



The prospective science teachers' skills in reconstructing indigenous knowledge of local culture on breast milk using pare (*Momordica charantia*)

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ARTICLE INFO

Keywords:

Indigenous knowledge
Knowledge reconstruction
Local culture

ABSTRACT

Traditional communities still maintain a traditional way of life that relies on nature (Nuangchalerm et al., 2022). In the Dieng community, which occupies the mountains, pregnant women have a tradition of stimulating breast milk using pare (*Momordica charantia*), which has been done for generations as the inheritance of their ancestors. This study aims to explore the tradition of the community using bitter melon to stimulate breast milk in pregnant women. Prospective science teachers explore reconstructing the community's indigenous knowledge through local cultural studies on breast milk stimulation in the Dieng Plateau community. The exploration process is measured as the skills of prospective science teachers in reconstructing indigenous knowledge. The learning strategy chosen is to visit learning resources in the environment to connect indigenous and scientific knowledge with the learning stages per Jerome Bruner's spiral curriculum. Students learning activities to build new knowledge include enactive, iconic, and symbolic stages. Students visit indigenous learning resources in the community to build knowledge through experiments. This research used mixed methods, with 11 pregnant Dieng women as the research target. The result of a t-test of correlation coefficient obtained by t-value equals 4.202 with a significance equal to 0.002. Hence, learning strategy with the cultural study influences students' skills in reconstructing indigenous knowledge of the community in Dieng. In conclusion, prospective science teachers have very good skills in reconstructing the community's indigenous knowledge through local cultural studies about breast milk. Students are helped to acquire knowledge after lecturers let them build hands-on experiences by exploring indigenous learning resources in the environment.

Introduction

Dieng community, which occupies the mountains of Wonosobo regency of Indonesia, has a tradition of stimulating breast milk using pare (*Momordica charantia*), and it has been done for generations as the inheritance of their ancestors. People consume pare raw or mashed and then drink the filtered water. Dieng people do not know the content of boiled water of this fruit, but they believe it is nutritious to stimulate the release of breast milk in pregnant or breastfeeding women. People need breast milk but do not know about it since they do not attend school. Therefore, they make the tradition of consuming pare lasts. The previous by Pandey et al. (2015), Zhou et al. (2020), and Khasawneh et al. (2020) showed that women's awareness of breastfeeding does not change significantly with education levels. People outside of Dieng use more scientific knowledge in modern ways to stimulate breast milk so that this unique culture becomes one of the attractions to be learned. Indigenous

knowledge in society has a high appeal to uncovering scientific truths. Building knowledge through information gathering, organizing, and processing aims to acquire new knowledge (Stapleton and Stefaniak, 2019). Learning design to build new knowledge is through enactive, iconic, and symbolic processes (Bruner, 1966). Exploring indigenous knowledge as a learning activity is essential for preserving a nation's traditions through education (Delany et al., 2018; Sumida Huaman, 2019; Bozhkov et al., 2020).

The tradition of using pare that this community trusts to stimulate the release of breast milk has scientific knowledge content behind it. Therefore, studying and testing scientifically to be reconstructed into scientific knowledge is interesting. Reconstructing knowledge from the environment prioritizes the learning process rather than the final result so that it has a sense of concern for the environment. Learning that prioritizes the process stimulates people to connect the acquired knowledge with new knowledge (Rutten and Soetaert, 2013;

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<https://doi.org/10.1016/j.ijedro.2022.100193>

Received 14 July 2022; Received in revised form 28 July 2022; Accepted 29 July 2022

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Woodhouse, 2017). Any indigenous knowledge of the reconstructed community will have a broader impact (Kidman et al., 2013; Raymond et al., 2019). Traditions possessed by traditional societies empirically can preserve nature, so it deserves to be maintained. People generally use *pare* as vegetables processed modernly (Arfianawati et al., 2016). People generally consume *pare* as a vegetable after heating it, while Dieng traditions for pregnant women is consuming *pare* raw. The truth handed down from the ancestors becomes the truth a traditional society believes (Glazebrook, 2021).

The study of breast milk stimulated from natural ingredients by a community is very interesting as a scientific study in building new knowledge. There is a scientific study about breast milk produced during pregnancy. It can not come out suddenly, so it needs stimulation (Gultie and Sebsibie, 2016; Gelano et al., 2018). Breast milk will come out when the nipple gets stimulation by the baby’s mouth (Osman et al., 2009; Pang et al., 2020). This stimulation will make the hormone oxytocin increase, and breasts produce milk. Stimulation is needed to stimulate the increase in the hormone oxytocin. Breast milk is produced in the breast by a gland affected by the hormone prolactin. This hormone orders the breast to produce milk. Meanwhile, muscle cells are around the producing cells to pump the milk to the empty channels into the nipple. The pumping cells are affected by a hormone known as oxytocin.

The community’s indigenous knowledge, such as the stimulating culture of breast milk from *pare* in the Dieng community, holds the scientific knowledge that needs to be reconstructed into scientific knowledge. Recommendations from Daglas and Antoniou (2012): breastfeeding studies relate to the culture of a unique community and can be learned to gain knowledge about good breastfeeding. Therefore, reconstruction is necessary because it is endangered due to the influence of modern life. There is an outdated notion of indigenous knowledge that impedes the progress of a nation. The modernization of people’s lifestyles outside rural communities and its trends harm the environment, raising awareness that ecological crisis can be saved by returning to people’s lives in the past. Reconstruction in this research is done from the laboratory test result of *pare* content. Scientific testing in the laboratory is a technique to uncover the scientific truth behind indigenous knowledge (Chergui et al., 2020; Wattanachaiyingcharoen et al., 2021).

