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# Development of Live Worksheet Based on Project-Based Learning to Promote Creative Thinking and Ecopreneurship on Biotechnology Concepts

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**Abstract**

This study aimed to develop teaching materials, one of which is student worksheets integrated with technology based on the project-based learning model to promote creative thinking and ecopreneurship on the concept of biotechnology at senior high school. The research used the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). Field trials of live worksheet development were conducted at a high school in Bekasi, Indonesia with a sample of 25 10th-grade students. The results obtained from the validity test were 86.33% (very valid), the results of the creative thinking questionnaire were 83% (creative), the results of the ecopreneurship questionnaire were 78% (high), and the response results were 77%-85% (good to very good). Live worksheets improve the understanding of biotechnology material and promote creative thinking and ecopreneurship skills.

Keywords: Live worksheet, Creative Thinking, Ecopreneurship, Conventional Biotechnology

## INTRODUCTION

Discussing entrepreneurship is crucial as more people seek jobs rather than create them. Increasing entrepreneurship boosts economic activity and reduces unemployment (Nur et al., 2014; Safitri & Nawawi, 2022; Zainea et al., 2020; Decker et al., 2014). The Indonesian government aims to integrate entrepreneurial skills into the school curriculum, preparing students to become independent entrepreneurs after graduation.

Independent Curriculum encourages teachers to be creative and innovative, through class projects that enhance student creativity and learning (Retnaningrum et al., 2023; Mabsutsah et al., 2023). Entrepreneurial activities require ecopreneurship skills and creativity. Ecopreneurship promotes environmentally friendly entrepreneurship education, practical application in daily life, and community awareness (Kainrath, 2011; Lubis, 2019).

The sense of ecopreneurship can even be fostered through STEM course projects (Martini et al., 2018). Entrepreneurship enables students to create high-value products that benefit the community (Afriadi & Yuni, 2018). Fostering entrepreneurial interest boosts creativity in transforming information into marketable products, like bio-entrepreneurship, which turns biological research into valuable new products (Aqil et al., 2020; Hong et al., 2012).

One of the products that can be utilized is local resources such as tubers, nuts, grains, fruits, and agricultural food products in Indonesia. For local resources in Indonesia not to be extinct, they are utilized by the method of utilizing biology, namely conventional

biotechnology, so that local resources have high nutritional value and taste as a food ingredient. Biodiversitypreneurship is an integration between biotechnology, biodiversity, and entrepreneurship, becoming an entrepreneurial activity through biotechnology products based on local biodiversity (Hayati & Fitriyah, 2021b).

Students often struggle with hands-on biotechnology practice, leading to lecture-based learning focused on concepts (Purwaningsih et al., 2009; Natadiwijaya et al., 2018). Project-based learning (PjBL) is an effective model for enhancing creativity when making biotechnology products. PjBL allows teachers to design project-based classroom activities, engaging students in continuous review and practical application (Wena, 2016; Pengestuti et al., 2023).

The entrepreneurship-oriented PJBL model is for high school students' creativity and entrepreneurial values in conventional biotechnology concepts (Ulfah et al., 2018). To support learning in the classroom, using the PjBL model requires using the correct teaching material device, namely using student worksheets. Using these student worksheets helps teachers and students be more directed when making projects. Good student worksheets can attract students' interest if it is neatly arranged, systematic, and easy to understand. It attracts students' attention and increases learning motivation and curiosity (Isnaningsih & Bimo, 2013; Dawson, 2007).

Student worksheets, integrated with technology in the form of electronic student worksheets, make it easier for students to access them anytime and anywhere; besides that, electronic student worksheets help students develop digital literacy skills so that students can operate electronic devices properly. The advantage of electronic student worksheets is that it can save paper usage and are easily accessible, in contrast to conventional student worksheets, which generally require much paper and cost a lot to print; students tend to feel bored with only visual displays, besides, it also does not utilize technology (Andriyani et al., 2020). One of the electronic student worksheets used today is a live worksheet. The live worksheet has many features that can meet students' learning expectations using effective technology and assist teachers in preparing more exciting materials and assignments (Chaniago et al., 2023; Zaini et al., 2021).

