reviews as data collection techniques. The research subjects were 27 students of grade 8 from a junior high school in Palembang. This study resulted in a learning trajectory consisting of two activities and post-test questions. In the first activity, the students can analyze and solve problems in planning fruit salad recipes with material averaging, social arithmetic, and data presentation. In the second activity, the students can make fruit salads and write recipes based on skills to make fruit salad products. The results of this study demonstrate that in project-based learning through PMRI with the context of fruit salad recipes and the LSLC system, students can learn collaboratively. The learning helps them solve problems by using average material, social arithmetic, and data presentation in developing fruit salad recipes.

Keywords: Fruit Salad's Recipes, Project-based Learning, LSLC, Design Research

Abstrak

Pembelajaran matematika dikaitkan dengan keterampilan abad 21 seperti komunikasi, kolaborasi, berpikir kritis dalam pemecahan masalah, kreativitas, dan inovasi. Untuk membantu siswa memperoleh keterampilan tersebut, dikembangkan suatu proyek pembelajaran melalui pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) dengan menggunakan resep salad buah dan pembelajaran kolaboratif berbasis Lesson Study for Learning Community (LSLC). Tujuan utama penelitian ini adalah mengembangkan resep salad buah untuk membantu siswa SMP dalam memecahkan masalah menggunakan mean, aritmatika sosial, dan penyajian data. Penelitian ini menggunakan metode penelitian desain tipe studi validasi dengan menggunakan foto, produk salad buah, dan telaah dokumen sebagai teknik pengumpulan data. Subjek penelitian adalah 27 siswa kelas 8 SMP di Palembang. Penelitian ini menghasilkan learning trajectory yang terdiri dari dua kegiatan dan soal post-test. Pada kegiatan pertama, siswa dapat menganalisis dan memecahkan masalah perencanaan resep rujak buah dengan materi rata-rata, aritmatika sosial, dan penyajian data. Pada kegiatan kedua, siswa dapat membuat salad buah dan menulis resep berdasarkan ketrampilan membuat produk salad buah. Hasil penelitian ini menunjukkan bahwa dalam pembelajaran berbasis proyek melalui PMRI dengan konteks resep salad buah dan LSLC, siswa dapat belajar secara kolaboratif. Pembelajaran ini membantu mereka memecahkan masalah dengan menggunakan materi rata-rata, aritmatika sosial, dan penyajian data dalam menyusun resep salad buah.

Kata kunci: Resep Salad Buah, Pembelajaran Berbasis Proyek, LSLC, Penelitian Disain

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The 21st-century skills are essential for students to face global challenges. To survive in the society and work, it is not enough for students to only have the core abilities known as 3M, which include reading, writing, and counting (Sulistyaningsih et al., 2019). Increasing knowledge and skills should be one of important objectives in the 21st century so that educators create a learning environment in the form of a classroom environment that helps students develop not only knowledge but also skills.

The 21st-century life skills consist of critical thinking, creative, communicative, problem-solving, and literacy skills needed by Indonesian people (Suryandari et al., 2018). In line with that, Wakhidah (2012) argues that the 21st-century skills people need to have include critical thinking skills, problem-solving skills, creative thinking skills, decision-making skills, and reflective reading and writing skills as well as communication skills both oral and written. Furthermore, Adams (2014) stated that one of the challenges faced by educators is to create a learning environment in the form of a classroom environment that helps students develop the skills they are looking for, so that they can face global challenges.

Mathematics learning guides students in achieving the 21st or 4C century skills, including communication, collaboration, critical thinking, problem-solving, creativity, and innovation (Putri & Zulkardi, 2018). The application of the 4C concept for the nation's next-generation has a major impact on the learning of the 2013 curriculum (Sugiyarti, Arif, & Mursalin, 2018). In facing the challenges of 21st-century, there are 4 aspects that 21st-century skills must have for students, including ways of working, ways of thinking, tools for working, and skills to live in the world (Binkley et al., 2012). Communication and Collaboration require students to be in an environment which allows them to communicate, work together, and carry out their responsibilities (Octriana, Putri, & Nurjannah, 2019). It is expected that students learn from each other in groups and are responsibility for the assignment given. The communication and collaboration strategies can be applied through a learning system called the Lesson Study for Learning Community (LSLC). It's a learning system that is very close to collaboration and learning communities (Rahmanti, Hobri, & Oktavianingtyas, 2018). The characteristics of lesson study for the learning community used are collaborative learning and caring communities. LSLC is the first learning system in Japan (Darra & Kanellopoulou, 2019).