The process of knowledge reconstruction is done through learning in the course of ethnosciences by involving prospective science teacher students. The research results of Parmin et al. (2016) and Rochwulaningsih et al. (2019), involving prospective students in finding knowledge in the environment can provide experience using the environment and community as a contextual learning resource. The skill of actively choosing learning resources in the environment through information gathering can be used to build knowledge (Bruner, 1960). The purpose of learning ethnoscience is to uncover, utilize, and reconstruct the indigenous knowledge of community into scientific knowledge. The

reconstruction of indigenous knowledge into scientific knowledge carried out through education has a significant impact on maintaining the traditions of a nation (Ait Si Mhamed, 2019; Zidny et al., 2022)

Reconstruction, which means building or restoring something based on the original incident, contains the primary values that must remain in rebuilding something under its original condition (Sumarni and Sudarmin, 2016). It aligns with the purpose of reconstruction, the past life phenomena, and the conception of thought expended by earlier thinkers. The reconstructors must look at all sides so that something is trying to be rebuilt, following the actual circumstances and avoiding excessive subjectivity, which can obscure the substance of something built up. Discovery is part of actively seeking knowledge to produce new, novel knowledge (Hurst, 2016; Zhou, 2020). The reconstruction of indigenous knowledge of the community is done carefully and based on the truth about the indigenous knowledge belonging to a particular tribe or community. The truth of converting indigenous knowledge into scientific knowledge through scientific procedures can be accounted for (Aikenhead and Ogawa, 2007; Zidny et al., 2020). The design of indigenous knowledge of Dieng people is can be seen in Fig. 1.

The indigenous knowledge of Dieng people believes that consuming raw *pare* can help pregnant women produce breast milk. This belief is traditional and not based on scientific knowledge because people close themselves off from scientific knowledge. *Pare* is a cultivated plant because the community uses it as a vegetable and is traded daily apart from stimulating breast milk. Changing indigenous knowledge about *pare* into scientific knowledge is needed to preserve tradition. Prospective science teacher students are studying this study through ethnoscience learning. The reconstruction process is a learning activity that gives students real experiences to build new knowledge.

The community’s indigenous knowledge has not been formalized as a study material because the nature of knowledge and experience has not been scientifically proven as a pattern of a concrete factual relationship with the cause (Corsiglia and Snively, 2001; Ogawa and Omoifo, 2002; Macfarlane, 2017). Reconstruction is needed to change people’s perceptions of indigenous knowledge that impressed as mythical, superstitious, and hostile perceptions of knowledge to be accountable (Lee, 2006; Rist and Dahdouh-Guebas, 2006). Ogawa and Omoifo (2002) describe the steps of reconstructing the formation of scientific knowledge derived from community knowledge through activities: identification, verification, and formulation. George (2001) put forward several principles of scientific knowledge in the context of reconstruction into scientific knowledge: (a) there must be a link between culture and science as the object of study; (b) the indigenous knowledge of the community studied, useful in life; (c) have a place in the content of science education, and (d) the methodology used should bridge the indigenous knowledge to scientific knowledge. Kidman et al. (2013), Lang et al. (2020), and Lederman et al. (2019) suggest that

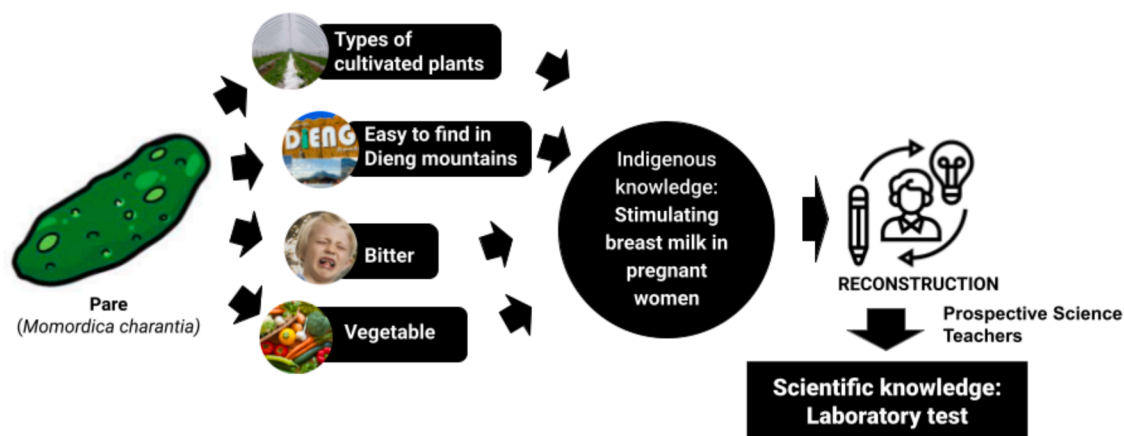


Fig. 1. Design of indigenous knowledge reconstruction.

characteristics of scientific knowledge are formal knowledge in the form of concepts, principles, and theory and tested experimentally in the laboratory.

The reconstruction of indigenous knowledge of the community benefits will be more widely felt when it involves activities in education. To meet the needs of ethnochemical pursuit, prospective science teachers also have a strategic role in reconstructing knowledge as potential teachers. Prospective science teachers must have the skill to utilize indigenous community knowledge in teaching (Parmin et al., 2015; Munford, 2020; Ruwhiu et al., 2022). This study reconstructs the knowledge of the Dieng community as part of the Java community. The Dieng community is slowly exposing itself to modern influences, but there is still a tradition of using *pare* to stimulate breast milk in breastfeeding women. Like other people inhabiting the mountainous areas, the Dieng community is endowed with fertile soil and abundant clean water. Agriculture is the main hereditary livelihood, so it is not surprising if indigenous knowledge about *pare* exists because this plant can thrive in the Dieng area.

