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Geometry Textbook Development Based on Gorontalo Local Wisdom for Elementary School Students

Pengembangan Bahan Ajar Geometri Berbasis Kearifan Lokal Gorontalo untuk Siswa Sekolah Dasar

Miftha Huljannah[1*)], Kasim Yahiji[2)], Herson Anwar[3)]
1), 2), 3) Fakultas Ilmu Tarbiyah dan Keguruan, IAIN Sultan Amai Gorontalo, Indonesia

Abstract
The current use of geometry textbooks in elementary schools still focuses on abstract theories and concepts, adhering to national standards that do not always align with local cultural characteristics. The development of a geometry teaching material based on the local wisdom of Gorontalo was chosen as one of the solutions to this issue. This research and development utilized the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. The subjects of the study were fourth, fifth, and sixth-grade students and teachers at MIT Al-Ishlah and SDN 3 Bulango Ulu. Data were collected through evaluation tests, expert validation questionnaires, and questionnaires for teachers and students. The results of the validation by content experts, language experts, and media experts were 78.4%, 83.33%, and 94.64%, respectively, all categorized as "valid." The responses from teachers and students during the trial phase were 83.33% and 81.71%, respectively, both categorized as "very practical." Thus, the Geometry Textbook Based on Local Wisdom of Gorontalo: Plane Figures and Solid Figures for 4th, 5th, and 6th Grade Students can be declared valid and practical for use in teaching.
Keywords: Development, Teaching Materials, Geometry, Local Culture

Abstrak
Penggunaan buku ajar geometri saat ini di Sekolah Dasar masih berfokus pada teori dan konsep yang bersifat abstrak dengan menggunakan standar nasional yang tidak selalu menyesuaikan karakteristik budaya lokal. Pengembangan bahan ajar geometri berbasis kearifan lokal Gorontalo dipilih sebagai salah satu solusi untuk masalah tersebut. Penelitian dan pengembangan ini menggunakan model ADDIE yang terdiri dari 5 tahap yaitu Analysis, Design, Development, Implementation, Evaluation. Subjek penelitian adalah siswa dan guru kelas 4, 5, dan 6 di MIT Al-Ishlah dan SDN 3 Bulango Ulu. Data dikumpulkan melalui tes evaluasi, angket validasi ahli, serta angket respon guru dan siswa. Hasil validasi ahli materi, ahli bahasa dan ahli media berturut-turut yaitu 78,4%; 83,33%; dan 94,64% dengan kategori "valid". Hasil respon guru dan siswa berturut-turut pada tahap uji coba yaitu 83,33% dan 81,71% dengan kategori "sangat praktis". Dengan demikian buku Geometri Berbasis Kearifan Lokal Gorontalo: Bangun Datar dan Bangun Ruang untuk Siswa Kelas 4, 5, dan 6 dapat dinyatakan valid dan praktis untuk digunakan dalam pembelajaran.
***Kata Kunci**: Pengembangan, Bahan Ajar, Geometri, Kearifan Lokal.*

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*Corresponding author:
E-mail: mifthahuljannah@iaingorontalo.ac.id

INTRODUCTION

The importance of learning geometry is shown in the curriculum in Indonesia with geometry being taught to pre-school children to college. Students need to have some geometry skills as mentioned in NCTM, namely the ability to examine the nature of the shape of the geometry of the field and geometry of space and can understand the relationship of geometry. The complexity of geometry material gives the assumption that it is difficult to be understood by students, so the need for learning innovation by teachers in the classroom. Teachers are required to innovate both in learning, researching, developing, training, and providing services in the field of education (Mubarokah et al., 2021). One form of educational innovation is by presenting better changes in the classroom, be it the use of technology, educational facilities, or teaching materials. The important thing that must be considered in building innovation is the willingness and aspiration of teachers to change their perceptions by bringing students to enjoy the aesthetic side of the teaching materials being studied (Gumati, 2020). There are several criteria for innovative teachers according to Mubarokah, which are continuing to learn, competence, sincerity, spiritualisation, totality, can be a motivator, driver of change, and discipline (Mubarokah et al., 2021). Teachers have made many innovations to improve the quality of learning in their classrooms, but it is still considered insufficient because innovation is not only done once or twice but it is a continuous cycle every time they encounter problems in learning.

