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Development of a Digital Pocket Book. it is Based on Dompu Cultural Ethnoscience "*Ngahi Rawi Pahu*" the Goal is to Strengthen 21st-Century Science Skills.

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Abstract: The purpose of this research is to develop a digital pocket book media based on Dompu cultural ethnoscience to strengthen 21st century science skills, which include critical thinking, creative, collaborative, and communication skills. The research method uses Research and Development (R&D) model with Addie step adaptation. Stages of research: needs analysis through interviews and observations on teachers and Junior High School students; digital pocket book content design with integration of local science and culture materials; product development through Android-based software; limited trials and revisions; and evaluation of media effectiveness. Semi-structured interview data collection techniques, participatory observation, media and material validation questionnaires, and student science skills tests. Quantitative descriptive data analysis for validation data and effectiveness tests, and qualitative analysis for interview and observation data. The results showed that the digital pocket book media has a very high feasibility rate, with a validation score of 92.5% and 94.0% material expert media expert. A trial of 60 students showed significant improvements in 21st century science skills, with an average pretest score of 63.4 and posttest of 86.7. Analysis of paired t-tests resulted in a value of $t = 14.52$ ($p < 0.001$), showing significant differences before and after the use of media.

Keywords: Digital Pocket Book; Ethnoscince; Ngahi Rawi Pahu; 21st Century Skills.

Introduction

In today's era of digitalization, education is required to produce individuals with 21st-century skills, such as critical thinking, creativity, communication, and collaboration. These skills are essential for facing the challenges of an increasingly complex and evolving era (Amin et al., 2022). However, the implementation of learning that can hone these skills still faces various obstacles, especially in integrating local cultural values rich in wisdom into the education curriculum (Zahro & Fauziah, 2024). One approach that can bridge this gap is ethnoscience, which is the combination of modern science and local wisdom (Andayani et al., 2021). This approach allows students to understand scientific concepts in the context of their own culture, making learning more meaningful and relevant (Festiyed et al., 2022). Research shows that ethnoscience-based learning can improve students' science literacy by linking lesson material to the local culture (Muhammad Fuad et al., 2020).

Various media such as modules, worksheets, and educational videos that highlight local culture as a context in science learning. For example, research Adelia

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et al. (2023); Khairunisa et al. (2025) shows that ethnoscience can improve science literacy and student engagement in learning. In addition, research by Mukti et al. (2022) proves that the ethnoscience approach can strengthen student character through the integration of cultural values in learning materials. However, the use of interactive digital formats that specifically highlight certain local cultures, such as "Ngahi Rawi Pahu" from Dompu, is still very limited. Therefore, this research is important because of the low integration of local culture in science learning, even though local wisdom such as the "Ngahi Rawi Pahu" philosophy from Dompu has strong scientific and character values to support contextual learning The development of an ethnoscience-based digital pocket book is an innovative solution to bridge this gap, as it provides interactive, accessible, and relevant learning materials for students.

The novelty of this research lies in the development of a digital pocket book based on ethnoscience that combines Dompu Ngahi Rawi Pahu cultural knowledge with a modern technological approach, which has not been widely applied in the local cultural learning of the Dompu community. Unlike traditional learning, which tends to use conventional textbooks, this research utilizes interactive digital media, such as images, videos, and animations, to present cultural material in a more interesting and easy-to-understand way. Thus, the development of an ethnoscience-based digital pocketbook that integrates the local cultural values of Dompu Nggahi Rawi Pahu is expected to be an innovation in science education that not only improves students' 21st-century skills but also preserves and internalizes local wisdom in the educational process.

Method

This research was conducted in junior high schools in Dompu Regency, West Nusa Tenggara (NTB), which became the location for testing the development of digital pocketbooks based on ethnoscience. This location was chosen based on the relevance of the local culture of "Ngahi Rawi Pahu," which is still strong in the school environment and surrounding community. All stages were carried out gradually in accordance with product development procedures based on the R&D method. Research population and sample.

The population in this study was all public junior high school students in Dompu Regency. The selection of this population was based on the suitability of the students' cognitive development level with the science material developed in the digital pocketbook based on ethnoscience. The research sample consisted of 150 eighth-grade students from SMPN 1 Woja who became subjects of limited trials and field trials. The sample consisted of one experimental class that used a digital pocket book based on ethnoscience and one control class that used conventional teaching materials to determine the effectiveness of the developed media in improving students' 21st-century skills.

This research design uses a Research and Development (R&D) approach by adapting the ADDE development model, which consists of several stages, namely: Analysis (needs analysis), planning, initial product development, expert validation, product revision, limited testing, further revision, and field testing. This approach was chosen to produce a valid, practical, and effective product in the form of a digital pocketbook based on Dompu cultural ethnoscience, "Ngahi Rawi Pahu," which aims to improve students' 21st-century skills. In the effectiveness testing stage, a quasi-experimental design in the form of a Nonequivalent Control Group Design was used, in which there were experimental and control classes, each given different treatments to compare the learning outcomes and skills achieved. The research stages are as shown in Figure 1.

