Developing The Gorga Batak Toba Mobile Book: A Digital Innovation for Fine Arts Practice and Education in Indonesian Higher Education

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Abstract: This study aims to develop mobile-book teaching materials for the Nusantara Ornaments course, focusing on Toba Batak Gorga as an effort to transform the digital learning ecosystem in higher education. The research employs a research and development (R&D) method using the 4-D model—Define, Design, Develop, and Disseminate. Data were collected through observations, interviews, document analysis, and questionnaires, and were analyzed using a developmental research approach. Product trials were conducted with Fine Arts students at Universitas Negeri Medan (small group, n = 120) and students at Universitas Negeri Padang, Universitas Negeri Semarang, and Universitas Muhammadiyah Makassar (large group, n = 240). Expert validation covered four domains: cultural heritage content, learning media, visual communication design, and language (Indonesian and Toba Batak). In the Define stage, the needs analysis emphasized integrating the philosophy of Gorga with contemporary digital design techniques. The Design stage produced responsive prototypes featuring high-resolution visuals and structured learning flows, while the Develop stage incorporated interactive features to support hybrid learning. Validation results showed an overall average score of 75.85% ("Good" category), consisting of 75.86% from cultural heritage expert I, 73.79% from cultural heritage expert II, 79.14% from the design expert, and 74.61% from the linguist. These findings confirm that the developed mobile book aligns with the 4-D development procedures and meets the criteria of an innovative learning medium that provides flexible access, supports both in-class and out-of-class learning, and promotes cultural preservation by transforming the knowledge of Toba Batak Gorga into accessible digital resources. The dissemination plan includes implementation guidelines for lecturers and a mechanism for continuous improvement informed by cross-cultural learning analytics across universities in Indonesia.

Introduction

Global digitalization encourages the preservation and education of traditional arts in Indonesia; The demands of documentation and transmission to younger generations are fueling the use of digital images and fabrication as well as mobile learning platforms, which have been shown to expand access and increase the effectiveness of learning in higher education (Bekele et al., 2018; Freina & Ott, 2015; Hidayat & Khotimah, 2019; Noh et al., 2009). Indonesia as a multicultural country has a wealth of diverse traditional arts, one of which is the Gorga Batak Toba, a typical North Sumatran carving art that is full of philosophical meaning. In an era of globalization that threatens traditional values, the preservation of local culture is crucial. Although governments and related agencies have digitized ancient manuscripts and established preservation policies, challenges such as limited funding, environmental degradation, and lack of innovative methodologies remain major

obstacles (Agostini, 2016; Sinulingga et al., 2025). Gorga Batak Toba is a traditional carving art imbued with a deep philosophical and spiritual meaning. Each motif inside the traditional Batak Toba house (Bolon house) serves not only as an aesthetic element but also as a symbol of education and cultural identity. Gorga Batak Toba material is an integral component of the archipelago ornament course offered by the Fine Arts Education Study Program, Department of Fine Arts, State University of Medan. There is an urgent need to develop teaching materials that are relevant, contextual, and engaging to students, as conventional approaches often fail to stimulate students' interest in traditional art forms (James et al., 2024; Triyono et al., 2024).

Previous research has generally focused on physical preservation and visual documentation (form, motif, meaning, and architectural context) (Situngkir, 2012). Documenting gorga on houses/buildings around Lake Toba and analyzing fractal geometry to "deconstruct" its traditional patterns (Sitindjak et al., 2016). Through a field survey in Samosir examined the evolution of the shape and meaning of the four gorga motifs in the Batak Toba house. Then various gorga ornaments were mapped in three tourist village areas and emphasized their symbolic function (Ditasona, 2018). Exploring geometric transformations (reflection, translation, rotation, etc.) in gorga motifs as an ethnomathematical study (Simanjuntak & Pardede, 2021). Interpreting the historical value and meaning of gorga in the traditional house of Batak Toba with a semiotic approach., and (Tulus & Siburian, 2022). Overall, the results of this study enrich the documentation and cultural meaning, but have not touched much on the development of digital learning media for higher education, so the research conducted by this researcher opens a research gap for the development of Gorga Batak Toba thematic mobile books.

