ASEAN Journal for Science and Engineering in Materials

Journal homepage: https://ejournal.bumipublikasinusantara.id/index.php/ajsem

Implementing Project-Based Worksheets on Making Kaolin Soap with The Addition of Kefir Curd to Develop Students' Scientific Performance in Islamic School

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ABSTRACT

This research aims to describe student activities during the application of project-based worksheets, analyze scientific performance, and analyze the characteristics of the resulting kaolin soap with the addition of kefir curd. The research method used is pre-experimental with a one-shot case study research design. The research subjects were 34 students of XI grade in an Islamic school in Bandung, Indonesia. The results of the research show that the percentage of student activity during the application of the worksheet is 87 in the very good category. The highest average score was 94 with a very good category at the stage of carrying out the research. The students' scientific performance ability in applying worksheets reached 86 in the very good category. The highest average score is 92 with the very good category found in the indicator for interpreting data. The results of the characterization of the kaolin soap produced follow Indonesian National standard No. 3532:2021 with a pH value of 10, the foam stability values respectively from highest to lowest are 89, 85, 83, 60, and 50%. Based on the organoleptic test, the soap has a solid texture and smells like clay with a bone-white color. This shows that the implementation of project-based worksheets can be carried out well.

ARTICLE INFO

Article History:
Submitted/Received 05 Sep 2023
First Revised 26 Oct 2023
Accepted 12 Dec 2023
First Available online 13 Dec 2023
Publication Date 01 Mar 2024

Keyword:
Kaolin soap,
Kefir curd,
Project-based worksheets,
Scientific performance,

1. INTRODUCTION

Chemistry is a science that studies matter based on experiments. In chemistry, there are two interconnected aspects, namely product and process aspects. These two aspects can help develop students' scientific performance. One learning model that can help students develop their scientific performance is project-based learning.

Based on research by Kadek *et al.* (2015) stated that project-based learning can improve students' scientific performance with a normalized gain score of 0.729, which is better than an increase in the normalized gain score of students' scientific performance using the guided inquiry model of 0.425. This shows that project-based learning can improve students' scientific performance. This learning directs students to be able to solve a problem.

Scientific performance is a skill that students must have. There are several aspects of scientific performance, including making observations, formulating problems, formulating hypotheses, designing research, interpreting data, and communicating (Harso & Fernandez, 2019). These aspects of scientific performance can be obtained by carrying out practicums.

The chemistry learning process using practical methods in some schools is still lacking because students only learn theoretically. Students are not allowed to directly observe changes or reactions that occur in learning material (Pradnyantika *et al.*, 2018). Effective chemistry learning is by connecting theory with practicum. In its implementation, learning media is needed in the form of worksheets.

Project-based worksheets can help students understand the material by applying it to a project so that students enjoy the learning process more (Rahmatullah & Fadilah, 2017). The application of project-based worksheets is a learning model that can develop 21st-century skills. Learning using project-based worksheets can develop students' intellectual abilities so they can solve problems around them (Dewi, 2022).

Project-based worksheets are created by presenting a problem related to the application of chemical concepts in life. As for completing it, it is done individually or in groups (Gunawan *et al.*, 2018). Colloids are a material whose applications can be found in everyday life. Based on basic competency 4.14 in the National Curriculum, namely making various colloid systems using materials found around them and analyzing the properties of the colloid systems made, students are required to make products in learning. Therefore, it is necessary to apply project-based worksheets as a learning medium. The application of project-based worksheets can train students to solve a problem by creating a product (Sahtoni *et al.*, 2017). One application of the colloid concept is soap.

Soap is an example of a lyophil colloid system. Soap has many benefits, one of which is: removing dirt and dead skin cells. This is because the nature of soap can emulsify to disperse oil and fat (Helsy *et al.*, 2018) and soap can be adsorbed on dirt grains. The soap-making process is divided into two, namely the hot process and the cold process. The difference between the two processes lies in the heating process in their manufacture. The cold process is carried out without heating, while the hot process (hot process) saponification reaction is carried out at a temperature of 70-80°C or using a heating process (Sukeksi *et al.*, 2018).

Research conducted by Sukeksi and Diana (2020) regarding the preparation and characterization of coconut oil-based soap with kaolin filler, the addition of kaolin can influence the properties of the soap produced and the hardness of the soap is best at a kaolin concentration of 15%. Kaolin is a white or grayish-white clay containing 10-95% kaolinite minerals. Kaolin is also usually used as an active ingredient in cosmetics because it has a high absorption capacity for substances such as oil, toxins, etc. (Sukeksi and Diana, 2020). Therefore, kaolin has the potential to be used in soap making. In this research, natural

DOI:
p-ISSN: 2828-920X e-ISSN: 2828-9951

ingredients were added to kaolin soap, namely kefir curd. This is because the addition of kefir curd has not been found in making kaolin soap.

