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Integration of Ethnoscience in Deep Learning: Perception of Science Teacher Candidates

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Abstract: Study aims to explore the perceptions of science teacher candidates regarding the integration of ethnoscience in deep learning. This study is exploratory research conducted at the Mandalika University of Education with research subjects of 28 students. This research uses a research instrument in the form of a closed questionnaire with answers using a Likert scale and has been validated by experts. This research data was analyzed using quantitative descriptive statistics and inferential statistics with independent sample t-test and Anova test. The results of this research are (1) perception of science teacher candidates regarding the integration of ethnoscience in deep learning based on gender, namely male students have an average 3.189 in Tall category and women 3.053 in Tall category; (2) the perception of male science teacher candidates regarding the integration of ethnoscience in deep learning based on home region, namely students from Mataram have an average at 2.983 in Tall category, West Lombok at 3.140 in Tall category, Central Lombok at 3.200 in Tall category, East Lombok at 3.100 in Tall category, and North Lombok at 3.067 in Tall category; (3) no significant difference in the perceptions of male and female students regarding the integration of ethnoscience in deep learning, as evidenced by the significance value of 0.371 which is greater than 0.05 (>0.05); (4) no significant difference in perception of science teacher regarding the integration ethnoscience in deep learning based on region, as evidenced by the significance value of 0.903 which is greater than 0.05 (>0.05).

Keywords: Ethnoscience; Deep learning; Science teacher candidates.

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Introduction

The growing complexity of 21st-century education requires transformative teaching approaches that are both cognitively rigorous and culturally relevant (Voogt & Pareja Roblin, 2012). In this context, ethnoscience—defined as the incorporation of indigenous or local knowledge systems into science education—has emerged as a promising strategy, particularly in diverse cultural settings such as Indonesia (Zidny, Sjöström, & Eilks, 2020; Abdullah, Halim, & Sulaiman, 2020; Saputra & Amin, 2020). Ethnoscience allows students to understand scientific phenomena through the lens of their cultural environment, thereby fostering meaningful, contextual learning (Abdullah et al., 2020; Saputra & Amin, 2020). When paired with deep learning—a pedagogical model that emphasizes higher-order thinking, creativity, and real-world application—ethnoscience can facilitate a more inclusive and empowering science learning experience (Fullan et al., 2018; Ab Kadir & Hashim, 2021). Thus, the integration of ethnoscience and deep learning is regarded as a potential strategy for delivering science learning that is both contextual and cognitively challenging.

Research has increasingly recognized the value of ethnoscience as a tool to enhance the identity, inclusivity, and engagement of learners, especially when mainstream curricula tend to be disconnected from students' cultural realities (Aikenhead & Michell, 2011; Khupe & Keane, 2017; Zidny & Eilks, 2020). Ethnoscience helps bridge formal science with traditional ecological knowledge, allowing learners to

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perceive science not as abstract content but as an extension of their lived experiences (Rahayu & Kaniawati, 2019; Nugraheni et al., 2020). Moreover, when embedded within deep learning pedagogies—such as engagement, exploration, explanation, elaboration, and reflection—ethnoscience can significantly enhance students' critical thinking and metacognitive development (Suryawati & Osman, 2018; Dewi et al., 2021).

Deep learning, as conceptualized by Fullan et al. (2018), aims to move beyond rote memorization toward cultivating six essential competencies: character, citizenship, collaboration, communication, creativity, and critical thinking. These competencies are in line with the United Nations Educational, Scientific and Cultural Organization (UNESCO) framework for Education for Sustainable Development (UNESCO, 2019). In the context of teacher education, equipping preservice teachers with these deep learning capacities is essential, as they will shape the next generation of learners. However, many teacher training programs still emphasize content delivery over inquiry-based and contextualized approaches (Pantiwati et al., 2020; Oktaviani et al., 2021).

Integrating ethnoscience into deep learning provides an avenue to ground abstract science content in the socio-cultural fabric of learners (Zidny, Sjöström, & Eilks, 2020; Ab Kadir & Hashim, 2021). For preservice teachers, this kind of learning experience is particularly impactful, as it helps shape their pedagogical beliefs and future classroom practices (Villegas & Lucas, 2002; Loughran, 2019). Scholars have suggested that when students—especially those training to become teachers—engage with localized scientific materials, they exhibit stronger motivation, creativity, and reflective capabilities (Jufrida et al., 2019; Yuliati & Widodo, 2020). Additionally, acknowledging indigenous knowledge within formal education environments promotes epistemological pluralism, which is essential for democratizing science education (Bang & Medin, 2021; Mavhunga, 2020; Aikenhead, 2006). In other words, preservice teachers' engagement in ethnoscience-based learning experiences can shape pedagogical beliefs that are more reflective, creative, and inclusive.

