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Project-based learning on macromolecules using Ketapang natural resources: Fostering creativity and entrepreneurship

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Abstract

The lack of variety of learning methods and teaching materials that are not contextualized causes low creative thinking skills and entrepreneurial attitudes of students in learning chemistry. This study aims to determine the differences in creative thinking skills and entrepreneurial attitudes of students simultaneously and respectively between groups using the Project-Based Learning (PjBL) model integrated with Ketapang natural resources and groups using a scientific approach. This research is a quasi-experiment with a pretest-posttest control group design, involving four XII classes that were randomly selected using cluster random sampling, with two classes (72 students) assigned to the experimental group receiving PjBL learning and two classes (70 students) to the control group receiving scientific approach learning. The instruments used were creative thinking skills test and entrepreneurial attitude questionnaire. Data were analyzed using descriptive statistics and MANOVA test. The results showed significant differences both simultaneously and per variable between the experimental and control classes. The integrated PjBL model made an effective contribution of 21.5% to both variables simultaneously, 13.6% to creative thinking skills, and 17.3% to entrepreneurial attitudes. This finding indicates that the project-based learning model associated with local potential is able to significantly improve students' thinking competencies and entrepreneurial attitudes.

Keywords: creative thinking skills, entrepreneurial attitude, Ketapang natural resources, project-based learning.

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INTRODUCTION

Ketapang Regency in West Kalimantan is a region rich in natural resources such as tropical rainforests, peatlands, and marine products, including ale-ale, a type of mollusk that has become a local culinary icon (Sari & Wijaya, 2018; Wibowo & Prasetyo, 2017). However, behind this wealth, education in Ketapang still faces major challenges, especially the low creative thinking skills of students in solving unstructured problems (Sari & Wijaya, 2018). One of the contributing factors is the lack of teaching materials that integrate local potential, even though the contextual approach is very important to increase learner motivation and engagement (Nuryadin, 2022; Afriana, 2018; Widodo, 2023).

Education in the era of globalization demands mastery of 21st century skills, such as creative thinking and entrepreneurial attitudes, which are essential for facing future economic challenges (Wulandari et al., 2020). Unfortunately, studies show that students in Indonesia still have low levels of creativity and entrepreneurial attitudes (Fitriani et al., 2019). The lack of local

context in learning makes it difficult for students to relate the material to real life. The Project-Based Learning (PjBL) model integrated with local resources is one solution to overcome this problem.

Research by Fitriani et al. (2019) showed that integrating the concept of entrepreneurship in chemistry learning encourages students to produce chemistry-based products that have selling value. In addition to improving concept understanding, this model also builds practical skills and entrepreneurial attitudes. Studies by Widiastuti and Mahardika (2020) and Wulandari (2022) reinforce these findings by showing that the local resource-based PjBL approach can increase engagement, creativity, and innovative product development.

However, the implementation of PjBL in Ketapang still faces obstacles, including limited facilities and lack of teacher competence in integrating local potential into learning (Yulianti, 2020; Rahman, 2021). Macromolecular material in chemistry which is classified as abstract also adds to the difficulty of students (Cooper et al., 2012; Talanquer, 2013; Johnstone, 2006; Taskin & Bernholt, 2014). In fact, if it is associated with local natural potential, such as food or seafood, macromolecular learning can become more concrete and meaningful.

PjBL models that incorporate local contexts not only improve learning outcomes, but also develop soft skills such as communication, collaboration, and time management (Fitria et al., 2019). In addition, this approach opens up local economic opportunities through scientific-based product innovation (Wijaya & Santoso, 2022; Aris et al., 2023). Therefore, the development of PjBL-based chemistry learning integrated with local natural resources is a strategic step to improve the quality of education in Ketapang contextually and sustainably.

Based on this background, this study aims to determine whether there are significant differences in creative thinking skills and entrepreneurial attitudes of students on macromolecular material between the Project-Based Learning (PjBL) learning model integrated with Ketapang natural resources with a scientific approach. In addition, this study also analyzed the magnitude of the effective contribution of the local potential-based PjBL model to the improvement of both skills, both simultaneously and each separately.

