9 (1) (2024) 30-39

International Journal of Active Learning

http://journal.unnes.ac.id/nju/index.php/ijal

The Influence of the Project-Based Learning Integrated Ethno-STEM of Chemical Equilibrium on the Pancasila Student Profile Mutual Cooperation Dimension

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Keywords

Mutual cooperation; Pancasila Student Profile; chemical equilibrium; ethno-STEM; project based learning

Abstract

The character of mutual cooperation has not been widely applied in the implementation of Pancasila Student Profile character education. The research aims to analyze the influence of the project-based learning integrated Ethno-STEM on the Pancasila Student Profile Mutual Cooperation Dimension. The research method was carried out using a true-experiment pretest-posttest control group design. Data collection instruments include an observation sheet for the Pancasila Student Profile Mutual Cooperation Dimension and a questionnaire for student responses to the project-based learning integrated Ethno-STEM in the Pancasila Student Profile Mutual Cooperation Dimension. Data analysis techniques include validity testing, reliability testing, testing the difference in the average value of each indicator, and testing the average value of each statement. The results of the research concluded that (a) the Pancasila Student Profile Mutual Cooperation Dimension assessment instrument that had been developed was declared very feasible and reliable, (b) the comparison of the average observation scores for each indicator of the Mutual Cooperation Dimension experimental class was higher than the control class shows that PjBL-Ethno-STEM can improve mutual cooperation attitudes, (c) the average student response strongly agrees with the project-based learning integrated Ethno-STEM is applied to provide the Pancasila Student Profile Mutual Cooperation Dimension.

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p-ISSN 2528-505X
e-ISSN 2615-6377

INTRODUCTION

The Merdeka Belajar curriculum is envisioned as a different curriculum because it is flexible, competency-based, focuses on developing character and soft skills, and is accommodating to world needs (Palangda *et al.*, 2023). The Merdeka Belajar Curriculum is one of the first steps in supporting the realization of national education goals, that is to to brighten the nation's life (Arlinwibowo *et al*., 2020). The Pancasila Student Profile is the main goal of educational development (Nurdyansyah *et al.*, 2022). The Pancasila Student Profile explains the competencies and character that need to be built in every Indonesian student towards developing the six dimensions of the Pancasila Student Profile (Kemendikbudristek, 2022) as a whole and comprehensively. The Pancasila Student Profile has several basic character values, including the value of mutual cooperation. Learning must go through various activities that show and display character during education (Sudarmin *et al*., 2019). Enforcing mutual cooperation behavior in character education is one solution to re-enforce national identity which is currently fading. However, the application of the character of mutual cooperation has not been widely implemented in the implementation of The Pancasila Student Profile character education.

The application of the Pancasila Student Profile Mutual Cooperation Dimension through learning models has not been widely researched. The results of the literature analysis show several studies that are relevant to the application of the character of mutual cooperation in learning models. Fitriyenni *et al* (2023) explain the project-based learning based on Balinese local wisdom *Tri Hita Karana*, students experience fun learning, practice mutual cooperation attitudes, and elaborate on local wisdom which is very interesting and easy to put into practice. The project-based learning model can also improve students' collaboration skills (Syafii, 2023). The project based learning model helps all students move, think, discuss and collaborate to complete projects well and on time, thus having a positive effect on improving students' critical thinking, communication, collaboration and creativity skills (Riskayanti, 2021). Acid-base titration learning activities using a problem-based guided inquiry model can train students' communication and collaboration skills (Rizal & Fitriza, 2021).

This research applies a project-based learning model because this model is based on the decision of the Minister of Education, Culture, Research and Technology number 56 of 2022 concerning guidelines for implementing curriculum in the context of learning recovery, including developing independence, creativity, collaborative, critical character per 21st century skills, and entrepreneurial character (Sudarmin, Pujiastuti, *et al*., 2023). The PjBL model is a comprehensive learning model and can involve students in cooperative and sustainable investigation activities (Candra *et al*., 2019). The project-based learning stages start with students determining basic questions which are determined by their ability to understand phenomena, express facts, until they have to build concepts in teams. The next stage is that students and their teams plan a project, create a project design, and prepare a schedule and carry out the project.