Kefir curd is a creamy white cream that is formed during the kefir-making process. Kefir curd is usually called kefir curd which contains 0.7% of lactic acid, 1.4% of protein, 2.30% of fat, and 3.15% of carbohydrates. Kefir has many benefits, one of which is that it has an antibacterial effect against many pathogenic organisms (John & Deeseenthum, 2015).

Research on making kaolin soap has been carried out by many previous researchers as shown in **Table 1**.

Table 1. Previous research.

No	Title	Description	References
1.	Nonformal education and social reproduction / transformation: Educational radio in Mexico	The use of educational radio in Mexico may play a role in non-formal education and whether this contributes to social reproduction or transformation in society	Ginsburg and Arias-Godinez (1984)
2.	Quality Evaluation of Transparent Soap from Whey Waste with Butterfly Pea Flower Extract (*Clitoria ternatea L.*)	Evaluation of the quality of making transparent soap using whey waste as a basic ingredient and butterfly pea flower extract	Malahayati *et al*. (2023)
3.	Chemical composition of Kaolin Clay (Nzu) and Bentonite Clay (Ulo) and consumption prevalence among women in Southern Nigeria	The paper will discuss two types of clay, namely Kaolin Clay (Nzu) and Bentonite Clay (Ulo), and the prevalence of their consumption among women in the southern part of Nigeria	Onyenweaku (2023)
4.	Preparation and characterization of coconut oil-based soap with kaolin as filler	How the use of kaolin as a filler can affect the properties of coconut oil-based soap	Sukeksi and Diana (2020)
5.	The effect of five insecticides on the predators Coccinella septempunctata and Hippodamia variegata	The research aims to evaluate the effects of five types of insecticides on predators Coccinella septempunctata and Hippodamia variegata	Skouras *et al.* (2019)
6.	Non-chemical Approaches Suppressed Damage and Oviposition Rate of Date Palm Hopper, Ommatissus lybicus	Analyzing non-chemical approaches that can reduce the damage caused by Ommatissus lybicus to date palm trees	Tofangdar *et al.* (2019)
7.	Biopesticides for management of Bemisia tabaci MEAM1 (Hemiptera: Aleyrodidae) and tomato yellow leaf curl virus	The use of biopesticides as an alternative to control Bemisia tabaci MEAM1 populations and reduce the spread of Tomato Yellow Leaf Curl Virus in tomato plants	Smith (2020)
8.	The problem of radioactive contamination of the skin	The paper discusses problems related to radioactive contamination of the skin	Schulte (1966)
9.	Catalytic acetylation of (+)-cedrol with heterogeneous catalyst H2SO4/SiO2 under solvent free conditions	This research discusses the catalysis process in the acetylation reaction of (+)-cedrol using the heterogeneous catalyst H2SO4/SiO2 under solvent-free conditions.	Elvia *et al*. (2015)
10.	Kaolin and potassium soap with thyme essential oil to control Monosteira unicostata and other phytophagous arthropods of almond trees in organic orchards	The research focused on the use of kaolin and potassium soap with thyme essential oil to control Monosteira unicostata and other phytophagous arthropods on almond trees in organic gardens.	Marcotegui (2015)

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p-ISSN: 2828-920X e-ISSN: 2828-9951

Based on the background that has been explained, this research aims to: a) describe student activities in applying project-based worksheets in making kaolin soap with the addition of kefir curd to develop students' scientific performance, b) analyze students' scientific performance in applying project-based worksheets in making kaolin soap with the addition of kefir curd, and c) analyzing the characteristics of the resulting kaolin soap with the addition of kefir curd.

2. LITERATURE REVIEW

2.1. Project based worksheets

A worksheet is a sheet that contains material and interactions from educators to students to carry out learning activities independently, by practicing learning outcomes to obtain predetermined goals (Siahaan *et al*., 2017). Project-based learning is a learning method that uses projects as a learning medium (Baker *et al*., 2011). Project-based learning is a learning tool that can develop students' attitudes, cognition, and psychomotor skills. Students are required to solve a problem by applying science skills such as observing, identifying, creating, and presenting learning products.