RESEARCH METHOD

This study used a quasi-experimental approach with a pretest-posttest control group design (See Table 1) to measure the effectiveness of the Project Based Learning (PjBL) model integrated with Ketapang local natural resources on improving students' creative thinking skills and entrepreneurial attitudes (Fraenkel, Wallen, & Hyun, 2012).

Table 1. Research Design

Groups	Pre-Test	Treatment	Post-Test
Experiment	T_1	X_1	T_1
	T_2		T_2
Control	T_1	X_2	T_1
	T_2		T_2

This study used T1 to measure creative thinking skills and T2 to measure entrepreneurial attitudes. X1 is learning with PjBL model integrated with Ketapang natural resources, while X2 is learning with scientific approach. The

research subjects consisted of two XII science classes in one of the state high schools in Ketapang. The study was conducted in West Kalimantan, with classes selected through cluster random sampling, following a normality prerequisite test using previous test data. The experimental classes received treatment using a Project-Based Learning (PjBL) model based on local potential—such as the utilization of ale-ale (local clams)—while the control classes were taught using the scientific approach in accordance with the Merdeka Curriculum.

This study measured two main variables: creative thinking skills and entrepreneurial attitudes, as influenced by the use of different learning models. The instrument used to measure creative thinking skills is a description test prepared based on indicators from Torrance (1974), namely fluency, flexibility, originality, elaboration, and problem solving, while entrepreneurial attitudes are measured using a Likert scale questionnaire based on indicators from Zimmerer and Scarborough (2002), Schumpeter (1934), McClelland (1961), and Kuratko (2009) which include risk-taking courage, creativity and innovation, independence, future orientation, resilience, and leadership.

Content validity was tested through expert judgment, and reliability was tested using Cronbach's Alpha formula to ensure the consistency of the instrument. Data were collected through pretest and posttest in both groups, then analyzed using N-Gain calculation (Hake, 1999) to see the improvement, as well as MANOVA (Multivariate Analysis of Variance) test to determine the significance of differences in creative thinking skills and entrepreneurial attitude between experimental and control classes simultaneously (Tabachnick & Fidell, 2013).

The MANOVA test was chosen because it is suitable for analyzing two dependent variables together and is able to reveal the effect of learning models on more than one aspect of learning outcomes. Before MANOVA, normality and homogeneity of variance tests were conducted to fulfill the assumptions of the analysis. Test of between-subject effects is used to see differences in each dependent variable, while partial eta squared measures the contribution of the model. According to Cohen (2007), effect sizes are classified as small (0.01-<0.06), medium (0.06-<0.14), large (0.14-0.20), and very large (>0.20).

RESULTS AND DISCUSSION

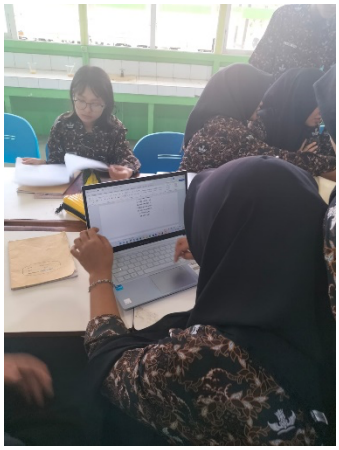
Results

The learning process in this study was implemented using the Project-Based Learning (PjBL) model consisting of five main stages. In the experimental group, the learning followed the Project-Based Learning (PjBL) model using five structured stages: (1) problem identification, (2) independent investigation and research, (3) planning and solution design, (4) collaboration and peer discussion, and (5) reflection and presentation. Students began by identifying real-life problems related to the underutilization of Ketapang (Terminalia catappa) in their environment. Through observation and discussion, they formulated guiding questions such as “What macromolecules can be obtained from Ketapang?” and “Can Ketapang be used to develop a useful product?”

In the next stage, students conducted research and small-scale investigations about the characteristics of Ketapang parts. For instance, Ketapang seeds were explored for their lipid content, which could be extracted and tested using simple laboratory methods. Ketapang leaves, which contain natural pigments and tannins, were used for experiments in making eco-friendly dye or antioxidant tests. This research formed the basis for their project ideas.

Students then planned their projects collaboratively, designed procedures, prepared materials, and executed their ideas—such as creating prototypes of natural soap or eco-dye based on their analysis of macromolecules. During the collaboration phase, they discussed data with peers, overcame challenges together, and revised their plans based on trial outcomes. Teachers acted as facilitators rather than instructors, allowing students to take ownership of their learning.

