Integrating Ethnophysics and Mobile Technology: A Needs Analysis of Android-Based Learning Media Through North Maluku Traditional Dance

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Abstract: *Ternate has a variety of traditional dances passed down from generation to generation as a regional identity. One effort to preserve local culture is by integrating traditional dances into Physics learning through an ethnophysics approach. This study aims to identify the need for Android-based ethnophysics learning media to be used in Physics education. The needs analysis focused on students in one of the schools in Ternate, Indonesia. The data collection method used was quantitative, employing purposive sampling techniques. A sample consisting of 66 students and 3 Physics teachers was used to obtain the data. Data were collected through observation, interviews, and the distribution of questionnaire surveys. The results of the needs analysis of students and Physics teachers regarding Android-based ethnophysics learning media that incorporates traditional dances from North Maluku into Physics subjects indicate that such media is indeed needed by both students and Physics teachers in one of the schools in Ternate, Indonesia.*

Key Words*:* Ethnophysics, Android-based Learning Media, Traditional Dances

Introduction

North Maluku, particularly Ternate, is a region rich in culture and history. Ternate is one of the four Sultanates in North Maluku that had a significant influence in the Indonesian archipelago in the past. The Sultanate of Ternate has a long history, having been established since the 13th century. It played a crucial role in the spice trade, especially cloves, which were the main commodity and attracted the interest of European nations. Ternate is home to various traditional dances, such as the Cakalele Dance, which is usually performed at traditional ceremonies or to welcome guests. This dance reflects the spirit of heroism and the history of wars that once took place in the region.

Culture encompasses all the creations, emotions, and creativity of a community, including forms of law, knowledge, tradition, art, language, and so forth, which have become part of the people's lives and are passed down from generation to generation as the identity of a society. Preserving local culture in our region is important, as it fosters a strong sense of national pride (Handayani, 2023; Agus, 2021). Incorporating cultural dances into education can be an effective way to introduce cultural values, history, and artistic skills to students. Learning strategies that focus on teaching local culture represent a form of education based on the unique skills of each region, aiming to strengthen students' character from early education (Suri, 2021; Sakti, 2024).

The initial step in integrating culture into the learning process is identifying physics concepts present within that culture (Govender, 2022; Mashoko, 2022). Traditional dances can be closely linked to physics concepts, particularly those related to motion, energy, and dynamics. Besides the movement in dance, the accompanying musical instruments can also

be associated with physics. Traditional music has a strong connection to physical concepts, especially sound waves.

Ethnophysics is a field of study that links physics concepts with culture, particularly the traditional practices and knowledge held by a community. The term combines “ethno,” referring to culture or ethnography, with “physics,” the science of nature and physical phenomena. Ethnophysics seeks to understand how physics concepts are applied or interpreted in specific cultural contexts (Batlolona, 2022; Astuti, 2022). It is often explored as content for educational materials, focusing on culture as the social heritage of a community (Gadaza, 2025; Murzyn-Kupisz, 2013).

Currently, there are still very few learning activities that relate cultural dances to physics concepts. Integrating traditional dance into physics lessons can be an innovative approach that not only deepens students’ understanding of physics but also enhances their appreciation of local culture. For example, using dance movements to explain concepts such as momentum, force, and energy can make learning more contextual and meaningful for students. This approach can also help preserve cultural heritage while encouraging student interest in science subjects. Teaching materials must be designed and written thoroughly and systematically so they can be used by educators to support and facilitate the learning process (Al-Kamzari, 2025).

The development of educational technology media has undergone significant changes over time, driven by advances in digital technology and the internet. Learning media can be seen as a tool for delivering educational messages and helping to clarify communication so that delivery is not too complicated (Lubis, 2023; Mudinillah, 2022). Utilizing more advanced learning media can significantly increase students' motivation and interest in learning. Technologies such as touch screens, interactive software, and digital presentation tools enable students to interact directly with learning content. This interactivity makes learning more engaging and can boost student participation. Attractive and interactive learning media can help students understand material more easily, anytime and anywhere. Media that includes images, videos, audio, animations, and simulations can engage more senses and enhance students’ memory retention (Astuti, 2019). One form of online learning media is Android-based learning media. The use of Android-based learning media has the potential to improve students’ academic performance, both in cognitive learning outcomes and learning motivation (Astuti, 2018; Listianingsih, 2021).