Project-based worksheets are worksheets used in project-based learning. This worksheet functions to train students to work together in solving certain problems, developing products, and evaluating products that have been produced (Almulla, 2020). Using project-based worksheets in learning is an effective way to develop students' 21st-century skills.

Project-based learning trains students to think critically, solve problems, communicate, collaborate, leadership, innovation, and creativity (Häkkinen *et al*., 2017). Project-based worksheets are created by presenting a problem related to applying a concept in life. Project-based learning provides opportunities for students to apply the knowledge gained to certain products. Apart from that, this worksheet can improve students' scientific skills and attitudes. As for completing it, it is done in groups (Gunawan *et al*., 2018).

Project-based learning will train high-level thinking skills so that students are stimulated to investigate, analyze, argue, and draw conclusions (Muis & Dewi, 2022). There are also weaknesses of project-based learning, namely that it provides a heavy workload and takes up quite a lot of time for teachers and students. Apart from that, the learning process which is always done in groups may make it difficult for students to work together. Working in groups for a long period may reduce students' self-confidence in learning independently (Dewi, 2022).

In practice, effective project-based learning has several characteristics. According Sani (2016), these include 1) Focusing students on observing important ideas and questions; 2) Including an inquiry process; 3) being Concerned with students' needs and interests; 4) being Student-centered by creating a product and making a presentation; 5) Using critical, creative thinking skills, making observations, drawing conclusions, and creating a product; 6) Relating to authentic problems.

There are six stages in implementing a project-based worksheet, namely identifying the problem, creating a research design, carrying out research, preparing a product draft/prototype, measuring, assessing, and evaluating the product, and finalizing and publishing the product.

2.2. Application of project-based worksheets in developing students' scientific performance

Scientific performance is a set of work carried out by researchers to solve a problem using scientific methods (Khanafiyah, 2010). Scientific performance can describe all scientific activities that can train and develop scientific skills and scientific attitudes.

DOI:
p-ISSN: 2828-920X e-ISSN: 2828-9951

Scientific performance consists of hands-on and minds-on skills. Hand-on skills are psychomotor skills while minds-on skills are cognitive skills (Sari & Wulanda, 2019). Students can acquire these two skills and be trained in scientific performance. Some of the scientific performance skills that are developed include making observations, formulating problems, formulating hypotheses, designing research, conducting research, interpreting data, and communicating research results (Harso & Fernandez, 2019). These abilities are related to project-based learning.

Project-based learning has the advantage of making students actively involved in learning. Students are encouraged to solve problems by applying the skills to research, identify, create, and communicate the products they create. The application of project-based worksheets can train and develop students' scientific performance. Students' scientific performance can be assessed as long as students apply project-based worksheets.

2.3. Kaolin soap

Soap is an example of colloid applications in everyday life. Soap is an example of a lyophil colloid. Lyophilic colloids are colloidal systems that have quite large attractive forces between the dispersed phase and the dispersion medium. This colloid is more stable than lyophobic colloids.

Soap can be made through a chemical reaction, namely the saponification reaction. The saponification reaction is a reaction between triglycerides with base strong (NaOH or KOH) deep media watery for producing glycerol and soap (salt sodium from hydrolyzed free fatty acids) (Baptista *et al*., 2019). Soap is very useful in everyday life as a cleanser for dirt on the skin. This is because soap can reduce the surface tension of water (Helsy *et al*., 2018). The saponification reaction between triacylglycerol and the alkaline base NaOH is shown in **Figure 1**.