The process of reconstructing indigenous knowledge in this study aims to build new knowledge through the active role of students during the learning process. Learning activities through uncovering new information, transforming information, and testing are carried out to obtain the truth of knowledge that refers to the three stages of Bruner's learning process. The research framework is presented in Fig. 2.

Based on the background, the problems in this research are as follows: 1) How the existence of the indigenous knowledge of the Dieng community about the stimulation of breast milk still survives? 2) How to reconstruct the Dieng community's indigenous knowledge about *pare* of breastfeeding stimulation? 3) How is the skill of prospective science teachers to reconstruct the indigenous knowledge of the Dieng community about breastfeeding stimulation? This research is a new way to develop the skills of reconstructing indigenous knowledge into scientific knowledge. This method is new because prospective teachers do it, so they have experience on how to utilize learning resources from the environment when they become teachers. The reconstruction will significantly impact achieving science learning objectives in schools. This research reinforces the importance of learning science through the discovery process so that the new knowledge gained lasts a long time.

Methodology

Research design

This study aims to measure the skill of prospective science teachers in reconstructing the indigenous knowledge of the community. The research method used is the mixed method by Creswell (2014). The important stages of building new knowledge in this research refer to Bruner's spiral curriculum (1966) through enactive, iconic, and symbolic processes. The research targets students to select, retain, and transform new knowledge from reconstructing indigenous learning resources in the community. Student learning activities in building new knowledge are shown in Fig. 3.

Sample and data collection

This study collects data on students' skills in reconstructing indigenous knowledge. The results of the t-test correlation coefficient to determine the effect of the skills of prospective science teachers in reconstructing the local wisdom of the Dieng community. Qualitative data in this study were obtained through oral exploration of rural communities in Dieng. Building new knowledge was revealed more clearly from interviews with students. The investigation of the students' skills in reconstructing the community's indigenous knowledge began with the skill of exploring the community's indigenous knowledge. Exploring knowledge is carried out through enactive, iconic, and symbolic stages to explore students' ways of building procedural scientific knowledge.

The location of the indigenous knowledge exploration in the Dieng community was found in two districts. The research was conducted in Dieng Kulon Village, Batur District, Banjarnegara Regency and Dieng Wetan Village, Keajar District, Wonosobo District. The research location is geographically interesting to study because of the conditions that are still natural and protected from environmental damage. The Dieng community, also known as the *rambut gimbal* community, still closes itself off from modern life so that their lives depend on nature.

The study also examined variables of local culture that were thought to be related to breastfeeding and influencing factors. This study is used to investigate the skill of prospective science teachers in reconstructing the indigenous knowledge of the community. The process of reconstructing indigenous knowledge into scientific knowledge is explored through in-depth interviews to reveal how students do it. The participants were 87 people, 52 women and 35 men, who took the ethnoscience course in the fifth semester. Students who take ethnoscience courses have completed a research methodology course to understand how to research. Understanding research is a prerequisite in reconstructing knowledge because it uses research stages.

In-depth interviews were conducted on the research targets to reveal the knowledge-building process. The interview instrument was structured with questions about the process: (1) Exploration of indigenous knowledge through gathering information from various literature and direct observation of knowledge sources; (2) the ability to simulate science through the study of concrete findings of exploration results; and (3) Presenting the results of scientific testing by integrating the obtained data and facts. Special interviews were also conducted for breastfeeding women in Dieng. Interviews revealed rational reasons and ways to use *pare* for women in the Dieng community. Information obtained from interviews is needed to explore various facts in the field. The interview instrument is open. Because the respondents are traditional people who do not attend school, the target is not to write but to convey orally.

The contents of the interview instrument were validated by learning psychologists. Content validation aims to ensure that the questions given are interesting for respondents to answer because they do not offend or are free from something they do not like. Interviews became this study's primary data collection instrument, so they were tested before use. The trial was conducted on a limited basis to 10 final-year prospective science teachers. From the trial results, two aspects need to be revised: (1)

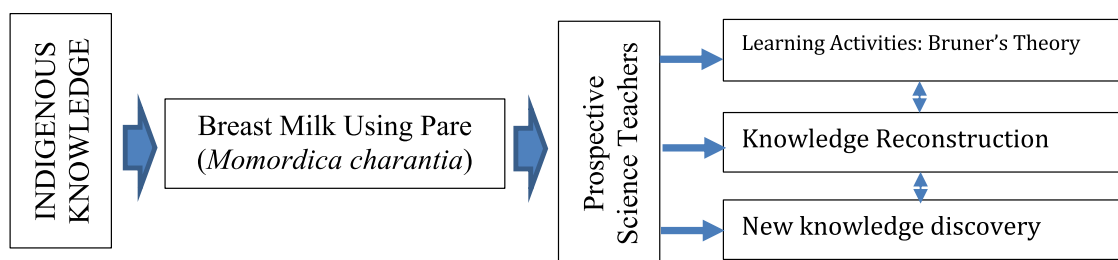


Fig. 2. Research framework.