Based on the discussion above**,** the researcher aims to conduct a study on the needs analysis of Android-based learning media containing ethnophysics material related to traditional dances in North Maluku, Ternate. The purpose of this study is to identify the needs for Android-based learning media featuring ethnophysics content. Without a proper needs analysis, effective learning objectives cannot be achieved through the development of instructional materials.

The novelty of this study lies in the needs analysis for the development of Android-based ethnophysics learning media by integrating the traditional dances of North Maluku as a context for physics education. While previous studies have often connected local wisdom with learning, they were mostly limited to printed teaching materials or conceptual cultural integration. This study offers a new contribution by directing the development of interactive digital media that not only enhances students’ understanding of physics concepts but also

serves as a medium for preserving local culture. Thus, this research opens opportunities for innovation in technology-based science education that is grounded in the richness of regional culture.

Method

This study collected data for a student needs analysis through a questionnaire using a quantitative approach. In quantitative research, a population or sample is typically used to represent the research subjects. The selection of the population or sample was carried out randomly, with certain considerations. Data were collected using specific research instruments, which served as a reference for drawing conclusions in the study.

The results of the student needs analysis were obtained from respondents namely, students using purposive sampling. This technique selects samples randomly while considering specific factors to obtain representative data. Respondents were randomly selected from in one of the schools in Ternate, Indonesia, consisting of 66 students enrolled in Physics classes. Data collection for the needs analysis was conducted through observation, interviews, and questionnaire responses.

The questionnaire included statements and questions related to student needs, the facilities available to both students and the school, as well as topics related to ethnophysics. The questionnaire was developed with a focus on assessing student needs regarding learning media, especially Android-based media. In addition, a needs analysis was also conducted involving three Physics teachers at SMA N 4 Ternate.

Results and Discussion

The analysis conducted in this study includes student character analysis, material analysis, curriculum analysis, student needs analysis, and teacher needs analysis at SMA N 4 Ternate. Based on the research carried out through observations, interviews, and data collection, the following results were obtained:

3.1. Student Character Analysis

One of the crucial stages in the lesson planning process is analyzing student characteristics. Character can generally be seen through interactions with parents, teachers, peers, and the environment, and it can also be inferred from learning outcomes, either directly or through others' observations.

Our analysis of student characteristics was obtained through interviews with Physics teachers at SMA N 4 Ternate. The interview revealed several student traits, such as a learning preference for new and engaging experiences. Students showed more interest in innovative and unique learning media. In addition, while some students were active in class, their talents had not been fully explored due to limited facilities and infrastructure. Several students lso expressed a stronger preference for extracurricular activities like dancing over classroom learning activities.

3.2. Material Analysis

Conducting material and instructional content analysis is essential to determine appropriate materials to be used in classroom learning. Physics is a scientific discipline focused on theories and formulas, both in academic content and in everyday life.

Our material analysis was conducted through interviews with Physics teachers and by observing the school environment at SMA N 4 Ternate. According to the Physics teacher, the material taught follows the curriculum and basic competencies. Meanwhile, from the school

environment observations, the school offers extracurricular and subject activities in the arts, such as performing traditional dances. This provides an opportunity to integrate these activities into learning and relate them to physics material, potentially increasing student engagement.

Based on this connection, the researcher conducted a material analysis focusing on motion in traditional dances from North Maluku.

3.3. Curriculum Analysis

In the curriculum analysis stage, the researcher reviewed the basic competencies in the Physics subject syllabus. Based on the analysis, physics topics related to motion are found in grades X and XI, and the data obtained are as follows:

Table 1. Basic Competencies in Physics Subjects Related to the Concept of Motion

Grade	Basic Competencies	Material
X	• Explain the nature of physics, its role in life, the scientific method, and laboratory safety procedures. • Analyze physical quantities in uniform linear motion (constant speed) and uniformly accelerated linear motion (constant acceleration), along with their applications in daily life, such as traffic safety. • Analyze interactions involving force as well as the relationship between force, mass, and linear motion, and their applications in everyday life.	• The Nature of Physics and the Scientific Procedure: The nature of physics and the importance of studying it, the scope of physics. • Linear Motion: Linear motion with constant speed, linear motion with constant acceleration. • Newton's Laws: Newton's laws of motion, applications of Newton's laws in everyday events. • Momentum and Impulse: Momentum, impulse, perfectly elastic collisions, partially elastic collisions, and inelastic collisions.
XI	• Apply the concepts of momentum and impulse, as well as the law of conservation of momentum, in everyday life.	• Rotational Equilibrium and Dynamics: Torque, moment of inertia, equilibrium of rigid bodies, center of mass, and the law of conservation of angular momentum in rotational motion.

Based on table 1, in Grade X, students are introduced to the nature of physics as a science that systematically studies natural phenomena and its important role in everyday life. The students are introduced to the scientific method, laboratory safety protocols, as well as the fundamental principles of uniform linear motion (constant velocity) and uniformly accelerated linear motion (constant acceleration). In addition, students analyze the relationship between force, mass, and motion based on Newton's Laws, as well as the application of these concepts in real-life situations such as traffic safety and daily physical activities. In Grade XI, the learning continues with the concepts of momentum and impulse, as well as the law of conservation of momentum, applied to various real-world events such as collisions and object motion. Students also begin to study rotational dynamics, including torque, moment of inertia, equilibrium of rigid bodies, center of mass, and conservation of angular momentum. This material equips students with a more advanced understanding of how objects move and interact in mechanical systems, thus expanding their physics knowledge into more practical and in-depth applications.

3.4. Needs Analysis

Needs analysis is essential to determine students' readiness and their requirements for learning media. At this stage, we distributed a needs questionnaire for Android-based learning media, which was completed by 66 students and 3 Physics teachers at SMA N 4 Ternate.

The questionnaire was created using Google Forms and consisted of several questions related to learning media and ethnophysics. The results of the needs analysis from both students and teachers are presented in the following data:

Table 2. Results of Students' Needs Analysis.

No	Student Needs Analysis Questions	Yes	No
1	Are you enthusiastic about participating in Physics learning in the classroom?	63	3
2	Do you find it difficult to learn Physics materials?	20	46
3	Is current Physics learning connected to local culture in your environment?	50	16
4	Do you need alternative learning materials that are easier and more interesting to understand Physics?	55	11
5	Are you familiar with the concept of ethnophysics?	27	39
6	Do you agree with the development of an Android-based ethnophysics learning application?	57	9
7	Do you own a smartphone or tablet?	57	9
8	Is Physics currently being taught using other learning approaches?	42	24
9	Does the printed textbook used in class help develop your creative thinking skills?	61	5
10	Does the printed textbook used in class enhance your understanding?	64	2
11	Have you ever learned using an Android smartphone?	54	12
12	Are you familiar with the traditional dances in Ternate?	58	8
13	Do you understand the concept of kinematics well?	26	40
14	Do you have a strong interest in learning Physics?	64	2
15	Do you prefer learning Physics through visual aids like images or videos?	47	19

Based on the table 2 of the results of the needs analysis given to the students of SMA N 4 Ternate, the following data were obtained: 63 students showed enthusiasm in physics learning activities in class, 57 students owned smartphones which had also been used in learning activities, and most students agreed with the idea of using alternative Android-based teaching materials via smartphones to explain physics concepts connected to local culture. Students showed greater interest in physics learning that presents material with visuals and images. Additionally, it was found that students are familiar with traditional dances; however, they do not yet understand the physics concepts involved in those dances.

Table 3. Results of Teachers' Needs Analysis.