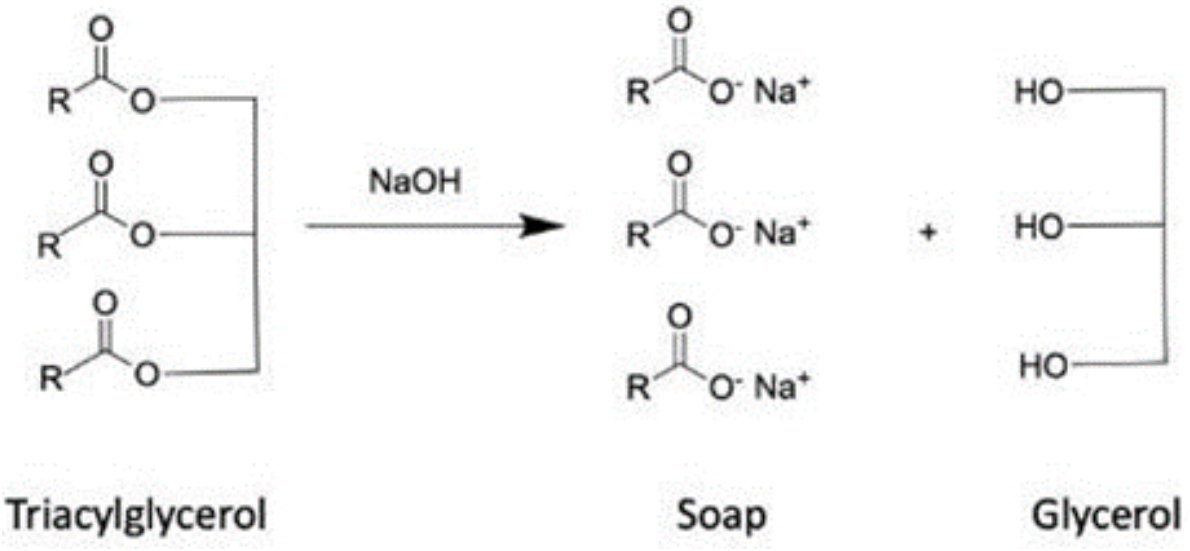

Figure 1. Saponification reaction (Baptista *et al*., 2019).

2.4. Kefir Curd

Kefir is a drink resulting from fermented milk and has many benefits, one of which is having an antibacterial effect against many pathogenic organisms (John & Deeseenthum, 2015). Kefir is fermented by lactic acid bacteria (LAB) such as Lactobacillus lactis, and Lactobacillus delbrueckii subsp. bulgaricus with yeast and produces lactic acid and ethanol. In this fermentation process, a solid layer (curd) and a clear layer (whey) are formed.

DOI:
p-ISSN: 2828-920X e-ISSN: 2828-9951

Kefir curd is a white cream formed from the fermentation process of milk with kefir seeds. The nutritional content of kefir curd includes 0.7% of lactic acid, 1.4% of protein, 2.30% of fat, and 3.15% of carbohydrates (Kurniati *et al*., 2020).

3. METHOD

This research method pre-experimental design with a one-shot case study research design. Treatment is given to a group and then observations are made on the results. The subjects in this research were class XI science subjects in an Islamic school (i.e. IPA MAN 2) in Bandung, Indonesia as many as 34 people with research instruments: student activity observation sheets, student worksheets, student scientific performance assessment sheets, presentations, and product assessment sheets.

Data collection was carried out by observing student activities to determine the implementation of student activities during learning, student worksheets to determine students ' abilities in working on worksheets as well as student scientific performance assessment sheets to determine students' scientific performance in carrying out the project-based learning, as well as worksheets Product assessment is used to determine the characteristics of the kaolin soap produced. The procedure for making kaolin soap with the addition of kefir curd is presented in **Figure 2**.