Making products requires materials and tools in certain proportions, this has indirectly trained several sub-elements in the mutual cooperation dimension such as collaboration, caring and sharing. Students work on projects directly, as if they were in the real life and can produce products realistically (Anggriani *et al.*, 2019). PjBL demands creativity from students that is above average, such as high learning motivation, collaborative learning attitudes, good concept understanding abilities, and self-regulated learning attitudes (Rais dalam Mubarok *et al*., 2020).

The Ethno-STEM approach is based on the popularity and interest in learning approaches through the integration of Ethnoscience, Science, Technology, Engineering, and Mathematics (STEM) (Sudarmin *et al*., 2024). STEM is an approach to connecting and integrating, exploring, combining two or more STEM subjects into learning based on real life problems (Ariyatun, 2021). The Ethno-STEM approach is defined as the process of building scientific concepts through local wisdom. In its application, the chemical equilibrium project using the Ethno-STEM approach is able to construct students' concepts and collaborate with teams in implementing a project.

The project-based learning integrated Ethno-STEM has not been widely applied to learning activities in

schools. This refers to the results of interviews with chemistry teachers at SMA Negeri 6 Semarang that students have not been equipped with an attitude of mutual cooperation and the STEM approach has not been applied to various scientific disciplines.

Through the PjBL model on chemical equilibrium concept, it is hoped that it can provide students with an attitude of mutual cooperation and cultural awareness. The project-based learning integrated Ethno-STEM involves project-based learning combined with four local culture-based STEM fields to develop critical, creative, innovative and collaborative thinking skills (Sudarmin, Pujiastuti, *et al*., 2023).

This research will integrate the project learning model with Sudarmin syntax, because it connects local wisdom with STEM in the learning stages. The stages of the "Sudarmin Project Model" (Sudarmin, 2021) include (1) Sajikan or present scientific problems or issues that require high-level thinking about the product being implemented; (2) Unjuk or demonstrate innovative and intelligent solutions, thoughts and ideas; (3) Diskusikan or discuss the initial product; (4) Analisis or analyze and decide best; (5) Rancang or design a manufacturing schedule; (6) Mantapkan or establish work schedules and product implementation; (7) Implementasikan or implement product manufacturing; and (8) Nilai or assess of product advantages and limitations. The Ethno-STEM approach learning that will be integrated in this research is related to ethnoscience/local wisdom in the form of the culture of *ganjel* rel bread as an iconic food of Semarang City.

METHODS

Research Types and Designs

This research was conducted using a true experiment with a pretest-posttest control group design. Research was carried out at SMA Negeri 6 Semarang in the even semester for the concept of chemical equilibrium. This research sample was taken using a cluster random sampling technique. The samples used were class XI MIPA 7 as the experimental class and class XI MIPA 8 as the control class.

Research subject

The independent variable of this research is the project-based learning integrated Ethno-STEM with the dependent variable being the Pancasila Student Profile Mutual Cooperation Dimension. Meanwhile, the control variables for this research are teachers, curriculum, chemical equilibrium material, and time allocation.

Data Collection Techniques and Instruments

Data collection techniques include observation, interviews and questionnaires. The observation technique uses an observation sheet on the achievement of the Gotong-Royong dimension elements of the Pancasila Student Profile. The interview technique is in the form of an interview with a chemistry teacher to collect information on a preliminary study regarding the learning process applied to students. The questionnaire technique uses a questionnaire sheet of student responses to the Pancasila Student Profile Mutual Cooperation Dimension.

Data Analysis Technique

Data analysis techniques include validity testing, reliability testing, testing the difference in the average value of each indicator, and testing the average value of each statement.

RESULTS AND DISCUSSION

Results of Analysis of the Implementation of the Project-Based Learning Integrated Ethno-STEM

The project-based learning integrated Ethno-STEM aims to create a learning environment that facilitates learning by building scientific concepts through local wisdom. The philosophical basis of ethnoscience is a

phenomenological and constructivist approach so that the learning process continues to be developed and linked to cultural phenomena and local wisdom according to the learning concept (Sudarmin, Sumarni, *et al*., 2022). Analysis of the project-based learning integrated Ethno-STEM concepts for the study of ganjel rel bread is presented in Table 1.