No	Teacher Needs Analysis Question Items	Yes	No
1	Do you know about Ethnophysics?	1	2
2	Have you ever implemented Ethnophysics-based learning?	0	3
3	In your current physics teaching, do you relate the material to the surrounding culture?	1	2
4	Do you need alternative teaching materials that are easier and more engaging to help understand physics concepts?	3	0
5	Do you use technology in your teaching?	3	0
6	Do you agree with the development of an Android-based Ethnophysics learning application?	3	0
7	Do you use a smartphone or tablet in your teaching?	3	0
8	Do you enjoy innovating in teaching physics?	3	0

No	Teacher Needs Analysis Question Items	Yes	No
9	Is the kinematics material you teach well understood by your students?	2	1
10	Have you ever used the surrounding environment as a learning resource in your teaching?	3	0

Based on the table 3, the results of the Android-based learning media needs questionnaire distributed to three Physics teachers at SMA N 4 Ternate, it was found that only one teacher was already familiar with ethnophysics, conducted learning activities by integrating cultural elements, and used a tablet in the teaching process. However, none of the three teachers had implemented ethnophysics-based learning, although all agreed with the development of an Android-based ethnophysics learning application.

Studying local culture provides double benefits for physics teachers. In addition to instilling cultural values in students as part of preserving regional heritage, teachers can also enhance the relevance of physics learning, making it easier to understand and more relatable to students' real-life experiences (Oladejo, 2023; Boe, 2018). This can foster interest and motivation in learning, as students feel that the material being taught is closely connected to their everyday lives (Ratri, 2025). Teachers who are able to relate physics to local culture also help create contextual, meaningful learning that appreciates diversity.

The integration of physics and local culture is also part of an ethnoscience approach that can strengthen students' identity as members of a scientific community rooted in their cultural heritage. Physics teachers are required to have sufficient understanding of local culture in order to identify the potential of local wisdom that can be transformed into physics learning material (Laos, 2020; Andrini, 2019; Suastra, 2017). In this way, teachers not only serve as conveyors of scientific knowledge but also as agents of cultural preservation and developers of innovative and character-based learning models. Learning oriented toward local wisdom can improve students' achievement, as it provides deeper contextual experiences that help them grasp the material more effectively (Eliezanatalie, 2023; Susanto, 2023; Hikmawati, 2023).

To support this integration, the use of Android-based learning media can be an effective and engaging solution (Humairah, 2020; Maryani, 2025; Cahya, 2020). This type of media enables teachers to present physics materials connected to local culture through interactive applications, videos, simulations, animations, and infographics that students can easily access via smartphones or tablets. Besides increasing the appeal of the lessons, Android-based media also supports independent and flexible learning (Novaliendry, 2020; Bahri, 2020). With the development of Android-based ethnophysics learning applications, teachers can enrich their teaching methods while utilizing technology as a bridge between science and culture.

The use of Android-based learning media offers numerous benefits in the learning process, one of which is enhancing student engagement and motivation (Romadiah, 2022; Arifah, 2025; Yulianti, 2024). With interactive interfaces, easy access, and flexibility in terms of time and place, students can become more active and independent in understanding the material (Purwanto, 2024; Pratama, 2024). Moreover, Android-based media allows the integration of various multimedia elements such as animations, videos, and simulations, which help explain

abstract concepts in a more concrete and engaging way. This greatly supports contextual learning and aligns well with the digital habits of today's generation.

Conclusion

The results of this study indicate that both students and physics teachers at SMA N 4 Ternate demonstrate a strong need for Android-based ethnophysics learning media that integrates traditional dances of North Maluku into physics education. Such media is expected to enrich the learning process by making physics more contextual, engaging, and culturally relevant, while also contributing to the preservation of local heritage. The findings highlight the potential of ethnophysics-based approaches in fostering student interest and motivation, as well as supporting teachers in developing innovative learning strategies. For future research, it is recommended to design, develop, and test a prototype of the Android-based ethnophysics application in classroom settings to evaluate its effectiveness in improving students' conceptual understanding, critical thinking skills, and cultural appreciation.

References

Agus, C., Saktimulya, S. R., Dwiarso, P., Widodo, B., Rochmiyati, S., & Darmowiyono, M. (2021). Revitalization of local traditional culture for sustainable development of national character building in Indonesia. In *Innovations and traditions for sustainable development* (pp. 347–369).

Al-Kamzari, F., & Alias, N. (2025). A systematic literature review of project-based learning in secondary school physics: Theoretical foundations, design principles, and implementation strategies. *Humanities and Social Sciences Communications, 12*(1), 1–18.