At the end of the project, students presented their findings in front of their peers and reflected on the scientific knowledge they gained as well as the entrepreneurial value of their products. These activities not only strengthen their understanding of macromolecule concepts but also foster creativity, problem-solving, and sustainable thinking (as seen in Figures 1a and 1b). In contrast, the control group received instruction using a scientific approach, which was more teacher-directed. Students in this group conducted structured experiments related to macromolecules using textbooks and worksheets, but without the opportunity to engage in contextualized project work.



(a)

(b)

Figure 1. Students prepare plans and schedules (a), then present the results of projects that have been carried out (b).

The results of descriptive analysis show that learning using the Project-Based Learning (PjBL) model integrated with Ketapang natural resources has a significant effect on students' creative thinking skills and entrepreneurial attitudes. This can be seen from the N-gain results of both variables, namely 0.374 (medium category) for creative thinking skills and 0.448 (medium category) for entrepreneurial attitudes in the experimental class, which is higher than the control class of 0.281 and 0.349 respectively. The increase in post-test mean scores also reflects the effectiveness of the treatment. The average post-test of creative thinking skills of experimental class students was 67.03, higher than the control class of 59.4. Similarly, in entrepreneurial attitudes, the experimental class obtained an average score of 79.08, while the control class was 63.98. The application of PjBL with a local context encourages students to be more active and reflective in thinking and shows a better entrepreneurial attitude.

The prerequisite test of analysis includes normality test of data distribution, homogeneity test of variance, and multivariate homogeneity test. The normality test was conducted using the Shapiro-Wilk test, which is

recommended for sample sizes of less than 50 (Ghasemi & Zahediasl, 2012). The results showed that all data were normally distributed, indicated by the significance value (Sig.) > 0.05 in each variable. Details of the normality test results are presented in Table 2.

Table 2. Normality analysis results

Variables	Groups	Sig.	df	Conclusion
Creative Thinking KWU	Experiment	0.954	72	Normally Distributed
	Control	0.972	70	
	Experiment	0.200	72	
	Control	0.200	70	

After the normality requirement is met, the next prerequisite test is the homogeneity and multicollinearity test. The homogeneity test results showed that the data came from homogeneous groups, indicated by the significance value of each variable > 0.05. Furthermore, the linearity test is seen from the significance value of deviation from linearity. If the significance value is greater than 0.05, then the relationship between the independent and dependent variables is considered linear. Based on the linearity test, the significance value is 0.078 (> 0.05), which means that there is a linear relationship between the creative thinking skills and entrepreneurial attitude variables and the learning model variables. Multicollinearity test is also conducted to ensure that there is no relationship between dependent variables that is too high. The Tolerance value for the creative thinking skills and entrepreneurial attitude variables is 0.804 (> 0.1), while the Variance Inflation Factor (VIF) value is 1.244 (< 10).

These results indicate no indication of multicollinearity between the two variables. Thus, all assumptions in the prerequisite test have been met. Therefore, data analysis can be continued using the MANOVA test to evaluate the effect of learning using the PjBL model integrated with Ketapang natural resources on students' creative thinking skills and entrepreneurial attitudes. The results of the analysis are shown in Table 3.

Table 3. MANOVA test results

Effect	Value	F	Sig.	Partial Eta Squared
Hotelling's Trace	0.274	19.059 [b]	0.000	0.215

Based on the data in Table 3, the multivariate test results show that the F-test value for Hotelling's Trace is 19.059 with a significance level of 0.000. This value indicates that there is a simultaneous significant difference in creative thinking skills and entrepreneurial attitudes between students in the experimental class using the PjBL model integrated with Ketapang natural resources and students in the control class using the scientific approach and worksheet from school.

To determine differences in creative thinking skills and entrepreneurial attitudes separately between experimental and control classes, further tests were carried out using the Test of Between-Subject Effects. The analysis results of the test are shown in Table 4, which provides further details on the effect of treatment on each variable individually.