Given the conditions mentioned above, a new approach to cultural heritage education is essential. This approach not only covers general learning but can also adapt to technological advances and the specific needs of students. This study uses a 4-D development model to create teaching materials in the form of a mobile book of Gorga Batak Toba material. This material is designed to be visually appealing, contextual, and interactive. This methodological framework facilitates product design literacy, testing, and improvement based on user and expert feedback. As a result, the teaching materials produced are improved in their effectiveness and are more in line with the characteristics of fine arts education (Bekele et al., 2018; Quesnel & Stoesz, 2025).

The novelty of the results of this research does not only lie in the development of mobile books as a digital learning medium, but further in the integration of the symbolic value of the Gorga Batak Toba culture into interactive digital design. Each Gorga motif that is full of philosophical meaning is not only represented visually, but is processed in digital format with interactive features such as zoom-in/zoom-out, quizzes, and gradual learning flows that allow students to understand philosophy while practicing fine art skills based on local wisdom. Thus, this research presents innovations in the form of cultural digitalization that not only maintain aesthetic aspects, but also move traditional symbolic values into the context of modern learning that is relevant to the creative industry era.

Academically, this research enriches the treasures of Educational Design Research in the context of local art and culture; In practice, it presents ready-to-use mobile book teaching materials, complete with implementation guidance (flow, assessment, and scaffolding) while bridging the collaboration of campuses, communities, and local artists for sustainable cultural preservation (Addison, 2000; Kukulska-Hulme et al., 2009; Leinonen et al., 2016; Marty, 2014; Mason & Vavoula, 2021)

Previous research on the Toba Batak Gorga has mostly focused on aspects of physical documentation and visual studies, such as shapes, symbolic meanings, architectural contexts, to geometric and ethnomathematical analysis. However, there has not been much research that has developed digital learning media specifically aimed at fine arts higher education, especially those that are able to integrate Gorga's philosophy into interactive learning experiences and skills-based practices. This gap is significant because art students in the digital age need learning resources that are contextual, accessible, and support cultural preservation in an innovative way, so that learning not only emphasizes mastery of visual techniques but also an understanding of local cultural values. Therefore, the development of Gorga Batak Toba-based mobile books is the right solution, because it not only documents cultural heritage, but also transforms it into a digital learning ecosystem that is in harmony with technological developments and learning needs in higher education.

Research Method

This research employs a research and development (R&D) method using the 4-D model, which consists of the Define, Design, Develop, and Disseminate stages. The selection of this method is based on the need to not only research theoretical concepts, but also produce innovative products that can be well integrated into the learning process (Agostini et al., 2024; Owen & Lyon, 2025). The mobile book development stage begins with a definition, including a needs analysis through student surveys related to device ownership, learning habits, media preferences, and difficulties in learning Gorga Batak Toba. The curriculum analysis then determines basic competencies and learning outcomes. Furthermore, the characteristic analysis examines the philosophy and meaning of Gorga Batak Toba, which is reduced to visual elements and digitization strategies so that the material is easier to understand and practice by students (Afrizal et al., 2024; Koszolko & Wilson, 2025; Thompson et al., 2023).

At the design stage, the content is arranged in harmony with the learning objectives, with a progressive order of Gorga Batak Toba material, introduction to philosophy and meaning, analysis of motifs and visual elements, technical exercises, and application projects. At this design stage, a mock-up of the mobile book appearance was made that emphasized visual hierarchy, legible typography, and color contrast. The navigation flow is designed to be concise and consistent, while the interactivity includes zoom-in and zoom-out features, motifs, and quizzes. At the media selection stage, the image format is set according to the needs of students for sharp and light vectors, using PNG/JPG format for photo documentation, and the mobile book platform used is compatible across operating systems, supports offline and online access, and facilitates content updates (Ally & Prieto-Blázquez, 2014).