Learning is not only about obtaining knowledge but also about creating new knowledge communicatively and collaboratively when facing complex problems. This requires interdisciplinary and innovative knowledge (Iwamoto, Hargis, & Vuong, 2016), by the 21st century skills, namely ways of thinking. Acquiring the ways of thinking by producing work contextually, both individually and in groups, can be done through a project-based learning model (Fisher, Kusumah, & Dahlan, 2020). Furthermore, Thomas (2000) argues that project-based learning is an effective learning model for teaching students in complex processes through procedures such as planning, decision-making, and creativity so that good problem-solving is obtained. One learning model that can increase students' activity and motivation is the Project-Based Learning (PjBL) model (Muhahiddah, Asikin, & Mariani, 2018). PjBL in Indonesia can be said to be the operationalization of the concept of "Production-Based Education" developed in schools that must be able to equip students with the "competency standards" needed to work in their respective fields (Sumarni, 2015).

Project-based learning creates a project that is suitable for everyday life so that students experience first-hand meaningful learning and skills for living in the world. So, a student-centered learning approach is needed based on the demands of the current world, including the 21st-century skills students must have

(Rafianti, Anriani, & Iskandar, 2018). This project learning requires students to work extensively over a long period of time to provide authentic and realistic products (Eickholt et al., 2019). The right approach is the Indonesian Realistic Mathematics Education (PMRI). The Indonesian Realistic Mathematics Education (PMRI) approach is an innovation in learning mathematics in Indonesia (Putri, Dolk, & Zulkardi, 2015). One of the characteristics of PMRI that is used as a starting point for learning is the use of context (Nursyahidah, Putri, & Somakim, 2013; Nasution, Putri, & Zulkardi, 2018).

WHO stated that countries could stop the spread of the virus by implementing strong measures to detect, among others, isolate and treat cases, promote commensurate and implement physical distancing. Isolating and social distancing must be accompanied with the adoption of a healthy and clean lifestyle (*Peduli hidup bersih dan sehat*) for the community (Karo, 2020). One of the factors of a clean and healthy lifestyle is maintaining health and immunity so that this virus does not hit the human body. Furthermore, consuming balanced and safe nutritional food such as vegetables and fruits can increase our immune system so as not to be infected by Covid-19 (Akbar & Aidha, 2020; Amalia, Irwan, & Hiola, 2020). Therefore, it would be interesting to integrate healthy and clean lifestyle activities into teaching and learning, especially in mathematics learning.

Various types of processed fruits are available, one of which is Fruit Salad. Students making a fruit salad recipe project learn about mathematical knowledge and make nutritious food independently to increase immunity, which helps the current pandemic. Hence, the research question addressed is how the learning project uses fruit salad recipes using mean material, social arithmetic, and data presentation in junior high schools.

METHOD

Participants

This research employed Validation Study which produces a learning trajectory from the learning design project of the fruit salad recipes. There were 3 stages carried out, namely preliminary design, design experiment, and retrospective analysis (Akker et al., 2006; Gravemeijer, 2004; Prahmana, 2017). This is similar to the LSLC learning system, which consists of 3 stages, namely, plan, do, and see (Masaaki, 2012; Haris & Putri, 2011).