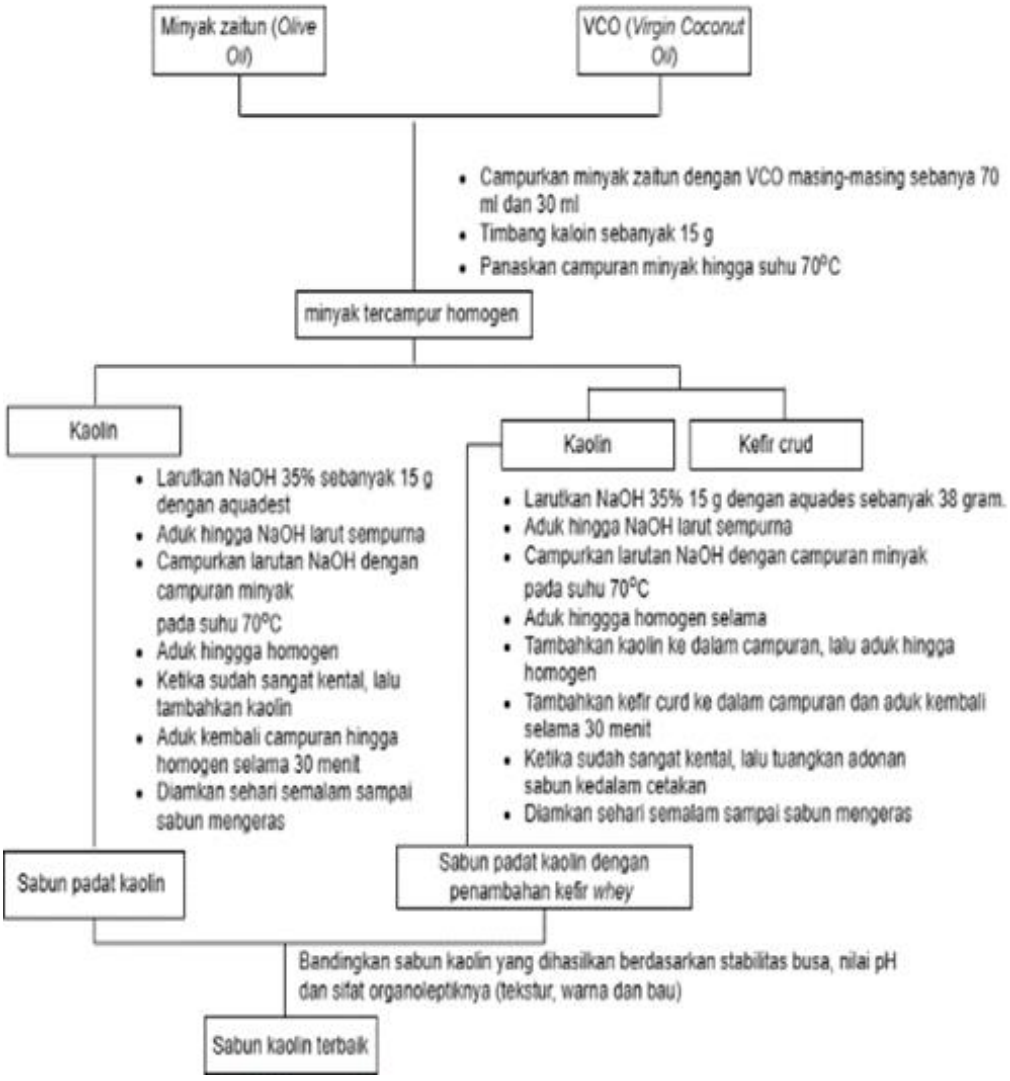

Figure 2. Procedure for making kaolin soap with the addition of kefir curd.

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p-ISSN: 2828-920X e-ISSN: 2828-9951

4. RESULTS AND DISCUSSION

4.1. Description of student activities in making kaolin soap with the addition of kefir curd and students' ability to complete project-based worksheets

This research was conducted over two meetings. The application of a project-based worksheet consists of six stages, namely identifying problems, creating a project design, carrying out research, compiling a product draft/prototype, measuring, assessing and improving the product, and finalizing and publishing the product (Sari & Wulanda, 2019).

Student activities in the application of this project-based worksheet are obtained through observation sheets of student activities which are assessed by observers. The purpose of using student observation sheets is to observe all student activities during the learning process. Student activity observation sheets are adapted to the stages of project-based learning.

The following is a description of student activities during learning:

(i) Problem identification stage. At the problem analysis stage, students are given project-based worksheets. After that, students are directed to observe the discourse contained in the worksheet and then students are directed to write down the three problems contained in the discourse in the form of questions. Based on the problem formulation, students are directed to create three appropriate hypotheses. Next, students are directed to write down the principles of making kaolin soap with the addition of kefir curd based on the information contained in the discourse and write practical objectives that follow the problem formulation that has been created. Based on the results of observations, several students looked confused when working on the worksheets given. This is because students are still not used to using worksheets as a learning medium and guide in carrying out practical activities. However, students remained enthusiastic in carrying out discussions with their group members to complete the worksheet.

(ii) Project Design Stage. At this stage, students are directed to determine the tools, materials, and experimental procedures for making kaolin soap with the addition of kefir curd. Students can determine tools, materials, and experimental procedures based on the data contained in the worksheet. Preparing a project design is important because it can determine the product that will be produced. Students are quite enthusiastic about working on the design stage of the project to be implemented. Several students actively asked about creating experimental procedures in the form of flow charts.

(iii) Stage of Carrying Out Research. At this stage, students are directed to carry out experiments that have been previously designed. Apart from that, students are directed to write down the results of their observations on the worksheet provided while making kaolin soap. Based on the results of observations, at this stage, each group was very active and enthusiastic in carrying out each step in the procedure for making kaolin soap. In their groups, each student takes turns weighing and dissolving the ingredients for making kaolin soap. Each group of students can work together well and in an orderly manner.

(iv) Stage of Preparing Product Draft/Prototype. At this stage, students are directed to test the quality of the soap produced, including foam stability, pH value, and organoleptic (color, texture, and odor). Apart from that, students are also directed to collect information regarding the criteria for soap according to SNI to find out whether the soap they make meets the standards. Students then explain the observational data that students obtained. Based on the results of observations, each group was active and quite enthusiastic in testing the soap products produced. Each group member divides the task to complete each test consisting of foam stability, pH value, and organoleptic (odor, texture, and color). Apart from that, students package the kaolin soap products they produce.