In the develop stage, the process is focused on the production of mobile books. Gorga Batak Toba motifs are digitized and developed into interactive content, such as layers of motifs that can be zoomed in and zoomed out. Furthermore, expert validation was carried out, which included an examination of cultural substance by Toba Batak experts, pedagogical feasibility by learning media experts, visual suitability by design experts, and the accuracy of language use (Indonesian and Batak) by linguists. After that, a limited trial was carried out with students to assess comprehension, usability, and attractiveness. The results of this trial are the basis for the revision and improvement of the product before it is implemented more widely. The development process involves a multidisciplinary team of experts, including subject matter experts, learning media experts, and linguists, with constructive feedback that

is continuously integrated into product refinement (Carletti, 2025; Ikrom Alghofiqi et al., 2021).

At the deployment stage, implementation is carried out by utilizing mobile books directly in the classroom and drawing practice sessions as companion learning resources. The teaching lecturer plays a role in directing the use of interactive features to match the set learning outcomes. Furthermore, the mobile book is evaluated through pre-test and post-test to measure the improvement of student understanding and skills, accompanied by an analysis of effectiveness and user feedback to assess the practicality and attractiveness of the product. The final stage of dissemination includes publication of results in proceedings or journals, presentations in seminars and workshops, as well as distribution of material packages and implementation guidelines to the Fine Arts Education Study Program of Universitas Negeri Medan, Universitas Negeri Padang, and Universitas Negeri Semarang (Azis et al., 2021; Kartono et al., 2021).

This study used a stratified random sampling technique to ensure the representation of samples from different classes (Louis Cohen, Lawrence Manion, 2017). The total population is 240 students and the research sample consists of 120 students who are divided into four groups based on class A (define) as many as 30 students, B (design) as many as 30 students, C (develop) as many as 30 students, and D (disseminate) as many as 30 students with the criteria of active students, participating in the learning process fully, willing to be respondents, and having no obstacles in using digital devices.

The research instrument was measured using a Likert scale questionnaire. The data analysis covers three aspects: validity, practicality, and effectiveness of teaching materials with t-test. Validity was determined through validator assessments with a Likert scale questionnaire, while practicality was measured from student responses through questionnaires with categories 1 = Strongly Disagree to 5 = Strongly Agree (Baso & Sappaile, 2007; Budiaji et al., 2013).

Result and Discussion

The results of the research are presented as data-based knowledge through research on the development of 4-D models. The definition stage is focused on identifying the needs of student teaching materials that are in accordance with the curriculum of ornamen nusantara courses, as well as establishing the basic conditions for the development of effective teaching materials (Kurniasih et al., 2023; Meke & Wondo, 2020).

Based on the validation of material experts and the decision of the development team, the draft mobile book is enriched with specific content about Gorga Batak Toba which is integrated in learning ornamen nusantara. The structure of the material is arranged in stages, starting from the understanding of the theoretical concept of traditional ornaments to an in-depth exploration of the Gorga Batak Toba motif as a contextual case study (L. H. Wang et al., 2022). The structure of the content of the mobile book that has been validated by subject matter experts consists of seven main components, namely: introduction to ornament of the archipelago, theoretical framework of traditional art, visual analysis of the Toba Batak Gorga, guidelines for the practice of creating works based on Gorga Batak Toba, digitization of traditional ornamental motifs of Gorga Batak Toba, representation of Toba Batak culture, learning evaluation.

Meta analysis showed that the integration of interactive components in art education mobile books increased knowledge retention by up to 47% compared to conventional methods (Galvis & Carvajal, 2022). This Meta Finding emphasizes the importance of digitizing Gorga Batak Toba cultural content in a mobile book format to support more

effective learning outcomes. Validation of material experts ensures the suitability of the content of the mobile book with the learning outcomes of the ornamen nusantara course through a comprehensive analysis of the Semester Learning Plan. The integration of Gorga Batak Toba material as a special local content is designed to meet learning outcomes that include: (1) conceptual understanding of the ornamen nusantara, (2) visual analysis of Gorga Batak Toba motifs, and (3) applicative skills in the creation of contemporary artworks based on archipelago wisdom. This is in line with the urgency of adjusting teaching materials to the characteristics of students (Ally & Prieto-Blázquez, 2014). The design stage with expert validation and the application of the mobile book format in this study is very relevant to the current conditions because this format is familiar in Indonesia and facilitates the transformation of traditional art learning to digital platforms (Koole & Lewis, 2018). The following is the appearance of mobile book design in this study.

