

Supplementary Material

Spatial and social relevance perceptions by pre-service teachers for learning about oil palm management as a local or nonlocal socioscientific issue

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S1 Module IV: Reflect.

S2 Coding manual and examples.

S1 Module IV: Reflect. *Reflection of Learning about Oil Palm Management*

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1. Writing Task Part 1

You have up to 2 minutes to read the following instruction carefully. Let's encounter the following question:

In which way can what you learned in the unit (on how weeding and fertilising can contribute to sustainable oil palm management) **be useful to you?**

Elaborate on how the information of the unit can be useful to you in your life. Please give examples. Please write 2-3 paragraphs. **You will have 15 minutes to write your answer.**

2. Group discussion

In the following, you find three discussion tasks. For each discussion task: First, read the tasks and corresponding material individually. Second, discuss the task in your group and take notes.

After completing all three group discussion tasks, we ask you to write a second short individual statement (10 min), for which you can use your notes.

2.1 Group Discussion Task 1

Discussion Task 1: Read the quotes below.

Discuss the relevant aspects regarding the usefulness that are pointed out by the two peers, who participated in the educational unit in the previous term. What further aspects would you add to these answers regarding the usefulness of the content of the unit? Please take maximum 20 minutes to discuss your ideas.

Student A: "This unit can be useful for my daily life because it provides an explanation of how oil palm is managed, the environmental impact of oil palm management, and the economic impact of oil palm [...]. From the impact of using fertilizers and herbicides, I can understand how to manage oil palm in a way that is more environmentally friendly but also provides abundant results to meet human needs. Even though there is no oil palm plantation in the area where I live, this knowledge can also be useful for me in managing other [crop] plantations so that they can provide abundant yields but are not detrimental to the environment. This unit can also help me provide information to the environment around me on how to manage sustainable plantations, so that future generations can meet their own needs."

Student B: "Through working on this unit with several sessions, it really helps understanding about sustainable palm oil management in the form of treatments that can have a positive impact on biodiversity and also help the community's economic level by continuing to produce high oil palm products. By working on this unit, it is also useful to increase my information and knowledge about oil palm management and although in the future I may not necessarily develop it further because my area is not suitable for opening oil palm plantations, but at least in the future I can spread or pass on the knowledge I have gained to other people or to my students after completing the course. This will increase knowledge literacy for others and may become a motivation so that these people can create innovations that are useful for the community and also make Indonesia more advanced with the latest innovations in the future."

2.2 Group Discussion Task 2

Read Material 1 (below). Discuss how scientific knowledge and scientific research on oil palm management can be useful for (i) oil palm smallholders, (ii) farmers of other crops, and (iii) everyone.

Please take maximum 15 minutes to discuss your ideas.

Material 1: Large Scale Oil Palm Plantations

The Oil Palm Management Experiment (OPMX) was designed with a clear focus on the management practices of companies that manage large scale oil palm plantations. The treatment method of conventional fertilization used in OPMX, is modelled after the usual practice of such palm oil producing companies. The goal of the experiment is, therefore, to derive possible management regimes for large scale companies based on OPMX results (Darras et al., 2019)¹.

Besides oil palm plantations managed by companies, there are also smallholder plantations. Smallholders are individual, family farmers that manage oil palm plantations without the help of the network of companies. They often hardly use fertilizer and almost only weed their plantations when they have the time. Smallholder plantations are often not bigger than 50 ha and rely on companies for processing their oil palm fruits into palm oil (Euler et al., 2016)². Plantations owned by companies occupy thousands of ha. The experimental design of OPMX focuses on oil palm companies and their management practices (Darras et al., 2019).

2.3 Group Discussion Task 3

Discussion Task 3: Discuss in which way the content of the unit can be useful for your future profession. Please take maximum 10 minutes to discuss your ideas.

3. Writing Task Part 2

You have up to 2 minutes to read through the following instruction carefully.

