Implementation of Traditional Games in Ethnoscience Learning

Sri Supiyati[1*], M. Khairul Wazni[2], Dadang Warta Chandra Wira Kusuma[3], Agus Muliadi[4]

[1]Department of Mathematics Education, Universitas Hamzanwadi, Selong, Indonesia
[2]Department of Biology Education, Universitas Hamzanwadi, Selong, Indonesia
[3]Department of Sport and Health Education, Universitas Pendidikan Mandalika, Mataram, Indonesia
[4]Department of Biology Education, Universitas Pendidikan Mandalika, Mataram, Indonesia

Abstract: This study aims to explore the perceptions of preservice teachers on the implementation of traditional *Sasak* tribe games in ethnoscience learning. This exploratory research was conducted at the Mandalika University of Education with a subject pool of 294 preservice teacher students. The research utilized a validated closed questionnaire instrument with responses gathered using a Likert scale. The data from this study were analyzed using quantitative descriptive statistics. The results of this study are (1) preservice teachers' perceptions of the implementation of traditional *Sasak* games in ethnoscience learning in each item of the statement, namely item 1 scored 3.30, categorized as Very High; item 2 scored 3.22, categorized as Tall; item 3 scored 2.88, also categorized as Tall; item 4 scored 3.41, categorized as Very High; item 5 scored 3.19, categorized as Very High; item 6 scored 3.28, categorized as Very High; item 7 scored 3.13, categorized as Tall; item 8 scored 3.38, categorized as Very High; item 9 scored 3.37, categorized as Very High; and item 10 scored 3.47, categorized as Very High; (2) preservice teachers hold highly favorable perceptions regarding the implementation of traditional *Sasak* games in ethnoscience learning, proven by the average score of 3.26, categorized as Very High.

Keywords: Ethnoscience; Learning; Traditional games

Introduction

Ethnoscience has garnered considerable attention in educational settings, particularly through its integration of indigenous knowledge into science learning (Nurcahyani et al., 2021). This approach encourages students to transform indigenous knowledge into scientific knowledge, thereby fostering independence in scientific work (Aisyah & Khotimah, 2023). Ethnoscience's application at the junior high school level, for instance, has led to the development of learning models that incorporate local wisdom, significantly enhancing the educational experience in science subjects (Parmin et al., 2017).

The role of ethnoscience extends beyond mere knowledge translation, but can enhances the contextuality and meaning of learning (Örtenblad, 2018). In biology education, ethnoscience has been integrated through problem-based learning, creating a bridge that allows students from diverse cultural backgrounds to access and apply modern scientific knowledge in a manner that respects and incorporates their cultural heritage (Suciyati & & Suryadarma, 2021). This educational strategy is further exemplified by the development of modules, such as those focusing on pond ecosystems, which aim to enhance students' scientific literacy by grounding learning in ethnoscience principles (Kusumah et al., 2022).

The impact of ethnoscience on cognitive achievement in science is profound (Verawati et al., 2022; Aisyah & Khotimah, 2023). It offers fresh insights and solutions to the challenges of science education, suggesting a significant potential to boost cognitive achievement across educational levels (Fasasi, 2017). For instance, the use of ethnoscience in the development of student worksheets incorporates local cultural values into the learning process, which not only enhances students' motivation and interest but also boosts their

scientific literacy and generic science skills, such as those needed in stoichiometry (Mahyuny et al., 2022; Rosidah, 2019).

Moreover, the integration of ethnoscience has led to the creation of innovative educational tools, such as an integrated interactive digital physics module inspired by the Larung Sesaji coastal culture. This module illustrates how ethnoscience can facilitate a cross-cultural approach in teaching and learning activities, making science education more inclusive and engaging (Midroro et al., 2022). Furthermore, ethnoscience-themed picture books and STEM-based teaching materials have been developed to improve students' higher-order thinking skills and scientific literacy, demonstrating the versatile applications of ethnoscience in enhancing educational quality in vocational and general schools (Agussuryani et al., 2021; Yuliana et al., 2021).