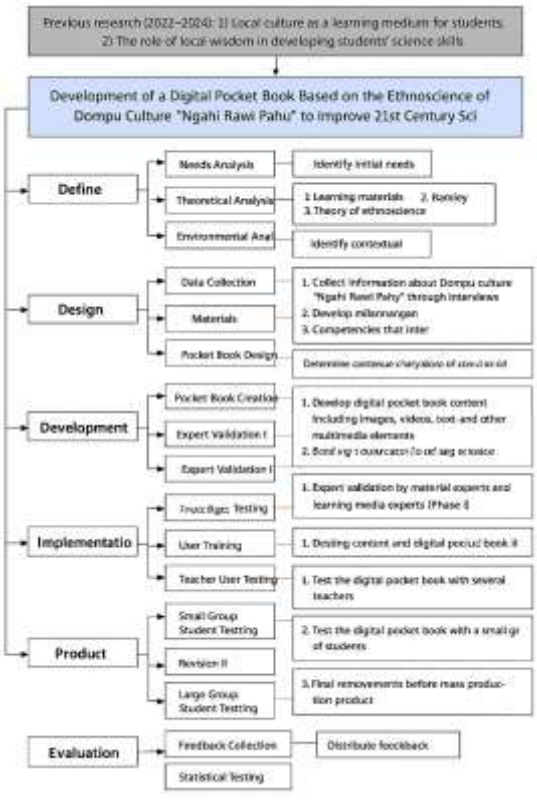

Figure 1. Research flow

Data analysis in this study was conducted quantitatively and qualitatively according to the type of data obtained at each stage. Qualitative data, such as suggestions and comments from experts and responses from students and teachers, were analyzed descriptively

to assess the feasibility and practicality of the product. Meanwhile, quantitative data in the form of expert validation scores were analyzed using averages to determine the level of product feasibility. In the effectiveness testing stage, student pretest and posttest data were analyzed using t-tests and ANOVA to see significant differences between the experimental and control classes. This analysis aimed to measure the extent to which ethnoscience-based digital pocketbooks were effective in improving students' 21st-century skills.

Result and Discussion

The results of the student needs analysis show that the majority of students (87%) feel that the science lessons they have been attending tend to be monotonous and uninteresting because they are limited to textbooks and verbal explanations from teachers. Based on questionnaires and interviews, students expressed a desire to use interactive digital learning media that includes visualizations of the material, videos, and quizzes that can be accessed via their devices. A total of 82% of students stated that they would be interested if science learning was linked to local wisdom, particularly the Dompu culture of "Ngahi Rawi Pahu," as it is considered relevant to everyday life and helps them understand scientific concepts in context. These findings are in line with the research by Sulistri et al. (2020), which states that the integration of ethnoscience in digital media can increase student motivation and engagement in the learning process. Therefore, the development of a digital pocketbook based on ethnoscience is expected to address students' need for learning media that is not only informative and easily accessible but also capable of meaningfully linking science with local cultural values.

Table 1. Validation results of digital pocket book media

Aspect	Score (%)	Categories
Material expert	92.5	Highly appropriate
Media expert	94.0	Highly appropriate

Based on the validation results, the Dompu Cultural Ethnoscience Digital Pocket Book "Ngahi Rawi Pahu" received very high scores in terms of both content and media. As shown in Table 1 and Graph 1, validation by content experts showed a percentage of 92.5% in the very good category, while validation by media experts reached 94.0% in the very good category. This indicates that the content is relevant to the curriculum, conceptually accurate in terms of science, and appropriate to the cultural context of Dompu. In terms of media, the display, navigation, and interactivity are also considered optimal for supporting 21st-century science learning.

Validation of the Dompu Cultural Ethnoscience Digital Pocketbook "Ngahi Rawi Pahu" from two assessment perspectives, namely subject matter experts and media experts. The subject matter expert validation scored 92.5%, indicating that the content presented is highly suitable for use in science education. This assessment covers aspects of material suitability with the curriculum, accuracy of scientific concepts, relevance of cultural integration, and completeness of reference sources. Meanwhile, media expert validation shows a score of 94.0%, which means that the quality of the design, appearance, navigation, and interactivity of the digital pocket book is in the very feasible category. This score, which is slightly higher than that of the subject matter experts, indicates that the developed media has met the criteria of visual appeal, ease of use, and effectiveness of interactive features in supporting the learning process (Mubin et al., 2024). Both scores show that the digital pocket book media has met high standards of suitability in terms of both substance and technical aspects. These results are in line with the findings of Fitria & Ayani (2025), who stated that digital media based on ethnoscience that is designed with consideration of content and technical aspects has great potential to increase student engagement and understanding. With a feasibility rating of over 90% in both aspects, this digital pocket book is suitable for use in science education and has the potential to make a significant contribution to strengthening students' 21st-century skills.

