




Increasing knowledge and skills in processing orange peel waste into eco enzymes for senior high school students

Wilda Amananti ^{a,1*}, Aldi Budi Riyanta ^{a,2}, Inur Tivani ^{a,3}, S. Susiyarti ^{a,4}

^a Politeknik Harapan Bersama, Tegal, Central Java 52193, Indonesia

¹ amanantiku@gmail.com* ; ² aldi.kimor@gmail.com; ³ tiva.nie40@gmail.com;

*Corresponding author

ARTICLE INFO	ABSTRACT
<p>Article history Received: 2024-03-07 Revised: 2024-07-03 Accepted: 2024-07-16 Published: 2024-08-02</p> <p>Keywords Ecoenzymes Knowledge Skills</p>	<p><i>Environmental education and awareness of sustainability are becoming a major focus in educational curricula around the world. This article discusses an innovative approach to environmental learning for high school students through the creation of ecoenzymes. Ecoenzym, is a mixture of fermented organic materials that has the ability to clean and recycle organic waste, as well as improve soil and water quality. The results of ecoenzyme training activities for high school students based on the pretest and posttest results are that the training has a positive impact on students' understanding of ecoenzymes and their ability to apply them in practice. The posttest results showed a significant increase in students' knowledge and skills after participating in the training, compared to the pretest results. In this training, students are given a deeper understanding of ecoenzymes. Students get the opportunity to participate in practical activities involving the use of ecoenzymes, which can increase their understanding of the concept. In conclusion, ecoenzyme training is an effective strategy in increasing the knowledge and skills of high school students in this regard. This suggests that practical, hands-on approaches such as this training can be an effective method in educating students about complex scientific concepts such as ecoenzymes.</i></p>
<p>Kata Kunci Ecoenzym Keterampilan Pengetahuan</p>	<p>Peningkatan pengetahuan dan keterampilan pengolahan limbah kulit jeruk menjadi eco enzim bagi siswa SMA. Pendidikan lingkungan dan kesadaran akan keberlanjutan menjadi fokus utama dalam kurikulum pendidikan di seluruh dunia. Artikel ini membahas pendekatan inovatif dalam pembelajaran lingkungan untuk siswa SMA melalui pembuatan ecoenzym. Ecoenzym, adalah campuran fermentasi bahan organik yang memiliki kemampuan membersihkan dan mendumur ulang limbah organik, serta memperbaiki kualitas tanah dan air. Hasil kegiatan pelatihan ecoenzym untuk siswa SMA berdasarkan hasil pretest dan posttest adalah bahwa pelatihan tersebut memiliki dampak positif terhadap pemahaman siswa tentang ecoenzym dan kemampuan mereka dalam menerapkannya dalam praktek. Hasil posttest menunjukkan peningkatan signifikan dalam pengetahuan dan keterampilan siswa setelah mengikuti pelatihan, dibandingkan dengan hasil pretest. Dalam pelatihan ini, siswa diberikan pemahaman yang lebih mendalam tentang ecoenzym siswa mendapatkan kesempatan untuk berpartisipasi dalam kegiatan praktis yang melibatkan penggunaan ecoenzym, yang dapat meningkatkan pemahaman mereka tentang konsep tersebut. Kesimpulannya, pelatihan ecoenzym ini merupakan strategi yang efektif dalam meningkatkan pengetahuan dan keterampilan siswa SMA dalam hal ini. Ini menunjukkan bahwa pendekatan praktis dan langsung seperti pelatihan ini dapat menjadi metode yang efektif dalam mendidik siswa tentang konsep-konsep ilmiah kompleks seperti ecoenzym.</p> <p style="text-align: right;">Copyright © 2024, Amananti et al. This is an open access article under the CC-BY-SA license</p> 

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INTRODUCTION

Environmental education has become the main focus in efforts to maintain environmental sustainability (Ardoin & Bowers, 2020). In this context, providing young people with understanding and practical skills about environmentally friendly practices such as making ecoenzymes has a significant impact (Sun et al., 2024). High school students, as future agents of change, have great potential to apply this knowledge in their daily lives and influence their communities (Ertekin & Yüksel, 2014). Ecoenzyme production training is an innovative and effective method for empowering high school students to take real action for the environment. Ecoenzymes, which are made from organic materials such as food waste, have great potential to reduce waste and environmental pollution, as well as provide an environmentally friendly alternative resource (Tan et al., 2020).