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p-ISSN: 2828-920X e-ISSN: 2828-9951

(v) Product Assessment Stage. At this stage, students are directed to compare the kaolin soap products produced with soap according to SNI or commercial soap. Several aspects assessed are color, odor, texture, pH value, and stability of soap foam. Apart from that, each group is directed to complete all the questions on the worksheet and prepare for the presentation.

(vi) Product Finalization and Publication Stage. At this stage, students are directed to make presentations on worksheets and the products produced. Presentations are carried out in groups and the order of presentation is adjusted to suit the groups who are ready. Each group member takes turns presenting the results of the practical report that has been made. After delivering the presentation, there was a question-and-answer session. Students were actively involved in making presentations on products and experimental results, but when entering the discussion session most students were not very active in asking questions or arguing. This resulted in the question-and-answer session being less interactive.

A recap of all student activities in applying project-based worksheets in making kaolin soap with the addition of kefir curd is presented in **Table 2**.

Table 2. Percentage of student activity in implementing project-based worksheets.

Group	Stages of Project-Based Worksheets	Implement ability (%)	Inter p relation
1	Identifying Problems	82.74	Very good
2	Designing Projects	91.67	Very good
3	Carrying out Research	93.75	Very good
4	Prepare *Draft/Prototype* Products	89.58	Very good
5	Measuring, Assessing, and Improving Products	83.33	Very good
6	Product Finalization and Publication	81.25	Very good
Average		87.00	Very good

Based on **Table 2**, the percentage of student activity implementation with the highest score is at the research carrying out stage with a percentage of 93.75% and student activity with the lowest percentage is at the finalization and product publication stage with the smallest percentage at 81.25%. This stage has the smallest value because some groups cannot determine the appropriate problem formulation and hypothesis based on the discourse provided. Apart from that, they did not write down in full the comparison between soap made and commercial soap and when making presentations several groups did not explain the methods used and the reactions that occurred in making soap.

The results of the analysis of student activities in implementing project-based worksheets obtained an average percentage score of 87 in the very good category. These results follow the research results of Martina Lona (2019) that the application of project-based learning can increase student activity in the learning process.

In addition to the description of students' activities regarding the application of project-based worksheets in making kaolin soap with the addition of kefir curd, the researcher also described students' abilities in completing the worksheets.

In the first stage, namely identifying problems, students' abilities in determining problems, hypotheses, soap-making principles, and experimental objectives regarding the discourse in the worksheet had an average of 75 with good interpretation. At this stage, several groups of students answered that were relevant to the topic being discussed, but there were also groups of students who answered that it was less relevant to the topic being discussed.

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p-ISSN: 2828-920X e-ISSN: 2828-9951

The second stage is designing the project, students' ability in designing designs has an average of 89 with very good interpretation. At this stage, students are instructed to determine the tools, materials, and experimental procedures for making kaolin soap with the addition of kefir curd.

The third stage was carrying out experiments, the students' ability to carry out experiments on making kaolin soap with the addition of kefir curd had an average of 91.5 with a very good interpretation. At this stage, students can carry out soap-making experiments well, but there are also groups of students who fail in making soap.

The fourth stage is preparing a product draft/prototype, analyzing students' abilities in carrying out soap quality tests such as foam stability tests, pH values, and organoleptic (odor, texture, and color) as well as explaining the observational data obtained. At this stage, the average value is 80 with a very good interpretation. Some groups can carry out soap quality tests correctly, but some groups are inadequate in carrying out soap quality tests.

The fifth stage is measuring, assessing, and improving the product, students' abilities at this stage have an average of 83.5 with very good interpretation. At this stage, students are instructed to compare the soap products produced with commercial soap based on foam stability, pH value, and organoleptic (color, texture, odor). Some groups are inaccurate in comparing the soap they produce with commercial soap.

The sixth stage, namely finalizing and publishing the product, analyzes the students' ability to present the results of worksheet work and the products produced. At this stage, the average score for the presentation is 83.66 and the average score for the product is 87.83 with all interpretations being very good.

Overall, students' abilities in completing project-based worksheets are presented in **Table 3**, a summary of the overall scores at each stage of the project-based worksheets.

Table 3. Recapitulation of group average scores at each stage of the worksheet.