Next, a limited trial was conducted on 60 junior high school students to measure the effectiveness of the media. The results of the pretest and posttest analysis in Table 2 and Graph 2 show an increase in the average score for 21st-century science skills from 63.4 in the pretest to 86.7 in the posttest. This increase indicates that the use of ethnoscience-based digital pocketbooks can improve students' critical thinking, creativity, collaboration, and communication skills.

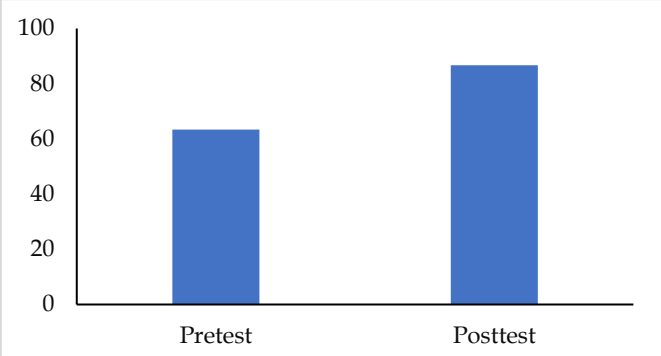

Figure 1. Comparison of pretest and posttest scores among students

The average pretest and posttest scores of students after using the Dompu Cultural Ethnoscience Digital Pocketbook "Ngahi Rawi Pahu" media. The average pretest score of 63.4 illustrates the initial ability of students before receiving treatment using this media. After learning using the digital pocket book, the average posttest score increased to 86.7, showing an increase of 36.7% from the initial condition (Figure 1). This increase shows that the use of ethnoscience-based media can help students understand science material in a more contextual and interesting way, so that 21st-century skills such as critical thinking, communication, and problem solving can be honed.

Statistically, the paired t-test results produced a t-value of 14.52 with $p < 0.001$, which means that there was a significant difference between the scores before and after the treatment. Thus, the developed media was not only substantively and technically feasible, but also effective in strengthening students' 21st-century science skills.

Table 2. Effectiveness Test Results (Pretest–Posttest)

Tes type	Avarage Score	N	Standard Deviasi	Increase (%)
Pretest	63.4	60	6.8	-
Posttest	86.7	60	5.2	36.7

Table 3. Paired t-test Statistical Test Results

Variable	t-count	df	Sig. (p)	Conclusion
Pretest–Posttest	14.52	59	< 0.001	significant difference ($p < 0.05$)

A paired t-test produced a t-value of 14.52 with $p < 0.001$, which means that the increase was statistically significant. This finding is in line with the research by Fitri et al. (2023), which reported that the integration of ethnoscience in technology-based learning can significantly improve student motivation and learning achievement. Thus, the digital pocketbook developed is not only appropriate in terms of content and design, but also proven to be effective in improving student learning outcomes, while providing a learning experience relevant to the local culture of Dompu.

Table 4. Summary of Interview and Observation Findings

Sources of Data	the main findings
Teachers	Learning Media are less varied; need local cultural integration; students are less active in asking questions
Students	are interested in digital media; want learning that features visuals and cultural stories
Classroom observation	student participation is low; learning activities tend to be one-way; teacher-student interaction is limited.

Table 6. Expert Validation Results

Assessment Aspects	Subject Matter Expert (%)	Media Expert (%)	Learning Expert (%)	Average (%)	Criteria
Content Suitability	90	–	–	90	Highly Recommended
Language	85	–	–	85	Highly Recommended
Media Presentation	–	88	–	88	Highly Recommended
Display Design	–	92	–	92	Highly Recommended
Model Suitability	–	–	89	89	Highly Recommended
Average	87.3	90.0	89.0	88.8	Highly Recommended

Based on interviews with teachers and students, as well as direct observation in the classroom. From the teachers' perspective, it was identified that the learning media used so far is still not very varied, so that learning tends to be monotonous. Teachers emphasized the need for

Integrating local culture to provide relevant context and increase student interest in learning (Luciani & Malihah, 2020). Teachers also observed low student activity in asking questions, which indicates a lack of engagement in the learning process. From the students' perspective, the majority expressed interest in the use of digital media, especially those that display visualizations of material and stories based on culture. This reflects that students want learning that is more interactive, contextual, and visually appealing (Noventue et al., 2024). Media that combines digital technology with local wisdom is believed to increase curiosity and facilitate understanding of the material. Classroom observations reinforce these findings, where student participation is low and learning activities are more one-way. Teacher-student interaction was also limited, which meant there was little opportunity for students to actively express their opinions or ask questions. This condition is in line with research Hartati et al. (2022) which confirms that science learning will be more meaningful if it utilizes contextual media that connects scientific concepts with local culture.