Ecoenzymes, derived from organic materials such as food waste, hold significant potential to mitigate waste and environmental pollution (Ochoa-Hueso et al., 2021). These naturally occurring enzymes can serve as an eco-friendly alternative resource, contributing to sustainable waste management practices and reducing the environmental footprint (Ikbal et al., 2024). By converting organic waste into valuable products, ecoenzymes not only promote a circular economy but also help in minimizing the adverse effects of waste disposal on the environment (Behrooznia & Nourmohammadi, 2024). Their application can lead to cleaner ecosystems, improved waste recycling processes, and a reduction in the reliance on chemical-based solutions, making them a promising innovation for a greener future (Kunjiraman et al., 2024). In this training, students will not only learn about the process of making ecoenzymes, but will also understand their impact on the environment and the importance of reducing carbon footprints (Benny et al., 2023).

In this article we explore the importance of ecoenzyme production training for high school students. We will look at how such training can provide a deep understanding of environmental issues, stimulate creativity and innovation, and encourage active participation in environmental conservation efforts. Thus, this article will not only explain the practical benefits of making ecoenzymes, but will also highlight the important role of high school students in maintaining environmental sustainability (Das et al., 2024). The Merdeka Curriculum in High School is an initiative that allows students to have more freedom in determining the course of their learning (Mufanti et al., 2024). Regarding the manufacture of ecoenzymes, this could be part of the Independent Curriculum program which emphasizes practical and applied learning (Rósa, 2024). Ecoenzyme is a mixture of organic ingredients such as water, sugar and other ingredients that can be used for various household and agricultural purposes (Ben Hmad & Gargouri, 2024).

In the context of the Independent Curriculum, making ecoenzymes can be used as a practical activity or student project. The process of making ecoenzymes involves an understanding of basic chemistry, fermentation reactions, and ecological principles (Qiu et al., 2021). Students can learn about the ingredients required, the fermentation process, and the environmental and economic benefits of ecoenzymes. Apart from that, making ecoenzymes can also teach important values such as environmental awareness, practical skills and social responsibility (Yusuf et al., 2018). Students can learn about the importance of processing organic waste into useful and environmentally friendly products. Thus, making ecoenzymes can be an example of how the Independent Curriculum in high school can provide space for students to learn through direct experience and practical application of science (van Reeuwijk et al., 2023).

Project-based learning is a learning approach that involves students in projects or assignments that require problem-solving, collaboration, and practical application of learned knowledge and skills (Kaushik, 2020). Project-based learning is an educational approach that actively involves students in hands-on projects or assignments (Kogitkov et al., 2016). These projects require problem-solving, collaboration, and the practical application of knowledge and skills acquired during the learning process (Kong et al., 2024). This method encourages students to engage deeply with the subject matter, fostering a more profound understanding and retention of the material. Through project-based learning, students not only gain academic knowledge but also develop critical thinking, teamwork, and real-world problem-solving abilities (Cheng et al., 2024).

By implementing project-based learning, SMA 2 Tegal aims to increase student engagement, understanding of concepts, and develop critical and collaborative thinking skills (Alemneh & Gebrie, 2024)). Through project-based learning, students can learn in a more relevant and holistic way because they are involved in real projects that require creative thinking and practical solutions (Chueh & Kao, 2024). Additionally, they can also gain additional skills such as communication, time management, and teamwork (Marnewick, 2023). The implementation of project-based learning at SMA 2 Tegal involves curriculum adjustments, the development of interesting and meaningful projects, teacher training, and measuring student learning outcomes. This approach aligns with the United Nations' Sustainable Development Goals (SDGs), particularly Goal 4: Quality Education, by promoting inclusive and equitable quality education and lifelong learning opportunities for all. By engaging students in real-world projects, SMA 2 Tegal helps them develop skills that contribute to sustainable development and prepares them to face future challenges with confidence and competence (Gomez-del Rio & Rodriguez, 2022).

METHOD

Figure 1 is a detailed flowchart that represents the procedure for the PKM training activities on making ecoenzymes.