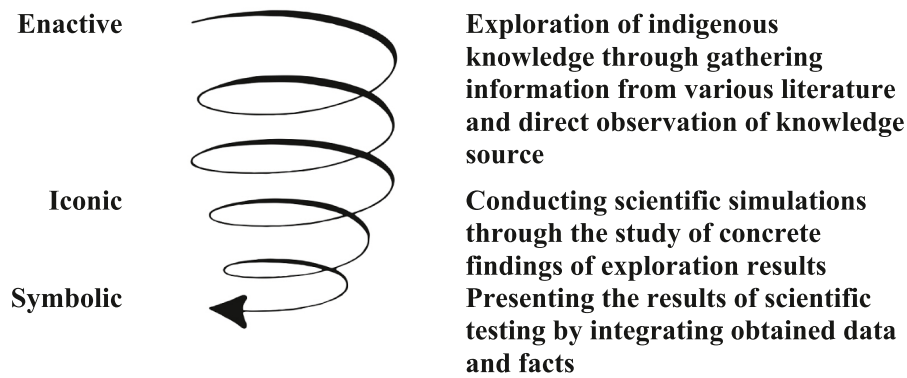


Fig. 3. Stages of building new knowledge.

not all respondents understand the word "reconstruction," so it is replaced by "the process of changing indigenous knowledge into scientific knowledge"; (2) the word "getting knowledge" is changed to "finding new knowledge" because students think that the quality of the process determines success. The interview instrument used to express a public opinion was not revised because the questions were considered easy to understand even by traditional people. The interview instrument was delivered orally because most target people were illiterate since they did not attend school.

Analyzing of data

The reconstructing skill of prospective science teachers was measured by exploration and testing the content of pare. Indicators of exploration report aspects assessed are 1) identifying objects, 2) drawing up instruments, 3) describing the history, 4) arranging interview results, and 5) presenting documentation. All interviews and observations are reconstructed by memory into field notes. Interview data became the main source of research data which was analyzed in depth to find ways of processing information to build new knowledge. Interview data from traditional communities reveal how to use pare as a stimulus for breast milk, with interview data from prospective science teachers reconstructing that knowledge.

In this research, the students' skills in reconstructing the community's indigenous knowledge are revealed from the reports on the activity of reconstructing indigenous knowledge collected by the students. The assessment of the reports consists of five aspects: identifying the indigenous knowledge of the community, exploration results, practicum test, the reconstruction of the indigenous knowledge, and the presentation of the reconstruction results.

After exploring the indigenous knowledge of the community, the students conducted laboratory tests to determine the content of *pare* associated with breast milk stimulation. Laboratory analysis was done as scientific work to transform the community's indigenous knowledge into scientific knowledge. After the results of laboratory analysis were obtained, the data was applied in learning ethnosience in three universities in Indonesia. These three universities were used in this study because all universities have science education study programs.

Findings/Results

The Dieng indigenous knowledge of breastfeeding

Dieng community lives in District Batur, District Banjarnegara and District Kejajar, Wonosobo Regency (Fig. 4). Dieng community is a Javanese ethnic, but because they have a way of life and even different traditions from the community of Java, the Dieng community is regarded as its ethnicity. The Dieng community is one of the ethnic groups unique in Indonesia. The influence of modern living has begun to change



Fig. 4. The map showing the spread of Dieng community.

the community's lifestyle that lies between two active mountains in Java, Mount Sindoro and Mount Sumbing. The tradition still firmly maintained in the Dieng community is the use of *pare* consumed by breastfeeding women to increase breast milk production.

The ancestors of the Dieng community inherited the knowledge of the use of *pare* as passing on other indigenous knowledge, hereditary and as a form united with nature. Life depends on nature. *Pare* is known as a wild plant that lives on the hillsides, so it is easily found. It is commonly consumed as fresh vegetables or raw mixed with salt. Women in the Dieng community commonly eat raw *pare*, and their experience of milk production is more and out of pocket. There is a belief that the baby must immediately unite with nature when they are born, which affects the breastfeeding length to be less than two months. Breastfeeding time is very short due to a lack of knowledge about breast milk.

Through exploration, students interviewed breastfeeding women in the Dieng community. Interview results revealed that not all *pare* types they believe impact milk production. The type of *pare* they eat is the green, small to oval, or a local *pare* that is originally a wild plant on the hillside. The *pare* is consumed and believed to stimulate breast milk based on the information obtained. It further reinforces that knowledge is inherited from their ancestors. When asked why they prefer to consume raw *pare* instead of cooked, breastfeeding women also have the same answer. As a vegetable, they prefer cooked *pare*, while for breast milk stimulation, they prefer raw *pare*. It is eaten raw, in their beliefs are still united with nature.

The interviews have explored the opinion of the research target community. The interviews with research targets revealed that the tradition of consuming bitter melon was carried out because they followed their ancestors. The tendency of respondents to answer various

interview questions with the results is shown in Table 1.

The analysis of interviews with the Dieng community was used as a reference for developing interview questions for prospective science teacher respondents. The entire results of interviews with students are presented in Table 2.

Students' skills in the exploration of indigenous knowledge

In this study, the students' skill in exploring the community's indigenous knowledge is done by prospective students of science teachers. The assessment results of the students' exploration report that the average value of exploring skills is presented in Fig. 5.

The average score of students in identifying objects is 87 from the range of values 0 to 100, creating instruments is 85, describing the indigenous knowledge history explored on *pare* is 90, presenting the interview results is 88, and presenting documentation during exploration activities is 90. The five aspects that have been assessed. The community's indigenous knowledge exploration skill is very good because the average value is 88. After assessing the skill of exploration, it was laboratory tests of *pare*. This study also analyzed the students' skills as prospective science teachers for the skill of reconstructing the indigenous knowledge of the community.