Andrini, V. S., Maduretno, T. W., & Yusro, A. C. (2019). Development of physics learning e-module based on local culture wisdom in Pontianak, West Kalimantan. *Journal of Physics: Conference Series, 1381*(1), 012045.

Arifah, A. F., Ubaidillah, U., & Muhith, A. (2025). Introducing android-based digital learning media assisted by iSpring Suite in science and social studies learning in elementary schools. *Journal of Educational Research and Practice, 3*(1), 149–166. https://doi.org/10.70376/jerp.v3i1.352

Astuti, D. P., Bhakti, Y. B., & Astuti, I. A. D. (2019). Developing Adobe Flash-based mathematics learning media for 7th-grade students of junior high school. *Journal of Physics: Conference Series, 1188*(1), 012098.

Astuti, I. A. D., Dasmo, D., Nurullaeli, N., & Rangka, I. B. (2018). The impact of pocket mobile learning to improve critical thinking skills in physics learning. *Journal of Physics: Conference Series, 1114*(1), 012030.

Astuti, I. A. D., Sumarni, R. A., Setiadi, I., & Damayanti, A. (2022). Ethnophysical studies on Salai Jin dance in North Maluku as a source of learning physics. In *Proceeding International Conference on Digital Education and Social Science* (Vol. 1, No. 1, pp. 80–87).

Bahri, A., Nur, M. S., Pagarra, H., & Saparuddin, S. (2020). Android-based mobile learning supported the independent learning of senior high school students in Covid-19 pandemic. In *Proceedings of the International Conference on Science and Advanced Technology* (pp. 22–32).

Batlolona, J. R., Leasa, M., Papilaya, P. M., Jamaludin, J., & Taihuttu, J. (2022). Exploration of students' conceptual understanding and ethnophysics: A case study of tifa in the Tanimbar Islands, Indonesia. *Jurnal Penelitian Pendidikan IPA, 8*(6), 2717–2727.

Bøe, M. V., Henriksen, E. K., & Angell, C. (2018). Actual versus implied physics students: How students from traditional physics classrooms related to an innovative approach to quantum physics. *Science Education, 102*(4), 649–667.

Cahya, R. N., Suprapto, E., & Lusiana, R. (2020). Development of mobile learning media based Android to support students understanding. *Journal of Physics: Conference Series, 1464*(1), 012010.

Eliezanatalie, S., & Deta, U. A. (2023). Needs analysis of physics learning media integrated local wisdom. *International Journal of Research and Community Empowerment, 1*(2), 39–45. https://doi.org/10.58706/ijorce.v1n2.p39-45

Gadaza, A., Manera, A., Santos, S., Alih, C., & Caban, R. (2025). Reviving the past, teaching the future: The role of Philippine cultural heritage in curriculum development of teacher education programs focus. *International Journal on Culture, History, and Religion, 7*(SI2), 80–97.

Govender, N., & Mudzamiri, E. (2022). 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, 17*(3), 827–850.

Handayani, R., Narimo, S., Fuadi, D., Minsih, M., & Widyasari, C. (2023). Preserving local cultural values in forming the character of patriotism in elementary school students in Wonogiri Regency. *Journal of Innovation in Educational and Cultural Research, 4*(1), 56–64.

Hikmawati, & Suastra, I. W. (2023). Local wisdom-based learning to develop student's creativity in high school physics studies course. *AIP Conference Proceedings, 2619*(1), 090016.

Humairah, N., Muchtar, Z., & Sitorus, M. (2020). The development of android-based interactive multimedia for high school students. In *Proceedings of the 5th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2020)* (pp. 113–119).

Laos, L. E., & Tefu, M. (2020). The development of physics teaching materials based on local wisdom to improve students' critical thinking ability. *JIPF (Jurnal Ilmu Pendidikan Fisika), 5*(2), 107.

Listianingsih, M., Astuti, I. A. D., Dasmo, D., & Bhakti, Y. B. (2021). Android-based comics: An alternative media to improve scientific literacy. *Jurnal Penelitian dan Pembelajaran IPA, 7*(1), 105–117.