The preliminary design of the research examines the literature on junior high school mathematics curriculum, the learning model which is PjBL, and approaches of PMRI and Learning system of LSLC. The researchers and mathematics teachers collaborated to make learning design project through LSLC and PMRI using the context of fruit salad recipes at junior high schools to improve the quality of learning (Rusiyanti, Zulkardi, & Putri, 2020). The design experiment consisted of two stages; the first was pilot experiment, which was carried out in small groups consisting of 8 students in different classes, namely class 8.9 which was divided into 2 groups with different levels of ability. In this stage, a trial of the learning design that has been made was carried out and if there was a revision, the second was teaching experiment to evaluate the learning process based on the learning objectives, namely how the learning project used fruit salad recipes by using mean material, social arithmetic, and data presentation in junior high schools in collaborative learning. Finally, the

data were analyzed in the retrospective analysis stage.

The instruments used in the research were developed collaboratively with the teachers because the teachers know the students' abilities, social norms at school, and what materials the students have studied. In the experimental design stage, the first pilot experiment was carried out to test whether this instrument was valid for 8th grade students or there were deficiencies or additional revisions from the results of this stage. Then, in the second stage, the teaching experiment was carried out by the subject of this study to determine whether the instrument provided was in accordance with the objective of this study.

This research was conducted at Junior High School 19 Palembang with 27 students of 8 grade. The subjects were selected based on the consideration that the students have studied these materials. Data collection in this study included interviews with mathematics teachers in the preliminary design stage; second, observations were done in the research class in the pilot experiment and teaching experiment stages. Observations were done to identify the learning situation in the classroom. Finally, the results of all the activities in this study are presented in the form of figures.

Project-Based Learning

This learning follows the project-based learning model, consisting of (1) first observation and interviews, (2) studying relevant literature, (3) preparing instruments, (4) implementing project-based learning, (5) answering basic questions, (6) designing learning products, (7) discussion of schedules, (8) implementation and monitoring, (9) examination of results, and (10) evaluation (Ummah, In'am, & Azmi, 2019). Besides, observation and interviews, the study of related literature will be discussed in the preparation of instruments with grade 8 teachers, discussing what materials have been studied to create project learning activities. Mahanal et al. (2010) stated that PjBL is learning designed for complex problems where students carry out investigations to understand them, emphasizing learning with long-duration activities; assignments given to students are multidisciplinary and product-oriented (artifacts). Hence, the context fits the larger learning objectives with various materials being taught (Grossman et al., 2019) so that the materials chosen are multidisciplinary, namely Mean, Social Arithmetic, and data of Presentation previously studied. The products are based on real everyday life in accordance with one of the characteristics of PMRI (Zulkardi, 2002). Meanwhile, a starting point for understanding in learning called context (Haris & Putri, 2011; Fauziah et al., 2019; Risdiyanti et al., 2019). Thus, the resulting product is fruit salad recipes, consisting of schedule determination and learning tools for making fruit salad.

Activities in learning are discussions on planning and making fruit salad recipes by providing complex basic questions. The final fruit salad recipes produced from this learning project are helpful, especially in dealing with real-world problems (Chandrasekaran et al., 2012), such as handling Covid-19 by maintaining the people's immune system. Finally, analyzing existing data such as student answer sheets, fruit salad products, and photos in the learning process is needed to answer the research question.

RESULTS AND DISCUSSION

Results and discussion of project learning used the context of fruit salad recipes by applying the steps of the PjBL learning model, the PMRI approach, and collaborative learning. Learning activities were done by the 27 students following the steps of the design research method in this study.

The researchers with grade 8 mathematics teachers consisted of Mrs. Mery Johan, M.Si and Mrs. Isrimawarni, S.Pd. Together, we made a fruit salad recipe learning project in grade 8 because the teachers know the condition and abilities of the students. Furthermore, they explored what learning materials the students have learned. Therefore, they are appropriate in designing learning instruments that will be implemented based on the first stage of preliminary design in design research.

The second stage of the design experiment was divided into two. The first, the pilot experiment stage, this stage is conducting a small group trial consisting of 8 students in different classes from the research subject by dividing into 2 groups with heterogeneous abilities (2 high abilities, 2 low proficiency, 4 medium ability). The researchers acted as model teachers who carried out the learning process. This stage was aimed to test the designs that have been made, find out whether they are in accordance with the learning process, and revise the learning design to be carried out in the next stage. Second, the teaching experiment stage was carried out by the research subjects in class 8.6.

