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## Using rice bran as a patisserie ingredient in project-based learning in the food engineering study program at UNY

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### ABSTRACT

The number of people with non-communicable diseases (NCD) and degenerative diseases tend to increase from time to time. The diseases are the results of a bad diet and free radicals. Rice bran is one of the food sources containing high fiber and antioxidants. However, it is rarely used as a food product. Rice bran may become the ingredient of patisserie products for the NCD diet. This type of research is a class action. The research was conducted at the Food Engineering Education Study Program. The research population was fourth-semester Food Engineering students with the research sample being students who chose a patisserie concentration and took the Bakery Processing Course. These rice bran-based pastisseries are made in the Food Engineering Education study program of the Faculty of Engineering at UNY. Through Project-based Learning (PjBL), the fourth-semester students taking the Bakery Processing course learned how to make rice bran products. 30 students were participating in this research which was conducted from June to September 2019. Based on the result of this study, it was found that the average student's knowledge pre-test score was 20.90, and the post-test average score was 23.10. In terms of students' attitudes, the average pre-test score was 46.25, and the average post-test score was 49.80. The students' skills at making rice bran-based pastisseries are considered "Good" because the score ranges between 93 and 100. PjBL is considered effective to be implemented in the Food Engineering class because it can improve students' knowledge, attitude, and skill scores.

**Keywords:** non-communicable diseases, project-based learning, pastisseries, rice bran

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### INTRODUCTION

In the last few decades, Indonesia has faced the problem of triple burden diseases, namely infectious, re-emerging, and new emerging diseases. On the other hand, the number of people with non-communicable and degenerative diseases is increasing from time to time (Warganegara & Nur, 2016). Although non-communicable diseases (NCDs) are not transmitted, they can be chronic. According to Basic Health Research/*Riskesdas* (2018), the prevalence of NCDs has increased when compared to the data from *Riskesdas* issued in 2013. The diseases recently increasing are cancer, stroke, chronic kidney disease, diabetes mellitus, and hypertension. The

prevalence of cancer rises from 1.4 per mil to 1.8 per mil, stroke rises from 7 per mil to 10.9 per mil, and chronic kidney disease rises from 2 per mil to 3.8 per mil. Based on blood sugar tests, the number of people with diabetes mellitus rises from 6.9% to 8.5%. Meanwhile, based on the results of the blood pressure test, the number of people with hypertension increases from 25.8% to 34.1%. The increase in the prevalence of non-communicable diseases is related to lifestyle, including the lack of consumption of food with high fiber, such as fruits and vegetables (Risksdas, 2018).

Free radicals are also suspected to be the cause of NCDs. The effects of free radicals can be interfered with by antioxidants-a substance that can slow down and prevent the oxidation of molecules. Antioxidants may reduce the impacts of free radicals in triggering chronic diseases caused by free radicals, such as cancer, brain dysfunction, and inflammation that can cause death. The human body can produce antioxidants from metabolism but with the increasing number of free radicals, the body needs to be supported by more antioxidant intake (Anliza & Hamtini, 2017). People in developed countries have changed their diets due to the increase in cardiovascular diseases caused by high cholesterol, diabetes, and ulcerative colitis. Bran is a rice by-product that contains a highly bioactive compound that plays an important role in maintaining health. However, bran is now considered a waste as people do not consider its potential as a functional food ingredient (Henderson et al., 2012).

The results of this study show that rice bran contains antioxidant bioactive compounds and fiber or *rice bran saccharide*. The antioxidant may prevent diabetes, Alzheimer's disease, heart disease, and cancer (Adom & Liu, 2002). Moreover, rice bran is easy to get as it is a by-product of rice milling and is the third most consumed cereal in the world (FAO, 2019). Rice bran can be used as the ingredient of patisseries for NCDs diet. Following the 2006 and 2013 Curricula of Tourism and Culinary Vocational High Schools in Indonesia, one of the competencies taught is making cakes or bread in Pastry and Bakery Product subject. The students of the Food Engineering Education study program are prospective teachers at vocational schools, so they need to master the competence related to pastry and bakery making. The students also need to identify the certain potentials and nutritional values of certain ingredients to be used in patisserie products. Rice bran is selected because it contains nutrition that benefits several diets. In this study, during the learning process, students developed healthy rice bran-based cookies with a substitution value of 30% that can decrease glucose, cholesterol, and triglyceride levels (Auliana & Rahmawati, 2017).

