Validity and Practicality: Application of Mathematics Learning in the Context of Local Wisdom of Palembang

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Abstract. This development research aims to design a mathematics learning application product based on Geogebra's digital geometry software on transformation materials with local contexts for junior high school students. The type of research used is development research (Design and Development) using the ADDIE development model which includes the stages of analysis, design, development, implementation, and evaluation. The assessment analysis results from the material, media and language validation experts obtained an average score of 4.17 with a valid category. Analysis of the practicality assessment of student and teacher responses with an average score of 85.6 is in the very good category. Based on the data obtained, it can be concluded that applying mathematics learning based on Geogebra's digital geometry software on transformation materials with the context of Palembang local wisdom developed is feasible based on validity and practicality.

Keywords: Learning Applications · Dynamic Geometry Software GeoGebra · Design and Development · Local Wisdom

1 Introduction

The advancement of information technology currently demands the development of technology in the field of education, one of which is in the form of digital-based pedagogic innovations to assist the learning process and improve students' mathematical literacy skills. Utilization of technology in the learning process is usually carried out through computer applications, by utilizing computer applications students can understand the material more easily, because students will see directly the visuals that are displayed clearly, and students can also repeat material that cannot be understood properly through independent study. In the 21st century, students are familiar with computers as students use the Internet, cell phones, computers, laptops, tablets, and other software to communicate with other people [1]. Mathematics teaching and learning can be motivated through a digital environment [2]. Suggests that the use of mathematics learning media can positively increase students' understanding of concepts [3].

One of the uses of mathematics learning applications that can be used is the dynamic geometry software Geogebra. This software has the facility to visualize mathematical

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objects. Geogebra application-assisted learning can positively impact student learning outcomes and motivate students to learn the material [4]. The use of GeoGebra-based learning videos can improve the ability to understand mathematical concepts [5]. The Geogebra Applet geometry material designed and developed is related to and in line with the Indonesian national curriculum [6]. Furthermore, the use of mathematics learning media using Geogebra greatly supports teachers in the learning process [7].

Students' understanding and achievement of the mathematical material being studied can be helped by linking mathematical concepts and the local context in which students live. Geometry transformation learning with the filter cloth motif approach makes the material can be delivered inductively, can stimulate students' creativity and scientific thinking, foster open thinking, and students can get to know and understand their culture better [8]. The design of reflection and translation learning in the context of the Sam Poo Kong pagoda in Semarang can help students understand the concept of reflection and translation material in class IX SMP [9]. In learning activities in the classroom, the use of context about Sidoarjo batik motifs brings students to reinvent situations in learning several transformation concepts [10]. Learning to link mathematical concepts and local wisdom has been done by many mathematics teachers, but digital applications for such learning, specifically for the relationship between the concept of transformation and the context of Palembang local wisdom is not yet available.

Based on the description above, the researcher considers that the application of mathematics learning based on the dynamic geometry software Geogebra has the potential to be designed. Therefore, researchers consider it necessary to conduct research on the design of mathematics learning applications based on Geogebra's dynamic geometry software on transformation materials with the context of Palembang local wisdom. This study aims to test the validity, and practicality of the designed mathematics learning application.

2 Method

This research is development research (Design and Development) to produce a product in the form of a learning application based on the dynamic geometry software GeoGebra on transformation material with the context of Palembang local wisdom. The subjects of this study were 31 students of class IX SMP LTI IGM Palembang. The ADDIE development model is used in this study. This model consists of five stages namely analysis, design, development, implementation, and evaluation [11] (Fig. 1).