The teacher of the project learning model was Mrs. Mery Johan, M.Si. In the learning process, apperception was carried out for ± 7 minutes; the students were seated in "U" form (Masaaki, 2012). The teacher distributed Students' Activity Sheet (SAS) to students by collaborating with groups of 3-4 people with a level of ability, in solving problems in SAS, namely making a fruit salad recipe with 2 stages of activity; the first was the planning stage and the second stage was the implementation of making fruit salad and the evaluation stage according to the steps of the model Project-based Learning. If there were students who did not understand, they asked their group mates for help by saying "Please teach me", and the friends who were asked to teach must teach their group mates until they could do it. [Figure 1](#) shows that the teacher gave apperception to project learning. Next, the teacher divided groups of students consisting of 3-4 students with different levels of ability, collaborating with each other to learn together to solve activity problem 1 given, namely planning in making fruit salad recipes. [Figure 1](#) shows 2 students collaborating between groups.



Figure 1. Apperception in the learning process

When the students worked on activity 1, the teacher monitored them according to the stage of the PjBL learning model. The teacher may not intervene with the students. If there were questions from students who did not understand, the students were asked to ask their peers so that collaboration between groups occurred (Figure 2). After the learning was completed, the use of a project-based approach was carried out in 2 stages with the first stage of helping students to become competent enough by developing knowledge from an increased understanding of concepts and the second stage of the skills needed to make products independently (Kokotsaki, Menzies, & Wiggins, 2016).



Figure 2. Students' answer in the activity 1

The last stage, retrospective analysis was to reflect the existing research results, namely the results of student answers, product presentations, and fruit salad products made. The results of the students' answers which consist of 2 activities, namely activity 1, planning fruit salad stages and activity 2 skills in making fruit salad recipes are as follows.

Activity 1 in Student Answer Sheet (SAS) 1

The teacher distributed Activity 1 in Student Answer Sheet 1 (SAS), activity objectives 1 Student can analyze and solve problems in planning making fruit salad recipes or the initial activity stages of planning / designing projects based on the knowledge that students have previously learned, namely averaging, social arithmetic and data presentation. In line with Pratama and Prastyaningrum (2016), project-based learning aims to solve problems by promoting everyday activities to find new knowledge related to the prerequisite knowledge. Then, students implement the prerequisite knowledge that is obtained to solve problems of everyday life; one of which is making fruit salad. The teacher gave an apperception about interesting learning, that they were going to make fruit salad. This required understanding of materials that have been studied previously, namely social arithmetic, data presentation, and averaging. Explaining the learning objectives by exploring previous knowledge and maintaining health and increasing endurance, the student must consume nutritious foods, namely fruits. The following is an example of a teacher's question to the students.

- "What are some nutritious foods?"
- "The benefits of consuming nutritious food, one of which is the fruit?"
- "Have you ever consumed a fruit salad?"
- "What is the average formula?"

The following is an example of a question given in activity 1 can be seen in [Figure 3](#).