Table 4. Results of test of between subject effects

Dependent Variabel	Sig.	Partieal Eta Squared	Decision
Creative thinking skills	0.000	0.136	H_o rejected
Entrepreneurial attitude	0.000	0.173	H_o rejected

Based on the Test of Between-Subject Effects test results, the significance value for the creative thinking skills variable is 0.000. Because the value is smaller than 0.05 (sig. <0.05), the null hypothesis (H_0) is rejected. That is, at the 5% significance level, there is a significant difference in creative thinking skills between students who take part in learning with the PjBL model integrated with Ketapang natural resources and students who get learning with a scientific approach.

The same test results also show a significance value for the entrepreneurial attitude variable of 0.000. Because this value is also smaller than 0.05, H_0 is again rejected. This indicates that, at the 5% significance level, there is a significant difference in entrepreneurial attitude between students in the experimental and control classes. Thus, the local potential-based PjBL model is effective in improving the two aspects separately.

Disscusion

The results showed that the application of the Project-Based Learning (PjBL) model integrated with Ketapang natural resources had a significant effect on improving students' creative thinking skills and entrepreneurial attitudes. This effectiveness is inseparable from the utilization of teaching materials designed contextually and in accordance with local potential. The learning process that integrates Ketapang natural resources as part of the learning project makes learning activities more relevant and interesting for students. In addition, the use of the PjBL approach that is tailored to the characteristics and environment of students is able to increase active participation, encourage creativity, and foster entrepreneurial attitudes. The findings in this study will be further elaborated in the following section.

Simultaneous differences in creative thinking skills and entrepreneurial attitude

This study measures creative thinking skills through a multiple choice test of 25 questions and entrepreneurial attitudes through a questionnaire containing 24 statements. The data were analyzed using MANOVA after fulfilling the prerequisite test, and the Hotelling's Trace test results showed that there was a simultaneous significant difference between the creative thinking skills and entrepreneurial attitudes of students who followed Project-Based Learning (PjBL) learning integrated with Ketapang natural resources and students who followed the scientific approach. The average score of students in the experimental class was higher than the control class, indicating that the difference in treatment positively affected the results of creative thinking skills and entrepreneurial attitudes.

The PjBL model provides hands-on learning experiences relevant to the local context, such as the utilization of ale-ale (Meretrix sp) into processed products (e.g. sausages or nuggets) related to chemistry. Learning is carried out through systematic stages: starting from formulating contextual questions, designing projects, preparing schedules, implementing projects, presenting results, to reflecting on the process. This activity is carried out collaboratively and supported by the teacher as a facilitator (Aprilina, 2024). This process has

proven to be able to increase students' creativity and entrepreneurial attitude through making innovative products (Zuniarti, 2021; Pratiwi et al., 2023).

In contrast, the scientific approach in the control class follows the 5M stages (observing, questioning, gathering information, associating, and communicating), but with the teacher as the center of learning, so that students only receive material during face-to-face meetings and knowledge construction takes place less optimally (Lestari et al., 2024). The application of PjBL based on local wisdom not only improves learning outcomes, but also forms entrepreneurial character because students are trained to find ideas, make decisions, and produce real products from the surrounding environment. This is in line with the findings of Rahayu, Nugroho, and Sari (2023), who stated that the local wisdom-based PjBL model encourages innovation and management of ideas into real work.

Differences in creative thinking skills

Students' creative thinking skills were analyzed through the average posttest scores between the experimental class that applied the Ketapang natural resource-based Project-Based Learning (PjBL) model and the control class that used the scientific approach. The MANOVA test results showed a significance value of 0.000 ($p < 0.05$), which indicated a significant effect of the application of PjBL on improving creative thinking skills. This finding is in line with the research of Lestari, Kurniawan, and Putri (2021), which states that project-based learning integrated with local potential can encourage student creativity through environmental observation, experimentation, and production of real work. Fitriani and Sulastri (2022) also emphasized that the PjBL model stimulates students to think actively and innovate when solving contextual problems in everyday life.

The implementation of PjBL in learning is carried out through Learner Worksheets (LKPD) which are prepared based on PjBL syntax and developed from local potential such as ale-ale from Ketapang. In this project, students are faced with real problems and solve them collaboratively through PjBL stages, starting from formulating fundamental questions to evaluating learning experiences (Fitriani & Wulandari, 2022). This learning process encourages individual responsibility in teams, effective communication, and adaptation through continuous project monitoring and reflection (Hayati et al., 2024). Regular reflection helps students improve the quality of their next project through feedback from teachers and peers.