Project Stages	Group						Average
	1	2	3	4	5	6	
1	67.0	75	83	67	83	75.0	75.00
2	89.0	89	89	89	89	89.0	89.00
3	100.0	83	83	100	100	83.0	91.50
4	78.0	89	91	78	78	67.0	80.00
5	67.0	100	67	100	100	67.0	83.50
6	85.0	85	87	86	88	83.5	85.75
Average	**81.6**	**87**	**84**	**87**	**89**	**78.0**	**84.38**

Information:

(i) Identify the problem
(ii) Designing projects
(iii) Carrying out research
(iv) Prepare product drafts/prototypes
(v) Measuring, assessing, and improving products
(vi) Finalization and publication of products

Table 3 shows that students can complete project-based worksheets well. The total average ability of students in completing worksheets is 84.38 with very good representation. The stage with the lowest score is the problem identification stage with a score of 75. This is because some students do not know how to determine problem formulation and hypotheses. At this stage, students are expected to be able to solve problems and find solutions to solve

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p-ISSN: 2828-920X e-ISSN: 2828-9951

these problems actively (Yusika & Turdjai, 2021). Therefore, the answers for each group are different according to their respective understanding.

The stage of the project learning worksheet that has the highest score is the stage of carrying out research with a score of 91.5. This is because they can carry out experiments on making kaolin soap with the addition of kefir curd well. Students looked active and collaborated in carrying out every step of the product-making experiment. This follows research by Marsiti *et al*. (2023) who explains that project-based learning increases collaboration between group members so that it can influence the student learning process which results in developing students' scientific performance.

4.2. Analysis of Student Performance in Doing Worksheets on the Project-Based Learning Process

Analysis of the development of students' scientific performance was obtained based on the students' scientific performance assessment sheet. Indicators for assessing students' scientific performance relate to the stages in the project-based worksheet. Indicators assessed in developing students' scientific performance abilities include the ability to formulate problems, formulate hypotheses, design experiments, carry out experiments, interpret research data, and communicate. The relationship between the stages in the project-based worksheet and the development of students' scientific performance is presented in **Table 4.**

Table 4. Relationships between worksheet stages and scientific performance indicators.

No	Project Learning Stages	Scientific Performance Indicators	Average	Category
1	Identify the problem	Formulate the problem Develop a hypothesis	78	Good
2	Designing projects	Designing experiments	83	Very good
3	Carrying out research	Carrying out experiments	89	Very good
4	Prepare product *drafts/prototypes*	Interpreting data	92	Very good
5	Product assessment			
6	Finalization and publication of products	Communicate	75	Good

At the stage of identifying problems, students' scientific performance indicators relate to students' ability to formulate problems and create hypotheses. This scientific performance indicator is related to one of the scientific performance skills, namely cognitive skills which are related to the ability to analyze, formulate, and solve problems (Harso & Fernandez, 2019).

At the project design stage, students' scientific performance indicators relate to students' ability to prepare tools and materials and determine experimental designs. This follows the scientific performance aspect, where students are required to determine appropriate tools and materials and determine project steps so that they are relevant to the project theme (Kadek *et al*., 2015).

At the stage of carrying out experiments, students' scientific performance indicators are related to the ability to carry out experiments. The ability to carry out this experiment follows one of the students' scientific performance skills, namely psychomotor skills (Harso, Fernandes, 2019). This skill can be obtained by students, one of them being through the practicum method.

Scientific performance indicators related to the draft/prototype stage, namely interpreting data. The indicator for interpreting data is that students are asked to look for information

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p-ISSN: 2828-920X e-ISSN: 2828-9951

regarding methods, principles of soap making, and the function of adding kaolin and kefir curd, and then explain the data obtained. This is following the scientific performance indicators of students, namely being able to carry out the steps in the project and utilize information from various sources to solve problems (Kadek *et al*., 2015).

At the product assessment stage, students' scientific performance indicators are also related to the ability to interpret data. Students are asked to look for information regarding soap standards according to SNI and then compare the soap produced with commercial soap. This follows scientific performance indicators, namely interpreting data where students can look for relevant data and then explain and conclude the data obtained (Harso & Fernandez, 2019).

The finalization and publication stage of student scientific performance indicator products is related to communication skills. At this stage, students are required to communicate the results of projects and worksheets by presenting them in front of the class. This is a characteristic of students' scientific performance indicators where students can present the research results obtained well (Harso & Fernandez, 2019).

Overall, the score obtained by students in completing each stage in the worksheet related to students' scientific performance is in the very good category. This is following research by Kadek *et al*. (2015) which shows that project-based worksheets can develop students' scientific performance. Project-based learning can improve students' scientific performance higher than other learning models.