Rindyani's research in developing worksheets was used in social studies material and other subjects (Hastuti, 2023). Dina's research on developing interactive worksheets is applied at the elementary and other levels (Hariyati & Rachmadyanti, 2022). Ernawati & Sujatmika's research developed a worksheet based on a scientific approach to improving critical thinking skills (Ernawati & Sujatmika, 2021). From research that has been carried out previously, there has been no direct development of worksheets in biology subjects using biotechnology

concepts by knowing the development of students' creative thinking in making conventional biotechnology products with variations that are different from those stated in textbooks or text materials, as well as developing students' ecopreneurship to reducing waste or plastic containers that can be used many times until they are damaged and then become trash. These learning activities can develop an honest and competent entrepreneurial spirit in students from an early age.

Preliminary studies conducted at a senior high school in Bekasi, Indonesia have not applied live worksheet-based student worksheets, so the student worksheets used are conventional student worksheets for additional/remedial grades for students who have not met the Minimum Completeness Criteria. Therefore, developing live worksheets is essential for research in this school. The senior high school in Bekasi, Indonesia supports digital-based learning as an example of using Microsoft for assignments and exams. The senior high school in Bekasi, Indonesia is a driving school in implementing the Independent Curriculum, especially in the Pancasila Student Profile Strengthening Project, which has the theme of entrepreneurship to instill an entrepreneurial spirit in students by producing a product from Pancasila Student Profile Strengthening Project activities to be sold to the community and the school environment.

However, the application of ecopreneurship in schools has yet to be sold from biotechnology products such as the sale of tempeh products and other products, so with some variations in the essential ingredients of conventional biotechnology products that can be developed, it is vital to do research. Based on the problems that have been described, the importance of this research can be formulated in developing a live worksheet with a project-based learning model that can promote creative thinking skills and ecopreneurship.

Moreover, the research aims to develop a project-based learning-based live worksheet to promote creative thinking skills and ecopreneurship on the concept of biotechnology in senior high school, which is feasible to use in biology learning.

## METHOD

This type of research is development research using the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation). The following is the design of the ADDIE development model (Branch, 2009).

The subjects of this research were 25 students of class X.5 regular at a senior high school in Bekasi, Indonesia. Data collection was carried out in preliminary research and field research. Preliminary data collection techniques involved interviews with biology teachers and questionnaires of students' needs, while field research used tests and questionnaires.

The data collection instrument used a validation questionnaire sheet for biotechnology material experts, media experts, and learning experts, namely biology teachers, creative thinking questionnaires, ecopreneurship questionnaires, and student response questionnaires after using a live worksheet.

The formula used to analyze validity test data is as follows:

$$V_{ah} = \frac{T_{se}}{T_{ah}} \times 100\%$$

Description:

$V_{ah}$ = Expert validation

$T_{se}$ = Total empirical score obtained

$T_{ah}$ = Total expected score

The formula used for calculating the percentage of answers to the questionnaire for creative thinking, ecopreneurship and students' responses after using the live worksheet, namely

$$N_A = \frac{Sp}{Sm} \times 100\%$$

Description:

NA = Final Score

Sp = Earned Score

Sm = Maximum Score

The criteria for scoring the validation test by experts can be seen in Table 1.

Table 1. Criteria for Scoring the Validation Test by Experts (Riduwan, 2014)

| Validity Criteria | Validity Level |
|---|---|
| 85,01% - 100,00% | Very valid |
| 70,01% - 85,00 % | Valid |
| 50,01% - 70,00% | Less valid |
| 20,01% - 50,00% | Not valid |
| 0% - 20,00% | Very invalid |

The indicator of creativity ability questionnaire & ecopreneurship ability questionnaire indicators can be seen in Table 2.

Table 2. Indicator of Creativity Ability Questionnaire (Samsinar, 2017) & Ecopreneurship Ability Questionnaire Indicators (Hidayah et al., 2019)

| Variable | Number | Indicator | Observed Aspect | Assesment |
|---|---|---|---|---|
| Creativity Ability | 1 | Fluency | Designing the manufacture of conventional biotechnology products based on local resources | Using a Likert scale: 5 = strongly agree |
| | 2 | Flexibility | Designing product packaging that can be 3R or without plastic | 4 = agree 3 = less agree 2 = disagree |

| Variable | Number | Indicator | Observed Aspect | Assesment |
|---|---|---|---|---|
| | 3 | Originality | Designing labels according to students' wishes | 1 = strongly disagree |
| | 4 | Elaboration | Analyze the advantages and disadvantages to find solutions so that profits can be increased. | |
| Ecopreneurship Ability | 1 | Eco Innovation | Make alternative packaging that does not cause waste that is difficult to decompose. | |
| | 2 | Eco Opportunity | Reading opportunities to utilize local resources | |
| | 3 | Eco Commitment | Honest in selling entrepreneurial products, making strategies so that customers can buy back the products offered | |

The creative thinking questionnaire scoring criteria & ecopreneurship questionnaire scoring criteria can be seen in Table 3.