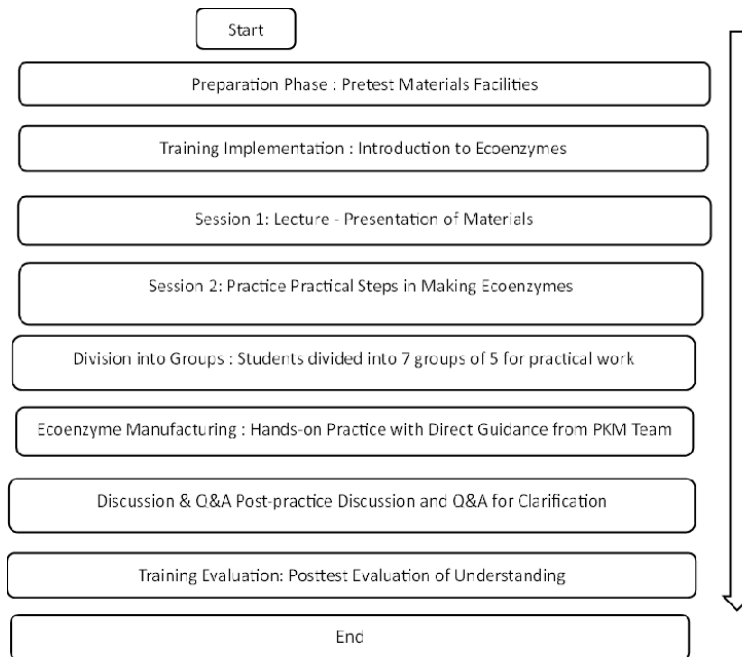


Figure 1. detailed flowchart that represents the procedure for the PKM

Selection of Training Methods

PKM activities will be carried out on December 11, 2024. The training methods used in this activity are lecture and practice methods. PKM activities are divided into 2 sessions. The first session was presentation of material and the second session was practice in making ecozymes. The PKM team provided material about ecoenzymes. The PKM team directly gathered the material and showed the steps in making ecoenzymes to the training participants. In practical activities, students are divided into 7 groups. Each group consists of 5 students. This approach was chosen because it allows direct interaction between the PKM team and students, making it easier to understand and consolidate skills. Before carrying out PKM activities, the PKM team gives a pretest first. The purpose of the pretest is to test students' initial abilities regarding ecoenzymes.

Provision of Materials and Facilities

Before carrying out the training, the materials and tools used to make ecoenzymes are prepared. Materials such as orange peel waste, sugar, water, and containers for making ecoenzymes. Apart from that, facilities such as classrooms and manufacturing equipment are also prepared to support the implementation of training.

Implementation of Training

The training begins with an introduction to the concept of ecoenzymes and their benefits for the environment. After that, the PKM team introduced the materials and tools used in making ecoenzymes. Students are then guided to carry out the steps for making ecoenzymes directly by the PKM team.

Ecoenzyme Manufacturing Practices

Students are given the opportunity to practice making ecoenzymes independently with direct guidance from the PKM team. During practice, participants are given direction and input to ensure that they can produce good quality ecoenzymes.

Discussion, Q&A

After the practice was completed, a discussion and question and answer session was held to ensure that students understood the concept and steps in making ecoenzymes. Students are given the opportunity to ask questions about things they don't understand and get further explanations from the PKM team.

Training Evaluation

Training is evaluated through an evaluation method, participants are given a posttest. The posttest was conducted to evaluate participants' understanding of the training material and the effectiveness of the training methods used.

RESULTS AND DISCUSSION

Increased awareness of the need for environmental conservation has encouraged people to seek environmentally friendly solutions in everyday life. One of the efforts taken is to develop ecoenzym, an environmentally friendly solution that can be used in various contexts, such as household cleaning, organic fertilizer, and so on. In an effort to educate the public, especially the younger generation, about the importance of ecoenzymes and how to make them, training in making ecoenzymes in schools is a very relevant step. (Moore et al., 2017).

This training was held at SMA N 2 Tegal involving class XII students. The methods used in this training include conveying basic theory about ecoenzymes, practical demonstrations of making ecoenzymes directly, and active participation of students in the manufacturing process. Apart from that, discussions were also held about the benefits of ecoenzymes for the environment and how to use them in everyday life.