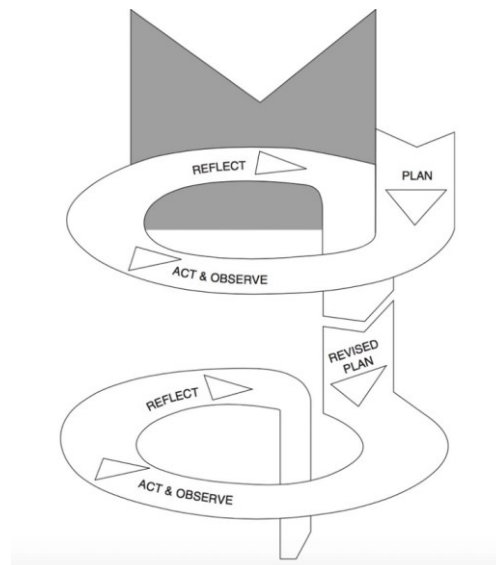
The model used in this classroom action research is Project-based Learning (PjBL) which constructs students' knowledge and makes students more independent in constructing knowledge. PjBL is developed to be implemented in the 2013 Curriculum. This learning model aims to encourage students to produce contextual works individually or with other students in teams.

Thus, it is suggested to be used to produce certain products. PjBL is also a learning activity in which students are given challenges through real tasks related to their daily lives to solve them together in groups (Goodman, 2010). Project-Based Learning allows students to collaborate to complete a project so that their empathy and responsibility may arise (Nisa & Nugraheni, 2021). This learning model supports scientific learning that is implemented in the 2013 Curriculum (Regulation of the Ministry of Education and Culture No. 22/2016). Based on Circular Letter No. 4/2020, during the Covid-19 pandemic, Project-Based Learning is selected as a learning model in distance learning because it can make students think independently, collaborate/cooperate with peers, and explore the learning. In project-based learning, students are the center of learning and are learning activities to improve their competencies (Koparan & Guven, 2014). Classroom action research is important to see the relationship between students and teachers in the learning process so that learning outcomes can be optimal. Al-Obaydi research in 2021 showed the final statistical results show that student-teachers have a positive perception of the use of action research in English teaching classes (Habeab Al-Obaydi et al., 2021).

Seven PjBL syntaxes can be applied in the deep vocational schools learning process. The seven steps consist of (1) formulating the expected learning outcomes, (2) understanding the concept of teaching materials, (3) skills training, (4) designing project themes, (5) making project proposals, (6) carrying out project assignments and (7) project presentations report. Studies show that the implementation of the seven steps of PjBL is practical and effective to improve students' abilities and productive competence (Jalinus et al., 2017).

## **METHOD**

This Classroom Action Research was developed based on the spiral model by Kemmis and McTaggart. There were two cycles with three meetings in each cycle. The cycle consisted of some stages, namely planning, implementation, observation, and reflection (Irfan, 2017). Classroom action research consists of two cycles and each cycle must achieve success at a certain level (Suharsimi, 2014).



Gambar 1. Model Kemmis dan Taggart

The characteristics of project-based learning include aspects of content, activities, conditions, and results. In project-based learning, aspects of learning content have the following characteristics: (1) problems are presented in the form of complex wholes; (2) students find interdisciplinary relationships between ideas; (3) students struggle to overcome ambiguity, and (4) answer real questions and attract students' attention. The activity aspect has the following characteristics: (1) students carry out investigations during a certain period; (2) students are faced with difficulty, finding sources and solving problems; (3) students make connections between ideas and acquire new skills; (4) students use real equipment; and (5) students receive feedback about their ideas from other people (Slameto, 2015).