Table 3. Creative Thinking Questionnaire Scoring Criteria (Arini & Asmila, 2017) & Ecopreneurship Questionnaire Scoring Criteria (Hayati & Fitriyah, 2021a)

| Variable | Score | Creativity Level |
|---|---|---|
| Creative Thinking Questionnaire | 81-100% | Very Creative |
| | 61-80% | Creative |
| | 41-60% | Moderately Creative |
| | 21-40% | Not Creative |
| | 0-20% | Very Not Creative |
| | Score | Ecopreneurship Level |
| Ecopreneurship Questionnaire | 88-100% | Very High |
| | 71-87% | High |
| | 54-70% | Neutral |
| | 37-53% | Low |
| | 0-36% | Very Low |

The live worksheet assessment can be seen in Table 4.

Table 4. Live worksheet Assessment

| Number | Assessment Component | Score |
|---|---|---|
| 1 | Determination of title, objective, problem formulation, hypothesis, material tools | 25 |
| 2 | Packaging and sales planning | 15 |
| 3 | Answering questions on the live worksheet | 15 |
| 4 | Scheduling and work steps | 20 |
| 5 | Cost breakdown of profit and loss, commitment, and evaluation | 25 |
| Total Scores | | 100 |

The criteria for scoring the learner response questionnaire can be seen in Table 5

Table 5. Criteria for Scoring the Learner Response Questionnaire (Sianturi & Dongoran, 2019)

| Score | Category |
|---|---|
| 81-100% | Very Good |
| 61-80% | Good |
| 41-60% | Fairly Good |
| 21-40% | Not Good |
| 0-20% | Very Not Good |

## RESULTS AND DISCUSSION

1. The Analysis Stage

The results of the analysis with the biology teacher of a senior high school in Bekasi, Indonesia namely: 1) Student worksheets that are used student worksheets that already exist on the internet and then developed in the form of conventional student worksheets (student worksheets using paper containing material and evaluation assessments, as well as additional values that do not reach Minimum Completeness Criteria; 2) The student worksheets used has not been integrated with electronic student worksheets; 3) The learning model is usually problem-based learning, which analyzes a problem and finds a solution; 4) Students are expected to have the skills to hone ecopreneurship so that after graduation, they already have a young entrepreneurial spirit; 5) Biotechnology products have never been sold; they are usually products determined from the Pancasila Student Profile Strengthening Project program after harvesting at the end of the semester. The results of an interview with a biology teacher at a senior high school in Bekasi, Indonesia can be seen in Table 6.

Table 6. Results of Interview with Biology Teacher of a Senior High School in Bekasi, Indonesia

| Indicators | Description of Interview Results |
|---|---|
| Effectiveness of student worksheets | Student worksheets help students practice the field, so student worksheets need to be arranged clearly and in detail. student worksheets are used directly in hard file forms because they can fill in observation data directly. student worksheets have never used live worksheets, usually taken from the internet and then developed according to the learning objectives in class |
| Learning Model Used | Problem-based learning is used to analyze cases in the field and provide solutions to ecosystem material and environmental changes. In biotechnology material, project-based learning is used to make cheese and yogurt products. |
| Creative Thinking Ability | There is a need for creative thinking skills in making biotechnology products so that they can create various flavors of yogurt and cheese from strawberry and vanilla milk. |

| | |
|---|---|
| Supporting Facilities and Infrastructure | The senior high school in Bekasi, Indonesia uses the Microsoft Teams application for the online learning process and Microsoft Forms for assignments and exams. |
| Biotechnology Material | Conventional biotechnology is easy to apply; adequate tools and infrastructure are needed for modern biotechnology. |
| Application of entrepreneurship/ecopreneurship | The application of entrepreneurship is needed to hone students' entrepreneurial interests, and when they graduate from school, they are expected to have a young entrepreneurial spirit. Regarding the sale of biotechnology products, they have never sold them. Usually, entrepreneurship is integrated with the Pancasila Student Profile Strengthening Project program from fish hatcheries, plantations, and crafts sold during the bazaar at the end of the semester. |

Another stage of analysis is the questionnaire of students' needs. The results of the analysis with the needs questionnaire of students in class X.5 Regular at a senior high school in Bekasi, Indonesia are; 1) Biology is less fun and challenging because the material is difficult to understand and memorize; 2) Biotechnology material that needs much memorization and does not understand the material; 3) Never used live worksheet; 4) Many students do not know live worksheet. The results of the learner need questionnaire can be seen in Table 7.