Students' skill in reconstructing indigenous knowledge

The results of investigating the skill of prospective science teachers in reconstructing indigenous knowledge through the investigation of local culture in Dieng plateau are used as the learning materials of ethnosience in three universities. Eighty-seven students from three universities have become the subjects of this study, and their skill of reconstructing indigenous knowledge in ethnosience learning is also assessed. The results of the students' skills in constructing indigenous knowledge are presented in Table 3.

The analysis results of the level of reconstructing the indigenous knowledge of 87 students showed that 18% of the knowledge is the existing ones, while 87% is the reconstruction process by the prospective science teachers. Moreover, the results showed 18 new findings as to the results of a laboratory experiment. A part of the knowledge has existed as scientific knowledge in the community.

Discussion

Exploration became the critical stage of this study in revealing the community's indigenous knowledge. The adequate skill of the prospective science teacher in revealing the indigenous knowledge of the community motivates them to find the indigenous knowledge from other areas. The uniqueness of Dieng people can be revealed by employing systematic exploration, which is used to reveal knowledge from generation to generation. According to the results of the research by Choiriyah et al. (2015), Woollard (2019), and Cook et al. (2021), breastfeeding habits depend on the local culture of a community. After

Table 1
Interviews with Dieng community.

Question	Respondents' Answers
Do those who are currently pregnant still consume <i>pare</i> ?	Yes, we still consume <i>pare</i> .
How do you choose <i>pare</i> ?	We choose <i>pare</i> which is not young but not old and dark green.
How do you consume <i>pare</i> ?	We eat <i>pare</i> that is fresh because it has just been picked. <i>Pare</i> was washed with water and eaten raw or not cooked first.
Are you sure breast milk production will increase by consuming <i>pare</i> ?	We are very sure because this is what our ancestors did long ago
Why did you choose to eat <i>pare</i> and not other fruits?	We only believe in what our ancestors have inherited.

Table 2
Interview about the Process of Building New Knowledge

Question	Respondent's Answer
Are you interested in carrying out the process of reconstructing indigenous knowledge into scientific knowledge?	I am not only interested but also very curious because indigenous knowledge is all around us but sometimes do not realize it.
How to gather information to start building new knowledge?	Information is collected from various literature, such as print media, electronic media, and analysis of popular and journal articles. Information from the literature is insufficient, and it is necessary to conduct a direct search through observation for the primary source of information.
How to concretize information so that it is easier to collect data and facts?	Information is abstract and not concrete, so it needs to be made concrete from the observation results in data and documentation.
How do you test indigenous knowledge to find rational reasons for reconstructing it into scientific knowledge?	From experiments to testing the object of study, for example, by testing <i>pare</i> consumed by the target community in the laboratory to find factors that stimulate breast milk
Have you gained new knowledge from the learning process that has been done?	The new knowledge gained is built on exploration and laboratory tests results.

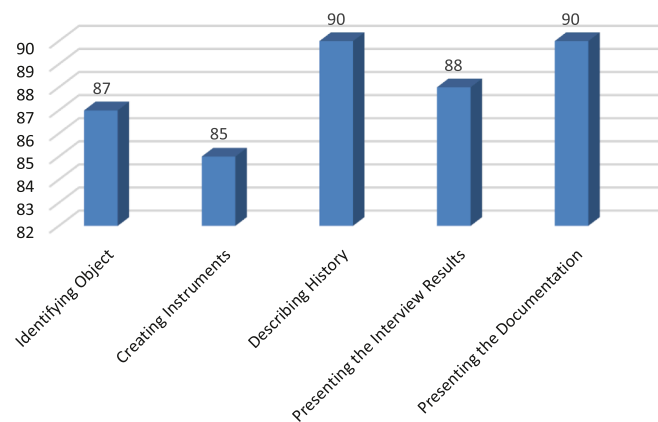


Fig. 5. Assessment results of students' exploration report.

Table 3
Influence of prospective science teachers' skills in reconstructing indigenous knowledge of Dieng community.

Aspects of the Reconstructed Knowledge	Number of Students (Persons) who obtained the score			
	≥ 85 (Very good)	70-84 (Good)	60-69 (Medium)	< 60 (Less)
Identification of indigenous knowledge of community	80	7	-	-
Results of exploration	62	11	14	-
Practicum test	53	12	13	9
Presentation of reconstruction results	57	21	9	-

interviewing Dieng breastfeeding women, the tradition of consuming *pare* is done without knowing what is in it. The results of Kuzma (2013) feed an instinct that every mother has to feed a baby, even in a traditional community. Exploration by prospective science teachers is a way of reconstructing indigenous knowledge at an early stage. Prospective teachers have the skills to develop instruments under data sources because traditional people cannot write. This study found exciting

information from exploring the indigenous knowledge of the Dieng community seen from Ethnoscience learning.

Analysis of the interview results showed that the application of Bruner's Theory with enactive, iconic, and symbolic stages had been applied to prospective science teachers to change indigenous knowledge into scientific knowledge. Learning to discover new knowledge from uncovering knowledge in traditional societies channels curiosity through learning science (Baptista and Molina-Andrade, 2021; Govender and Mudzamiri, 2021; Gillette and Singleton, 2022). Knowledge exploration begins with gathering information from various sources strengthened by observations. Students' new experience is to validate the accuracy of various information with various facts from direct observations. Students concretize abstract knowledge sources through collecting documents from real objects during the exploration process. Analysis of real learning objects is easier to learn, so it helps understand the source of knowledge. Discovering new knowledge practices scientific work skills through science learning (Nickles, 2020; Fahd et al., 2022). Students become skilled at reconstructing indigenous knowledge into scientific knowledge through integrating data and facts that are strengthened by integrating information sources with reality. The interview results revealed that students felt they had found new knowledge that could be scientifically justified because it was obtained from the results of exploration and laboratory testing.