The validation results show that the digital pocketbook is in the highly feasible category. This means

that the media has met the feasibility aspects of content, language, and presentation in accordance with BSNP standards. The integration of ethnoscience through the Ngahi Rawi Pahu culture enriches the context of science learning and is considered relevant by the validators.

Table 7. Media Effectiveness Test Results

21st Century Skills	Pre-test (Mean)	Post-test (Mean)	N-Gain	Categories
Critical Thinking	62	82	0.53	Moderate
Collaboration	64	85	0.58	Moderate
Creativity	60	84	0.60	Moderate
Communication	65	88	0.66	High
Average	62.8	84.8	0.59	Moderate

The effectiveness test results show that the Dompu Ngahi Rawi Pahu culture-based digital pocketbook media can significantly improve students' 21st-century science skills. The average pre-test score of 62.8 increased to 84.8 on the post-test, with an N-Gain value of 0.59, which is classified as moderate. This shows that the developed media is quite effective in strengthening 21st-century skills. In terms of critical thinking, there was an increase from 62 to 82 with an N-Gain of 0.53 (moderate). This increase indicates that the media can help students practice critical thinking skills through the context of local culture. The collaboration aspect also increased from 64 to 85 with an N-Gain of 0.58 (moderate), indicating that ethnoscience-based media encourages interaction between students in solving problems together.

The creativity aspect received the second highest increase, from 60 to 84 with an N-Gain of 0.60 (moderate). This confirms that the integration of local culture provides space for students to imagine, develop ideas, and create creative solutions. Meanwhile, the communication aspect showed the highest results with an increase from 65 to 88 and an N-Gain of 0.66 (high). These results are in line with the cultural characteristics of Ngahi Rawi Pahu, which emphasize the importance of communication, togetherness, and mutual cooperation.

The development of a digital pocket book based on the ethnoscience of the Dompu Ngahi Rawi Pahu culture showed excellent expert validation results. This indicates that the media meets the criteria for content, language, and presentation. The integration of local culture in learning media is in line with efforts to contextualize science so that it is closer to students' experiences. According to Tanjung et al. (2025), culture-based learning can improve students' conceptual understanding because they learn through contexts that are familiar in their daily lives.

Student response to the media was also very positive, especially in terms of visual appeal and ease of use. Digital pocket books facilitate more interactive learning and can be accessed at any time, thereby increasing learning motivation (Nudiati & Sudiapermana, 2020). This is in line with the findings of Andriyani et al. (2024), who stated that the use of digital media in learning can increase student active participation and create a more enjoyable and meaningful learning experience.

The effectiveness of the media was demonstrated by an increase in pre-test and post-test scores, with an average N-Gain in the moderate to high range. The greatest improvement was in communication skills, which are relevant to Ngahi Rawi Pahu values such as mutual cooperation and deliberation. These results reinforce the findings of Lestari et al. (2024) that the integration of ethnoscience not only improves cognitive learning outcomes but also develops 21st-century skills, particularly communication and collaboration. Overall, these findings prove that the developed media is not only suitable for use but also capable of improving students' important 21st-century skills. Although most aspects were in the moderate category, the achievement in communication skills, which was in the high category, provided a strong indication that local culture-based media is effective in shaping character while strengthening students' abilities to face modern learning challenges (Pratama & Setyasto, 2024).

Conclusion

The results showed that the digital pocket book media has a very high feasibility rate, with a validation score of 92.5% and 94.0% material expert media expert. A trial of 60 students showed significant improvements in 21st century science skills, with an average pretest score of 63.4 and posttest of 86.7. Analysis of paired t-tests resulted in a value of $t = 14.52$ ($p < 0.001$), showing significant differences before and after the use of media. Needs analysis involving teachers, students, and classroom observation reveals the need for Learning media that are varied, interactive, and integrate local wisdom. Thus, this digital pocket book not only

enhances the understanding of science concepts, but also fosters an appreciation of local culture, as well as supporting the strengthening of 21st century skills such as critical thinking, creativity, and collaboration.

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Author Contributions
D.S: Developing a research plan, Coordinating all stages of the research, from planning to implementation to report preparation, Planning and designing the initial product, Developing a digital pocketbook based on ethnoscience, Responsible for validity and quality. N.I: Conducting preliminary studies to identify the problem, conducting validation with subject matter, media, and language experts, analyzing the needs of collecting initial data, designing the visual and technical appearance of the digital pocketbook using the application, conducting limited product trials with students, and preparing research reports and scientific articles based on the results of the data analysis. N.A: create digital pocket book designs in applications/websites.

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Conflicts of Interest
The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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