Making Ecoenzyme, counseling and outreach regarding making Ecoenzyme from orange peel which is suitable for use in making Ecoenzyme has been carried out directly with the target audience, namely SMA 2 Tegal students. The activities are divided into 2, namely the introduction and socialization of ecoenzymes and the practice of making ecoenzymes. Before carrying out the activity, students were given a pretest about the introduction of ecoenzymes and about making ecoenzymes. Based on the pretest results, in general, students in this ecoenzyme introduction and socialization activity did not know about Eco Enzyme. The average student score based on the pretest results regarding the introduction of ecoenzymes is 68. Meanwhile, the average score from the pretest results regarding making ecoenzymes is 54.5. The low pretest results were caused by students not knowing, never hearing, seeing, how to make and knowing the benefits of ecoenzyme. This is natural because the science of Ecoenzymes has only been known in the Tegal area for 2 years.

The next activity is the introduction and outreach about ecoenzymes. This activity was carried out with a presentation about ecoenzymes. material delivered by the PKM team. The material discussed in this activity includes:

1. Understanding eco enzymes
2. Discoverer of ecoenzymes
3. Benefits of eco enzyme
4. Material for making ecoenzymes
5. How to make eco enzyme
6. Manufacturing steps
7. Eco enzyme storage
8. Eco enzyme harvesting

This training succeeded in attracting students' interest in environmental issues and ecoenzymes. They not only understand the basic concept of ecoenzymes, but are also able to make them independently with teacher guidance. Students' active participation in the process of making ecoenzymes shows a good level of understanding of the material. Apart from that, the discussions held also provided a deeper understanding of the benefits of ecoenzymes and how they are used in everyday life (Figure 2).



Figure 2. Practical activities for making Eco Enzyme

The next activity is the practice of making ecoenzyme. making ecoenzyme using orange peel waste. Eco enzyme is a fermented liquid made from organic ingredients such as fruit, vegetables or other food waste. In this PKM tradition,

orange peel is used. The manufacturing process is relatively simple and can be done at home. The following are the general steps in making eco enzyme (Septiani et al., 2021). Choosing organic materials can use various types of fruit, vegetables, or other organic food waste as raw materials. Commonly used examples are orange peel, pineapple peel, or vegetable scraps. In this PKM activity, orange peel is used as the organic material. Wash clean the organic materials that will be used. Cut the ingredients into smaller pieces to speed up the fermentation process. Place the chopped organic materials in a large container. Make sure the container is clean and sterile to avoid contamination. Add sugar to the container containing the orange peel. Sugar functions as an energy source for microorganisms that will carry out fermentation. The ratio between organic ingredients and sugar is usually around 1:3 (Indraloka et al., 2023). After that, add clean water into the container until all the ingredients are submerged. Close the Container and Allow Fermentation to Take Place: Cover the container with a cloth or a loose lid so that air can enter but insects do not enter. Place the container in a place that is not exposed to direct sunlight and room temperature. The fermentation process will last for several weeks to several months, depending on temperature and environmental conditions. stir the mixture periodically to ensure even distribution of nutrients and avoid the growth of unwanted bacteria. After the fermentation process is complete, filter the mixture using a sieve or clean gauze to separate the liquid from the solid ingredients. The resulting liquid is eco enzyme which is ready to be used. Store ecoenzyme in an airtight bottle or container in a cool, dark place to extend its life (Budiyanto et al., 2022).

Ecoenzyme production training at school has many benefits. First, it increases environmental awareness among students, which is a long-term investment in the formation of environmentally responsible attitudes and behavior (Wu et al., 2024). Second, through this training, students learn to become agents of change in their environment by empowering them to make environmentally friendly decisions in their daily lives (Liu et al., 2024). Third, this training also facilitates the integration of scientific concepts in practical life, helping students understand the relationship between science and the environment (Rumayor et al., 2024). However, there are several challenges that need to be overcome in implementing this training, such as limited resources and perhaps limited understanding among students (Presberger et al., 2023). Therefore, there needs to be strong support from schools, teachers and the government in facilitating this kind of training on an ongoing basis (Anokye et al., 2024). Overcoming these challenges necessitates robust support from schools, educators, and government bodies. Continuous investment in training programs, teacher development, and access to resources is crucial for sustaining the impact of such initiatives (Cheng et al., 2024). By addressing these challenges collaboratively, schools can effectively nurture a generation of environmentally conscious individuals equipped to tackle global environmental issues (Cao, 2022)

The next step in PKM activities is posttest activities. Based on the posttest results, it shows that there is an increase in students' knowledge about introducing ecoenzymes and making eco enzymes. This can be seen from the results of the pretest and posttest scores (Table 1).