Figure 1. Results of Teaching Material Design Development

The development stage of this research is very much in line with the systematic procedures for research on the development of 4-D models. This alignment is evident in the production of teaching materials based on the results of concept analysis, resulting in a comprehensive product that includes the structure of the introduction, content, and conclusion (Gentile et al., 2025; Ludovico, 2025; Mangione et al., 2025). The following is the test flow of the validation of teaching materials from experts:
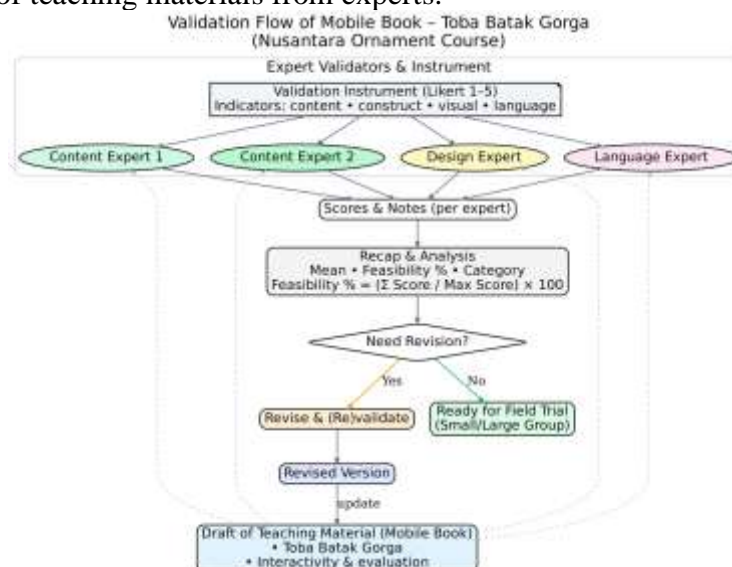

Figure 2. Teaching Material Validation Test Flow from Experts

The testing of teaching materials after improvement was tested on a limited scale involving 120 students. The purpose of this test is to measure the level of effectiveness and ease of understanding of the learning material. The following image shows the testing activities with students.

Figure 3. Small Group Trial Activities for Students

The results of the presentation of data in small groups to students can be seen in the table below:

Table 1. Percentage of Small Group Trial Results

No	Validation Aspects	Value	Max	%	Criterion
1.	Cover of the Teaching Material	86	100	86%	Excellent
2.	Topic/ title	80	100	80%	Good
3.	Systematics of the material presented	82	100	82%	Good
4.	Simple and straightforward language	79	100	79%	Good
5.	Materials presented	81	100	81%	Good
6.	Mobile book materials	78	100	78%	Good
7.	Important material	80	100	80%	Good
8.	Summary	73	100	73%	Good
9.	Evaluation	75	100	75%	Good
10.	Communicative language	84	100	84%	Good
11.	EYD-compliant languages	79	100	79%	Good
12.	Easy-to-understand terms	75	100	75%	Good
13.	Helps with learning	72	100	72%	Good
14.	Used anywhere	75	100	75%	Good
15.	Taken anywhere	81	100	81%	Good
16.	Convenience when used	88	100	88%	Excellent
17.	Speed in use	87	100	87%	Excellent
	Percent of the overall	**1.355**	**1.700**	**79,705%**	**Good**

The results of the calculation of the percentage of assessment by students are included in the good category, but the product is still through revision. The revision is adjusted to student feedback, namely: correction of typing errors, punctuation and capitalization control, references should not be too broad to supporting materials such as educational theory, research theory, and philosophy of education.