Table 7. Results of the Needs Questionnaire for Class X.5 Regular at a senior high school in Bekasi, Indonesia

| Indicators | Description of Questionnaire Results |
|---|---|
| Biology material | Difficult because it is necessary to memorize biological terms, much material that must be understood and memorized, and logic is needed for every process in biological material. |
| Biotechnology material | It is difficult to memorize the terms and processes in biotechnology, and there is a lack of understanding of biotechnology processes and materials. |
| Use of student worksheets in class | Students often use student worksheets in class, and if there is a technology-based student worksheet, students will be happy to learn it. |
| Knowing the Live worksheet | Many students do not know live worksheets because they usually use paper student worksheets |

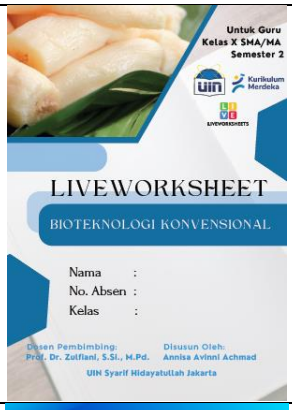
Teaching materials based on live worksheets are crucial for nurturing students' creative thinking and ecopreneurship skills. The significance of creativity is highlighted in Government Regulation No. 17/2010, which underscores the aim of education to cultivate knowledgeable, capable, critical, creative, and innovative individuals (Purwaningrum, 2016). Providing a

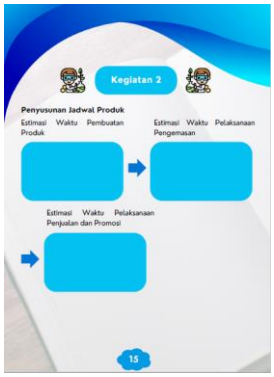
platform for constructing students' creative thinking skills in education is essential for effectively addressing challenges and adapting to changes (Susanto et al., 2020; Subariyanto et al., 2022; Ferrari et al., 2009; Tohiroh et al., 2020).

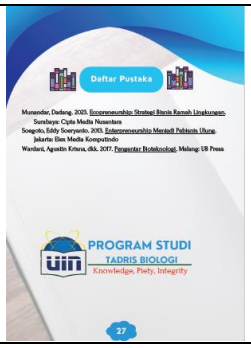
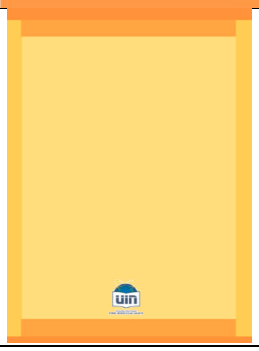
2. Design and Development Stage

At the design stage, there are several changes, namely 1) Changes in design form, 2) Simplification of the number of pages, 3) Changes in a word editor, and 4) Adjustment of learning objectives. In the stages of developing live worksheet electronic student worksheets, there are student worksheets features that integrate with indicators of creative thinking skills and ecopreneurship indicators, as well as 1-3 activities that integrate with the PjBL learning model, assessment, and evaluation. The revised display of student worksheets using live worksheets can be seen in Table 8.