In Indonesia, the relevance of ethnoscience-based pedagogy is reinforced by the national education reform agenda, particularly the "Merdeka Belajar" policy, which calls for greater autonomy, contextualization, and student agency in learning (Anshori, 2021; Suyatna et al., 2022). Several studies have found that Indonesian preservice teachers generally support the integration of cultural values and local wisdom in science learning, viewing it as a way to increase engagement and curriculum relevance (Rohmah et al., 2020; Kurniasari & Ristanto, 2021). Moreover, this integration aligns with national aspirations to produce graduates who are both scientifically literate and culturally grounded.

Despite its potential, there remains a lack of empirical research exploring preservice teachers' perceptions of ethnoscience integration in deep learning contexts (Abdullah et al., 2020; Kurniawan & Herlanti, 2021). Much of the literature tends to focus on learning outcomes or the development of teaching materials, with limited attention paid to the perspectives of future educators themselves (Zidny & Eilks, 2020; Yuliana et al., 2022). However, as Richardson (2003) emphasizes, teachers' beliefs and perceptions are pivotal in shaping their classroom behaviors and instructional choices. Therefore, understanding how preservice teachers perceive the fusion of ethnoscience and deep learning is vital to promoting sustainable and culturally responsive science teaching.

Mandalika University of Education has students from the Sasak, Samawa, and Mbojo tribes. This unique cultural diversity makes the institution a valuable context for exploring how future educators interpret the relevance and utility of integrating ethnoscience into deep learning. Given that many of these preservice teachers are deeply embedded in their local cultures, their insights could provide critical guidance for curriculum developers and policy makers aiming to indigenize and deepen science education in Indonesia.

Several prior studies offer foundational support for this inquiry. For example, Ogunniyi & Hewson (2008) demonstrated that exposure to culturally relevant science content positively influences teachers' epistemological and pedagogical orientations. In the Indonesian context, Suryani & Nurtanto (2021) revealed that preservice teachers expressed a strong preference for instructional models that reflect local realities. Such findings suggest that integrating ethnoscience and deep learning could resonate well with learners, especially when scaffolded by teacher preparation programs that value cultural diversity and pedagogical innovation.

Thus, it is important to conduct research with the aim of exploring the perceptions of science teacher candidates regarding the integration of ethnoscience in deep learning. The findings contribute to both the theoretical discourse on culturally responsive pedagogy and the practical development of teacher education programs that equip future educators for the demands of a globally connected but locally rooted classroom.

Method

This study employed a descriptive-exploratory design (Fraenkel, Wallen, & Hyun, 2012; Kerlinger & Lee, 2011) to investigate perceptions of science teacher

candidates regarding the integration of ethnoscience in deep learning. The exploratory nature of the research allows for an in-depth understanding of attitudes and perspectives without imposing any experimental manipulation. In line with this, the study also adopts an ex post facto approach, where existing data on student attitudes are analyzed post hoc without researcher interference or treatment (Cohen, Manion, & Morrison, 2021; Takona, 2024). This combination of approaches is considered most appropriate for the present study, as it enables the researchers to capture authentic perceptions and naturally occurring variations in beliefs, thereby ensuring that the findings genuinely reflect the participants' readiness to adopt ethnoscience in deep learning practices.

The study involved 28 science teacher candidates enrolled at Mandalika University of Education, selected through a convenience sampling technique. This non-probability sampling method was chosen based on considerations of accessibility and voluntary participation (Fink, 2011). The data were collected via an online questionnaire distributed using Google Forms.

The primary research instrument was a closed-ended questionnaire based on a Likert-type scale, consisting of four response categories: *Strongly Agree*, *Agree*, *Disagree*, and *Strongly Disagree* (Joshi et al., 2015). The instrument was developed with reference to validated indicators of perceptions of science teacher candidates regarding the integration of ethnoscience in deep learning (Muliadi et al., 2022). The questionnaire consisted of 10 items constructed based on the core principles of deep learning, which include mindful, meaningful, and joyful learning. To ensure content validity and alignment with the research objectives, the instrument underwent expert review and validation.