The main characteristic of classroom action research is the attainment of significant operational procedures in the form of learning models/approaches/strategies to be implemented (Rasyid, 2019). The participants of this study were students of Food Engineering Education of the Faculty of Engineering at UNY. They were the fourth-semester students in class D. The participants took the Bakery Processing course from June to September 2019. The object of the research was the PjBL model, while the affected variable was students' knowledge, attitudes, and skills. The learning instruments prepared were: 1) lesson plans to teach rice bran-based patisserie material and 2) a learning module with rice bran diet material. The feasibility of the lesson plan was checked by a teacher of Pastry Products subject at a vocational high school and a lecturer of Bakery Processing in the Food Engineering Education study program. The instruments of this research were knowledge test items, attitude questionnaires, and worksheets that were tried out and declared valid and reliable. The collected data were analyzed using a t-test to compare students' knowledge measured in the pretest and post-test.

## **RESULTS AND DISCUSSION**

Based on the observation, it was found that students found it difficult to master the competence and skills in making patisseries. Therefore, there was a need to implement an effective and relevant learning method. The appropriate learning method used is PjBL. Using this method, students more easily understand learning materials that require them to complete a certain project, which in this case is rice bran-based patisseries for various diets. The steps of PjBL learning conducted in this study are presented below.

### **Step 1 (Determining the project)**

The lecturer presents the topic, while students ask questions about how to solve the problems. In addition, they should find the correct procedures to solve the problems.

### **Step 2 (Planning the procedure of the project)**

The lecturer groups the students according to the project procedure, and the students solve the problems through group discussion and observation of several patisserie products.

### **Step 3 (Scheduling the project)**

The lecturer determines the procedure and schedule to do the project. After the deadline is determined, the students follow the procedure and schedule.

### **Step 4 (Completing the project with lecturer's monitoring)**

Monitoring is provided by the lecturer to see the students' activeness in completing the project and the efforts done to solve the problem. The students complete the tasks following the schedule planned.

### **Step 5 (Developing report and project publication)**

The lecturer and students discuss the completed project. The discussion will become the content of reports to be presented to other people.

### **Step 6 (Evaluating the project and result)**

The lecturer directs the process of presentation, reflects on the process, and draws a conclusion about what the students get during the lesson in general in the observation sheet.

## **1. Cycle I**

This study implemented PjBL in a bakery processing course with a rice bran-based patisseries diet as the topic. A learning module was used during the teaching-learning process. Cycle I consisted of three meetings that used the PjBL steps above consecutively. In meeting 1, the first step of PjBL (determining the project) was presented by the lecturer by asking questions related to daily lives and non-communicable diseases the students. Then, the lecturer told them that the increase in rice production led to the increase of its by-product that may be the potential to be used in food production. The lecturer then explained the objectives of the lesson. The students were asked to observe low-fat and low-sugar patisserie products and rice bran cookies produced by Auliana and Rahmawati. Next, the students read the module prepared and answered

questions related to patisseries, the nutritional potentials of rice bran, and its potential as the ingredient of patisserie products. The questions were then used to become the theme of the project, namely the rice bran-based cake, pastry, and bakery for various diets, namely low-calorie diet, low-fat diet, and low-sugar diet.

In the second meeting (planning the procedure of the project), PjBL was still implemented. The students were divided into ten groups, and each group was asked to analyze 3 patisserie products (cake, pastry, or bakery) to be developed into one prototype patisserie product with rice bran as the ingredient. This activity was supervised by the lecturer. After step two was completed, the next step (scheduling the project) was done. Under the lecturer's supervision, the students determine the schedule for producing the rice bran patisseries. It was agreed that the product prototype should be produced in one meeting, so the real product should be completed in three meetings (300 minutes). At last, the reports should be presented at the end of the cycle.

In the next meeting, meeting 3, the fourth step (completing the project with the lecturer's monitoring) was conducted. In this meeting, the students may use rice bran as the substitute ingredient in patisseries. They might also use various equipment and work processes in making the cookies. At the end of this meeting, the students were asked to draw conclusions related to the learning materials learned. The teacher asked the students to make a summary of each material in the form of reports. Because this third meeting is the end of Cycle 1, the knowledge test was conducted, the questionnaires were distributed, and the performance test was done. The results of the tests are presented in Table 1 below.