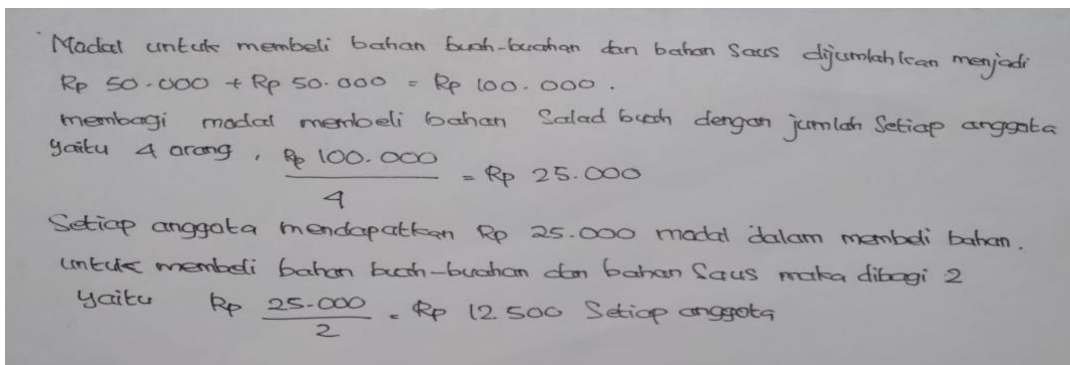
<p>Buatlah salad buah, berdasarkan ketentuan sebagai berikut :</p> <p>Setiap Kelompok diberikan modal untuk membeli buah-buahan untuk salad buah (<i>Use of context</i>) sebesar Rp. 50.000,00 dan membeli bahan saus sebesar Rp. 50.000,00 per-kelompok. Bagilah harga beli setiap anggota kelompokmu secara adil dalam membeli bahan salad buah.</p> <p>1. Berapa harga beli dalam :</p> <ul style="list-style-type: none"> a. membeli buah-buahan untuk setiap anggota b. membeli bahan saus salad buah untuk setiap anggota. 	<p>Make a fruit salad, according to the following conditions:</p> <p>Each group is given a capital to buy fruits for a fruit salad of Rp. 50,000.00 and buy sauce ingredients for Rp. 50,000.00 per group. Divide the purchase price of each member of your group fairly when buying fruit salad ingredients.</p> <p>1. What is the purchase price in:</p> <ul style="list-style-type: none"> a. purchase of fruits for each member b. purchase of fruit salad dressing ingredients for each member.
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Figure 3. Questions in SAS 1

Finally, the students answered questions based on the instructions given to SAS, along with the students' answers in SAS 1.

1. What is the purchase price, buy fruits for each member and buy fruit salad dressing ingredients for each member, based on the capital information that is determined to be (Rupiah) Rp. 50,000 for sauce ingredients and Rp. 50,000 for fruit ingredients.

Student answer:



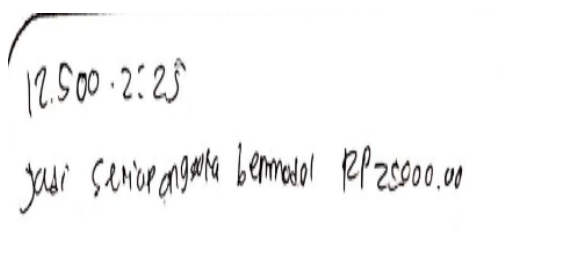
The first or second capital yield costs Rp. 50,000, combined or added to become 1, namely Rp. 100,000, so each member consists of 4 people, then get $100,000 / 4 = Rp. 25,000$ then divided by 2 (2 fruit salad ingredients) to become Rp. 12,500 each member

Figure 4. Student's answer to question number 1 in SAS 1

The students' answers are shown in [Figure 4](#), as a sign that they can solve the question by analyzing and solving problems using the average material and social arithmetic in the purchase price.

2. What is the purchase price of fruit salad ingredients for each member?

Student answers:



$12.500 \times 2 = 25$

The total capital of Rp. 12,500 multiplied by 2 (2 fruit salad ingredients); the result is Rp. 25. 000

So, each member spent Rp. 12.500 for buying fruit salad ingredients

Figure 5. Student's answer to question number 2 in SAS 1

The students' answers are shown in [Figure 5](#), by adding or multiplying the 2 results obtained from question no.1 to Rp. 25,000 for each member. So, the problems were analyzed and solved by adding up the purchase price of materials according to learning objectives.

3. Determining the price list of fruit salad ingredients in the table. The students were asked to list the purchase price by presenting it in a table.