Geometry learning can be done by teachers using concrete objects found in the environment around students, especially objects that are included in local wisdom. According to KBBI, or the Indonesian Dictionary, local wisdom consists of two words: wisdom which means wisdom or policy, and local meaning local, thus local wisdom means local policy, or local knowledge. Many teachers are aware about this. Geometry lessons are still considered difficult and less interesting by students because they contain abstract concepts (Yustinah, et al., 2017). Integrating local wisdom in learning not only makes it easier for students to understand the material, but also helps preserve the surrounding culture.

Indonesia's cultural diversity needs to be preserved as a form of concern for the nation's next generation. Given the rapid progress of today's generation in accepting world changes, it is not impossible that cultural values will be eroded. Today, the cultural

values adhered to by each region and tribe are gradually becoming extinct (Tinja et al., 2017). This is evidenced by the fact that very few young people, especially students, know the culture in their respective regions. Instead, they know more about foreign cultures. This is one of the impacts of technological development that cannot be dismissed. One of the media to pass on culture is education. Through education, culture can be developed and passed on to (Farhatin et al., 2020). Cultural inheritance in education can be achieved through the classroom learning process. To realise a learning atmosphere that supports cultural inheritance, appropriate learning innovations are needed. One of them is learning that integrates local wisdom. Local wisdom-based education is education that teaches students to always be integrated and related to the concrete situations they face (Ferdianto & Setiyani, 2018). Through local wisdom-based education supports the empowerment of local skills and potential of each region.

Contextualised learning strategies and local wisdom-based teaching materials are suitable for integrating culture in learning. Through contextualised learning, students will connect what they learn with their daily lives (Tinja et al., 2017). Local wisdom is a characteristic and uniqueness that is owned by a region to distinguish the region from others. Contextualised learning can be achieved using teaching materials that present explanations and examples based on the real situation where the student is in order to make learning more meaningful. Interesting and local wisdom-based teaching materials are one of the supporting components in the contextual learning process. Through contextual learning, learning will be more meaningful because it is based on the real situation of students (Prastitasari et al., 2018).

Some previous research on the development of local wisdom-based teaching materials showed good results. The research by Fitriani et al. (2021) who developed geomtery teaching materials based on Acehnese local wisdom, obtained valid, practical, and effective results and could improve student learning outcomes. There is also the research by Rahmawati et al. (2024) who developed a learning module on flat building material based on local wisdom of Sasak tribe in elementary school gave the results that the teaching module is valid and practical to be used in the learning process. The research by Setyanto et al. (2024) who developed local wisdom-based mathematics e-modules on building space material for fourth grade elementary school students, obtained valid, practical results and received enthusiastic responses from students, which were marked by student activeness reaching the active category. In addition, there is also the research

conducted by Kusumawati & Anugrahana (2024) developed a mathematics module on flat building material based on local wisdom of Lembata NTT for grade IV elementary school students who obtained very good results for the quality of the module and feasible to use as additional teaching materials and student learning outcomes were in the high and complete category. The difference between previous research and this study lies in the content of local wisdom integrated in teaching materials. So far, there has been no development of geometry teaching materials, especially flat and spatial shapes that integrate Gorontalo local wisdom content.

Gorontalo is one of the ethnic groups in Indonesia. Gorontalo region has its own uniqueness, ranging from language, customs, cultural tourism, buildings, clothing, food, musical instruments, to games. Gorontalo culture needs to be preserved and passed on to the next generation so that it is not forgotten. So it is important that this culture is introduced to students through learning.

Geometry teaching materials in the form of books used in learning in elementary schools in Gorontalo, especially in MIT Al-Ishlah Gorontalo and SDN 3 Bulango Ulu, still focus on theories and concepts that are abstract and less associated with Gorontalo local wisdom. The teaching materials used mostly take references from modules developed by the ministry of education using national standards that do not always adjust the characteristics of local culture. In addition, the material is delivered in a less interesting way, relying only on national textbooks and practice questions. The integration of Gorontalo local culture in the material only relies on the teacher's ability spontaneously in the learning process in class. The lack of local wisdom content in the learning context makes the material taught less meaningful resulting in students feeling less connected to the teaching material, making it difficult for students to understand abstract geometry concepts. Integration of local wisdom content can make teaching materials more relevant and easily understood by students so that they feel more 'involved' in learning. Thus teaching materials are needed that present the link between abstract geometry concepts with Gorontalo cultural content such as historical buildings, speciality foods, and traditional ornaments.