The integration of traditional games into educational settings further amplifies the impact of ethnoscience. Traditional games not only enhance cognitive and social skills through engaging and culturally relevant activities but also contribute significantly to the development of critical thinking and a deeper understanding of complex scientific concepts. For instance, these games have been effectively used in mathematics and science education, providing a means to explore and understand complex concepts in an enjoyable and culturally grounded context (Dewi et al., 2020; Putranta et al., 2021; Nursyahidah et al., 2013). In addition to academic benefits, traditional games play a crucial role in character education and moral development. They help instill values such as respect for cultural heritage, promote social skills, and contribute to the holistic development of students, thus supporting a well-rounded educational approach that goes beyond traditional academic learning (Pramantik, 2021; Sovia et al., 2022).

The integration of traditional games into ethnoscience education offers unique opportunities to enrich learning by blending cultural heritage with scientific inquiry. However, several gaps have been identified in the research and implementation of these practices, highlighting areas that require further exploration and development. There is a notable gap in research regarding the acceptance and readiness of using serious games, including traditional games, as educational tools within the context of ethnoscience. The potential of these games to enhance learning and engagement is widely acknowledged, yet there is insufficient understanding of how educators, students, and communities perceive and adapt to the use of these games in educational settings (Eichenberg et al., 2016).

Another critical research gap lies in the application of traditional games at various educational levels,

particularly in ethnoscience education. While some studies explore the use of traditional games in early childhood settings, there is a scarcity of research focused on their systematic integration across different levels of education. This includes a lack of detailed studies on how these games can be used to promote ethnoscientific literacy and connect scientific concepts with local cultural knowledge (Sulistyaningtyas & Fauziah, 2019; Zulirfan et al., 2023). Furthermore, there is an underexplored area in the specific scientific principles, such as physics concepts, embedded within traditional games and their application in teaching ethnoscience. Existing studies have only scratched the surface of identifying and utilizing these principles within educational frameworks. There is a significant opportunity for future research to systematically analyze and catalog the scientific principles inherent in traditional games, enhancing their educational value in ethnoscience learning environments (Afzal et al., 2021; Rizki et al., 2022).

Previous research still does not explore about the impact of traditional games on character education, moral development, and the preservation of cultural heritage within ethnoscience education. These areas are crucial for understanding how traditional games can contribute not only to academic skills but also to holistic education, promoting moral values and social skills among students (Taheri & Chahian, 2015; Rasna & Tresnayani, 2021). Thus, surveying preservice teacher perceptions also plays a critical role in addressing these gaps. By understanding how future educators perceive the integration of traditional games and technology in ethnoscience education, programs can be developed to better prepare teachers for implementing innovative, culturally responsive educational practices. This feedback is vital for refining teacher education programs and enhancing the effectiveness of ethnoscience education, ensuring that it is aligned with both technological advancements and traditional cultural values (Kay, 2006; Tondeur et al., 2016; Baran et al., 2017).

The integration of traditional games into educational curricula has gained significant attention for its potential to enrich learning experiences and outcomes across various educational levels and disciplines. This integration taps into the emotional, cognitive, and cultural aspects of learning, offering a multidimensional approach to education that aligns well with ethnoscience concepts. The successful implementation of user-centered game-based learning, particularly in higher education disciplines such as civil engineering, showcases the versatility of traditional games. These educational strategies have been found to significantly improve learning outcomes, student motivation, and knowledge acquisition across various fields (Ebner &

Holzinger, 2007; Chugh & Turnbull, 2023). This suggests that traditional games, when thoughtfully integrated into learning, can provide effective and engaging learning experiences that extend beyond traditional educational methods.

The potential of traditional games to support the development of essential skills and values in students has been explored in various educational contexts, including mathematics and character development. These games have been shown to enhance the learning of complex concepts and contribute significantly to character education, highlighting their role in promoting holistic development in students (Kusuma et al., 2021; Kamid et al., 2021; Suhra et al., 2020). Moreover, the integration of traditional games into physics learning exemplifies their ability to convey complex scientific principles in an accessible and engaging manner. This approach not only demystifies challenging concepts but also connects them to students' cultural backgrounds and everyday experiences (Putranta et al., 2021).

The exploration of ethnoscience concepts through traditional games is particularly promising. Traditional games provide a practical medium for bridging modern scientific principles with indigenous knowledge, making science education more inclusive and relevant to diverse student populations. For instance, games like *Otok-otok*, *Kolecer*, and *Engklek* have been found to contain inherent physics and mathematical concepts that, when explored within the framework of ethnoscience, can greatly enhance students' understanding and appreciation of both science and their cultural heritage (Sholahuddin & Admoko, 2021; Mardana et al., 2022). These findings underscore the potential of traditional games not only as tools for cognitive and emotional engagement but also as effective mediums for integrating ethnoscience into education, thereby promoting a more inclusive, engaging, and culturally responsive educational environment.