Table 1. Analysis of Project Concept Integrated Ethno-STEM

Ganjel Rel Bread

Ethnoscience:

Ganjel rel bread is a typical Semarang culinary dish with one of the ingredients being baking soda.

Science:

Sodium bicarbonate mixed into bread dough will produce the following reaction:

2NaHCO3(s) ⇋ Na2CO3(s) + CO2(g) + H2O(g) ΔH = +85 kJ/mol

Ethnotechnology:

Baking soda added to bread dough causes the dough to rise.

Technology:

Sodium bicarbonate in bread dough will produce H2O and CO2 gas which causes the dough to rise.

Ethnoengineering:

The addition of baking soda will affect the rise of the bread.

Engineering:

If a mass of baking soda (NaHCO3) is added, the equilibrium will shift to the reaction product (Na2CO3,CO2, dan H2O).

Ethnomathematics:

Calculate the CO2 and H2O gases produced so that the cake dough is not too alkaline due to excessive amounts of Na2CO3.

Mathematics:

If the Kc value is known, the resulting concentrations of CO2 and H2O can be determined using the equilibrium constant formula.

$$K_c = [CO_2][H_2O]$$

The results of the analysis of the Alur Tujuan Pembelajaran (ATP) and their development, in the chemistry project learning integrated Ethno-STEM, students must understand the relevant concept of *ganjel* rel bread, namely the concept of chemical equilibrium. Sudarmin (2021) has found the project-based learning integrated Ethno-STEM following Sudarmin's syntax which is applied to learning activities. The project-based learning integrated Ethno-STEM with Sudarmin syntax is presented in Table 2.

Table 2. Stages of the "Sudarmin" Syntax Project

Project Stages	Student Activities	Teacher Activities
Sajikan or Present science problems or issues that require high-level thinking about the product being implemented	Students and teams make observations and look for information about *ganjel* rel bread through bread producers and articles	The teacher guides students in making observations and looking for information on *ganjel* rel bread
Unjuk or Demonstrate innovative and smart solutions, thoughts and ideas	Students and teams develop innovative ideas about designing the making of *ganjel* rel bread	The teacher monitors the development of innovative ideas for making *ganjel* rel bread for each team
Diskusikan or Discuss the initial product	Students and teams discuss the initial design for making *ganjel* rel bread by determining the tools, materials and working methods	The teacher monitors the progress of the initial design for making *ganjel* rel bread for each team
Analisis or Analyze and decide best	Students intelligently decide on a plan for making *ganjel* rel bread by considering the	The teacher provides suggestions for the design of making *ganjel* rel bread

	teacher's suggestions	for each team
Rancang or Design a manufacturing schedule	Students intelligently arrange project work time	The teacher guides the preparation of project work time
Mantapkan or Establish work schedules and product implementation	Each team consolidates their work schedule with the teacher's approval	The teacher provides suggestions for the work schedule of each team
Implementasikan or Implement product creation	Each team implemented the creative idea of making *ganjel* rel bread	The teacher monitors student activities while completing the product
Nilai or Assess product advantages and limitations	Each team presents a project to obtain feedback and assessment	The teacher facilitates teams to provide feedback on each product

The project-based learning integrated Ethno-STEM activities on local wisdom of *ganjel* rel bread are presented in Figure 1.

(a) (b)

(c) (d)

(e) (f)

Figure 1. Project Activites: (a) Sajikan Masalah, (b) Unjuk Solusi, (c) Diskusikan and Analisis Produk Awal, (d) Rancang and Mantapkan Jadwal, (e) Implementasikan Produk, (f) Nilai Produk

Analysis of The Research Instrument Development

The results of the data obtained are validity and reliability values of observation sheets, observation scores for the Pancasila Student Profile Mutual Cooperation Dimension, and student responses to the project-based learning integrated Ethno-STEM in the Pancasila Student Profile Mutual Cooperation Dimension. The assessment instruments developed are indicators of the Pancasila Student Profile Mutual Cooperation Dimension and an assessment rubric that will be used as a guide for teachers to carry out authentic assessments of students' attitudes. Pancasila Student Profile Indicators of The Mutual Cooperation Dimension developed consists of 3 indicators, such as collaboration, caring and sharing (Kemendikbudristek, 2022).