Based on suggestions, it is clear that students respond positively to the teaching materials, which shows that the teaching materials have a good appeal and the material **is** easy to understand. This is in line with the results of large-scale tests of 240 students conducted at three universities in Indonesia, namely Universitas Negeri Padang, Universitas Negeri Semarang, and Universitas Muhammadiyah Makassar which showed an increase from the average percentage of previous results, but remained in the good category with a total score of 2,850 out of a maximum of 3,400, reaching a percentage of 83.823%. The increase in results from the first stage to the second stage of the test confirms that the teaching materials for the archipelago ornament course are feasible and can be well received by students.

The results of the cumulative analysis of data from the validator team showed that the resulting teaching material products required partial improvement with an achievement rate of 75.85%, which was included in the good category and qualified for implementation. This shows that the teaching material products have been well received. The validation expert team gave approval to the teaching material product developed with recommendations to conduct trials accompanied by partial revisions based on the notes provided as improvement

guidelines. A summary of the data from these expert validators is presented in the Table below:

Table 2. Summary of the Percentage of Teaching Material Validation Test Results

No	Validator	%	VG	G	A	L	VL	Results
1.	Subject Matter I	75,862%	-	√	-	-	-	Partial Revision
2.	Material Expert II	73,79%	-	√	-	-	-	Partial Revision
3.	Design Expert	79,14%	-	√	-	-	-	Partial Revision
4.	Linguist	74,615%	-	√	-	-	-	Partial Revision
Average		**75,85%**	**-**	**√**	**-**	**-**	**-**	**Partial Revision**

The abbreviation descriptions in the table, VG (Very Good), G (Good), A (Adequate), L (Less), and VL (Very Less). Product revisions are carried out based on the results of assessments and input from experts and trial participants. The improvements made include aspects of content, materials, appearance, and grammar. The main objective of this revision is to improve the product to be feasible and ready for use in an authentic learning process. The revised draft product into a final version that can be directly implemented in learning activities (Anwar, 2024).

The development of these teaching materials is based on needs analysis and concept analysis, in accordance with the stages of the 4-D model (Thiagarajan, 1974). The results of the needs analysis through interviews and the study of the Semester Lecture Plan document show that students still lack learning resources that can be accessed through digital media on their smartphone devices. Therefore, at the design stage, this research requires a digital teaching material format that is realized in the form of a mobile book. The selection of the structure of teaching materials is based on the consideration of the real needs of students in the field. This research and development produced a product in the form of mobile book teaching materials for archipelago ornament courses. The teaching materials are prepared by integrating cultural analysis and curriculum studies on the traditional ornamental material of Gorga Batak Toba, and are equipped with various relevant reference sources to strengthen the learning process in the Fine Arts Education Study Program. In line with Alba's views in 2019, he said that the development of teaching materials must be in line with the dynamics and development of the applicable curriculum (Alba et al., 2019).

This mobile book teaching material is designed to be accessible through smartphones and other digital devices. The ideal screen size is set according to the standard 6.9-inch smartphone, but the zoom-in and zoom-out features allow users to adjust the display on devices with larger screen sizes. The selection of font sizes follows the digital readability standard, which is 14sp, so it is comfortable to read on various devices. The design of the cover is made more attractive than the design of the content page, materials, and text of teaching materials. Each image is equipped with information that serves to strengthen the understanding of the description of the material, presented in proportions that are in accordance with the standard format of digital devices, especially smartphones. The main goal of this mobile book is to make it easier for students to learn the material in a more practical, flexible, and interesting way, so that it can be accessed anytime and anywhere. In line with Prawindia's opinion in 2016, he revealed that the selection of a development design model greatly determines the attractiveness of a book to read, as manifested in the development of this mobile book (Prawindia et al., 2016).