The data analysis involved both descriptive and inferential statistical techniques. Descriptive statistics (mean and percentage) were used to capture the general trends of students' perceptions toward the integration of ethnoscience in deep learning. To interpret the mean scores, assessment criteria adapted from Nugroho et al. (2023) were used, as outlined in Table 1.

Table 1. Criteria for conversion of average student perception scores

Average score ($\bar{p}$)	Category
$3.25 < X \leq 4.00$	Very High
$2.50 < X \leq 3.25$	Tall
$1.75 < X \leq 2.50$	Low
$1.00 < X \leq 1.75$	Very Low

Inferential statistical analysis was used to determine differences in students' perceptions of the integration of ethnosciene in deep learning based on gender and semester level. Differences in student perceptions based on gender were analyzed using the t-test at a significance level of 5% with the formulation of a statistical hypothesis, namely H_0: $\mu 1 = \mu 2$ (no significant difference in student perceptions based on gender) and H_1: $\mu 1 \neq \mu 2$ (there is a significant difference in students' perceptions based on gender). Meanwhile, differences in student perceptions based on home region were analyzed using the Anova (Analysis of Variance) test at a significance level of 5% with the formulation of a statistical hypothesis, namely H_0: $\mu 1 = \mu 2$ (no significant difference in students' perceptions based on home region) and H_1: $\mu 1 \neq \mu 2$ (there are significant differences in students' perceptions based on home region). If the results of the analysis are significant or the p-value of the t-test and Anova test is less than 0.05, then H_0 is rejected and H_1 is accepted or vice versa.

Result and Discussion

Description of the data from measuring students' perceptions regarding the integration of ethnoscience in deep learning based on gender is presented in Table 2.

Table 2. Results of students' perceptions data analysis based on gender

Gender	*N*	Lower	Median	Upper	Mean
Male	9	3.000	3.100	3.500	3.189
Female	19	2.700	3.000	3.500	3.053

Based on the results of data analysis in Table 2, it can be explained that students' perceptions regarding the integration of ethnoscience in deep learning based on gender, male students have an average 3.189 in Tall category and women 3.053 in Tall category. The data description is emphasized in the following Figure 1 presentation.

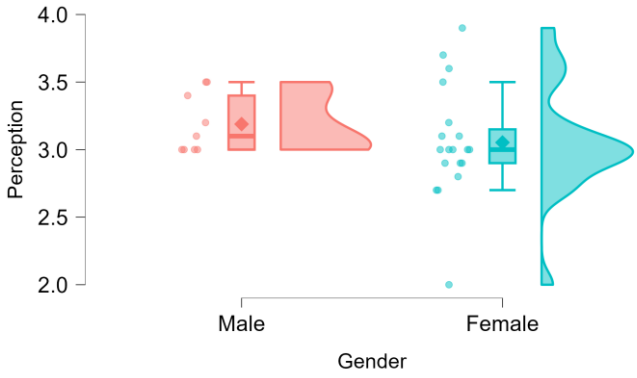

Figure 1. Students' perceptions regarding the integration of ethnoscience in deep learning based on gender

Description of the data from measuring students' perceptions regarding the integration of ethnoscience in

deep learning based on home region is presented in Table 3.

Table 3. Results of students' perceptions data analysis based on home region

Home Region	*N*	Lower	Median	Upper	Mean
Mataram	6	3.000	3.000	3.500	2.983
West Lombok	5	2.700	3.000	3.700	3.140
Central Lombok	6	3.000	3.050	3.200	3.200
East Lombok	5	2.900	3.000	3.100	3.100
North Lombok	6	2.700	3.050	3.500	3.067

Based on the results of data analysis in Table 3, it can be explained that students' perceptions regarding the integration of ethnoscience in deep learning based on home region, students from Mataram have an average at 2.983 in Tall category, West Lombok at 3.140 in Tall category, Central Lombok at 3.200 in Tall category, East Lombok at 3.100 in Tall category, and North Lombok at 3.067 in Tall category. The data description is emphasized in the following Figure 2 presentation.