Table 8. Revised Display of Student Worksheets using Live worksheet

| Components | Before Revision | After Revision |
|---|---|---|
| Front cover page, the title of student worksheets, the logo of UIN Syarif Hidayatullah Jakarta, the logo of Independent Curriculum, the logo of the live worksheet, the identity of learners, use of student worksheets |  |  |
| The introductory words in the form of the compiler's remarks and the opening of the compiler were changed to features in the E-student worksheets in the form of infobioven, biori, bioency, bioflexi, bio-origin, bioela, bioeval, ecoport, ecoino, ecocomit |  |  |

| Components | Before Revision | After Revision |
|---|---|---|
| Instructions for use contain instructions for using the live worksheet for teachers and students, and the time allocation for the work |  |  |
| Activity 1 contains the stages of the project-based learning model, namely designing and determining products/projects, packaging materials, and sales targets |   |   |
| Activity 2 contains the stages of the project-based learning model, namely scheduling the implementation of making products/projects, carrying out the implementation of making products/projects |  |  |

| Components | Before Revision | After Revision |
|---|---|---|
| |  |  |
| Activity 3 is evaluating the implementation of the project/product, and there is an assessment and bibliography |   |    |
| Back cover page |  |  |

The summary of expert team suggestions for the validation test can be seen in Table 9.

Table 9: Summary of Expert Team Suggestions for the Validation Test

| Suggestions for Improvement by The Validator Team |
|---|
| Media and Design (The title is changed to the title of the thesis included. The editorial of the word SMA/MA was changed to SMA/equivalent, given the year for the second page. The allocation of work time was changed to meetings, not days. Unique stickers were added. The introduction was changed to the features in the student worksheets. Evaluation: They make a questionnaire / organoleptic test of taste, uniqueness of packaging, good / not to peers who buy, obstacles found by students who sell, and testimonials from peers. The creative thinking indicators are more raised, and the PPA syntax is more explicitly explained. The colors are too monotonous, and the typeface is formal and better adapted to high school-level students. The back page is better distinguished; the study program and faculty logo should be removed. Less assessment is given in student worksheets if students do student worksheets) |
| Biotechnology Material Expert (Learning objectives have a structure known as Audience, Behavior, Condition, and Degree. Try to adapt it to the learning objectives you create. It is good to sharpen learning objectives by analyzing this fermentation. Using this as a concept exercise, too, is good, not just a Biori. It is worth noting the way this tempoyak is made. Is the making<br>1. Intentionally include microorganisms/enzymes as formulated in the definition of conventional biotechnology?<br>OR<br>1. Tempoyak is added with sugar and allowed to stand, hoping the microorganisms will grow and ferment.<br>If the process is the second one, does it include conventional biotechnology, where the microorganisms involved are still being determined precisely what type they are?<br>It is also necessary to include a link to avoid going directly to the signup stage in the instructions for use. Conventional biotechnology utilizes microorganisms and enzymes to produce new food and non-food products, biomaterials, biopolymers, new compounds, and bioenergy. Lack of conjunctions in the definition of biotechnology. The conjunction with the method is inappropriate because fermentation is the conventional method. Suggestion: the conjunction "known by" or "referred to as". |

Developing student worksheets involves analysing school curricula, identifying student worksheets requirements, titling student worksheets, formulating core competencies, selecting assessment tools, assembling materials, and structuring student worksheets (Prastowo, 2016). Live worksheets based on the Project-Based Learning model cater to student needs, provide teaching resources, and fulfil Independent Curriculum goals by fostering creativity in creating biotechnology product variations. Achieving Independent Curriculum objectives entails producing learning outputs, such as products, to enhance student comprehension and stimulate creativity (Hehakaya & Pollatu, 2022).

The live worksheet is associated with local food diversification and conventional biotechnology utilization. Indonesia's diverse crops have led the community to develop a variety of processed foods from one type of food, which can be called food diversification

(Widowati & Nurfitriani, 2023). Food diversification processing by removing products using the fermentation stage becomes a creativity and learning resource for students (Sawitri & Santoso, 2017; Kwangmuang et al., 2021; Budiarti & Hernani, 2022).

At the design and development stage using validity testing by a team of experts that include 3 experts. The validity test results can be seen in Table 10.

Table 10. Validity Test Results

| Validator | Validation | Aspects Rated | Assessment (%) | Category | Average Rating Results | Category |
|---|---|---|---|---|---|---|
| 1 | Design and Media | Systematization of Presentation | 80,00 | Valid | 83,44 | Valid |
| | | Presentation Graphics | 84,00 | Valid | | |
| | | Product Usage | 80,00 | Valid | | |
| | | Product Display | 86,67 | Very Valid | | |
| | | Product Quality | 83,30 | Valid | | |
| | | Language | 86,67 | Very Valid | | |
| 2 | Biotechnology Material | Completeness of Material | 80,00 | Valid | 80,00 | Valid |
| | | Accuracy of Material | 80,00 | Valid | | |
| | | Presentation of Meaningfulness and Usefulness | 80,00 | Valid | | |
| | | Activities that Support the Material | 80,00 | Valid | | |
| | | Language | 80,00 | Valid | | |
| 3 | Learning Expert | Activities that Support the Learning Model | 86,67 | Very Valid | 95,56 | Very Valid |
| | | Product Display | 100 | Very Valid | | |
| | | Language | 100 | Very Valid | | |
| Average | | | | | 86,33 | Very Valid |