Student answers:

NO	Nama buah	jumlah (Rp)	harga (Rp)
1	Buah melon	250 gram	4.500,-
2	Buah pepaya	250 gram	4.000,-
3	Buah jeruk	250 gram	5.000,-
4	Buah semangka	250 gram	3.500,-
5	mayonaisse	500 gram	13.000,-
6	susu	250 gram	5.000,-
7	1 cup	400 ml	1.000
		Jumlah	= 31.000,-
		Sisa	= 2.300,-

No	Name	Unit	Price (Rp)
1	Melon	250 g	4.500
2	Avocado	250 g	4.500
3	Orange	250 g	5.000
4	Watermelon	250 g	3.500
5	Mayonnaise	500 g	13.000
6	Milk	250 g	5.000
7	One's cup	400 MI	1.000
Total			31.000

The rest of money Rp. 2.300

Figure 6. Student's answer to question number 3 in SAS 1

Students' answers are shown in [Figure 6](#), as a sign that in solving question no. 3. the students analyzed the purchase price list, calculated the unit weight, and presented the data in a table although there were errors but in adding up the whole list it should be Rp. 36,000 then exceeding the given capital limit of Rp. 33,300 with 3 members; the shortage is Rp. 2,700.

4. How many SDM (Tablespoon) of dressing do you want based on the fruit salad making process?

Student answers:

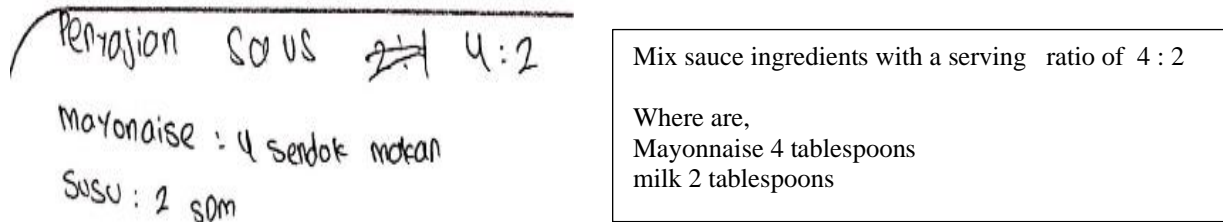


Figure 7. Student’s answer to question number 4 in SAS 1

The students' answers are shown in Figure 7. The students developed the comparison without leaving the existing provisions, namely 4: 2, an innovative and creative thinking.

5. Determine each ingredient weight of the fruit salad to fill 1 cup (400 MI).

Students’ answers:

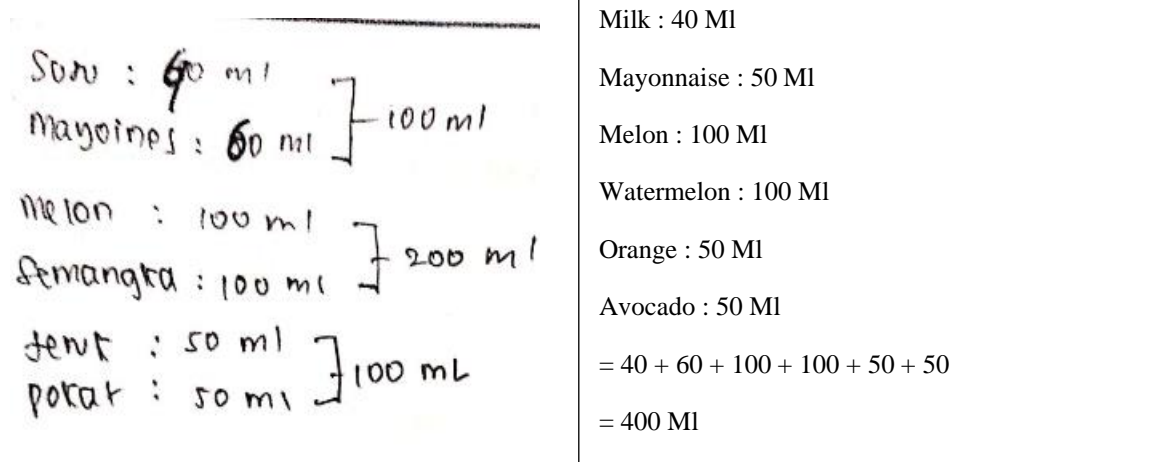


Figure 8. Student’s answer to question number 5 in SAS 1

The student's answer is shown in Figure 8, with a variety of materials filled in; there are 40, 60, 50 to 100 MI according to the wishes of each student based on their likes and dislikes of the materials given. If the material is liked, then the student will calculate the weight than the weight the student did not like but the bottom line should fill 1 cup (400 MI).