Table 1. The Results of the Knowledge Test and Survey on Attitude in Cycle 1

Criteria	Knowledge	Attitude
Good if >80%	9	15
Moderate if 60-80%	12	15
Poor if <60%	9	-

Based on Table 1, it was indicated that students' knowledge had not met the target. It was expected that 70% of the students had scores higher than 80% or were declared "passed". In addition, the results of the performance test that focused on students' competency in making rice bran-based patisseries were optimum, so the product should be re-tested.

Table 2. The Performance Test Result in Cycle I

Group	Product	Preparation	Process	Result	Average Score
1	Almond cookies (low-fat diet, low-sugar diet)	23	12	45	80
2	Kaasstengels/Dutch cheese cookies (low sugar diet)	22	14	42	78
3	Sesame cookies (low-fat diet, low-sugar diet)	20	14	46	80
4	Fruit pies (low-fat diet)	21	13	45	79

5	Bread (low-calorie diet, low-fat diet, low-sugar diet)	22	13	45	80
6	Plaited bread (low-calorie diet, low-fat diet, low-sugar diet)	22	12	41	75
7	Donuts (low sugar diet)	21	14	40	75
8	Mini angel food (low-calorie diet, low-fat diet)	20	14	41	75
9	Egg white cake (low-calorie diet, low-fat diet, low-sugar diet)	21	14	43	78
10	Zand cookies (low-fat diet, low-sugar diet)	22	13	40	75

Therefore, the researcher who was also the lecturer discussed with colleagues (lecturer team) to improve the material of rice bran's potential as a functional food product to be used as a patisserie ingredient. The lecturer tried to make the learning process more interesting using a learning strategy in Cycle II. During the learning process, videos of rice-bran potentials as a functional food ingredient, rice bran-based patisserie-making process, and rice bran-patisserie potentials were played. Next, the treatment was changed by redesigning the prototype of the patisserie product, the recipes were further analyzed, and more research journal articles were read. It was expected that some changes might improve students' knowledge, attitudes, and skills to meet the learning objectives determined. Research by Septiani et. al shows that the results of reflection in cycle 1 there are still 47.37% of the 19 students who have completed learning and 52.63% of the number of students still need to improve learning (Annuar & Zola, 2019).

## 2. Cycle II

Cycle II was conducted by referring to Cycle I. This Cycle was done to improve and revise some treatments performed in the previous cycle. The treatment provided in this Cycle were: a) revising the material and implementing a more interesting learning strategy and b) providing learning videos of rice-bran potentials as a functional food ingredient, rice bran-based patisserie making process, and rice bran-patisserie potentials. In the second meeting of Cycle II, the product prototype design was analyzed. Then, before the third meeting, the students were asked to read the procedure of making the food products through and through, so in the third meeting, they would have improved their skills in following the procedure of making the rice-bran food products.

Table 3. The Results of the Knowledge Test and Survey on Attitude in Cycle II

Criteria	Knowledge	Attitude
Good if >80%	23	21
Moderate if 60-80%	7	9
Poor if <60%	-	-

Based on the results of the knowledge test and attitude survey done in Cycle II, it can be indicated that the PjBL implementation in rice bran-based patisserie making is successful. Data in Table 3 show that students' knowledge and attitudes meet the target because 70% of the students had scores higher than 80%. Because based on the scores they were declared "passed", the process was ended in Cycle II. Table 3 also shows that 75% of the students had "Good" knowledge, and 70% of the students have "Good" attitudes. Meanwhile, in terms of skills, there was an improvement in patisserie products made by the students when compared with the patisserie produced in Cycle I.