The instruments prepared were then validated by validators and their reliability analyzed using Cronbach's Alpha values. Validity shows the extent to which a research instrument accurately measures the variables to be measured (Heale & Twycross in Mudhakiyah *et al*., 2022).

The results of the validation by the validator of the Pancasila Student Profile Mutual Cooperation Dimension assessment instrument developed showed valid results. The results of the validation of the observation sheet by the validator are presented in Table 3.

Table 3. The Results of The Validation of The Observation Sheet by The Validator

Validator	Score	Category	Conclusion
Validator 1	70	Very valid	Suitable for use without revision
Validator 2	74	Very valid	Suitable for use without revision
Average	72	Very valid	Suitable for use without revision

Reliability analysis was carried out to determine whether the Pancasila Student Profile Mutual Cooperation Dimension assessment instrument had high consistency or not. The results of the reliability analysis are presented in Table 4.

Table 4. The Results of The Reliability Analysis

N	Criterion Value	Cronbach's Alpha value	Category
35	0,70	0,86	Reliable

The results of the reliability analysis have a Cronbach's Alpha value of 0.86 > 0.70. It can be concluded that this instrument has high reliability.

Analysis of the Achievement of the Mutual Cooperation Dimension for Each Indicator

The Pancasila Student Profile Aspects of the Mutual Cooperation Dimension are examined through the observation values of each indicator. A comparison of the average observation scores for the Pancasila Student Profile of the Gotong-Royong Dimension for the experimental class and the control class is presented in Figure 2.

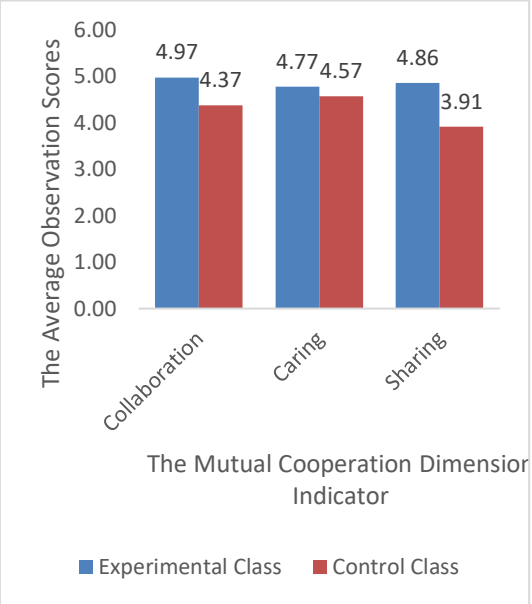

Figure 2. Comparison of the Average Observation Scores for the Pancasila Student Profile Mutual Cooperation Dimension of the Experimental Class and the Control Class

Comparison of the average observation scores of the Pancasila Student Profile Mutual Cooperation Dimension for the experimental class and the control class shows that project learning can improve mutual cooperation attitudes. According to research by Muchtar *et al* (2024), the project-based learning offers a student-centered learning approach, emphasizing active, collaborative learning and practical application of knowledge. The implementation of project-based learning integrated Ethno-STEM with Sudarmin syntax has been effective and able to increase learning achievement significantly (Sudarmin, Pujiastuti, *et al*., 2022). Students are more motivated and interested in being involved in the problem solving process when real problems are presented and integrated with local culture (S. Sudarmin *et al*., 2020).

The first Pancasila Student Profile Mutual Cooperation Dimension indicator is collaboration. The average score on the collaboration indicator presented in Figure 2 shows that the experimental class is higher than the control class. The achievement of indicators in the experimental class is in the very good category with an average of 4,97, while in the experimental class it is also in the very good category with an average of 4,37. This is proven by Syafii's (2023) statement that project-based learning is able to improve students' collaboration skills in the learning process.

Collaboration is the most prominent value of the mutual cooperation character compared to other characters which can be seen through students working together in their teams (S. Sudarmin, Zahro, *et al*., 2019). During project work there will be cooperation and communication between teams (Sudarmin *et al*., 2024).