Recent studies on the integration of ethnoscience and traditional games in educational settings have demonstrated significant potential to enhance teaching and learning across various scientific disciplines. Sholahuddin & Admoko (2021) investigated the application of physics concepts in the traditional *Kolecer* game, identifying key concepts such as equilibrium, pressure, Newton's laws, work and energy, and kinetic energy. This study illustrates how traditional games can be transformed into engaging educational tools that help students understand physics concepts through hands-on, culturally embedded experiences. Similarly, Suciyati & Suryadarma (2021) focused on the integration of ethnoscience in problem-based learning to enhance biology education. Their findings suggest that traditional games can enrich the understanding of biological concepts, making learning more contextual and meaningful within diverse cultural settings. This approach not only supports deeper comprehension but also fosters greater student engagement and enthusiasm for science.

Mardana et al. (2022) further explored this integration by analyzing the traditional game of *Tajog* to uncover embedded physics concepts, notably kinetic energy. This connection between traditional games and scientific concepts underscores the potential of ethnoscience to bridge modern science with cultural traditions, facilitating a more comprehensive and inclusive science education. Additionally, the research conducted by Fasasi (2017) on the impact of ethnoscience instruction on cognitive achievement in science highlights the broader educational benefits. The study indicates that incorporating ethnoscience through traditional games can significantly enhance cognitive development and academic performance, offering a potent strategy for improving science education outcomes. Despite these promising findings, but there is a need for further research focusing on the impact of traditional games on cognitive development in students', particularly in how these games can be designed to maximize educational benefits. Moreover, the potential of traditional games to promote cultural preservation and increase learning motivation calls for deeper exploration to better understand and leverage these games in enhancing educational outcomes across various learning environments.

The objective of this study is to analyze preservice teacher perceptions of implementing traditional games in ethnoscience learning. This analysis is particularly important given the increasing emphasis on integrating culturally relevant teaching methods into science education, which can enhance learning outcomes and increase student engagement. The investigation into preservice teacher perceptions will offer insights into the practical aspects of deploying traditional games in educational settings, identifying potential barriers and facilitators in their use. Thus, the novelty of this study lies in its focus on the unique intersection of traditional games and ethnoscience within the context of teacher education.

Method

This study is an exploratory descriptive research (Kerlinger & Lee, 2000; Fraenkel, Wallen & Hyun, 2012), aimed at describing the perceptions of preservice teachers regarding the implementation of traditional games in ethnoscience learning (Muliadi, Mirawati & Prayogi, 2021). The study employs an ex post facto approach because the researchers only examined and measured existing attitudinal data without any

manipulation or intervention (Cohen et al., 2021; Takona, 2024). The respondents were 294 preservice education students at the Mandalika University of Education, selected through convenience sampling based on accessibility and willingness to participate in an online-distributed questionnaire (Fink, 2011).

This research employed a closed questionnaire as its instrument, featuring responses based on a Likert scale (Muliadi et al., 2022). The scale included degrees of agreement: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) (Joshi et al., 2015) and was administered via Google Forms (Alfiah et al., 2020). The questionnaire comprised 10 items, each aligned with indicators of preservice teachers' perceptions of ethnoscience, as developed by Soemardiawan, Wardhani & Muliadi (2023). The questionnaire was validated by experts and confirmed as valid.

The research data were analyzed using descriptive statistics, which included calculating the frequencies, means, and standard deviations of the responses. This method was selected to provide a clear and straightforward interpretation of the data, reflecting the main trends and variability within the responses. The average data on student perceptions were interpreted using the assessment criteria developed by Nugroho et al. (2023), as presented in Table 1.

Table 1. Criteria for conversion of average student perception scores

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

Result and Discussion

The description of the data measuring the perceptions of preservice teachers regarding the implementation of traditional Sasak tribe games from Lombok in ethnoscience learning is presented in Table 2.