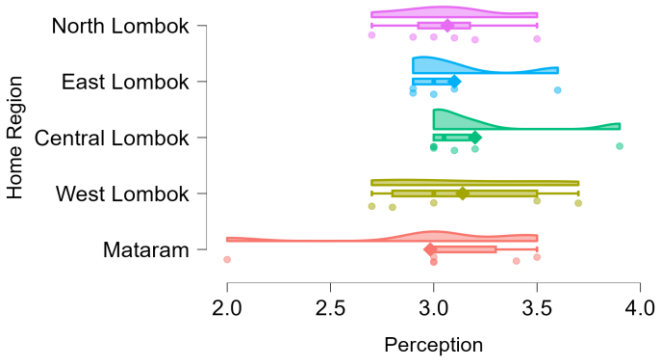

Figure 2. Students' perceptions regarding the integration of ethnoscience in deep learning based on home region

Perception data of in perception of science teacher candidates regarding the integration of ethnoscience in deep learning were analyzed using parametric statistics, after fulfilling the prerequisite tests, namely the homogeneity test and normality test as presented in Table 4.

Table 4. Homogeneity and normality test results

N	Homogeneity		Normality	
	Levenes Statistical test scores	p	Shapiro-Wilk test scores	p
28	0.949	0.339	0.919	0.032

The result of data analysis in Table 4, it is known that the normality test results show a significance value of 0.000 which is smaller than 0.05 (<0,05), which means the data is not normally distributed, while the homogeneity test results explain that the significance value of 0.339 is greater of 0.05 (>0.05) which means the data variance is homogeneous.

Analysis of differences in perceptions of science teacher candidates regarding the integration of ethnoscience in deep learning based on gender was carried out using the independent sample t-test at a significance level of 5% with the results of the analysis as presented in Table 5.

Table 5. t-test results

Variances	t-test for Equality for Means		
	t	df	p
Gender	0.910	26	0.371

The results of the t test in Table 5 explain that the significance value of 0.371 is greater than 0.05 (>0.05), so H_1 is rejected and H_0 is accepted, which means that there is no significant difference in the perceptions of male and female students regarding the integration of ethnoscience in deep learning.

Differences in perceptions of science teacher candidates regarding the integration of ethnoscience in deep learning based on home region were analyzed using the Anova (Analysis of Variance) test with the results as presented in Table 6.

Table 6. Anova test results

Cases	Sum of Squares	df	Mean Square	F	p
Home Region	0.156	4	0.039	0.255	0.903
Residual	3.514	23	0.153		

Based on the results of the Anova test in Table 6, it shows that the significance value of 0.903 is greater than the alpha testing value of 0.05 (>0.05), so that H_1 is rejected and H_0 is accepted, which means that there is no significant difference in perception of science teacher regarding the integration ethnoscience in deep learning based on region.

The results of this study indicate that: (a) science teacher candidates hold very positive perceptions regarding the integration of ethnoscience into deep learning, and (b) there are no significant differences in their perceptions based on gender or region of origin. The present study confirms that science teacher candidates generally exhibit very positive perceptions of integrating ethnoscience into deep learning, which aligns with growing evidence that contextual and culturally grounded instruction enhances the quality of science learning. Ethnoscience-based education fosters a meaningful connection between scientific concepts and students' sociocultural experiences, thus creating a more relevant, engaging, and humanistic learning environment (Aikenhead, 2006; Rahayu & Kaniawati, 2019; Yuliati & Widodo, 2020). Through this lens, local

wisdom becomes not only a vehicle for content delivery but also a pedagogical approach that facilitates identity development and reflective thinking.

Consistent with findings by Suryani & Nurtanto (2021), this study indicates that gender does not significantly affect students' perceptions. Both male and female teacher candidates equally appreciate the role of ethnoscience in enriching science instruction. This suggests a shared epistemological openness to culturally responsive pedagogy, regardless of gender. It supports the claim made by Bang & Medin (2021), who argue that the power of culturally embedded instruction lies in its ability to activate students' cognitive and emotional engagement by reflecting their lived realities within the curriculum.

Furthermore, the lack of significant differences based on students' home regions—such as Mataram, West Lombok, Central Lombok, East Lombok, and North Lombok—illustrates the cross-regional resonance of ethnoscience in educational settings. This echoes the findings of Mulyani et al. (2021) and Nugraheni et al. (2020), who emphasized that localized science instruction fosters conceptual integration and cultural appreciation across diverse student populations. These findings affirm the notion that cultural relevance is a universal pedagogical strength, not limited to students from rural or traditional backgrounds.