Project-based learning encourages students to think creatively in devising solutions to environmental problems, generating innovative ideas, and increasing social awareness. The learning process involves higher-order thinking skills such as analysis, synthesis, and proposing creative solutions, which also shape entrepreneurial character (Sari & Permana, 2023). Group discussions provide a space for collaboration of ideas and increase awareness of social, economic, and environmental issues (Oktaviani & Prasetyo, 2021). This is in line with Navas and Luna (2017), who stated that project-based learning is able to foster collaboration, critical communication, and independent and creative task completion skills. Thus, PjBL-based LKPDs are not only academically meaningful, but also equip students with 21st century competencies.

Differences in entrepreneurial attitude

The Test of Between-Subjects Effect test results show a significant difference in entrepreneurial attitudes between experimental and control class students, with a significance value of 0.000 ($p < 0.05$), which means that the null hypothesis is rejected and the alternative hypothesis is accepted. This means that the Project-Based Learning (PjBL) model integrated with Ketapang's natural resources has a real influence on improving students' entrepreneurial attitudes. This is reinforced by the posttest results which show that the entrepreneurial attitude of students in the experimental class is higher than the control class. Students' active involvement in contextual projects such as processing plantation products, utilizing natural waste, and processing ale-ale into sausage or nugget products, trains them to become independent, solutive, and responsible individuals.

Project-based learning with local context is proven to significantly improve entrepreneurial attitude. Students become more proactive, collaborative, and enthusiastic about entrepreneurial activities as they experience the hands-on process of managing projects. This is in line with the findings of Setiawan et al. (2022) who stated that direct experience in project-based learning is able to shape students' entrepreneurial attitudes. In addition, Safitri et al. (2024) also confirmed that the integration of PjBL in biopreneurship learning can increase students' entrepreneurial interests and attitudes through the exploration of local potential, such as ketapang leaves, which are utilized into environmentally friendly products.

Thus, the application of the local potential-based PjBL model not only helps students understand the learning material, but also effectively fosters entrepreneurial attitudes. Students learn to take initiatives, face challenges, and explore business opportunities from the surrounding environment. This ability is very important in preparing the younger generation to face the world of work and business in the future, making learning more meaningful and relevant to the needs of the 21st century.

Effective contribution to creative thinking skills and entrepreneurial attitude

The application of the Project-Based Learning (PjBL) model integrated with the context of the surrounding environment, especially in macromolecular materials, contributes significantly to improving students' creative thinking skills and entrepreneurial attitudes. The analysis results show a partial eta squared value of 0.215 (21.5%), which is included in the very large category, indicating that this model plays an important role in learning these two aspects simultaneously. Creative thinking skills contributed 13.6% (medium category), and entrepreneurial attitude contributed 17.3% (large category), proving that project-based learning encourages the development of higher order thinking skills as well as readiness to face real challenges.

Learning through local potential-based projects, such as processing ale-ale into sausage and nugget products, provides contextual experiences that strengthen students' responsibility, innovation and risk-taking. Students are directly involved in the entire process, from planning to product presentation, so their skills develop holistically. This is supported by Wahyudi (2021), who states that contextualized project-based learning can improve critical and creative thinking skills and shape students' positive attitudes. In addition, according to Fadillah and Fitria (2022), this kind of learning also fosters a sense of responsibility and active involvement of students during the learning process.

Through active engagement in real projects, students learn to work in teams, complete collaborative tasks and develop innovative and adaptive attitudes. This process creates learning that is relevant to everyday life and fosters an understanding of the importance of sustainability and the economic value of local resources. These results reinforce previous findings that the integration of PjBL with local potential is able to foster 21st century skills that are highly needed in the world of work and entrepreneurship (Sugianto & Sari, 2021; Amelia et al., 2020).