The five stages that will be used are, 1) the analysis stage, namely conducting library research, 2013 curriculum analysis, material transformation analysis, and local context analysis, 2) the design stage, namely producing a product in the form of a mathematics learning application consisting of four learning applications. Each learning application contains elements in the form of an application front display, material content, interactive activities, conclusions, practice questions, and formative tests, 3) The development stage is developing a mathematics learning application using Geogebra software based on the validation of competent experts in the material field, media, and language, as well as revising the application based on suggestions and comments, 4) the implementation stage is the product trial stage to a small one to one scale, small group to measure the

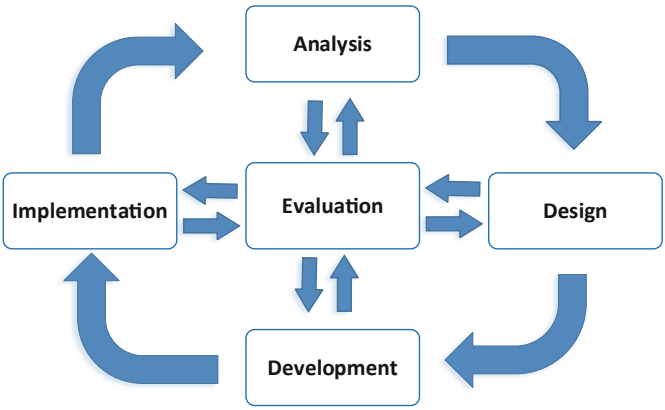


Fig. 1. Stages of the ADDIE model

Table 1. Criteria for the validity of learning applications [13]

Score	Category
4.21–5.00	Very good
3.41–4.20	Well
2.61–3.40	Enough
1.81–2.60	Not Enough
1.00–1.80	Very Less

practicality of learning applications and after that, it is continued on a large scale field test, also to measure practicality learning applications, 5) the evaluation stage is the final revision of the learning applications produced based on questionnaires and field observations at the implementation stage.

The research instruments include validation sheets, teacher and student response questionnaires, and observational data. The validator provides feedback, comments, and suggestions from the validation sheet. Practicality questionnaires were given to teachers and students to provide feedback and comments. The validity and practicality sheets are given in the form of a Likert scale with a scale of 5. The Likert scale is used to measure attitudes, opinions, and perceptions of a person or group of events or social phenomena [12].

The analysis technique in this study is divided into several stages, namely:

1. Validity analysis stage

This is done by looking for the average validation sheet from the material, media, and language aspects that have been carried out by the expert team. The validity category can be seen in Table 1.

Table 2. Practical response criteria for learning applications

Score	Category
$85 < N \leq 100$	Very good
$70 < N \leq 85$	Well
$55 < N \leq 70$	Enough
$N \leq 55$	Not Enough

Learning applications are said to be valid if the average score of each validator meets the minimum good category. It will be revised again if it is less than the set value or if comments and suggestions are given.

2. Practical analysis stage

The criteria for student and teacher responses to the practicality of learning applications can be seen in Table 2.

Learning applications have been declared to have practical value if the average student and teacher responses are in the minimally good category.

3 Results and Discussion

The description of the results of the design of mathematics learning applications based on dynamic geometry software Geogebra on the transformation material with the ADDIE model is as follows:

3.1 Analysis

As the pandemic period has passed, students are accustomed to using communication information technology-based learning media in the form of computers, smartphones, tablets, or others. The existence of information and communication technology supporting facilities available in schools will greatly support the success of updating learning strategies and techniques.

The results of the curriculum analysis were carried out to map the Core Competencies (KI) and Basic Competencies (KD) related to the design of learning applications as the basis for making indicators and learning objectives on transformation materials. Learning applications can also expand students' knowledge and motivate students in learning because learning applications aim to simplify the learning process [14]. The use of local wisdom contexts in learning in the form of superior products is very beneficial for the meaning of learning processes and outcomes because students get contextual learning experiences and apperception materials to understand concepts as a result, learning becomes interesting and fun.

Based on the analysis above, it is used as a guide for designing mathematical learning applications based on dynamic geometry software Geogebra on transformation materials with the context of Palembang local wisdom.

3.2 Design

The learning application is designed using Geogebra online software with a choice of activity designs. The design of this application is supported by the Corel Draw application to create the front view of the apcation, and the sub-menu section, and is supported by Google Forms for formative tests, all of these are elements of the application design which are summarized in the Geogebra application.