The development of geometry teaching materials based on Gorontalo local wisdom is expected to contribute to various parties, especially to grade 4, 5 and 6 students as well as teachers and schools. Contributions to students in the form of a better

understanding of geometry concepts, can increase interest in learning, can strengthen cultural identity and feel proud of Gorontalo culture. Contributions to teachers in the form of ease in delivering material through contextual learning and can increase creativity in teaching, and improve the quality of learning. The contribution of this research to schools is a solution to the problem in the form of alternative teaching materials to be used in schools in order to improve student learning outcomes.

RESEARCH METHOD

This research uses the Research and Development (RnD) method. The teaching materials developed in this study are in the form of geometry textbooks for flat and spatial shapes based on local wisdom. The research and development procedure refers to the ADDIE development model with steps namely: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Sugiyono, 2021). At the analysis stage, needs analysis was carried out in the form of identifying problems, material analysis, analysis of textbooks used in class. At the design stage, researchers compiled the design of Gorontalo local wisdom-based geometry teaching materials with attractive, made product validation questionnaires for material experts, linguists, and design experts, making teacher and student response questionnaires, and student test sheets. The development stage, with the researchers making Gorontalo local wisdom-based geometry textbook products, conducting validity tests by material experts and design experts, and making stage I revisions. This stage was done to obtain data on the validity of the textbook. The implementation stage, namely conducting coursebook trials after being declared valid by experts. Product trials were conducted on students and teachers to obtain data on the practicality of coursebooks. The evaluation stage was carried out to assess and analyse the practicality results and student test results.

The textbook trial subjects in this study were grade 4, 5, and 6 students and grade 4, 5, and 6 mathematics teachers at MIT Al-Ishlah and SDN 3 Bulango Ulu with a total of 67 students. Data collection techniques in this study were geometry evaluation tests and questionnaires. The evaluation test used was in the form of essay questions as many as 3 numbers for each grade 4, 5 and 6. This test was conducted on a limited trial and an extended trial on 25 July 2023 and 9 August 2023. This evaluation test aims to assess student learning completeness after using Gorontalo local wisdom-based Geometry textbooks. The questionnaires used were expert validation questionnaires, teacher response questionnaires and student responses. The questionnaire form used a Likert

scale with a value range of 1 to 4. Expert validation consists of 3 experts, namely material experts, design experts, and linguists. This questionnaire aimed to assess the validity of the Gorontalo local wisdom-based geometry textbook that has been prepared. While the teacher and student response questionnaire is used to see the practicality of Gorontalo local wisdom-based geometry textbooks. The data analysis technique used qualitative and quantitative analysis. Qualitative analysis was carried out at the analysis stage and evaluation stage. While quantitative data analysis is used in the validity and practicality test process.

FINDINGS AND DISCUSSION

The main result of this research and development is teaching materials in the form of textbooks on local wisdom-based geometry materials for high grade elementary school students which are grades 4, 5, and 6. The process carried out in this research and development refers to the ADDIE development model:

Analysis

Researchers analysed the teaching materials used at MI Terpadu Al-Ishlah Gorontalo and SDN 3 Bulago Ulu. The schools use modules developed by the ministry of education and by schools as mathematics teaching materials. However, the module does not contain examples of geometry shapes explicitly and in accordance with the daily environment of students. In fact, geometry will be more effective if taught through examples related to students' daily environment.

Mathematics learning can be meaningful if it is related to students' real-life experiences, which is in line with research conducted by Hariatiningsih (2016) who found that context-based learning by linking material to the student's environment has a significant impact in efforts to improve learning on flat and spatial building materials. So it is necessary to have teaching materials that contain real examples in the student's environment. Teaching materials are easier to understand through materials based on experiences and observations that are in accordance with the environment or situation of the students (Ketut Suastika & Rahmawati, 2019). In addition, strengthening the value of local wisdom is very important to instil in students during the current rapid technological development through the education and learning process as an effort to preserve cultural values. Teaching materials developed based on local wisdom can be used as teaching

materials to increase students' knowledge of the material studied (Tinja et al., 2017). It can be inferred that the need for textbooks based on local wisdom is considered high.