Preparing practical student worksheets involves three essential requirements: 1) Didactic requirements entail designing student worksheets to facilitate concept discovery and diverse activities, fostering student learning inside and outside the classroom; 2) Construction requirements involve crafting clear associations in language, sentence structure, vocabulary, and overall clarity of the student worksheets; 3) Technical requirements focus on the visual

elements, including images and overall design aesthetics of the student worksheets (Jayantri et al., 2017; Darwis et al., 2023).

Appearance holds significance as it is the initial factor that captures students' interest when engaging with student worksheets, often preceding the content (Rohaeti et al., 2009). From the requirements for the preparation of student worksheets, the validity test of the student worksheets development resulted in an average of 86.33, with a very valid category. From the validation results, the development of student worksheets can be implemented by students and biology teachers at a senior high school in Bekasi, Indonesia which is easily understood by students and helps in making conventional biotechnology products for the exploration of processing local food resources with the fermentation process.

3. Implementation Stage

During the implementation stage, students took a pretest to assess their initial knowledge of biotechnology. The researcher explained the upcoming activities. The teacher divided the class into five groups of 5-6 students. Groups 1-2 made doughnuts using fruits and vegetables, and groups 3-5 made tapas with ingredients other than cassava. The students suggested making doughnuts from red spinach, red dragon fruit, and tapai from bananas, glutinous rice, and sweet potato. The Students' Pretest and Posttest Results can be seen in Table 11.

Table 11. Students' Pretest and Posttest Results

| | Pretest Score | Postest Score |
|---|---|---|
| Average | 70,88 | 78,92 |

Based on Table 11, the post-test results show that 21 students scored above 75, indicating an improved understanding of biotechnology and entrepreneurial attitudes. Project-based learning enhances learning outcomes and fosters more active, flexible learning (Haerani, 2022). Authentic projects in this model help learners grasp and apply taught concepts (Shin, 2018). The results of the project-based learning-based live worksheet can be seen in Table 12.

Table 12. Results of Project-Based Learning Based Live worksheet

| | Live worksheet Score |
|---|---|
| Average | 78,64 |

Based on Table 12, the results of students' work on filling in the live worksheet, 19 students got scores above 75. This is because there are students who need clarification about the difference between objectives, hypotheses, and problem formulations, so students are mistaken in filling in. Students' inability to formulate hypotheses indicates suboptimal learning. They advocate for inquiry-based approaches and experimental activities to help students develop temporary conjectures, particularly for abstract concepts. Similarly, students struggling with problem formulation benefit from inquiry-based methods that encourage

problem identification (Azizi & Rasyidi, 2019). The creative thinking questionnaire results can be seen in Table 13.

Table 13. Creative Thinking Questionnaire Results

| Indicator | Total Score Percentage | Category |
|---|---|---|
| Fluency | 82% | Creative |
| Flexibility | 78% | Creative |
| Originality | 80% | Creative |
| Elaboration | 75% | Creative |
| Average | 82% | Creative |

Students achieved an average of 82% in creative thinking, classified as the creative category. This success stems from coherent experimentation in product manufacturing, aided by a structured product implementation schedule to ensure timely completion. Clear instructions in activity guidelines facilitate proper project execution. Student worksheets should outline sequential and sustainable steps to foster students' active engagement and enhance concept retention (Hidayati et al., 2012). Noting that project-based learning fosters creative development in students (Sumarni, 2013).

In addition, in the fluency indicator, students are also asked to make 1 question related to explaining brief information from the reading in the student worksheets. Asking students to think about their questions is a valuable activity. Questions tend to stimulate creative and critical thinking, especially deeper ones that encourage students to think further. Open-ended questions in the worksheet link conventional biotechnology products like tempoyak with food additives, allowing learners to draw on personal experience and internet research. In the student worksheets, learners decide whether to buy tools and materials from a market or online, encouraging them to develop effective sales strategies (Iskandar et al., 2023; Chakraborty & Nafukho, 2014). Students demonstrate good problem-solving skills and fluency (Fatmah, 2021).