CONCLUSION

Based on the results of the study, it can be concluded that the application of the Project-Based Learning (PjBL) model integrated with Ketapang natural resources has a significant effect on improving students' creative thinking skills and entrepreneurial attitudes, both simultaneously and on each variable. The results of the analysis showed a significant difference between students who participated in learning with this model and those who used the scientific approach. In addition, this integrated PjBL model also made an effective contribution to improving learning outcomes, with a contribution of 21.5% simultaneously, as well as 13.6% on creative thinking skills and 17.3% on entrepreneurial attitudes, respectively. Thus, the application of the local potential-based PjBL model not only improves understanding of chemical concepts, but is also able to encourage creative thinking skills and shape the entrepreneurial character of students more optimally.

REFERENCES

Afriana, J., Purwanto, P., & Widodo, A. (2018). The effectiveness of project-based learning in improving students' creative thinking and conceptual understanding. *Journal of Science Education, 19*(2), 45–54.

Amelia, R., Hasanah, U., & Mulyani, Y. (2020). Implementasi model project-based learning berbasis potensi lokal untuk menumbuhkan jiwa kewirausahaan siswa. *Jurnal Pendidikan Ekonomi, 13*(1), 41–49. https://doi.org/10.23887/jjpe.v13i1.27854

Aprilina, F. N. A. (2024). Pengaruh model pembelajaran project-based learning terhadap keterampilan berpikir kreatif peserta didik. *Jurnal Pembelajaran, Bimbingan, dan Pengelolaan Pendidikan, 4*(5), 4. https://journal3.um.ac.id/index.php/fip/article/view/5447

Aris, Y., Wijayanti, D., & Sulastri, D. (2023). A holistic approach to enhance students' entrepreneurial attitude and creative thinking through PjBL. *International Journal of Education and Practice, 11*(2), 95–107.

Cohen, J. (2007). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Routledge Academic.

Fitriani, E., Aini, N., & Wulandari, L. (2019). Penerapan model pembelajaran berbasis proyek untuk meningkatkan kreativitas dan sikap kewirausahaan. *Jurnal Pendidikan Kimia Indonesia, 3*(1), 23–30.

Hake, R. R. (1999). *Analyzing Change/Gain Scores*. Indiana University.

Hayati, E., Widodo, A., & Nurhayati, S. (2024). Integrasi pembelajaran berbasis proyek untuk meningkatkan kreativitas dan kemandirian belajar siswa. *Jurnal Pendidikan Sains Indonesia, 12*(1), 45–56. https://doi.org/10.21831/jpsi.v12i1.59632.

Kuratko, D. F. (2009). *Entrepreneurship: Theory, Process, and Practice*. South-Western Cengage Learning.

Lestari, M., Kurniawan, H., & Putri, N. R. (2021). Pengaruh model PjBL berbasis potensi lokal terhadap keterampilan berpikir kreatif dan hasil belajar siswa. *Jurnal Pendidikan Sains Indonesia, 9*(1), 45–54. https://doi.org/10.24815/jpsi.v9i1.4567

McClelland, D. C. (1961). *The Achieving Society*. Van Nostrand.

Navas, J., & Luna, P. (2017). Project-based learning effectiveness in fostering students' collaboration and problem-solving skills. *International Journal of Educational Research, 85*, 61–70. https://doi.org/10.1016/j.ijer.2017.07.002

Nuryadin, T. (2022). Pengembangan bahan ajar kontekstual berbasis potensi lokal. *Jurnal Inovasi Pendidikan IPA, 8*(2), 112–121.

Oktaviani, S., & Prasetyo, Z. K. (2021). Penerapan model PjBL berbasis potensi lokal untuk menumbuhkan jiwa kewirausahaan. *Jurnal Pendidikan, 9*(3), 101–112. https://doi.org/10.23887/jp2.v9i3.39201

Pratiwi, A. R., Hidayati, R., & Mahmudah, N. (2023). Penerapan model project based learning untuk meningkatkan kreativitas dan sikap kewirausahaan siswa sekolah menengah. *Jurnal Inovasi Pendidikan dan Pembelajaran, 5*(1), 45–52. https://doi.org/10.31004/jipp.v5i1.435

Rahayu, N., Nugroho, S. E., & Sari, D. K. (2023). Integrasi kearifan lokal dalam project based learning untuk meningkatkan keterampilan abad 21. *Jurnal Inovasi Pendidikan IPA, 9*(2), 88-99.

Rahman, A., et al. (2021). The role of community collaboration in supporting integrated pjbl, local culture, and cep learning models in Ketapang. *International Journal of Educational Research, 105*, 92–103.