Table 2. Preservice Teachers' Perceptions

Statement Items	Answer				Σ Score	Mean
	SA	A	D	SD		
Students have knowledge of traditional games	111	167	9	7	970	3.30
Students understand how to play traditional games	99	170	16	9	947	3.22
Students frequently play traditional games	63	155	55	21	848	2.88
Traditional games contain distinctive indigenous science	136	146	10	2	1004	3.41
Indigenous science in traditional games is relevant to science education materials	90	172	30	2	938	3.19
Traditional games can be developed as a resource for science learning (ethnoscience learning)	104	170	18	2	964	3.28
Ethnoscience learning based on traditional games can enhance understanding of science	79	175	38	2	919	3.13
Ethnoscience learning based on traditional games can improve understanding of local wisdom	121	166	5	2	994	3.38
Ethnoscience learning based on traditional games can enhance understanding of the diversity of traditions and cultures	119	165	9	1	990	3.37
Ethnoscience learning based on traditional games can foster an attitude of cultural preservation	144	146	3	1	1021	3.47

Based on the data analysis presented in Table 2, it is observed that the preservice teachers' perceptions of the implementation of traditional *Sasak* games in ethnoscience learning scored highly across several items. Specifically, item 1 scored 3.30, categorized as Very High; item 2 scored 3.22, categorized as Tall; item 3 scored 2.88, also categorized as Tall; item 4 scored 3.41, categorized as Very High; item 5 scored 3.19, categorized as Very High; item 6 scored 3.28, categorized as Very High; item 7 scored 3.13, categorized as Tall; item 8 scored 3.38, categorized as Very High; item 9 scored 3.37, categorized as Very High; and item 10 scored 3.47, categorized as Very High. A detailed representation of the data is provided in Figure 1.
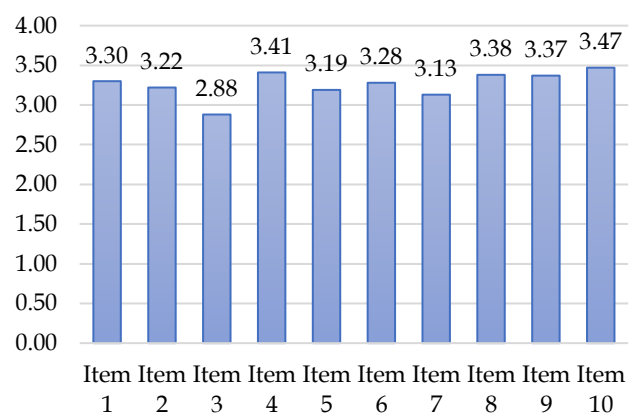
Figure 1. Preservice Teachers' Perceptions

The perceptions of preservice teachers on the implementation of traditional games in ethnoscience learning were analyzed using quantitative descriptive statistics as presented in Table 3.

Table 3. Results of student perception data analysis

Variable Group	N	Σ Score	Variance	Standard Deviation	Mean	Category
Preservice Teachers Perception	294	959.50	0.207	0.454	3.26	Very High

Based on the data analysis presented in Table 3, it can be explained that the perceptions of preservice teachers regarding the implementation of traditional Sasak games in ethnoscience learning have an average score of 3.26, categorized as Very High.

The research results indicate that preservice teachers hold highly favorable perceptions regarding the implementation of traditional *Sasak* tribe games in ethnoscience learning. These findings confirm that preservice teachers possess a positive outlook on the significance of integrating traditional Sasak tribe games into ethnoscience education. This demonstrates that the students have a robust understanding of ethnoscience and its application in science education (Ningrat et al., 2024). Students with a deeper comprehension of ethnoscience are more likely to hold positive views concerning the importance of incorporating local cultural values into ethnoscience learning (Freeman et al., 2014; Hacieminoglu, 2016).

The highly positive perceptions among the students illustrate that preservice teachers have a substantial interest in ethnoscience education (Fulmer et al., 2019; McDonald et al., 2019). This finding reaffirms that ethnoscience learning have a significant role in enriching students' knowledge and understanding by integrating local wisdom and cultural experiences into formal education settings. This approach not only helps students develop a deeper understanding of scientific concepts but also fosters a connection between classroom learning and real-life experiences (Khoiri et al., 2021). By incorporating ethnoscience into teaching practices, students are encouraged to explore and transform indigenous knowledge into scientific knowledge, which can lead to improved critical thinking skills and problem-solving abilities (Parmin et al., 2017; Budiarti et al., 2022).