There are four separate learning apps and each has a link. The first application is an application for learning mathematics for sub-translational transformation materials, https://www.geogebra.org/m/gztfh6bp. The following is a display of the translation material application, as shown in Fig. 2.

The second application is an application for learning mathematics with transformation materials with dilated sub-materials, https://www.geogebra.org/m/absxnb4b, the application display is shown in Fig. 3.

The third application is a mathematics learning application for the transformation of rotational sub-materials, https://www.geogebra.org/m/upyt7wnw, the application display is shown in Fig. 4.

The fourth application is a mathematics learning application for the transformation of reflection sub-materials, https://www.geogebra.org/m/dh7pjmqj, the application display is shown in Fig. 5.

Simultaneously at this stage, the research assessment instrument design was also carried out which consisted of a validation sheet, a questionnaire for teacher and student responses, and field observations. The results of the validation sheet are used to assess statements related to the material, media, and language aspects of the validator and at the same time see suggestions and comments given for the development of learning applications. Teacher and student response questionnaires were used to assess the positive

Fig. 2. Display of Sub Translation Materials

Fig. 3. Display of Sub Dilated Materials

Fig. 4. Display of Sub-Rotation Materials

Fig. 5. Display of Reflection Sub Material

statements given to determine the practicality of the application. Field observations to find out the findings of the shortcomings of the learning application.

3.3 Development

At this stage, the development of the learning application design is carried out. The resulting product is a mathematics learning application that contains transformation material with the context of Palembang local wisdom.

Product validation was developed by two validators, all of whom are material, media, and language experts. This validation is carried out by a mathematics lecturer. First, validation is carried out on the material aspect.

Based on Table 3 for the material aspect, the average score is 3.94 whereas points 3 and 8 only get an average score of 3.50. According to the explanation from the validator, this is because at point 3 the rotation material for the arrangement of several objects in the introductory section does not show any displacement from the same object, at point 8, the evaluation questions given do not include higher-order thinking skills, based on the suggestions given by the validator. Then repairs are made.

Second, validation is carried out on the media aspect.

Based on Table 4 on the material aspect, the average score is 4.30 with a very good category and the advice given by the validator is a checkmark on the line option $x = a$, and the slide bar for $y = 0$ is not in the application, based on the suggestions given. Given by the validator, improvements are made to the learning application.

Third, validation is carried out on the language aspect.

Table 3. Results of the assessment of material aspects

SN	Indicator	Average
1.	The material presented is by the basic competencies	4.50
2.	Concepts and definitions are presented by those applicable in the field of Mathematics	4.00
3.	The material presented can be understood clearly	3.50
4.	The material presented is arranged in a sequential and systematic manner	4.00
5.	Student activities are presented clearly and support student understanding	4.00
6.	The practice questions given are by the material and learning objectives	4.00
7.	Student activities are presented clearly and support student understanding	4.00
8.	Aspects of cognitive learning from remembering to evaluating stages have been integrated into learning applications	3.50
The average number of validation scores		**3.94**

Table 4. Media aspect assessment results

SN	Indicator	Average
1.	Learning applications are presented on computers and devices that can be accessed using the internet network	4.50
2.	Learning applications use computers to present and combine text, and images as a learning tool	4.00
3.	There are teaching materials that are presented via a link on the Geogebra website so that they can be accessed by students anytime and anywhere if they are concerned	4.50
4.	Learning application design has an attractive appearance to reading and learn	4.50
5.	Learning application design using attractive color composition	4.00
The average number of validation scores		**4.30**

Based on Table 5 on the language aspect, the average score is 4.30 with a very good category and the advice given by the validator is the word “how” should be replaced with the question word “what” because the desired answer is the coordinates of the results, based on the suggestions given. Given by the validator, improvements are made.

The validation process is carried out once and revised according to suggestions and comments from the validator. The tabulation results from the validator can be seen in Table 6.