Improvements to the substance and appearance of the product are carried out based on the results of evaluation from validators and student input as test subjects. At the validation stage, the mobile book teaching materials were declared suitable for use, and the results of the

trial in both small and large groups showed the enthusiasm of students in learning it. The feedback provided became the basis for the revision, especially related to the feasibility of content, presentation, and language aspects. Some of the notes submitted by validators need to be revised again before the product is tested more widely. The final revision is based on the assessment and suggestions of students as direct users of teaching materials. Input from experts and test results are followed up by the researcher, except in certain parts where the rejection can be scientifically justified (Azis et al., 2021; Thiagarajan, 1974).

Based on the results of the assessment, revisions were made at the stage of improving the development of teaching materials. Product improvement is focused on three main aspects, namely the text content component, the presentation component, and the language component. These three aspects are studied in depth and followed up to produce a better quality mobile book teaching material product. According to (Ally & Prieto-Blázquez, 2014). Consideration from a subject matter expert is a top priority before considering other aspects. Meanwhile, the language aspect is an important element to make teaching materials more communicative, polite, and in accordance with technical rules.

Material that is too general is reduced, while more specific content about archipelago ornaments, especially traditional Gorga Batak Toba ornaments, is increased. Each material is equipped with authentic images and reference sources. Practice questions are arranged in each chapter with a technical form that is relevant and applicable for students of the Department of Fine Arts, State University of Medan. In line with Wijiningsih's opinion in 2017, the quality of the content of the material and practice questions is a key aspect in the development of teaching materials so that they can be applied effectively in learning (Wijiningsih et al., 2017).

The benefits of developing teaching materials can be shown through the percentage of evaluation results at the validation and trial stages. The higher the percentage, the greater the benefits (Alba et al., 2019; Wijiningsih et al., 2017). This teaching material is designed according to the characteristics of the material in the Fine Arts Education Study Program, Department of Fine Arts, Faculty of Languages and Arts, State University of Medan. Its effectiveness is measured through summative evaluation at the dissemination stage, which involves students as the main users (Munandar et al., 2022). Furthermore, dissemination is also expanded to the general public because teaching materials can be accessed openly, including through academic forums such as seminars and association forums (Indrawini et al., 2017). Based on these findings, the narrow implications of this study show that the teaching material products developed can be considered for lecturers in delivering learning materials, especially in the current era of online learning, and the broader implications of this development have a potential impact on culture-based curriculum and teaching practices, as well as the fulfillment of the alignment of digital transformation trends in higher education.

Conclusion

The development of teaching materials in the form of mobile books using the 4-D model (Definition, Design, Development, Disseminate) resulted in products with a satisfactory/good feasibility level through comprehensive validation from subject matter experts (74.826%), design experts (79.14%), and linguists (74.615%) with an average validation of 75.85%. Field tests showed consistently positive results, with a small group (120 students) responding to 79.705% and a large group (240 students) increasing to 83.823%, both in the good category, with an appreciation for ease of access and high-resolution visual quality. Based on the consistency of the evaluation results above 75.85%, this mobile book has met the eligibility criteria to be applied in learning in the Department of

Fine Arts, Universitas Negeri Medan, Universitas Negeri Padang, Universitas Negeri Semarang, and Universitas Muhammadiyah Makassar by integrating digital technology that facilitates flexible and interactive learning, and is ready to be disseminated as a medium to preserve cultural arts in education through the Innovative and Accessible Digitalization for the Young Generation.

Recommendation

The mobile book developed is recommended to be implemented first in the Department of Fine Arts. The implementation of products among lecturers and developers of the fine arts education curriculum is important to harmonize learning with technology and based on duality. Implementation in other study programs requires adjusting the content to be in harmony with the CPL, student characteristics, and the scientific context of each one. Advanced experimental research is suggested to test the influence of mobile books on the improvement of students' traditional design digitization skills. In addition, this mobile book is worthy of being used as the main reference in the Nusantara Ornaments course as well as an innovative learning resource for the preservation and transformation of traditional ornaments into digital media that is relevant to today's contemporary creative industry.

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