Design

Researchers made products in the form of Gorontalo local wisdom-based geometry textbooks and research instruments. Gorontalo local culture integrated in this textbook are historical buildings such as traditional houses, *otanaha fort, limboto tower, tugu ketupat*, Soekarno landing house and so on; traditional foods such as *wapili* cake, wajik and others; and some typical Gorontalo ornaments such as *Alikusu* and *Pahangga*. This stage begins with making a material framework, collecting references, pictures of objects that have local wisdom as examples of flat and spatial shapes, compiling material content, and designing books. The preparation of the material framework in the form of theoretical concepts, formulas and evaluation questions was adapted from a combination of various mathematics books. The preparation and design of the book was done using the Canva application. The selection of the Canva application in designing textbooks is because it has a variety of attractive designs, has interesting features and varied images of flat and spatial shapes, and is practical in designing. Regarding the use of Canva in designing teaching materials, similar research was found in fourth grade elementary school which showed the results of the development of mathematics modules using Canva were very feasible to use in the material of the perimeter and area of flat shapes in fourth grade elementary school (Pasmawangi et al., 2023).

This textbook is designed based on content, language, and design criteria. This is in line with the research and development of a sixth grade elementary school book that is prepared based on content that contains the curriculum, physical books that contain structure and design, and the use of language that is in accordance with the character of students (Momand et al., 2019). Broadly speaking, this coursebook contains a cover, preface, table of contents, material on flat and spatial shapes, student activities and evaluation. The material in this coursebook is adjusted to the applicable curriculum at MI Terpadu Al-Ishlah. Similar research suggests that the development of teaching materials is highly dependent on the syllabus or curriculum model (Cahyadi, 2019). The material in the teaching materials is adjusted to the curriculum and the needs of students (Meilana & Aslam, 2022). The scope of geometry material according to the syllabus in fourth grade is about the area and perimeter of flat shapes. The scope of geometry material in fifth grade is to get to know the cubes and beams that include nets and their surface area and

volume. While the scope of geometry material in sixth grade includes the surface area and volume of prisms, pyramids, tubes, cones and spheres. Thus, the material of flat and spatial shapes in this textbook is presented in four chapters: 1) Recognise flat shapes; 2) Area and perimeter of flat shapes; 3) Recognise spaces, 4) Surface area and volume of spaces. At the end of each chapter, there is an evaluation to train students' understanding.

Development

The draft coursebook as an initial product that has been completed was submitted to experts to test its validity or feasibility. Expert validation was carried out on 3 components which are material, language and design. The results of the assessment of material experts for local wisdom-based geometry textbooks for grades 4, 5, and 6 elementary schools can be seen in Table 1 below.

Table 1. Results of Material Expert Recapitulation

No	Assessment Aspects	Question Item	Score
1	Content Eligibility	4	12
2	Systematisation of Content	7	21
3	Material Coverage	8	24
4	Local Wisdom	3	12
	Total	22	69
	Percentage	78,4%	
	Interpretation	Valid	

Based on the results of the expert assessment recap presented in the form of scores, a total score of 69 out of 88 was obtained, which corresponds to a percentage of 78.4%, classified as "good" (valid). However, certain aspects received a score of 2 or were deemed less satisfactory, particularly the items "the variety of presented example problems" and "the variety of practice problems provided." The expert validator suggested that the examples and practice problems should incorporate narrative diction related to local cultural content. Following the validation process by the subject matter expert, the geometry teaching material was revised, particularly in the sections on example problems and practice problems, in accordance with the validator's recommendations. These results are in line with research that integrates local cultural content in the material, sample questions, and evaluation questions meet the criteria of valid and feasible to use in learning (Nango et al., 2021).