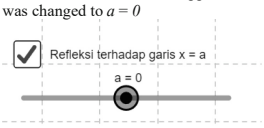
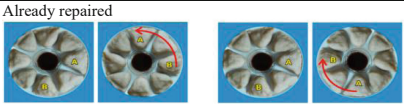
Table 5. Results of the assessment of language aspects

SN	Indicator	Average
1.	Learning applications are presented Instructions for using learning applications are written clearly	4.50
2.	The terms used are precise and by the field of mathematics	4.00
3.	The use of language supports the ease of the reader in understanding the flow of the material	4.00
4.	The language used is polite and does not reduce moral values in education	4.50
5.	The use of words and sentences in learning applications is by the General Guidelines for Indonesian Spelling (PUEBI)	4.50
The average number of validation scores		**4.30**

Table 6. Expert validation analysis

SN	Aspects	Average	Category
1	Material	3.93	Good
2	Media	4.30	Very Good
3	Language	4,30	Very Good
	Total average	**4.17**	**Good**

Table 7. The results of the revision of the learning application at the validation stage

Initial Design	Revised Results
Put a checkmark on the line option $x = a$. Slide the slide bar to $y = 0$. But the tick is not in the app.	Added a check mark to the app, and the slider bar for $y = 0$ was changed to $a = 0$ 
there is rotational material of the arrangement of several pempek on the plate in the introduction does not indicate any displacement of the same pempek	Already repaired 
If any point (x, y) is reflected on the line $x = 0$ what are the coordinates of the reflected image?" The word how should be replaced with the question word "What" because the desired answer is the coordinates of the results. There is a typo, for example, what is requested is y but, in the sentence, it is written $x = a$	sentences have been corrected according to the suggestions given

Based on Table 6, shows that the learning application has met the valid category and is suitable for use at the implementation stage. Several sections must be revised according to suggestions from the validator as seen in Table 7.

3.4 Implementation

At this stage, the learning application has been declared valid and ready to be used in the learning process. The implementation is a trial phase that is carried out on small-scale one-to-one subjects, small groups, and large-scale field test subjects. This learning application is based on Geogebra in the form of links that can be opened via computers, and smartphones with Windows, Android, IOS, Linux, and Mac OS operating systems.

The one-to-one trial was conducted on 3 students of class IX SMP LTI IGM Palembang, what was tested was a Geogebra-based learning application on transformation material (dilation, translation, rotation, and reflection). Per day. The purpose of this implementation is to observe the learning process, and student responses to the practicality of using the application. Table 8 the results of the average student's responses to the practicality of the application.

In the learning observation process it was found that in the evaluation element section, the display of questions with a size of 1000 × 800 pixels could not be seen in full using a smartphone with a screen size of 6.4 inches as shown in Fig. 6, this becomes an input for the revision of the application that will be tested on small group trial.

After revising the observation of the one-to-one trial, the size of the question display became 780 × 800 pixels as shown in Fig. 7, followed by the small group test for 5 different students in the same school. This application is implemented for four days. Each application is tested daily, to observe the learning process and student responses to the practicality of using the application. The following is Table 9 the results of the average student responses to the practicality of the application.

In the observation process during learning activities, there were not so many revisions, only a few key answers to questions that did not fit in the elements of the practice questions. During the implementation of the implementation at the small group stage, a teacher response questionnaire was also given to the assessment of the practicality of the application. The following table shows the average results of the teacher's response to the practicality of the application (Table 10).

Table 8. The results of the practicality assessment in the one-to-one trial

SN	Indicator	Average
1.	This learning application design fosters my interest in learning	4.3
2.	This learning application makes my learning motivation better	4.3
3.	Words or sentences in this learning application make it easy for me to understand the material	4.3
4.	I think this learning application is very easy to use	4.3
5.	The material in this learning application is adapted to the environment that I know	4.7
6.	This learning application can help me to study independently	4.3
Amount		**26.2**
Score		**87.3**

Fig. 6. Display of evaluation questions 1000 × 800 pixels

Fig. 7. Display of evaluation questions 780 × 800 pixels

After the implementation of the small group trial, it was followed by a field test for 23 different students in the same school. The implementation was carried out for four days, each application was tested per day with the same goal, namely to observe the learning process, and student responses to the practicality of using the application. The following is Table 11 the results of the average student responses to the practicality of the application.