The last activity in learning was assessing and evaluating after the PjBL learning stages. The results of the designs that have been made were presented by taking representatives from each group. The teacher listened to the results of the students’ presentations and if there were different results, the students may present the results. The teacher asked the students who presented them. Next, the learning about planning in making recipes was evaluated based on knowledge of social arithmetic material, data presentation, and averages. Furthermore, in the second day, the students brought utensils such as bowls,

glasses and forks to make fruit salad and read information about the process of making fruit salad based on the duration set by the teacher.

The second day of learning was the stage of implementing the product or making fruit salad recipes. The teacher explained the previous lesson, namely designing recipes fruit salad based on the questions given in activity 1. Next, the teacher asked the students to make fruit salads and write recipes for the activity. In the process of making fruit salad, the students worked in the previous group. The teacher reminded the students to use the equipment brought and the duration for making fruit salad, shown in [Figure 9](#).



Figure 9. The second day of learning project

The teacher asked the students in the process of making fruit salad, participated actively, and innovated in creating fruit salad recipes in accordance with the provisions given by the teacher. According to Birgili (2015), in project-based learning, students are required to actively participate in creating innovative solutions to problems through their daily life experiences.

The students collaborated together in the process of making fruit salad. The students compared the making of fruit salad to the planning stage as the implementation stage at that time, as shown in [Figure 10](#).



Figure 10. Students make the products

The students published their product work, namely fruit salad, to classmates to be presented and assessed by the teacher. Figure 11 shows students displaying the product.



Figure 11. Students display the products

The final stage was to assess the results of the products by presenting the results of their work, namely fruit salad with the recipes that have been made. The teacher asked questions about the process and product results. Figure 12 shows students presenting their work.



Figure 12. Students present the results of the product

Activity 2 in SAS 2

In activity 2, the students were asked to make a fruit salad recipe. In accordance with Curtis (2002), problems that must be resolved in the form of related questions will produce a summary report or product. In this case, the recipe is written, which would be a report and presented. The results of students' answers about fruit salad recipes are shown in Figure 13.

Langkah - langkah pembuatan salad :

Bahan = semangka = 100 ml
 Jeruk = 100 ml
 Melon = 100 ml
 mayonaise = 2 sdm / 60 ml
 susu = 1 sdm / 40 ml

alat = mangkuk
 sendok
 gelas takar → wadah 400 ml

cara pembuatan

1. mengukur buah - buahan dan bahan saus menggunakan gelas takar, sesuai dgn ukurannya
2. campur bahan saus menggunakan mangkuk, aduk sampai merata.
3. campur saja kan buah - buahan dengan bahan saus
4. hidangkan menggunakan wadah 400 ml
5. siap siap dimakan.
6. cara pembuatan sesuai dengan perencanaan walaupun pacaknya tidak ada

Sebagian jeruk diadukan 400 ml

The steps for making a salad:

Ingredients:

watermelon = 100 ML, Orange = 100 ML, Melon = 100 ML, mayonnaise = 2 tablespoons or 60 ml, milk = 1 tablespoon or 40 ml. tools: bowl, spoon, measuring cup, cup 400 ML

Method of preparation:

1. measure the fruit and sauce ingredients using a measuring cup, according to its size.
2. mix the sauce ingredients using a bowl, then stir until evenly distributed.
3. Mix the fruits with the sauce ingredients,
4. serve using a 400 ML cup.
5. Salad is ready to eat.
6. how to make it according to plan even though there is no avocado so that the citrus fruit becomes 100 ML

Figure 13. The results of the student's answers in SAS 2

The results of the students' answers in the planning stage of each material differed in weight based on their likes and dislikes of the materials. However, they met 400 ML. Then, in the implementation stage, there was a slight difference where the first orange of 50 ML planning becomes 100 ML. Next, he did not add avocado anymore because he already filled the container for the sauce ingredients he was by the planning stage with the implementation not changing or adding them. From the whole way of the manufacturing process, he wrote the recipe for the process of making fruit salad clearly, concisely, and correctly based on the differences from the planning stage with the various material content provided and the addition in the weight of the material in the manufacturing process, from the results of students' answers, in the learning process to apply and integrate various existing concepts and procedures while improving professional skills (Repko, Szostak, & Buchberger, 2017; Fauziah et al., 2017). In line with the Buck Institute for Education (2002), Project-based learning helps students master content and processes.