The second indicator is caring. The average score on the caring indicator is presented in Figure 2, showing that the experimental class is higher than the control class. The achievement of indicators in the experimental class is in the very good category with an average of 4,77, while in the experimental class it is also in the very good category with an average of 4,57. Shpeizer (2019) explains the two most important elements of the project-based learning can increase personal and social integration, as well as a combination of theoretical and practical. It also encourages students to use high-level thinking skills, use direct experience methods, and involve various ways of communication to learn to find solutions to solve real problems by creating products (R. F. K. Sudarmin *et al*., 2017). Experimental class students were more detailed in conveying a description of the surrounding culture compared to the control class (S. Sudarmin, Kurniawan, *et al*., 2019).

The third indicator is sharing. The average score on the sharing indicator presented in Figure 2 shows that the experimental class is higher than the control class. The achievement of indicators in the experimental class is in the very good category with an average of 4,86, while in the control class it is in the good category with an average of 3,91. Through team collaboration, students learn to share ideas, discuss problems, and solve problems as a team (Dianti *et al*., 2023). Sudarmin *et al* (2023) explain that the application of the project-based learning integrated Ethno-STEM will contribute to improving the quality of learning and a shift from individual learning to collaborative learning.

The advantages of implementing the project-based learning integrated Ethno-STEM can be seen through students' responses to the learning applied in the Pancasila Student Profile Mutual Cooperation Dimension. From the results of the analysis of student response questionnaires, it was concluded that the average student response strongly agreed with the project-based learning integrated Ethno-STEM with the concept of chemical equilibrium. The percentage of students who strongly agreed was 47,4%; 40,0% agreed; 10,4% quite agreed; 1,7% disagreed; and 0,4% strongly disagreed.

The weakness of implementing The project-based learning integrated Ethno-STEM is that there is limited time in implementing the learning. The limitation of applying the PjBL model with a STEM approach in research is that the abilities between teams are not commensurate so that the time required for discussions tends to be different and longer, resulting in the learning process taking longer than conventional learning (Sumarni *et al*., 2019). Furthermore, unstable internet networks cause students to have difficulty completing assignments or collecting product reports according to the predetermined time limits.

CONCLUSION

The results of the research concluded that (a) the Pancasila Student Profile Mutual Cooperation Dimension assessment instrument that had been developed was declared very feasible and reliable, (b) the comparison of the average observation scores for each indicator of the Mutual Cooperation Dimension experimental class was higher than the control class shows that PjBL-Ethno-STEM can improve mutual cooperation attitudes, (c) the average student response strongly agrees with the project-based learning integrated Ethno-STEM is applied to provide the Pancasila Student Profile Mutual Cooperation Dimension.

REFERENCES

Anggriani, F., Wijayati, N., Susatyo, E. B., & Kharomah, D. (2019). The Influence of Project-Based Learning on Chemical Products on High School Students' Understanding of Concepts and Science Process Skills. *Jurnal Inovasi Pendidikan Kimia*, *13*(2), 2404–2413.

Ariyatun, A. (2021). Analysis of Ethno-STEM Integrated Project Based Learning on Students' Critical and Creative Thinking Skills. *Journal of Educational Chemistry (JEC)*, *3*(1), 35–44. https://doi.org/10.2158 0/jec.2021.3.1.6574

Arlinwibowo, J., Retnawati, H., Kartowagiran, B., & Kassymova, G. K. (2020). Distance learning policy in Indonesia for facing pandemic COVID-19: School reaction and lesson plans. *Journal of Theoretical and Applied Information Technology*, *98*(14), 2828–2838.

Candra, R. A., Prasetya, A. T., & Hartati, R. (2019). Analysis of Students' Creative Thinking Abilities Through Blended Project-Based Learning. *Perspektif Ilmu Pendidikan*, *13*(2), 2437–2446.

Dianti, S. A. T., Pamelasari, S. D., & Hardianti, R. D. (2023). Project-Based Learning Approach with a STEM Approach to Improving Students' Scientific Literacy Abilities. *Seminar Nasional IPA XIII*, 432–442.