The data obtained from the implementation phase were analyzed using a Likert scale. The alternative answers to the statements chosen by all respondents in each one-to-one, small group, and field test take the average value. To get the value of practicality, the average result of all indicators is added up multiplied by 100, and divided by the maximum number of all indicators. The results of the average student and teacher response questionnaires to the application practicality assessment can be seen in Table 12.

Based on the value of practicality results in Table 12, it shows that the responses of students and teachers are very good for GeoGebra-based learning applications. This means showing that the designed learning application can be implemented well. GeoGebra-assisted learning media received very positive responses from teachers and students, so

Table 9. The results of the practicality assessment in the small group trial

SN	Indicator	Average
1.	This learning application design fosters my interest in learning	4.4
2.	This learning application makes my learning motivation better	4.2
3.	Words or sentences in this learning application make it easy for me to understand the material	3.4
4.	I think this learning application is very easy to use	3.6
5.	The material in this learning application is adapted to the environment that I know	4.2
6.	This learning application can help me to study independently	4.0
Amount		**23.8**
Score		**79.3**

Table 10. The results of the teacher's response to the practicality of the application

SN	Indicator	Score
1.	This application can help foster student interest in learning	5
2.	This learning application makes student learning motivation better	5
3.	Words or sentences in this learning application make it easy for students to understand the material	4
4.	I think this learning application is very easy to use for students	4
5.	The material in this learning application is adapted to the environment known to students	5
6.	This learning application can help students to learn independently	5
7.	This learning application can be used as a teaching aid for teachers	5
8.	This learning application encourages students to think critically	5
9.	This learning application trains students to be able to solve problems	5
Amount		**43**
Score		**95.6**

it can be said to be practical [15]. The high percentage of student responses and learning outcomes proves that the development of Geogebra-assisted mathematics learning media can improve students' conceptual understanding and is effectively and practically used as an additional reference for mathematics learning media, especially geometry transformation material [16].

Table 11. The results of the practicality assessment in the field test

SN	Indicator	Average
1.	This learning application design fosters my interest in learning	4.0
2.	This learning application makes my learning motivation better	4.0
3.	Words or sentences in this learning application make it easy for me to understand the material	3.7
4.	I think this learning application is very easy to use	4.2
5.	The material in this learning application is adapted to the environment that I know	4.0
6.	This learning application can help me to study independently	4.1
Amount		**24.0**
Score		**80.0**

Table 12. The value of the practicality of the application

SN	Implementation	Score	Category
1	One to one	87.3	Very Good
2	Small group	79.3	Good
3	Field test	80.0	Good
4	Response teacher	95.6	Very Good
	Average	**85.6**	**Very Good**

4 Conclusion

The results of the research on the design of mathematics learning applications based on dynamic geometry software Geogebra on transformation material with the context of Palembang local wisdom that has been developed are valid with an average value of 4.17 and good category, and practical with an average value of 85.6 very good categories.

This research was carried out only in one school, it is recommended that further research can be carried out in more schools so that the level of reliability of this mathematics learning application can be known. With so many students and teachers using this application on transformation material using the context of local wisdom, it can make it easier for students to understand the concept of transformation.