Lubis, L. H., Febriani, B., Yana, R. F., Azhar, A., & Darajat, M. (2023). The use of learning media and its effect on improving the quality of student learning outcomes. *International Journal of Education, Social Studies, and Management, 3*(2), 7–14.

Maryani, I., Suyatno, S., Arfiani, I., Nizaar, M., Astuti, I. A. D., & Sulisworo, D. (2025). Gamified mobile-based learning approach: Efforts to improve students' engagement and learning quality in remote schools in Indonesia. *Educational Process: International Journal*.

Mashoko, D. (2022). Indigenous artefacts and physics curriculum: Teaching science as a cultural way of knowing. *Cultural Studies of Science Education, 17*(3), 863–874.

Mudinillah, A., Chaniago, N. D. O. P., & Pahmi, P. (2022). Utilization of the Inshot application as a learning media in elementary schools during the COVID-19 pandemic. *Lingeduca: Journal of Language and Education Studies, 1*(1), 24–36.

Murzyn-Kupisz, M., & Działek, J. (2013). Cultural heritage in building and enhancing social capital. *Journal of Cultural Heritage Management and Sustainable Development, 3*(1), 35–54.

Novaliendry, D., Darmi, R., Hendriyani, Y., Nor, M., & Azman, A. (2020). Smart learning media based on android technology. *International Journal of Innovation, Creativity and Change, 12*(11), 715–735.

Oladejo, A. I., Okebukola, P. A., Akinola, V. O., Amusa, J. O., Akintoye, H., Owolabi, T., Olateju, T. T. (2023). Changing the narratives of physics-learning in secondary schools: The role of culture, technology, and locational context. *Education Sciences, 13*(2), 146.

Pratama, W. (2024). Development of android-based occupational safety and health learning media to improve understanding of work accidents for vocational high school students. *VANOS Journal of Mechanical Engineering Education, 9*(2). http://dx.doi.org/10.30870/vanos.v9i2.29354

Purwanto, H., Sari, Y. Y., & Fitriani, S. (2024). Enhancing Pancasila student profiles: Android-based learning media in the independent curriculum for elementary schools. *Al-Ishlah: Jurnal Pendidikan, 16*(4), 5706–5717. https://doi.org/10.35445/alishlah.v16i4.6097

Ratri, D. P., Rachmajanti, S., Anugerahwati, M., Laksmi, E. D., & Gozali, A. (2025). Fostering cultural competence: Developing an English syllabus for young learners in the Indonesian EFL context with emphasis on local culture to maintain students' identity. *Cogent Education, 12*(1), 2440177.

Romadiah, H., Dayurni, P., & Fajari, L. E. W. (2022). Meta-analysis study: The effect of android-based learning media on student learning outcomes. *International Journal of Academic Education, 3*(4), 253–263. https://doi.org/10.46966/ijae.v3i4.300

Sakti, S. A., Endraswara, S., & Rohman, A. (2024). Integrating local cultural values into early childhood education to promote character building. *International Journal of Learning, Teaching and Educational Research, 23*(7), 84–101.

Sakti, S. A., Endraswara, S., & Rohman, A. (2024). Revitalizing local wisdom within character education through ethnopedagogy approach: A case study on a preschool in Yogyakarta. *Heliyon, 10*(10).

Suastra, I. W., Jatmiko, B., Ristiati, N. P., & Yasmini, L. P. B. (2017). Developing characters based on local wisdom of Bali in teaching physics in senior high school. *Jurnal Pendidikan IPA Indonesia, 6*(2), 306–312.

Suri, D., & Chandra, D. (2021). Teacher's strategy for implementing multiculturalism education based on local cultural values and character building for early childhood education. *Journal of Ethnic and Cultural Studies, 8*(4), 271–285.

Susanto, R., Husen, M. N., & Lajis, A. (2023). The effect on the integration of local wisdom in physics educational applications: A review. *AIP Conference Proceedings, 2751*(1), 060006. https://doi.org/10.1063/5.0143441

Yulianti, A., & Sedayu, B. A. (2024). The influence of using android-based interactive learning applications on student learning motivation. *Journal of Advanced Learning Media Development, 1*(2), 62–68. https://doi.org/10.37396/jalmd.v1i2.8