Safitri, A., Jufri, A. W., & Bachtiar, I. (2024). Pengaruh pembelajaran project based learning berbasis biopreneurship terhadap sikap ilmiah dan minat wirausaha pada siswa. *Journal of Classroom Action Research, 6*(3), 617–623. https://doi.org/10.29303/jcar.v6i3.7854

Sari, D. P., & Permana, D. (2023). Pengembangan LKPD berbasis project based learning untuk meningkatkan keterampilan berpikir kreatif. *Jurnal Inovasi Pendidikan Kimia, 17*(2), 87–95. https://doi.org/10.15294/jipk.v17i2.63294

Sari, N., & Wijaya, D. (2018). Pengembangan model pembelajaran berbasis proyekuntuk meningkatkan kreativitas peserta didik. *Jurnal Ilmiah Pendidikan, 15*(2), 101-110.

Sari, R. N., & Wijaya, H. (2018). Potensi lokal ale-ale sebagai sumber belajar kontekstual. *Jurnal Pendidikan Lingkungan dan Pembangunan Berkelanjutan, 5*(1), 45–52.

Schumpeter, J. A. (1934). *The Theory of Economic Development*. Harvard University Press.

Setiawan, A., Musyafa, F. N., & Wibowo, H. (2022). Kewirausahaan berbasis project-based learning: Meningkatkan keterampilan dan sikap wirausaha siswa. *Indonesian Social Science Journal, 4*(1), 45–56.

Sugianto, D., & Sari, N. P. (2021). Pengembangan kewirausahaan melalui project-based learning berbasis potensi lokal. *Jurnal Pendidikan dan Kewirausahaan, 9*(2), 157–165. https://doi.org/10.24036/jpk.v9i2.118761

Tabachnick, B. G., & Fidell, L. S. (2013). *Using Multivariate Statistics* (6th ed.). Pearson Education.

Talanquer, V. (2013). School chemistry: The need for transgression. *Science Education, 97*(3), 364–382.

Taskin, V., & Bernholt, S. (2014). Students' understanding of chemical formulae: A review of research and implications for teaching. International *Journal of Science and Mathematics Education, 12*(6), 1405–1432.

Torrance, E. P. (1974). *Torrance Tests of Creative Thinking: Norms—Technical Manual*. Ginn and Company.

Wibowo, A., & Prasetyo, E. (2017). *Potensi Sumber Daya Pesisir dan Laut di Kalimantan Barat*. LIPI Press.

Widiastuti, M., & Mahardika, I. K. (2020). Enhancing students' creative thinking skills through project-based learning. *International Journal of Instruction, 13*(3), 301–316.

Widiyanti, D., & Priyambodo, E. (2021). The effectiveness of project-based learning model to improve student collaboration and creativity in science learning. *Jurnal Pendidikan IPA Indonesia, 10*(2), 265–273. https://doi.org/10.15294/jpii.v10i2.29032

Widodo, A. (2023). Kontribusi potensi lokal dalam pendidikan kontekstual. *Jurnal Pendidikan Kontekstual, 11*(1), 67–76.

Wijaya, H., & Santoso, H. (2022). Innovative product development through project-based learning in chemistry: A case study on chemo-entrepreneurship. *Asian Journal of Science Education, 4*(1), 35–47.

Wulandari, A., Priyambodo, E., & Setiawan, W. (2021). The impact of project-based learning on students' motivation and learning outcomes. *Jurnal Pendidikan Teknologi dan Kejuruan, 27*(2), 209–218.

Wulandari, M., et al. (2020). Integrating project-based learning and entrepreneurship in chemistry education. *Journal of Educational Research, 113*(3), 213–225.

Yulianti, T. (2020). Hambatan implementasi pembelajaran kontekstual di daerah 3T. *Jurnal Pendidikan Daerah, 6*(1), 22–29.

Zimmerer, T. W., & Scarborough, N. M. (2002). *Essentials of Entrepreneurship and Small Business Management*. Prentice Hall.

Zuniarti, Z. (2021). Project-based learning untuk meningkatkan kreativitas dan kewirausahaan siswa. *Jurnal Pendidikan dan Pembelajaran Kimia, 10*(1), 33–40.

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