Table 1. Table of Pretest and Posttest Results

Pretest Value for Introduction to Eco Enzyme	PostTest Value for Introduction to Eco Enzyme
68	87
Practical Pretest Value for Making Eco Enzyme	PostTest Value for Practical Production of Eco Enzyme
54.5	92

CONCLUSION

The conclusion of the ecoenzyme training activities for high school students based on the pretest and posttest results is that the training has a positive impact on students' understanding of ecoenzymes and their ability to apply them in practice. The posttest results showed a significant increase in students' knowledge and skills after participating in the training, compared to the pretest results. In this training, students are given a deeper understanding of ecoenzymes. students get the opportunity to participate in hands-on activities making ecoenzymes which can increase their understanding of the concept. In conclusion, ecoenzyme training is an effective strategy in increasing students' knowledge and skills. This suggests that practical, hands-on approaches such as this training can be an effective method in educating students about complex scientific concepts such as ecoenzymes.

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REFERENCES

- Alemneh, S., & Gebrie, G. (2024). The role of project-based learning in improving the writing ability and sub- writing abilities of 10th grade Amharic speaking students. *Social Sciences & Humanities Open*, 9(January), 100843. <https://doi.org/10.1016/j.ssaho.2024.100843>
- Anokye, K., Mohammed, A. S., Agyemang, P., Agya, B. A., Amuah, E. E. Y., & Sodoke, S. (2024). Understanding the