The flexibility indicator requires students to formulate questions, make hypotheses, and state the purpose of biotechnology experiments. Defines *flexibility* as generating varied questions and viewing problems from different perspectives (Munandar, 1992). Students can create hypotheses and problem statements, reflecting their creative thinking abilities (Setiawan et al., 2021; Prastika et al., 2021).

In the originality indicator, learners are asked to determine the material tools to be used in the project's implementation, the name for their product brand sticker/logo, the packaging material that uses 3R materials, and the place of sale, promotion, and sales target. Good planning can increase business profits and reduce errors (Suhermini & Safitri, 2010). In answer

to the live worksheet, some students answered to give discounts to the first five buyers and sales targets if they reach 100 thousand to buyers at school and the closest relatives around the house.

Emphasize that achieving originality involves generating unique ideas or responses (Oktaviani & Supriyadi, 2024; Brophy, 2010). Uniqueness distinguishes students' approaches, such as utilizing distinct product packaging stickers for promotion. Creative ideas stem from existing knowledge rather than appearing out of nowhere (Ward, 2004; Underwood, 2015). While original ideas are not directly recalled from memory, they are created by combining existing concepts in new ways (Finke et al., 1992; Nijstad et al., 2010; Welch, 1946). Practical marketing communication ideas must not only be original but also practical. Hence, persistence or fluency generates creative sales promotion campaigns (Althuizen et al., 2016; Novemsky et al., 2007). In addition, the making of various biotechnology products to students' originality abilities can be seen in Figure 1 and Figure 2.

Figure 1 Learner's Conventional Biotechnology Product Results


Figure 2 Results of Learner Logo Stickers

In the elaboration phase, students outline detailed expenses, income, profits, and losses to optimize sales and address product deficiencies. Elaborative thinking involves thoroughly describing ideas (Oktaviani & Supriyadi, 2024). In responses on the live worksheet, some students report profits of 2000 and 5000 rupiah, alongside losses of 1000 rupiah. Conversely, some students skip this section as they distribute the finished doughnuts to neighbours immediately after fermentation at night.

Creativity is another dimension that requires flexible thinking and playing with ideas. So that creative people are great problem solvers and can solve problems well (Zulfiani et al., 2023). If students can think of elaboration, it will allow them to store knowledge in long-term

memory by knowing the relationship between new views that are owned (Mahanani et al., 2017; Kalyuga, 2009). The ecopreneurship questionnaire results can be seen in Table 14.

Table 14. Ecopreneurship Questionnaire Results

| Indicator | Total Score Percentage | Category |
|---|---|---|
| Eco-Innovation | 78% | High |
| Eco-Opportunity | 75% | High |
| Eco-Commitment | 87% | High |
| Average | 78% | High |

Students' ecopreneurship questionnaire results average 78%, indicating a high proficiency. Student worksheets integrated into the live worksheet offer insights, including tips for encouraging repeat purchases and profit-loss calculations, fostering entrepreneurship experience among students. Perspective on entrepreneurship education, which nurtures students' interest in entrepreneurial spirit and behavior, empowering them to become job creators (Sowmya et al., 2010; Jena, 2020).

The live worksheet integrates activities featuring eco-innovation indicators, prompting students to devise unique product names. The brand is crucial for consumer recall, making it essential to create a catchy, strong, and creative product brand. A good brand helps consumers identify the product quickly, adds value, and boosts loyalty. It serves as an effective, economical tool to convey value and offerings. A strong brand forms a unique mental link, is easily understood, and can be strategically managed by marketing (Kodrat, 2020; Sweeney & Swait, 2008). Students have named their products creatively, such as "Dooba," "Telang Twist Delight," and "Purple Bliss Tapai," reflecting food or distinctive words associated with colours and their preferences. Entrepreneurship emphasizes novelty, introducing new ideas, products, or services to meet consumer needs efficiently (Okpara, 2007; Sapiro, 2024).