Geometry textbooks based on local wisdom are developed based on the characteristics of students both in terms of language and presentation of the material. According to Magdalena et al. (2020) in their research state that the development of teaching materials in schools needs to pay attention to the characteristics of students and the needs of students according to the curriculum. Similar research was also conducted by Mailani & Wulandari (2019) which shows the results of the suitability of mathematics textbooks that are in accordance with the characteristics of elementary school students are feasible and effective for use in classroom learning.

Furthermore, the results of the assessment of linguists for geometry textbooks based on local wisdom for grades 4, 5, and 6 elementary schools are as follows.

Table 2. Results of Language Expert Recapitulation

No	Assessment Aspects	Question Items	Score
1	Local Wisdom	3	12
2	Language	9	28
	Total		40
	Percentage		83,33%
	Interpretation		Very Valid

Based on the results of the linguistic expert's assessment recap, a score of 40 out of 58 was obtained, corresponding to a percentage of 83.33%, classified as "very good" (highly valid). The linguistic validator provided several recommendations: 1) Overall, the language used in the book aligns with the linguistic development of children in grades 4 to 6 of elementary school. However, certain explanations containing lengthy sentences should be streamlined to ensure that students can fully comprehend the content; 2) On the "Preface" page, it is recommended to use the term *Prakata* if the introductory text is written by the book's author. The term *Kata Pengantar* is more appropriate if the introduction is provided by someone other than the author; 3) On page 2, immediately following the cover page, the title of the book, *Bangun Datar dan Bangun Ruangan,* should be italicized to indicate that it refers to the book's title; 4) Imperative or motivational sentences, such as *ayo perhatikan* ("let's pay attention"), *ayo berlatih* ("let's practice"), and similar phrases, should end with an exclamation mark. Following the validation by the linguistic expert, the geometry textbook was revised in accordance with the provided recommendations.

The results of the assessment of design experts for geometry textbooks based on local wisdom for grades 4, 5, and 6 elementary schools can be seen in Table 3 below.

Table 3. Results of Design Expert Recapitulation

No	Assessment Aspects	Question Items	Score
1	Textbook Presentation	9	32
2	Textbook Content Design	19	74
	Total	28	106
	Percentage	94,64%	
	Interpretation	Very Valid	

The score obtained based on the recapitulation of the design result assessment was 106 out of a total score of 112 and with the percentage value of 94.64% with a very good/very valid category. However, there are still suggestions from design expert validators regarding the design of the coursebook cover; the cover background should be coloured. An attractively designed cover will make students interested in opening coursebooks, a neat and attractive layout design will make students happy in using coursebooks. Students tend to judge a book by its cover as their first impression, if the cover is attractive and the text is neatly arranged so that it makes it easier for students to learn, then the possibility of student interest in the book is considered high (Laabidi & Nfissi, 2016). This finding is also in line with the results of research on how textbook design can influence learning which states that book design, including cover, images and layout, is one of the important factors that can influence the level of visual attention given to textbook elements (Behnke, 2016).

After validating the material experts and design experts, the geometry textbook was improved in the sample questions and evaluation questions as well as the cover according to the suggestions of the validators, which can be seen in Table 4 below.

Table 4. Textbook Revision from Material Expert and Media Expert Validation

Recommendation	Before Revision	After Revision
Some practice questions should contain story diction related to local cultural content. (Material Expert)		

The cover background should be coloured (Design Expert)	

Implementatiton

After the local wisdom-based geometry textbook was declared valid by material expert validators and design expert validators, the book was then tested on students and mathematics teachers in grades 4, 5, 6 of MIT Al-Ishlah and SDN 3 Bulango Ulu. The trial was conducted on 67 students consisting of 25 grade 4 students, 20 grade 5 students, and 22 grade 6 students as well as 6 mathematics teachers. The results of the recapitulation of the teacher response questionnaire in the limited trial are presented in Table 5 below.

Table 5. Results of Teacher Response Questionnaire Recapitulation

No	Assessment Aspect	Question Item	Score
1	Attractiveness	4	40
2	Presentation of Material	5	50
3	Language	2	20
	Total	11	110
	Percentage	83,33%	
	Interpretation	Very Practical	

The results of the teacher response questionnaire obtained a value of 83.33%. The geometry textbook: flat and spatial shapes can be categorised as very practical. However, there was input from teachers such as errors in writing. While the recapitulation of student response questionnaire results can be seen in Table 6 below.