- perception and awareness of senior high school teachers on the environmental impacts of plastic waste: Implications for sustainable waste education and management. *Social Sciences and Humanities Open*, 10(March), 100999. <https://doi.org/10.1016/j.ssaho.2024.100999>
- Ardoin, N. M., & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review*, 31(July), 100353. <https://doi.org/10.1016/j.edurev.2020.100353>
- Behrooznia, Z., & Nourmohammadi, J. (2024). Polysaccharide-based materials as an eco-friendly alternative in biomedical, environmental, and food packaging. *Giant*, 19. <https://doi.org/10.1016/j.giant.2024.100301>
- Ben Hmad, I., & Gargouri, A. (2024). Stable and effective eco-enzyme cocktails in powder and liquid form of *Stachybotrys microspora* used as detergent additives. *Heliyon*, 10(3), e25610. <https://doi.org/10.1016/j.heliyon.2024.e25610>
- Benny, N., Shams, R., Dash, K. K., Pandey, V. K., & Bashir, O. (2023). Recent trends in utilization of citrus fruits in production of eco-enzyme. *Journal of Agriculture and Food Research*, 13(May), 100657. <https://doi.org/10.1016/j.jafr.2023.100657>
- Budiyanto, C. W., Yasmin, A., Fitdaushi, A. N., Rizqia, A. Q. S. Z., Safitri, A. R., Anggraeni, D. N., Farhana, K. H., Alkatiri, M. Q., Perwira, Y. Y., & Pratama, Y. A. (2022). Mengubah Sampah Organik Menjadi Eco Enzym Multifungsi: Inovasi di Kawasan Urban. *DEDIKASI: Community Service Reports*, 4(1), 31–38. <https://doi.org/10.20961/dedikasi.v4i1.55693>
- Cao, T. (2022). Research on interactive development of China's energy and financial structure based on coupling coordination degree model. *Energy Reports*, 8, 1743–1751. <https://doi.org/10.1016/j.egy.2022.03.027>
- Cheng, C. Y., Hung, C. C., Chen, Y. J., Liou, S. R., & Chu, T. P. (2024). Effects of an unfolding case study on clinical reasoning, self-directed learning, and team collaboration of undergraduate nursing students: A mixed methods study. *Nurse Education Today*, 137(6), 106168. <https://doi.org/10.1016/j.nedt.2024.106168>
- Cheng, W., Li, Q., Wu, Q., Ye, F., & Jiang, Y. (2024). Digital capability and green innovation: The perspective of green supply chain collaboration and top management's environmental awareness. *Heliyon*, 10(11), e32290. <https://doi.org/10.1016/j.heliyon.2024.e32290>
- Chueh, H. E., & Kao, C. Y. (2024). Exploring the impact of integrating problem based learning and agile in the classroom on enhancing professional competence. *Heliyon*, 10(3), e24887. <https://doi.org/10.1016/j.heliyon.2024.e24887>
- Das, S. C., Khan, O., Khadem, A. H., Rahman, M. A., Bedoura, S., Uddin, M. A., & Islam, M. S. (2024). Evaluating the biocatalytic potential of fruit peel-derived eco-enzymes for sustainable textile wastewater treatment. *Results in Engineering*, 21(November 2023), 101898. <https://doi.org/10.1016/j.rineng.2024.101898>
- Ertekin, T., & Yüksel, Ç. (2014). The Role of Ecological Literacy Education with Academic Support in Raising Environmental Awareness for High School Students: "Enka Ecological Literacy Summer Camp Project Case Study." *Procedia - Social and Behavioral Sciences*, 120, 124–132. <https://doi.org/10.1016/j.sbspro.2014.02.089>
- Gomez-del Rio, T., & Rodriguez, J. (2022). Design and assessment of a project-based learning in a laboratory for integrating knowledge and improving engineering design skills. *Education for Chemical Engineers*, 40(February), 17–28. <https://doi.org/10.1016/j.ece.2022.04.002>
- Ikbāl, M. S., Tisha, F. A., Asheque, A. I., Hasnat, E., & Uddin, M. A. (2024). Eco-friendly biopolishing of cotton fabric through wasted sugarcane bagasse-derived enzymes. *Heliyon*, 10(4), e26346. <https://doi.org/10.1016/j.heliyon.2024.e26346>
- Indraloka, A. B., Istanti, A., & Utami, S. W. (2023). The physical and chemical characteristics of eco-enzyme fermentation liquids from several compositions of local fruits and vegetables in banyuwangi. *IOP Conference Series: Earth and Environmental Science*, 1168(1). <https://doi.org/10.1088/1755-1315/1168/1/012018>
- Kaushik, M. (2020). Evaluating a first-year engineering course for project based learning (PBL) essentials. *Procedia Computer Science*, 172(2019), 364–369. <https://doi.org/10.1016/j.procs.2020.05.056>
- Kogtikov, N., Dukhanov, A., & Bochenina, K. (2016). Modeling knowledge transfer and the transdisciplinary effect on project-based learning activities. *Procedia Computer Science*, 80, 1989–1999. <https://doi.org/10.1016/j.procs.2016.05.519>
- Kong, S. C., Cheung, M. Y. W., & Tsang, O. (2024). Developing an artificial intelligence literacy framework: Evaluation of a literacy course for senior secondary students using a project-based learning approach. *Computers and Education: Artificial Intelligence*, 6(November 2023), 100214. <https://doi.org/10.1016/j.caeai.2024.100214>
- Kunjiraman, S., Singh, I. S. B., Sarasan, M., & Puthumana, J. (2024). Immobilized microbial consortia: An eco-friendly and sustainable solution for aquaculture waste management. *The Microbe*, 4(April), 100100. <https://doi.org/10.1016/j.microb.2024.100100>
- Liu, J., Liu, F., & Wang, L. (2024). Automated, economical, and environmentally-friendly asphalt mix design based on machine learning and multi-objective grey wolf optimization. *Journal of Traffic and Transportation Engineering (English Edition)*, 11(3), 381–405. <https://doi.org/10.1016/j.jtte.2023.10.002>
- Marnewick, C. (2023). Student experiences of project-based learning in agile project management education. *Project Leadership and Society*, 4(August), 100096. <https://doi.org/10.1016/j.plas.2023.100096>
- Moore, M., Locke, M. A., Jenkins, M., Steinriede, R. W., & McChesney, D. S. (2017). Dredging effects on selected nutrient concentrations and enzymatic activity in two drainage ditch sediments in the lower Mississippi River