Based on this research results, people are afraid of disobeying the tradition of their ancestors. They still do the tradition, although they do not understand scientifically what they do. Women in Dieng also believe that the lack of breastfed infants affects children's health. According to Park et al. (2014) and Mimouni-Bloch et al. (2013), lack of breastfeeding affects low children's intelligence. Based on the observation results, geographically, *pare* are growing well around Dieng, and soil fertility also has air humidity per the optimum growth of *pare*. Geographical conditions are supported by the community's firm belief that the tradition of consuming *pare* will inevitably last a long time. The community will maintain the traditions inherited from their ancestors because they have felt the benefits obtained (Murin et al., 2022).

The tradition of consuming *pare* by breastfeeding women in the Dieng community is a hereditary indigenous knowledge proved by this study. It becomes an impressive research result as the teaching materials are in ethnoscience. The prospective science teachers have the skill to explore indigenous knowledge as part of reconstructing the process of indigenous knowledge. The five aspects of exploring indigenous knowledge by 87 students achieve an 88 average score. It means that the indigenous knowledge of the Dieng community motivates the students to further explore the knowledge in the community. However, the reconstruction knowledge by students has not achieved a high category because only 18% of the results are new findings.

Prospective science teachers must master the skill of reconstructing a community's indigenous knowledge. Moreover, this research shows that prospective science teachers should also master the scientific work and master the skill of reconstructing knowledge. Although all the findings are not novel, this research has reminded the students about the importance of saving the nation's traditions through learning. Moreover, the research systematically integrates scientific work, indigenous knowledge, scientific knowledge, and cultural preservation, enriching the innovative learning strategy.

Conclusion

The indigenous knowledge of the Dieng community about the utilization of *pare* lasts because of the community's beliefs. Breastfeeding women in Dieng still consume *pare* from generation to generation. The community's indigenous knowledge needs to be reconstructed into scientific knowledge. The strategy of reconstructing indigenous knowledge is conducted through exploration and scientific experiments. The results show that the prospective science teachers have very good skills in reconstructing indigenous knowledge of the community. Students are

trained to discover new knowledge through the learning stages from Bruner's theory. Discovering knowledge is most important in science learning because the results of procedural scientific testing determine the truth of this knowledge.

Recommendations

Countries in the world are rich in culture, and so is Indonesia. Ancestors bequeathed each community a variety of indigenous knowledge. Therefore, we recommend that future researchers dig deeper into the indigenous knowledge in Indonesia so prospective science teachers can reconstruct it to improve the teaching skills they will need in the future. Researchers should not hesitate to reconstruct the community's indigenous knowledge into scientific knowledge after applying learning theory oriented towards process rather than results.

Limitations

This research is limited to the research location. Prospective science teachers who undertook the exploratory stage are limited to three specific universities with science education departments. The exploration stage was carried out only in a few villages that were considered attractive because they were still natural and far from damage.

CRedit authorship contribution statement

Parmin Parmin: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Erna Noor Savitri:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **Miranita Khusniati:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **R. Ahmad Zaky El Islami:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

References

- Aikenhead, G. S., & Ogawa, M. (2007). Indigenous knowledge and science revisited. *Cultural Studies of Science Education*, 2, 539–620. <https://doi.org/10.1007/s11422-007-9067-8>
- Ait Si Mhamed, A. (2019). Indigenous innovations in higher education: Local knowledge and critical research. *International Review of Education*, 65, 833–837. <https://doi.org/10.1007/s11159-019-09796-z>
- Arfianawati, S., Sudarmin, M., & Sumarni, W. (2016). Model pembelajaran kimia berbasis etnosains untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *Jurnal Pengajaran MIPA*, 21(1), 46–51.
- Bozhkov, E., Walker, C., McCourt, V., et al. (2020). Are the natural sciences ready for truth, healing, and reconciliation with indigenous peoples in Canada? Exploring 'settler readiness' at a world-class freshwater research station. *Journal of Environmental Studies and Sciences*, 10, 226–241. <https://doi.org/10.1007/s13412-020-00601-0>
- Bruner, J. S. (1960). *The process of education*. Cambridge: Harvard University Press.
- Bruner, J. S. (1966). *Towards a theory of instruction*. Cambridge: Harvard University Press.
- Baptista, G. C. S., & Molina-Andrade, A. (2021). Science teachers' conceptions about the importance of teaching and how to teach western science to students from traditional communities. *Human Arenas*. <https://doi.org/10.1007/s42087-021-00257-4>
- Chergui, S., Boudjemaa, K., Benzehra, A., et al. (2020). Pathogenicity of indigenous *Beauveria bassiana* (Balsamo) against *Ceratitis capitata* wiedemann (Diptera: Tephritidae) under laboratory conditions. *Egyptian Journal of Biological Pest Control*, 30, 128. <https://doi.org/10.1186/s41938-020-00331-z>
- Choiriyah, M., Hapsari, E. D., & Lismediati, W. (2015). Tradisi dan lingkungan sosial memengaruhi dukungan menyusui pada bayi berat badan lahir rendah di Kota Malang. *Kesmas: National Public Health Journal*, 10(1), 37–43.
- Cook, E. J., Powell, F., Ali, N., et al. (2021). Improving support for breastfeeding mothers: A qualitative study on the experiences of breastfeeding among mothers