Fitriyenni, S., Kadir, K., & Askar, R. A. (2023). Development of a Chemistry Module for Integrated Atomic Structure Material with Islamic Values Assisted by Quick Response (QR)-Code. *Dharmas Education Journal (DE_Journal)*, *4*(1), 51–58. https://doi.org/10.56667/dejourna l.v4i1.905

Kemendikbudristek. (2022). Decree of the Head of the Educational Standards, Curriculum and Assessment Agency of the Ministry of Education, Culture, Research and Technology Number 009/H/KR/2022 concerning Dimensions, Elements and Sub-Elements of the Pancasila Student Profile in the . In *Kemendikbudristek BSKAP RI* (Issue 021).

Mubarok, A. R., Sumarni, W., & Wisnu Sunarto. (2020). The Influence of Project Based Learning with Coco Leaf craft art products on Class X Students' Understanding of Redox Concepts. *Chemistry in Education*, *1*(2252), 133–139.

Muchtar, F. Y., Bundu, P., & Anshari, . (2024). The Effectiveness of the Tudang Sipulung Integrated Project-based Learning Model to Improve the Character of Mutual Cooperation at the Elementary School Level. *Asian Journal of Education and Social Studies*, *50*(5), 163–169. https://doi.org/10.9734/ajess/ 2024/v50i51350

Mudhakiyah, Z., Wijayati, N., Haryani, S., & Nurhayati, S. (2022). Development of instruments for assessing students' psychomotor aspects in chemistry learning practicum on reaction rate material. *Chemistry in Education*, *11*(2), 166–172. http://journal.unnes.ac.id/sju /index.php/chemined

Nurdyansyah, F., Muflihati, I., Muliani Dwi Ujianti, R., Novita, M., Kusumo, H., . M., & Charles Ryan, J. (2022). Indonesian Character Building Strategy: Planning the Pancasila Student Profile Strengthening Project in Kurikulum Merdeka. *KnE Social Sciences*, *c*. https://doi.org/10.18502/kss.v7i19.12456

Palangda, L., Walukow, M. R., Naharia, O., Wullur, M. N., & Sumual, S. D. M. (2023). Implementation of Merdeka Belajar Policy: Constraints in the Pancasila Students Profile Strengthening Project. *International Journal of Multidisciplinary Approach Research and Science*, *1*(02), 104–116. https:// doi.org/10.59653/ijmars.v1i02.62

Riskayanti, Y. (2021). Peningkatan Keterampilan Berpikir Kritis, Komunikasi, Kolaborasi Dan Kreativitas Melalui Model Pembelajaran Project Based Learning Di SMA Negeri 1 Seteluk. *Secondary: Jurnal Inovasi Pendidikan Menengah*, *1*(2), 19–26. https://doi.org /10.51878/secondary.v1i2.117

Rizal, N., & Fitriza, Z. (2021). Description of High School Students' Communication and Collaboration Skills in Learning Acid-Base Titrations Using Guided and Problem-Based Inquiry Models. *Edukimia*, *3*(1), 031–037. https://doi.org/ 10.24036/ekj.v3.i1.a212

Shpeizer, R. (2019). Towards a successful integration of project-based learning in higher education: Challenges, technologies and methods of implementation. *Universal Journal of Educational Research*, *7*(8), 1765–1771. https://doi.org/10.13189/ujer.2019.070815

Sudarmin. (2021). Berkreasi Mendesain Pembelajaran Berbasis Etnosains untuk Mendukung Pembangunan Berkelanjutan. In *Pustaka Rumah C1nta*. https://repo.ugj.ac.id/file/dosen/1401819261.pdf

Sudarmin, Kasmui, Sumarni, W., Diliarosta, S., Pancawardani, H., & Listiaji, P. (2023). Developing student life skills through an ethno-STEM integrated project learning about herbal tea making from tropical forest plants in Indonesia. *AIP Conference Proceedings*, *2614*(1), 030001. https://doi.org/10.1063/5.012609 7

Sudarmin, Priatmoko, S., Mahatmanti, F. W., Listiadji, P., Rr, S., & Pujiastuti, E. (2024). *Response Analysis of Training Participants of The Project Learning Integrated Ethno-Stem for The Study of Herbal Tea as A Covid-19 Immunity*. *28*(1).