By analyzing and evaluating project learning against Learning Trajectory (LT), the results shown in activity 1 and activity 2 are based on the principles and characteristics of the PMRI approach, the characteristics of the Project-Based Learning model by collaborating with groups based on LSLC in learning. From the results and previous discussions, there are several findings as follows.

First, the students understand the importance of a healthy lifestyle by consuming nutritious food; one of which is fruit which is useful for maintaining and increasing endurance. The students can also independently develop skills in activity 2 after planning fruit salad making in activity 1. nutritious fruit salad recipes easily, healthy, and economically. Second, at the beginning of the meeting, the students were less active in thinking for solving a problem by using the context. The students were also less used

to collaborating in learning between their respective groups. Third, after entering the implementation stage, the students were familiar with the project learning process so that it is not awkward to collaborate with each other. Through collaboration students can solve real-world problems, and through learning using the LSLC and PMRI systems (Kurniawan, Putri, & Suniarti, 2020; Putri, Gunawan, & Zulkardi, 2017), students can also develop critical skills that will help them prepare themselves for 21st century skills to meet the challenges faced (Meyer, 2016).

Fourth, students further sharpen their understanding of concepts while increasing their ability to apply knowledge as measured by standardized tests (Geier et al., 2008). Activity 1 is planning stage where students are asked to calculate the capital price for each member, then the use of the concept of the average is to divide the results of the amount of data by the total data (Harahap & Negoro, 2017), it is necessary to collaborate with groups (LSLC) because each member will get the capital cost of making fruit salad fairly. Likewise, in calculating the list of ingredients to be purchased to make fruit salad using mathematics learning, namely the purchase price of social arithmetic, students can calculate the total amount or financial calculations in buying fruit salad ingredients (Paramitha, 2017), as well as the use of data presentation in table form. , students can not only read the results of the purchase price list for fruit salad ingredients but other people can also easily read the purchase price list by using a table by presenting data that is easy for others to understand (Hasan, 2016). The ability to understand mathematical concepts carried out on and also students become proficient in transferring conceptual ideas with various learning situations that occur (Chong et al., 2018; Brown & Campione, 1996; Scardamalia & Bereiter, 1991). such as transferring conceptual ideas, among others, averaging, social arithmetic, and presenting data in learning situations, namely making fruit salad recipes.

Project learning in previous research such as in Sari and Putri (2021) discussed the "Entrepreneurship in a School Cooperative" project with a focus on the use of social arithmetic material for school cooperatives and project learning. Furthermore, Meitriova and Putri (2020) discussed the "Saving Water" with a focus on data presentation material for calculations in saving water. Thus, the researcher created a project learning trajectory by combining average material, social arithmetic, and data presentation into a fruit salad recipe project. Therefore, the students not only understand knowledge but also use it in everyday life such as making fruit salad recipes for themselves and the recipes can be useful for others.

CONCLUSION

The project learning trajectory through averaging mean, social arithmetic, and data presentation helps students not only in improving the materials, but also in the process of making fruit salad collaboratively with the group through the use of context in PMRI and the LSLC system which worked well in problem solving learning. The learning trajectory can be seen from 2 activities, namely the planning, implementation and assessment stages of products collaboratively with the group according to the LSLC system so that 21st century skills emerge, namely communication, collaboration, critical

thinking, problem solving, creative and innovation. Learning trajectory with disciplinary material in the context of fruit salad becomes a starting point for project learning. The values include not only knowledge in meaningful contexts, but also the process of making skills that are interesting and fun for students based on the principles of PMRI characteristics.

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