Table 4. The Performance Test Result in Cycle II

Group	Product	Preparation	Process	Result	Average Score
1	Almond cookies (low-fat diet, low-sugar diet)	23	14	50	87
2	Kaasstengels/Dutch cheese cookies (low sugar diet)	24	14	50	88
3	Sesame cookies (low-fat diet, low-sugar diet)	23	14	50	87
4	Fruit pies (low-fat diet)	22	14	50	86
5	Bread (low-calorie diet, low-fat diet, low-sugar diet)	23	14	53	90
6	Plaited bread (low-calorie diet, low-fat diet, low-sugar diet)	24	14	48	85
7	Donuts (low sugar diet)	24	14	43	81
8	Mini angel food (low-calorie diet, low-fat diet)	23	14	44	81
9	Egg white cake (low-calorie diet, low-fat diet, low-sugar diet)	24	14	43	81
10	Zand cookies (low-fat diet, low-sugar diet)	24	13	44	81

Based on the data presented in the table above, it can be concluded that in Cycle II, students' knowledge, attitudes, and skills improved. The results of the learning process conducted in Cycles I and II show that 1) during the learning process where PjBL was implemented, students were very enthusiastic, happy, and active in participating in the teaching-learning process, and 2) the results of the performance test show that students' skills improved. With revisions and improvements, the two cycles were able to improve students' knowledge, skills, and attitudes toward learning. Results and Discussion should be an objective description of the results and should be concerning the objectives of the research. You should discuss the findings of the previous studies and specifically mention what new observation or insight was generated through your study results and highlight differences between your findings and the previous studies. Results of the research show: 1) there was an increase in the average value of student knowledge, namely from 62.03 with 48.8% completeness in cycle I and in cycle II to 82.38 with 96.77% completeness, 2) there was an increase in the average value of students' practice skills, namely



from 48.1 with 0% completeness in cycle I and in cycle II to 83.32 with 96.77% completeness (Rachmawati, 2018). The results of other studies showed that there was an increase in classical completeness from the pretest of 56% with an average of 66.4, an increase in cycle I of 72% with an average of 75.07, and an increase in cycle II of 88% with an average of 86.13.

These results indicate that the application of the PjBL learning model can improve learning outcomes in the Application of Electronic Circuits in class XI TAV students at SMK Negeri 1 Bireuen Aceh (Septiani et al., 2022). Action research conducted on prospective English teachers showed participants experienced growth in teaching efficacy, increased self-awareness, improved problem-solving skills, and increased self-learning. These results suggest that action research is a valuable tool for developing pre-service English teacher candidates' self-efficacy (Cabaroglu, 2014). Another study using classroom action research found that classroom action learning reduced some of the negative behavior of students, increased interest in class, and contributed to the professional development of classroom teachers (ARI & CIFTCI, 2022). Meanwhile, classroom action research conducted by Dorji (2020) shows that students admit the importance of classroom action research to improve skills and they intend to conduct their action research in the future. The study showed that there was an increase in classical mastery from the pretest by 59% with an average of 70.4, an increase in the first cycle by 72% with an average of 75.07, and an increase in the second cycle by 88% with an average of 76.13 which means the application of the Project Based Learning model can improve learning outcomes Application of Electronic Circuits in class XI TAV 1 SMK Negeri 3 Singaraja (Gede et al., 2015). Enawisnat et al. found that the results of student learning research increased from 83% complete and 17% incomplete in cycle I to 100% in cycle II. For learning activities, there was an increase from 79.31% in Cycle I to 85.79% in Cycle II (Enawisnat et al., 2022). Likewise, the results of Napitupulu's research found that classroom action research with a scientific approach of 2 cycles could improve student skills in writing class action research proposal backgrounds, the results showed that students were very active in observing, asking questions, testing, associating and communicating to motivate students to achieve results maximum learning (Napitupulu, 2021). This research is expected to be able to equip students of culinary engineering education to become more proficient in making patisserie products with various ingredients and be able to develop them as products that are beneficial to health.

## **CONCLUSION**

Based on the data analysis of this classroom action research, it can be concluded that PjBL can be implemented in learning rice bran-based patisseries. It was found that students are

more enthusiastic in asking, answering, and expressing opinions during the teaching-learning process. Moreover, this research also found that

1. The students' pretest average score is 20.90, and the posttest average score is 23.10;
2. Based on the survey, the average score of students' attitudes on pretest is 46.25, and the average score on post-test is 49.80;
3. Students' skills in making rice bran-based patisseries are considered "Good" because their scores are between 81 and 90;
4. In terms of knowledge and attitudes, the pretest and posttest scores are improved. This means that PjBL is effective to be implemented in the Food Engineering Education study program at UNY.

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