Preservice teacher students acknowledge that integrating traditional games into ethnoscience learning can strengthen knowledge about science and local wisdom, as well as foster an attitude of cultural preservation. This is supported by the opinion of Nurhasnah et al (2022) that the integration of traditional games in ethnoscience learning is crucial for recognizing and preserving local culture while enhancing students' skills, values, and attitudes towards the environment. It provides a platform for students to bridge their preconceptions with scientific concepts, creating a more holistic understanding of various subjects (Sholahuddin et al., 2022). Ethnoscience learning materials have been shown to positively impact students' scientific literacy, critical thinking, and cognitive achievement in science (Verawati et al., 2022; Fasasi, 2017). Thus, traditional games have a crucial role in ethnoscience learning by offering a unique avenue to integrate cultural heritage and experiential knowledge into educational settings. These games not only provide a platform for students to engage with their cultural roots but also contribute to the holistic development of students across various domains (Gultom et al., 2022).

Implementing traditional games in ethnoscience learning can enhance students' physical-motor skills, socio-emotional development, moral understanding, cognitive abilities, and language proficiency (Gultom et al., 2022). Moreover, traditional games have been found to be effective in improving students' physical fitness and overall well-being (Kusuma et al., 2021). The incorporation of traditional games in education can also serve as a means to strengthen students' character, instill moral values, promote social skills, and enhance language and motor functions (Pramantik, 2021). By utilizing traditional games as educational tools, students can develop a deeper understanding of cultural values and traditions while honing essential skills and competencies (Sulistyaningtyas & Fauziah, 2019). Additionally, traditional games have been linked to improving students' personality traits, motivation, and learning outcomes, highlighting their significance in enhancing educational experiences (Trajkovik et al., 2018).

The implementation of traditional games in educational settings can contribute to the promotion of character education, intellectual development, and emotional intelligence among students (Lubis & Khadijah, 2018). These games offer a practical and engaging way to teach various educational values and foster a positive learning environment (Murtiningsih & Ainia, 2022). By integrating traditional games into the curriculum, educators can create meaningful and contextually rich learning experiences that cater to diverse learning styles and preferences (Suciyati et al., 2021). According to Sotero et al (2020), the use of traditional games in education can also contribute to promoting culturally-sensitive scientific education by articulating local and scientific knowledge, especially in universities as producers of preservice teachers.

Integrate traditional games in ethnoscience learning for preservice teachers, it is essential to consider their perceptions, preparedness, and pedagogical approaches. Preservice teachers can benefit from the incorporation of traditional games as a means to connect with cultural heritage, promote holistic student development, and enhance educational outcomes (Sulistyaningtyas & Fauziah, 2019). Moreover, training preservice teachers to manage cooperative interactions, design developmentally appropriate games, and scaffold learning activities can enhance their ability to implement student-centered models effectively (Silva et al., 2021). By engaging preservice teachers in community-based field experiences, they can expand their pedagogical approaches and gain a deeper understanding of teaching and learning in diverse contexts (Hamilton & Margot, 2019). Additionally, exposure to live models of universal design for learning and blended learning practices can prepare preservice teachers to implement evidence-based strategies in their future classrooms (Hayward et al., 2020).

Conclusion

Based on the research results above, it can be concluded that (1) preservice teachers' perceptions of the implementation of traditional *Sasak* games in ethnoscience learning in each item of the statement, namely item 1 scored 3.30, categorized as Very High; item 2 scored 3.22, categorized as Tall; item 3 scored 2.88, also categorized as Tall; item 4 scored 3.41, categorized as Very High; item 5 scored 3.19, categorized as Very High; item 6 scored 3.28, categorized as Very High; item 7 scored 3.13, categorized as Tall; item 8 scored 3.38, categorized as Very High; item 9 scored 3.37, categorized as Very High; and item 10 scored 3.47, categorized as Very High; (2) preservice teachers hold highly favorable perceptions regarding the implementation of traditional Sasak games in ethnoscience learning, proven by the average score of 3.26, categorized as Very High.

Author Contributions
Sri Supiyati: developing literature study topics and defining literature analysis methodology.
M. Khairul Wazni, Dadang Warta Chandra Wira Kusuma: browsing and mapping literature related to the topic of literature study.
Agus Muliadi: analyzing literature related to literature study topics, writing draft articles, revising, and editing final articles.

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