Write a short individual statement by answering the question.

In which way can what you have learned in the unit³ be useful to

(a) you,

(b) others⁴, and

(c) everyone?

Please integrate ideas of the group discussion (e.g., from your notes).

You will have 10 minutes to write your answer.

¹ Darras, K. F. A., Corre, M. D., Formaglio, G., Tjoa, A., Potapov, A., Brambach, F., et al. (2019). Reducing fertilizer and avoiding herbicides in oil palm plantations—ecological and economic valuations. *Front. For. Glob. Change* 2, 65. doi: [10.3389/ffgc.2019.00065](https://doi.org/10.3389/ffgc.2019.00065)

² Euler, M., Schwarze, S., Siregar, H., and Qaim, M. (2016). Oil palm expansion among smallholder farmers in Sumatra, Indonesia. *J Agricultural Economics* 67, 658–676. doi: [10.1111/1477-9552.12163](https://doi.org/10.1111/1477-9552.12163)

³ In the unit you learned about how weeding and fertilising and corresponding scientific research can contribute to sustainable oil palm management and other crops.

⁴ Harackiewicz, J. M., Hecht, C. A., Asher, M. W., Beymer, P. N., Lamont, L. B., Wheeler, N. S., et al. (2023). A prosocial value intervention in gateway STEM courses. *Journal of Personality and Social Psychology*. doi: [10.1037/pspa0000356](https://doi.org/10.1037/pspa0000356)

S2 Table: Coding manual and examples.

Table S2. Coding manual: Categories ('social': 1. pronoun, 2. profession; 'spatial': 3. spatial scale reference), codes and coding rules as well as exemplary references to the relevance/utility value reflection task. Responses to the task written by pre-service teachers (PST) studying at universities local or nonlocal to oil palm management. The codes 'profession-unrelated' and 'profession-related' were nested into the pronoun codes 'I' and 'We'.

Categories		1. Pronoun first-person personal pronouns and related terms	
	Codes	I including me, my, myself → individual identity	We including us, our, ourselves, all, everyone, everybody, and group or collective, which include the respondent (e.g., students, prospective teachers, family, community, society, Indonesian → collective-societal identity
2. Profession as educator	Profession-unrelated → reference to profession-unrelated areas of life, e.g. to private everyday life	"The unit is very useful for me because it can expand my understanding of oil palm management. [...] With this unit, I can find out more about oil palm management. And I can apply it to my daily life" (ID 29, local PST).	"[...] we will be able to utilize the unit's experience and lessons when we encounter oil palm in the future" (ID 23, local PST).
	Profession-related → reference to future profession as educator, e.g., as teacher or multiplier	"[This unit] can be an idea or example when I want to develop a learning unit. It also has a continuing good effect on my profession as a teacher, [...] since this learning unit can be utilized by students as well" (ID 19, local PST).	"If we become teachers in the future, after studying the modules given, we can provide insights regarding palm oil [...] to students" (ID 42, nonlocal PST).
Category	Codes	Exemplary responses, which fulfilled the utility value criteria (personal, specific, and content-relevant; see Hulleman and Harackiewicz, 2021)	
3. Spatial scale reference	Local → to local level, region, island, community, and surrounding environment	"[Working on this unit] helps to understand sustainable palm oil management in the form of treatments that can have a positive impact on biodiversity and also help the community's economic level [...] it is also useful to increase my information [...]" (ID 9, local PST).	
	National → to national level, e.g., with relation to politics, economics, and laws	"This lesson is very useful for me, as a member of the younger generation that will become the nation's successor and who will need to know how to manage the earth's natural resources in the future" (ID 91, local PST).	
	Global → to global level transcending national borders	"The information in the unit is extremely useful both in my knowledge and in my daily life. [...] The unit also provides solutions for sustainable palm oil management. This makes it easier for us to understand the global effects of such management. So, we can also be careful in managing other plants [...]" (ID 98, nonlocal PST).	