- who reside in a deprived and culturally diverse community. *International Journal for Equity in Health*, 20, 92. <https://doi.org/10.1186/s12939-021-01419-0>
- Corsiglia, J., & Snively, G. (2001). Rejoinder: Infusing indigenous science into western modern science for a sustainable future. *Science Education*, 85(1), 82–86.
- Creswell, John W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches*. Los Angeles: SAGE Publications.
- Daglas, M., & Antoniou, E. (2012). Cultural views and practices related to breastfeeding. *Health Science Journal*, 6(2), 353–361.
- Delany, C., Doughney, L., Bandler, L., et al. (2018). Exploring learning goals and assessment approaches for indigenous health education: A qualitative study in Australia and New Zealand. *Higher Education*, 75, 255–270. <https://doi.org/10.1007/s10734-017-0137-x>
- Fahd, K., Miao, Y., Miah, S. J., et al. (2022). Knowledge graph model development for knowledge discovery in dementia research using cognitive scripting and next-generation graph-based database: A design science research approach. *Social Network Analysis and Mining*, 12, 61. <https://doi.org/10.1007/s13278-022-00894-9>
- Gelano, T. F., Bacha, Y. D., Assefa, N., et al. (2018). Acceptskill of donor breast milk banking, its use for feeding infants, and associated factors among mothers in eastern Ethiopia. *International Breastfeeding Journal*, 13, 23. <https://doi.org/10.1186/s13006-018-0163-z>
- George, J. (2001). *Culture and science education: A look from the developing world*. An ActionBioscience. org.
- Gillette, M. B., & Singleton, B. E. (2022). Inevitable epistemological conflict: Reflections on a disagreement over the relationship between science and indigenous and local knowledge. *Ambio*, 51, 1904–1905. <https://doi.org/10.1007/s13280-022-01739-7>
- Glazebrook, T. (2021). What is worth knowing? Science, knowledge, and gendered and indigenous knowledge-systems. *Axiomathes*, 31, 727–741. <https://doi.org/10.1007/s10516-021-09597-w>
- Govender, N., & Mudzamiri, E. (2021). Incorporating indigenous artefacts in developing an integrated indigenous-pedagogical model in high school physics curriculum: views of elders, teachers and learners. *Cultural Studies of Science Education*. <https://doi.org/10.1007/s11422-021-10076-2>
- Gultie, T., & Sebsibie, G. (2016). Determinants of suboptimal breastfeeding practice in Debre Berhan town, Ethiopia: A cross sectional study. *International Breastfeeding Journal*, 11(1), 5.
- Hurst, M. (2016). *Jerome Bruner's theory of development: Discovery learning & representation*. Retrieved from: <http://study.com/academy/lesson/jerome-bruner-theory-of-development-discovery-learning-representation.html>.
- Kidman, J., Yen, C. F., & Abrams, E. (2013). Indigenous students' experiences of the hidden curriculum in science education: A cross-national study in New Zealand and Taiwan. *International Journal of Science and Mathematics Education*, 1–22.
- Khasawneh, W., Kheirallah, K., Mazin, M., et al. (2020). Knowledge, attitude, motivation and planning of breastfeeding: A cross-sectional study among Jordanian women. *International Breastfeeding Journal*, 15, 60. <https://doi.org/10.1186/s13006-020-00303-x>
- Kuzma, J. (2013). Knowledge, attitude and practice related to infant feeding among women in rural Papua New Guinea: A descriptive, mixed method study. *International Breastfeeding Journal*, 8(1), 16.
- Lang, F., Kammerer, Y., Stürmer, K., et al. (2020). Investigating professed and enacted epistemic beliefs about the uncertainty of scientific knowledge when students evaluate scientific controversies. *European Journal of Psychology of Education*. <https://doi.org/10.1007/s10212-020-00471-8>
- Lederman, N. G., Abd-El-Khalick, F., & Smith, M. U. (2019). Teaching nature of scientific knowledge to kindergarten through university students. *Science & Education*, 28, 197–203. <https://doi.org/10.1007/s11191-019-00057-x>
- Lee, T. S. (2006). I came here to learn how to be a leader": An intersection of critical pedagogy and Indigenous education. *InterActions: UCLA Journal of Education and Information Studies*, 2(1).
- Macfarlane, A. (2017). Erratum to: Tairahia Black (Ed): Enhancing mātauranga māori and global indigenous knowledge. *New Zealand Journal of Educational Studies*, 52, 205. <https://doi.org/10.1007/s40841-016-0045-0>
- Mimouni-Bloch, A., Kachevanskaya, A., Mimouni, F. B., Shuper, A., Ravah, E., & Linder, N. (2013). Breastfeeding may protect from developing attention-deficit/hyperactivity disorder. *Breastfeeding Medicine*, 8(4), 363–367.
- Munford, D. (2020). Introducing prospective science teachers to the landscape of science education. *Science & Education*, 29, 771–780. <https://doi.org/10.1007/s11191-020-00118-6>
- Murin, I., Horský, J., & Alác, J. (2022). Demographic change and local community sustainability: Heritagization of land abandonment symbols. In A. Sjölander-Lindqvist, I. Murin, & M. E. Dove (Eds.), *Anthropological perspectives on environmental communication. Palgrave studies in anthropology of sustainability*. Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-78040-1_6.