The live worksheet incorporates eco-opportunity indicators, prompting students to execute planned tasks concerning material tools, packaging, and sales targets. For packaging, students opt for banana leaf wraps, ensuring food quality and imparting a pleasant aroma, as supported by (Sari et al., 2019; Hailu et al., 2014). Banana leaf wrapping extends food shelf life for 2-4 days and promotes resourcefulness by repurposing waste. This approach aligns with environmental preservation efforts, allowing students to utilize natural resources responsibly.

Additionally, students opt for plastic packaging, specifically Oriented Polypropylene (OPP). OPP exhibits resistance to organic solvents, though aromatic solvents may cause expansion. It boasts excellent transparency as a water vapor barrier, good temperature resistance, and cost-effectiveness compared to other films (Sampurno, 2019). Due to its low density, OPP is easily biodegraded by Hong Kong caterpillars, thus contributing to

environmental sustainability (Nofiyanti et al., 2023; Wang et al., 2022). Given the cost constraints, with bioplastics priced at 69,000 per unit on Tokopedia, students prefer the more economical OPP plastic for their packaging needs.

The live worksheet features an eco-commitment indicator called the commitment table. It evaluates various factors such as the halal status of tools and materials, honesty in manufacturing and sales to avoid harmful additives, maintaining fair pricing based on expenses, ensuring product hygiene, and demonstrating confidence in marketing efforts. Emphasizes that honesty in manufacturing and sales builds trust with buyers, as ethical businesses prioritize creating halal, quality products without deceptive practices (Utami, 2015).

The significance of courage and self-confidence for entrepreneurs (Dewi et al., 2020). The confidence to pursue goals and the courage to present products to buyers are vital factors. With daring to take these steps, opportunities for success may be recovered. Eco-commitment involves dedication to working diligently and investing time and energy into their tasks (Hutabarat & Mulyaningsih, 2018; Chukwuka & Nwomiko, 2018). This commitment instills values such as honesty, confidence, using halal materials, and maintaining product hygiene in students. Those with positive traits like a good personality, willingness to learn, and strong motivation are more likely to succeed in entrepreneurship (Antonio et al., 2014; Markman & Baron, 2003).

The live worksheet includes tips and tricks for encouraging repeat purchases, such as offering discounts on special occasions like birthdays or anniversaries. During the evaluation, a learner cited a lack of experience in sales and product creation as contributing to a perceived lack of taste. Emphasize that fostering entrepreneurship in schools aims to familiarize students with the business landscape, empower them to become entrepreneurs in their respective fields, cultivate a professional work ethic, and instill entrepreneurial behaviors and attitudes (Anwar et al., 2012).

Entrepreneurship explores the potential to develop talent, recognize new products, and create new products (Mala et al., 2023), so this live worksheet makes an entrepreneurial experience for students. The results of project-based learning research juxtaposed with bio entrepreneurship can train students' entrepreneurial skills (Yuniartiek et al., 2015; Agustina et al., 2022). Evaluation is used to obtain the results of an assessment of the results that have been achieved (Purhantara, 2013; Stufflebeam, 2001).

4. Evaluation Stage

The evaluation stage asks for responses from students who have used PJBL-based biotechnology student worksheets. This can be seen in Table 15.

Table 15. Students Response Results

| Indicator | Total Score Percentage | Category |
|---|---|---|
| Readability | 84% | Very Good |
| Material | 79% | Good |
| PJBL Learning Model | 82% | Very good |
| Language | 85% | Very good |
| Display | 77% | Good |

Student feedback shows that the student worksheets use easy language, vibrant colors, and precise layouts, aiding comprehension. Engaging elements like stickers and consistent fonts keep students interested. Project-based learning promotes active participation and practical experimentation, improving understanding of biotechnology. Applying conventional processes in product manufacturing helps students grasp the transformation of organisms into fermented foods. Project-based learning boosts motivation, problem-solving, cooperation, resource management, and organizational skills (Wena, 2016; Kokotsaki et al., 2016).

A live worksheet's limitation is that it requires users to create an account first. In addition, a web live worksheet is more comfortable when using a laptop/tablet than a cellphone because the size of the screen layout affects user reading and comfort (Ardiansah & Zulfiani, 2023). This is also based on what was found in the field: Students must copy the answers in other places, such as Word or Notepad notes, so that when refreshing the website, the answers are not lost, and then press finish.

## CONCLUSION

The PjBL-based live worksheet effectively promotes students' creative thinking and ecopreneurship skills. Experts validated the worksheet, and it was well-received by students. Future studies should include an effectiveness test.

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