Table 6. Results of Recapitulation of Student Response Questionnaires

No	Assessment Aspect	Question Item	Score
1	Textbook Display	4	627
2	Presentation of Material	3	395
3	Assignment and Evaluation	3	421
4	Attractiveness	2	322
	Total	12	1765
	Percentage	81,71%	
	Interpretation	Very Practical	

The results of the teacher and student response questionnaire obtained a percentage of 82.52%, with a very practical interpretation. Thus the Gorontalo local wisdom-based geometry textbook can be said to be very practical based on the results of the percentage of teacher and student response questionnaires. These results are in accordance with the research and development of geometry teaching materials based on the learning cycle 7e model integrated with *Ngada* local cultural content by Nango, et.al. (2021) which states that mathematics textbooks based on local wisdom are considered practical to improve students' mathematical abilities.

Evaluation

Giving evaluation tests to students after teachers and students do learning using geometry textbooks developed aims to see the completeness of learning. Evaluation results were used to provide feedback on the development of textbooks. This evaluation test was given at 2 stages of trials, namely limited trials and expanded trials. The limited trial was given to fourth, fifth and sixth grade students of MIT Al-Ishlah Gorontalo. Furthermore, the trial was extended to students in grades 4, 5 and 6 of SDN 3 Bulango Ulu. The tests given were different for each grade level, adjusted to the curriculum and the limitations of the material taught in the class. The test results of each school were compared with the passing gradea (KKM) value that applies at MIT Al-Ishlah which was 85 and that applies at SDN 3 Bulango Ulu which was 75.

Based on the evaluation test conducted during the limited trial at MI Terpadu Al-Ishlah, it was found that 36 out of 45 students met the passing grade (KKM), indicating an 80% success rate. These 36 students comprised 10 students from grade 4 (66.6%), 15 students from grade 5 (100%), and 11 students from grade 6 (73.3%). In the expanded trial, the results showed that 55 out of 67 students from two schools involved in the trial met the KKM, yielding a success rate of 82.08%. The results of this also increased quite significantly. This is in line with research Fitriani et al. 2021) which shows that the use of local wisdom-based geometry teaching materials can improve student learning completeness. In addition, research by (Harahap, 2021) that using local culture-based teaching materials is very effective in the learning process because in addition to students gaining mathematical knowledge, students can also get to know their own local culture.

At this stage, the final revision of the geometry textbook based on Gorontalo local wisdom, focused on plane and solid shapes, was carried out in accordance with feedback obtained from the limited and expanded trials. As a result, the geometry textbook integrating Gorontalo local wisdom has been deemed valid and practical for use in teaching students in Grades 4, 5, and 6. This textbook is intended to enhance students' understanding of plane and solid shapes.

CONCLUSION

The development of a geometry textbook integrating Gorontalo local wisdom for students in Grades 4, 5, and 6 was carried out using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Validation results from subject matter experts, linguists, and media experts showed respective percentages of 78.4%, 83.33%, and 94.64%, all categorized as "highly valid." In a limited trial, teacher response surveys achieved a percentage of 83.33%, and student response surveys scored 81.71%, both categorized as "highly practical." In the expanded trial, teacher response surveys yielded a percentage of 94.32%, while student responses reached 91.71%. Furthermore, the results of the student evaluation tests during the limited trial phase indicated that 80% of students achieved the Minimum Competency Criteria (KKM). In the expanded trial phase, this percentage increased to 82.08%. Based on the findings, the *Geometry Textbook Based on Gorontalo Local Wisdom: Plane and Solid Shapes for Grades 4, 5, and 6* is deemed valid and practical for use as a teaching reference. Additionally, the study found that the integration of Gorontalo local wisdom in the geometry textbook improved students' understanding of plane and solid shapes, as the

examples provided were more relevant to their daily lives. Students also demonstrated greater interest in learning about Gorontalo culture, which was presented through images of historical buildings, traditional foods, and Gorontalo's unique ornaments.

The researchers recommend further studies to investigate the effectiveness of using this geometry textbook in other schools within the Gorontalo region.

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