Sudarmin, Pujiastuti, R. S. E., Asyhar, R., Prasetya, A. T., Diliarosta, S., & Ariyatun. (2023). Chemistry Project-Based Learning for Secondary Metabolite Course With Ethno-Stem Approach To Improve Students ' Conservation and Entrepreneurial Character in The 21st Century. *Journal of Technology and Science Education*, *13*(1), 86–103.

Sudarmin, Pujiastuti, R. S. E., Diliarosta, S., Ariyatun, & Ramadhani, R. (2022). Implementation of the Inquiry Learning Model Integrated Ethno-STEM for Secondary Metabolites on the Concept Mastery and Conservation Characteristics of Students. *International Conference on Science, Education and Technology*, 1288–1293. https://proceeding.unnes.ac.id/index.php/iset1288

Sudarmin, R. F. K., Nuswowati, M., & Sumarni, W. (2017). Development of ethnoscience approach in the module theme substance additives to improve the cognitive learning outcome and student's entrepreneurship. *Journal of Physics: Conference Series*, *824*(1), 12024.

Sudarmin, S., Kurniawan, C., N, P., . M., . A., & I, N. (2019). The Implementation of Chemical Project Learning Model Integrated with Ethno-Stem Approach on Water Treatment Topic Using Kelor (Moringa oleifera) Seed Extract As Bio-Coagulant. *KnE Social Sciences*, *2019*, 492–501. https://doi.org/10.18502/kss.v3i 18.4740

Sudarmin, S., Sumarni, W., Azizah, S. N., Yusof, M. H. H., & Listiaji, P. (2020). Scientific reconstruction of indigenous knowledge of batik natural dyes using ethno-STEM approach. *Journal of Physics: Conference Series*, *1567*(4). https://doi.org/10.1088/1742-6596/1567/4 /042046

Sudarmin, S., Zahro, L., Pujiastuti, S. E., Asyhar, R., Zaenuri, Z., & Rosita, A. (2019). The development of PBL-based worksheets integrated with green chemistry and ethnoscience to improve students' thinking skills. *Jurnal Pendidikan IPA Indonesia*, *8*(4), 492–499. https://doi.org/10.15294/jpii.v8i4.175 46

Sudarmin, Sumarni, W., Diliarosta, S., Asmaningrum, H. P., Rizgiana, A., & Listiaji, P. (2022). Learning Model Design of Inquiry Integrated Ethno-STEM for Bioactivity of Secondary Metabolites from Sarang Semut (Ant Nest) Extracts. *AIP Conference Proceedings*, *2600* (December). https://doi.org/10.1063/5.01 13832

Sudarmin, Sumarni, W., & Mursiti, S. (2019). The learning models of essential oil with science technology engineering mathematic (STEM) approach integrated ethnoscience. *Journal of Physics: Conference Series*, *1321*(3). https://doi.org/10.1088/1742-6596/1321/3/ 032058

Sumarni, W., Wijayati, N., & Supanti, S. (2019). Kemampuan Kognitif Dan Berpikir Kreatif Siswa Melalui Pembelajaran Berbasis Proyek Berpendekatan Stem. *J-PEK (Jurnal Pembelajaran Kimia)*, *4*(1), 18–30. https://doi.org/10.17977/um026v4 i12019p018

Syafii, I. (2023). Meningkatkan Keterampilan Kolaborasi Siswa melalui Model Pembelajaran berbasis Proyek: Materi Hakikat Ilmu

Kimia dan Metode Ilmiah. *Jurnal Pendidikan Indonesia : Teori, Penelitian, Dan Inovasi*, *3*(1), 99–105. https://doi.org/10.59818/jpi.v3i1.439

Hasmawaty, Muliati, & Bachtiar, M. Y. (2023). Optimalisasi Aplikasi Platform Merdeka Mengajar (MM) Melalui Komunitas Belajar Gugus PAUD. *Madaniya*, *4*(2), 574–581.