When analyzed through the lens of deep learning (Fullan et al., 2018), the integration of ethnoscience aligns with three essential learning experiences: *mindful, meaningful*, and *joyful* learning. As highlighted by Dewi et al. (2021), students develop deep cognitive structures and stronger reflective capabilities when their learning is rooted in real-world, cultural, and community contexts. The use of traditional games, ecological practices, or local materials not only increases interest and motivation, but also contributes to interdisciplinary thinking and sustainability values (Suryawati & Osman, 2018; Haryani et al., 2021).

Additionally, the integration of ethnoscience has been shown to enhance critical and creative thinking in various Indonesian contexts. For instance, research by Pratiwi et al. (2020) demonstrated that students exposed to cultural practices in the classroom exhibited improved scientific reasoning and argumentation. Meanwhile, Jufrida et al. (2019) found that the local wisdom–science integration approach improves motivation, engagement, and student confidence, especially among future science educators.

From a pedagogical standpoint, these findings underscore the importance of embedding ethnoscience in science education programs (Snively & Corsiglia, 2001; Khupe & Keane, 2017). Teacher candidates who experience learning rooted in their own cultural backgrounds are more likely to value and implement culturally relevant strategies in their future classrooms (Aikenhead & Michell, 2011; Gay, 2018; Zidny & Eilks, 2020). As Richardson (2003) argues, preservice teachers' beliefs and perceptions play a critical role in shaping instructional decisions, especially when transitioning from theory to classroom practice.

This perspective is reinforced by international scholarship. For example, Ogunniyi & Hewson (2008) emphasize that engaging preservice teachers in indigenous knowledge systems (IKS) supports the development of pluralistic epistemologies, allowing them to accommodate diverse student needs. Similarly, Jegede (1995) introduced the concept of collateral learning, where students' traditional worldviews coexist and interact with scientific reasoning, resulting in a richer learning experience. In the Indonesian context, studies by Kurniasari and Ristanto (2021) also highlight that ethnoscience-based learning materials significantly improve students' environmental attitudes and conceptual understanding.

The growing policy support—such as "Merdeka Belajar" initiative—further supports this pedagogical direction. The policy encourages educators to localize curriculum content and prioritize student-centered, inquiry-based instruction that reflects community wisdom (Anshori, 2021; Suyatna et al., 2022). Ethnoscience serves as a natural partner for this reform, aligning with the goals of curriculum differentiation, social inclusion, and sustainable learning (Firmansyah et al., 2021).

These findings validate the argument that ethnoscience can be effectively integrated into deep learning without being constrained by demographic boundaries, and they also highlight important practical implications. For university lecturers and teacher education institutions, this means that the integration of ethnoscience in deep learning should be translated into curriculum design, instructional strategies, and assessment models that are explicitly culturally responsive. Embedding ethnoscience in teaching practice courses, microteaching, and practicum activities can equip preservice teachers with first-hand experience in contextualizing science concepts. Likewise, educational institutions are encouraged to provide systematic support—such as workshops, collaborative projects with local communities, and resource development—that reinforce the relevance of ethnoscience in formal education. These efforts not only prepare future teachers to apply culturally grounded pedagogy in their classrooms but also strengthen the alignment of higher education with national educational reforms such as *Merdeka Belajar* (Anshori, 2021; Gay, 2018; Zidny & Eilks, 2020; Suyatna et al., 2022).

Conclusion

Based on the results of the research above, it can be concluded that (1) perception of science teacher candidates regarding the integration of ethnoscience in deep learning based on gender, namely male students have an average 3.189 in Tall category and women 3.053 in Tall category; (2) the perception of male science teacher candidates regarding the integration of ethnoscience in deep learning based on home region, namely students from Mataram have an average at 2.983 in Tall category, West Lombok at 3.140 in Tall category, Central Lombok at 3.200 in Tall category, East Lombok at 3.100 in Tall category, and North Lombok at 3.067 in Tall category; (3) no significant difference in the perceptions of male and female students regarding the integration of ethnoscience in deep learning, as evidenced by the significance value of 0.371 which is greater than 0.05 (>0.05); (4) no significant difference in perception of science teacher regarding the integration ethnoscience in deep learning based on region, as evidenced by the significance value of 0.903 which is greater than 0.05 (>0.05).

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Agus Muliadi: developing literature study topics and defining literature analysis methodology, writing draft articles, revising, and editing final articles.
Ika Nurani Dewi: analyzing literature related to literature study topics.

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Conflicts of Interest
The authors declare no conflict of interest.

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