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References

1. L. Korenova, "GeoGebra in teaching of primary school mathematics," *Int. J. Technol. Math. Educ.*, vol. 24, no. 3, pp. 155–160, 2017.
2. M. Gök and M. İnan, "Sixth-grade students' experiences of a digital game-based learning environment: A didactic analysis," *JRAMathEdu (Journal Res. Adv. Math. Educ.*, vol. 6, no. 2, pp. 142–157, 2021, doi: https://doi.org/10.23917/jramathedu.v6i2.13687.
3. U. D. Susiaty and D. Oktaviana, "Desain Aplikasi Media Pembelajaran Untuk Membantu Pemahaman Siswa Tentang Konsep Geometri," *SAP (Susunan Artik. Pendidikan)*, vol. 3, no. 1, pp. 18–26, 2018, doi: https://doi.org/10.30998/sap.v3i1.2731.
4. O. Asdarina and H. Khatimah, "Pengembangan Modul Pembelajaran Matriks Berbantuan Aplikasi Geogebra," *AKSIOMA J. Progr. Stud. Pendidik. Mat.*, vol. 10, no. 2, p. 860, 2021, doi: https://doi.org/10.24127/ajpm.v10i2.3515.
5. E. Nurdin, A. Ma'aruf, Z. Amir, R. Risnawati, N. Noviarni, and M. P. Azmi, "Pemanfaatan video pembelajaran berbasis Geogebra untuk meningkatkan kemampuan pemahaman konsep matematis siswa SMK," *J. Ris. Pendidik. Mat.*, vol. 6, no. 1, pp. 87–98, 2019, doi: https://doi.org/10.21831/jrpm.v6i1.18421.
6. Nisiyatussani, V. Ayuningtyas, M. Fathurrohman, and N. Anriani, "GeoGebra applets design and development for junior high school students to learn quadrilateral mathematics concepts," *J. Math. Educ.*, vol. 9, no. 1, pp. 27–40, 2018, doi: https://doi.org/10.22342/jme.9.1.4162.27-40.
7. Q. Syafitri, M. Mujib, N. Netriwati, C. Anwar, and W. Wawan, "The Mathematics Learning Media Uses Geogebra on the Basic Material of Linear Equations," *Al-Jabar J. Pendidik. Mat.*, vol. 9, no. 1, p. 9, 2018, doi: https://doi.org/10.24042/ajpm.v9i1.2160.
8. S. Maskar and R. R. Anderha, "Pembelajaran transformasi geometri dengan pendekatan motif kain tapis lampung," *MATHEMA J. Pendidik. Mat.*, vol. 1, no. 1, pp. 40–47, 2019.
9. A. A. P. Lestari, A. A. Nugroho, and F. Nursyahidah, "Desain Pembelajaran Refleksi dan Translasi Berkonteks Klenteng Sam Poo Kong Semarang," *J. Elem.*, vol. 7, no. 2, pp. 381–393, 2021, doi: https://doi.org/10.29408/jel.v7i2.3400.
10. Lestariningsih, "Desain Pembelajaran Transformasi Menggunakan Motif Batik Tulis Sidoarjo," *J. Edukasi*, vol. 3, no. 1, pp. 83–98, 2017.
11. N. Dwitiyanti, S. A. Kumala, and F. Widiyatun, "Using the ADDIE model in development of physics unit convertion application based on Android as learning media," *Form. J. Ilm. Pendidik. MIPA*, vol. 10, no. 2, pp. 125–132, 2020, doi: https://doi.org/10.30998/formatif.v10i2.5933.
12. Riduwan, *Skala Pengukuran Variabel-variabel Penelitian.* Bandung: Alfabeta CV, 2013.
13. Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: PT Alfabeta, 2016.
14. R. Saputra, S. Thalia, and T. Gustiningsi, "Pengembangan Media Pembelajaran Berbasis Komputer Dengan Adobe Flash Pro Cs6 Pada Materi Luas Bangun Datar," *J. Pendidik. Mat.*, vol. 14, no. 1, pp. 67–80, 2020, doi: https://doi.org/10.22342/jpm.14.1.6794.67-80.
15. N. P. U. Vidanti, I. G. A. Mahayukti, and I. P. W. Ariawan, "Pengembangan LKS Berbasis Open Source Software Geogebra Untuk Meningkatkan Prestasi Belajar Matematika Siswa Kelas VIII SMP Negeri 1 Singaraja," *J. Wahana Mat. dan Sains*, vol. 10, no. 2, pp. 48–57, 2016.
16. I. Meirawati Handayani and D. Sulisworo, "Pengembangan Media Pembelajaran Matematika Berbantuan Development of Geogebra-Assisted Mathematics Learning Media on Geometry Transformation Materials," *J. Equ.*, vol. 4, no. 1, pp. 47–59, 2021.