- Valley. *International Soil and Water Conservation Research*, 5(3), 190–195.
<https://doi.org/10.1016/j.iswcr.2017.06.004>
- Mufanti, R., Carter, D., & England, N. (2024). Outcomes-based education in Indonesian higher education: Reporting on the understanding, challenges, and support available to teachers. *Social Sciences and Humanities Open*, 9(February), 100873. <https://doi.org/10.1016/j.ssaho.2024.100873>
- Ochoa-Hueso, R., Delgado-Baquerizo, M., Risch, A. C., Schrama, M., Morriën, E., Barmantlo, S. H., Geisen, S., Hannula, S. E., Resch, M. C., Snoek, B. L., & van der Putten, W. H. (2021). Ecosystem coupling: A unifying framework to understand the functioning and recovery of ecosystems. *One Earth*, 4(7), 951–966.
<https://doi.org/10.1016/j.oneear.2021.06.011>
- Presberger, D., Quoß, F., Rudolph, L., & Bernauer, T. (2023). Factual information on the environmental impacts of consumption abroad increases citizens' problem awareness, but not support for mitigating such impacts. *Environmental Science and Policy*, 146(March), 101–112. <https://doi.org/10.1016/j.envsci.2023.04.019>
- Qiu, X., Peng, D., Tian, H., Wang, H., Liu, X., Cao, L., Li, Z., & Cheng, S. (2021). Soil ecoenzymatic stoichiometry and microbial resource limitation driven by thinning practices and season types in Larix principis-rupprechtii plantations in North China. *Forest Ecology and Management*, 482(35), 118880.
<https://doi.org/10.1016/j.foreco.2020.118880>
- Rósa, B. (2024). In pursuit of social emotional learning in a Swedish pre-service teacher education programme: A qualitative study of intended curriculum. *Teaching and Teacher Education*, 142(June 2023).
<https://doi.org/10.1016/j.tate.2024.104527>
- Rumayor, M., Margallo, M., Pinedo, J., & Albo, J. (2024). Learning by doing using the Life Cycle Assessment tool: LCA projects in collaboration with industries. *Education for Chemical Engineers*, 48(March), 44–52.
<https://doi.org/10.1016/j.ece.2024.05.002>
- Septiani, U., Najmi, & Oktavia, R. (2021). Eco Enzyme : Pengolahan Sampah Rumah Tangga Menjadi Produk Serbaguna di Yayasan Khazanah Kebajikan. *Jurnal Universitas Muhammadiyah Jakarta*, 02(1), 1–7.
<http://jurnal.umj.ac.id/index.php/semnaskat>
- Sun, L., Qu, L., Moorhead, D. L., Cui, Y., Wanek, W., Li, S., Sang, C., & Wang, C. (2024). Interpreting the differences in microbial carbon and nitrogen use efficiencies estimated by 18O labeling and ecoenzyme stoichiometry. *Geoderma*, 444(April), 116856. <https://doi.org/10.1016/j.geoderma.2024.116856>
- Tan, X., Machmuller, M. B., Huang, F., He, J., Chen, J., Cotrufo, M. F., & Shen, W. (2020). Temperature sensitivity of ecoenzyme kinetics driving litter decomposition: The effects of nitrogen enrichment, litter chemistry, and decomposer community. *Soil Biology and Biochemistry*, 148(May), 107878.
<https://doi.org/10.1016/j.soilbio.2020.107878>
- van Reeuwijk, M., Rahmah, A., & Mmari, K. (2023). Creating an Enabling Environment for a Comprehensive Sexuality Education Intervention in Indonesia: Findings From an Implementation Research Study. *Journal of Adolescent Health*, 73(1), S15–S20. <https://doi.org/10.1016/j.jadohealth.2022.07.016>
- Wu, H., Liu, W., & Zeng, Y. (2024). *Acta Psychologica Validating the AI-assisted second language (L2) learning attitude scale for Chinese college students and its correlation with L2 proficiency ☆*. 248(36).
- Yusuf, M., Samsura, D. A. A., & Yuwono, P. S. H. (2018). Toward a framework for an undergraduate academic tourism curriculum in Indonesian Universities: Some perspectives from stakeholders. *Journal of Hospitality, Leisure, Sport and Tourism Education*, 22(November 2016), 63–74. <https://doi.org/10.1016/j.jhlste.2018.02.003>