4.3. Analysis of kaolin soap with the addition of kefir *curd*

Soap is made through a saponification reaction, namely a reaction between triglycerides and bases in an aqueous medium (Baptista *et al*., 2019). In making kaolin soap, the triglycerides used are olive oil and coconut oil, and the base used is NaOH (Sodium hydroxide). In making kaolin soap, natural ingredients are added, namely kefir curd. The method used in making this soap is the hot process method, namely the saponification process is carried out by heating at a temperature of 60-70oC until it forms a gel phase (Burleson *et al*., 2017).

In making kaolin soap, modifications were made by adding kefir curd. The composition of the ingredients used in making kaolin soap with the addition of kefir curd is presented in **Table 5.**

Table 5. Kaolin soap formula with the addition of kefir curd.

Material	Formula 1	Formula 2	Formula 3
NaOH (g)	14	14	14
Coconut oil (g)	30	30	30
Olive oil (g)	70	70	70
Aquades (g)	38	38	38
Kefir *curd* (g)	0	7	14

The characteristics of kaolin soap are determined by testing the quality of the soap following SNI No. 3532:2021 (solid soap standard). Tests on kaolin soap include organoleptic tests (odor, texture, and color), foam stability, and acidity degree (pH).

4.3.1. Organoleptic test

Organoleptic tests are carried out using human senses. Each group was directed to observe the color, texture, and smell of the soap produced. The organoleptic test results of the soap produced by each group are presented in **Table 6**.

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p-ISSN: 2828-920X e-ISSN: 2828-9951

Table 6. Organoleptic test results.

Group	Organoleptic Test		
	Texture	Smell	Color
1	Solid and hard	Resembles clay	White bone
2	Congested	Resembles clay	White
3	Congested	No smell	White bone
4	Dense and soft	No smell	White bone
5	Congested	No smell	White bone
6	Solid, slightly soft	Resembles clay	Ivory

Based on the organoleptic test for each group, there were no differences between F1, F2 and F3. The addition of kefir curd has the potential to affect the texture of the soap. This is following research by Marya *et al.* (2022) The addition and increase of kefir curd influences the texture of the soap to become softer.

4.3.2. Foam Stability

The foam stability test was carried out by dissolving 1 g of kaolin soap with 10 mL of distilled water, shaking for one minute, and then measuring the height of the foam produced. Testing on foam stability aims to determine the stability of the foam produced by solid soap (Nurrosyidah *et al*., 2019). For kaolin soap with the addition of kefir curd, the foam stability test results are presented in **Table 7**.

Table 7. Observation data for foam stability tests.

Group	Foam Stability (%)
1	50
2	60
3	85
4	89
5	83
6	85

Based on these data, the average stability of the foam produced has a high value. This is following research (Dewi & Lestari, 2022) that the stability of the foam in the soap produced meets the requirements for stability of foam in solid soap based on SNI, namely around 60-90%.

4.3.4. Acidity

Testing the degree of acidity or pH test is carried out by dissolving 1 g of the resulting kaolin soap with 10 mL of distilled water, then shaking for one minute. After that, drop the soap solution over the universal indicator and observe the color changes that form on the universal indicator. The results of testing the degree of acidity of kaolin soap with the addition of kefir curd are presented in **Table 8**.

Overall, the test value for the degree of acidity of the kaolin soap produced by all groups has the same value, namely 10. Based on research Helsy *et al.* (2018) Adding more kefir will lower the pH value of the soap. This is because students are not careful when observing color changes on universal indicator paper. However, the pH value of the kaolin soap produced follows the pH standard for solid soap, namely around 8-11 (Sukeksi *et al*., 2018).

DOI:
p-ISSN: 2828-920X e-ISSN: 2828-9951

Table 8. Tests for the degree of acidity.

Group	Acidity
1	10
2	10
3	10
4	10
5	10
6	10

5. CONCLUSION

Based on the research that has been carried out, it can be concluded that the percentage of student activity during the application of the worksheet is 87 in the very good category. The highest average score was 94 with a very good category at the stage of carrying out the research. The students' scientific performance ability in applying worksheets reached 86 in the very good category. The highest average score is 92 with the very good category found in the indicator for interpreting data. The results of the characterization of the kaolin soap produced following SNI No. 3532:2021 with a pH value of 10, the foam stability values respectively from highest to lowest are 89, 85, 83, 60, and 50%. Based on the organoleptic test, the soap has a solid texture and smells like clay with a bone-white color. This shows that the implementation of project-based worksheets can be carried out well.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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DOI:
p-ISSN: 2828-920X e-ISSN: 2828-9951