- Nickles, T. (2020). Scientific discovery as a topic for philosophy of science: Some personal reflections. *Topoi*, 39, 841–845. <https://doi.org/10.1007/s11245-018-9566-0>
- Nuangchalern, P., et al. (2022). Science Attitude on Environmental Conservation of Thai and Indonesian Novice Science Teacher Students. *International Journal of STEM Education for Sustainability*, 2(2), 148–155. <https://doi.org/10.53889/ijses.v2i2.62>. In this issue.
- Ogawa, M., & Omoifo, C. (2002). Students' perceptions and patterns of transition in science learning in two non-western countries. In *Annual meeting of the National Association of Research in Science Teaching (NARST)*.
- Osman, H., El Zein, L., & Wick, L. (2009). Cultural beliefs that may discourage breastfeeding among Lebanese women: A qualitative analysis. *International Breastfeeding Journal*, 4(1), 12.
- Pandey, D., Sardana, P., Saxena, A., Dogra, L., Coondoo, A., & Kamath, A. (2015). Awareness and attitude towards breastfeeding among two generations of Indian women: A comparative study. *Plos One*, 10(5), Article e0126575.
- Pang, W. W., Tan, P. T., Cai, S., et al. (2020). Nutrients or nursing? Understanding how breast milk feeding affects child cognition. *European Journal of Nutrition*, 59, 609–619. <https://doi.org/10.1007/s00394-019-01929-2>
- Park, S., Kim, B. N., Kim, J. W., Shin, M. S., Yoo, H. J., & Cho, S. C. (2014). Protective effect of breastfeeding with regard to children's behavioral and cognitive problems. *Nutrition Journal*, 13(1), 111.
- Parmin, S., Ashadi, S., & Yoris, M (2016). Preparing prospective teachers in integrating science and local wisdom through practicing open inquiry. *Journal of Turkish Science Education*, 13(2), 3–14.
- Parmin, S., Ashadi, A., & Sutikno, S (2015). Skill of teacher candidates in integrating the concept of science with local wisdom. *Jurnal Pendidikan IPA Indonesia*, 4(2).
- Raymond, C. M., Kenter, J. O., van Riper, C. J., et al. (2019). Editorial overview: Theoretical traditions in social values for sustainability. *Sustainability Science*, 14, 1173–1185. <https://doi.org/10.1007/s11625-019-00723-7>
- Rist, S., & Dahdouh-Guebas, F. (2006). Ethnoscience—A step towards the integration of scientific and indigenous forms of knowledge in the management of natural resources for the future. *Environment, Development and Sustainability*, 8(4), 467–493.
- Rochwulaningsih, Y., Sulistiyono, S. T., Utama, M. P., et al. (2019). Traditional knowledge system in palung salt-making in Bali Island. *Journal of Ethnic Foods*, 6, 10. <https://doi.org/10.1186/s42779-019-0018-2>
- Ruwihui, D., ArahangaDoyle, H., DonaldsonGush, R., et al. (2022). Correction to: Enhancing the sustainability science agenda through Indigenous methodology. *Sustainability Science*, 17, 1137. <https://doi.org/10.1007/s11625-021-01063-1>
- Rutten, K., & Soetaert, R. (2013). Narrative and rhetorical approaches to problems of education. Jerome Bruner and Kenneth Burke revisited. *Studies in Philosophy and Education*, 32(2013), 327–343. <https://doi.org/10.1007/s11217-012-9324-5>
- Stapleton, L., & Stefaniak, J. (2019). Cognitive constructivism: Revisiting Jerome Bruner's influence on instructional design practices. *TechTrends*, 63, 4–5. <https://doi.org/10.1007/s11528-018-0356-8>
- Sumarni, W., & Sudarmin, W. Supartono (2016). Preliminary analysis of assessment instrument design to reveal science generic skill and chemistry literacy. *International Journal of Evaluation and Research in Education (IJERE)*, 5(4), 331–340.
- Sumida Huaman, E. (2019). Comparative indigenous education research (CIER): Indigenous epistemologies and comparative education methodologies. *International Review of Education*, 65, 163–184. <https://doi.org/10.1007/s11159-018-09761-2>
- Wattanchaiyingcharoen, W., Lepcha, O., Vitta, A., et al. (2021). Efficacy of Thai indigenous entomopathogenic nematodes for controlling fall armyworm (*Spodoptera frugiperda*) (J. E. Smith)(Lepidoptera: Noctuidae). *Egyptian Journal of Biological Pest Control*, 31, 149. <https://doi.org/10.1186/s41938-021-00497-0>
- Woollard, F. (2019). Requirements to justify breastfeeding in public: A philosophical analysis. *International Breastfeeding Journal*, 14, 26. <https://doi.org/10.1186/s13006-019-0217-x>
- Woodhouse, H. (2017). Contrasting views of emotion in learning: Alfred North Whitehead and Jerome Bruner. *Interchange*, 48, 217–230. <https://doi.org/10.1007/s10780-016-9299-1>
- Zhou, Q., Chen, H., Younger, K. M., et al. (2020). I was determined to breastfeed, and I always found a solution": Successful experiences of exclusive breastfeeding among Chinese mothers in Ireland. *International Breastfeeding Journal*, 15, 47. <https://doi.org/10.1186/s13006-020-00292-x>
- Zhou, J. (2020). A critical discussion of Vygotsky and Bruner's theory and their contribution to understanding of the way students learn. *Review of Educational Theory*, 3(4), 82–87.
- Zidny, R., Sjöström, J., & Eilks, I. (2020). A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & Education*, 29, 145–185. <https://doi.org/10.1007/s11191-019-00100-x>
- Zidny, R., Sjöström, J., & Eilks, I. (2022). Correction to: A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & Education*, 31, 265–266. <https://doi.org/10.1007/s11191-021-00194-2>