Hijriani, H., Amaluddin, A., & Larekeng, S. H. (2024). The Effectiveness of Merdeka Mengajar Platform towards the Learning of English Reading Comprehension as the Implementation of Independent Curriculum at UPTD SMPN 19 Barru. *Jelita*, *5*(1), 65–80. https://doi.org/10.56185/jelita.v5i1.450

Kemdikbud. (2020). Kepmendikbud Nomor 719/P/2020 tentang Pedoman Pelaksanaan Kurikulum pada Satuan Pendidikan dalam Kondisi Khusus. *Www.Kemdikbud.Go.Id*, *022651*, 9. https://www.kemdikbud.go.id/main/blog/2020/08/kemendikbud-terbitkan-kurikulum-darurat-pada- satuan-pendidikan-dalam-kondisi-khusus

Kementerian Pendidikan, Kebudayaan, Riset, dan T. (2020). *Mengenal Platform Merdeka Mengajar*. https://pusatinformasi.belajar.id/hc/id/articles/4433405881241-Mengenal-Platform-Merdeka-Mengajar#:~:text=Platform Merdeka Mengajar adalah platform,mengajar%2C belajar%2C dan berkarya.

Maisaroh, Renita, Khoirunnisa, L., & Surani, D. (2024). Implementasi Platform Merdeka Mengajar dalam Kurikulum Merdeka melalui Kegiatan In House Training (IHT). *Jurnal Pendidikan Tambusai*, *8*(1), 9666–9673.

Parasuraman, A., & Colby, C. L. (2015). An Updated and Streamlined Technology Readiness Index: TRI 2.0. *Journal of Service Research*, *18*(1), 59–74. https://doi.org/10.1177/1094670514539730

Prabowo, D. A., Fathoni, M. Y., Toyib, R., & Sunardi, D. (2021). Sosialisasi Aplikasi Merdeka Mengajar dan Pengisian Konten Pembelajaran pada SMKN 3 Seluma Untuk Mendukung Program SMK-PK Tahun 2021. *JPMTT (Jurnal Pengabdian Masyarakat Teknologi Terbarukan)*, *1*(2), 55–60. https://jurnal.ikhafi.or.id/index.php/jpmtt/article/view/410

Rohimat, S., Sanusi, S., & Munthahanah, M. (2022). Diseminasi Platform Merdeka Mengajar Untuk Guru Sma Negeri 6 Kota Serang. *ABDIKARYA: Jurnal Pengabdian Dan Pemberdayaan Masyarakat*, *4*(2), 1–9. https://doi.org/10.47080/abdikarya.v4i2.2035

SK Nomor 46/M/2022 Peta Jalan Pengelolaan Platform Digital Di Kementerian Pendidikan Kebudayaan Riset Dan Teknologi (2022).

Srianita, Y., Rahmi, A. M., & Juhriati, I. (2023). Peningkatan budaya belajar mandiri melalui platform merdeka belajar bagi guru paud. *Jurnal Pendidikan Tambusai*, *7*(1), 3007–3013.

Surani, D., Asnawati, A. N., & Kusuma, A. W. (2022). Sosialisasi Aplikasi Merdeka Mengajar Dan Pengenalan Platform Simba Dalam Meningkatkan Pemahaman Media Pembelajaran Kepada Tenaga Pendidik Di Smpn 10 Cilegon. *Jubaedah : Jurnal Pengabdian Dan Edukasi Sekolah (Indonesian Journal of Community Services and School Education)*, *2*(2), 164–171. https://doi.org/10.46306/jub.v2i2.77

Teo, T. (2009). Examining the relationship between student teachers' self-efficacy beliefs and their intended uses of technology for teacing: A structural equation modelling approach. *The Turkish Online Journal of Educational Technology*, *8*(4), 7–16.

Triningsih, W., Utami, R. T., Murtiyasa, B., & Setyaningsih, N. (2024). Pemanfaatan Fitur Asesmen Murid dalam Platform Merdeka Mengajar (PMM) pada Pembelajaran Statistika di Sekolah Dasar. *Jurnal Basicedu*, *8*(1), 127–135. https://doi.org/10.31004/basicedu.v8i1.6960

UNESCO. (2022). *Education: from school closure to recovery*. Online.

Zyad, H. (2016). Integrating Computers in the Classroom: Barriers and Teachers' Attitudes. *International Journal of Instruction*, *9*(1), 65–78. https://doi.org/10.12973/iji.2016.916a