

PAPER • OPEN ACCESS

The practicality of mathematics learning module on triangles using GeoGebra

To cite this article: A I Suryani *et al* 2020 *J. Phys.: Conf. Ser.* **1470** 012079

View the [article online](#) for updates and enhancements.



IOP | ebooks™

Bringing you innovative digital publishing with leading voices to create your essential collection of books in STEM research.

Start exploring the [collection](#) - download the first chapter of every title for free.

The practicality of mathematics learning module on triangles using GeoGebra

A I Suryani¹, Anwar², Hajidin³ and I Rofiki⁴

^{1,2,3}Mathematics Education, Universitas Syiah Kuala, Jln. Tgk. Chik Pante Kulu No. 5, Kopelma Darussalam, Banda Aceh. Indonesia, 23111

⁴Mathematics Education, Universitas Islam Negeri Maulana Malik Ibrahim, Jl. Gajayana No. 50, Malang, Indonesia, 65144

Email: anwarramli@unsyiah.ac.id

Abstract. The 2013 curriculum in Indonesia requires students to be able to develop knowledge independently, creatively and skillfully in solving mathematics problems. One way that can be taken by professional mathematics teachers to support the curriculum is to develop precise learning modules that integrate software dynamically and open source, such as GeoGebra. This study aims to determine the practicality of the module developed in mathematics teaching and learning on triangles using GeoGebra. The study used the Plomp development model, which consists of three phases, namely preliminary research, prototyping phase, and assessment phase. The test trial was conducted four times on students of class VII SMP Negeri1 Idi Rayeuk, Aceh. The results showed that the mathematics teaching and learning module using GeoGebra software fulfilled valid and practical criteria. The validity of the module is obtained based on the results of validation by five validators. Meanwhile, the practicality of the module is achieved based on the recommendations of five validators stated that the module could be used with a minor revision and the level of implementation of learning using the module is good. For future research, it is crucial to apply this study on a broader scale to determine the effectiveness of the module.

Keywords: GeoGebra, Mathematics Learning, The Practicality, Triangles

1. Introduction

Teacher as an actor in the planning process of learning has an important role to organize the learning process effectively and efficiently. As stated by [1] that in order to create an atmosphere of active learning, teachers can take advantage of a variety of learning resources and media technology. Learning with media technology provides the opportunity for students to solve problems individually, improve students' understanding of the material presented, stimulate students to learn with passion, and provide convenience to the students to determine their own pace of learning [2]. Therefore, it takes the role of teachers in using the learning resources (for example, the module) that can assist the student in the learning process actively and independently.

The module is a kind of package of programs for the purposes of study that covers materials, methods, and evaluation that can be used independently [3]. Some development module has been developed both in universities [4] as well as in secondary education [5]. Research conducted by [4] states that assisted learning software module makes it easy for users because the software that is used



in accordance with the characteristics of the Calculus II (Integral Calculus) is to check the complex calculations. While [5] states that aided software modules in accordance with the properties of matter triangle which was held on the junior high school students visualize geometric objects. In the study conducted by [6], the scaffolding on learning triangle is given manually. However, over the times, learning media need to keep up with technology. Therefore, it is expected by the module can assist students in learning, saving time in teaching, changing the role of the teacher of a teacher becomes a facilitator, and enhance the learning process becomes more effective and interactive. The module has a high adaptive to the development of science and technology. Thus, the integration of media technology in the module is expected to assist the student in the learning process.

One of the media technology that can be used in the learning process is the use of GeoGebra software. GeoGebra is a computer program for teaching mathematics especially geometry and algebra. GeoGebra developed by Markus Hohenwarter in 2001. The reason for choosing the GeoGebra due to several advantages, among others, is open source and can be obtained free of charge [7]. In addition, based on the results of the study [8], it is known that more GeoGebra is dynamic and easy to apply. By using GeoGebra, the process of teaching and learning of mathematics was considered to be more useful and meaningful [9].

Based on the research results[5] stating that software-assisted learning modules provide a positive impact for users so it is advisable to develop a module with other materials in mathematics. In addition, the results of research [10] there is an increase in student responses before and the response by using the module. Learning modules that have been developed contains steps GeoGebra usage clearly, in order to help teachers and students in integrating media in the learning process. This module can also help students to learn independently and can visualize geometric objects quickly and accurately. Based on the description, the purpose of this study was to determine the practicality of mathematics learning modules developed material triangles using GeoGebra.

2. Method

This is development research. The research was conducted in SMP Negeri 1 Idi Rayeuk, Aceh. Development model used in the research is the development model of Plomp [11] which consists of three phases including 1) the preliminary phase, 2) the design phase, and 3) the assessment phase. The test trial was conducted in four meetings. The participants were twenty-six students. Instruments used in the preliminary phase that analysis sheet consisting of student's characteristics analysis sheet, the needs analysis sheet, the analysis sheet of 2013 curriculum, the analysis sheet of the learning modules concept, the analysis sheet of literature and learning resources, the analysis sheet of the existing module, as well as the analysis sheet of the situation and condition. While at the design phase of the instrument is the validation module sheet. Activities performed on the stage of prototyping phase is to design GeoGebra software-assisted learning modules on triangle according to the results of a needs analysis in the preliminary stages of research. The module is said to be valid if it fulfills the indicators proposed by [12] that is the validator states that the module developed on a strong theoretical basis, and the components are consistently interconnected modules. Meanwhile, at the assessment phase, the instruments used are the learning implementing sheet, observation sheet of students activities, observer's response questionnaire, student's questionnaire response, and test. A module is said to be practical if it fulfills the indicators proposed by [12] stating that the modules could theoretically be implemented in the learning process, as well as the learning implementation level by using module included good category.

3. Results and Discussion

This research has produced GeoGebra-based geometry learning modules as part of digital learning. Unlike the other modules, this learning module requires teachers to use Geogebra in their learning to help students' creativity in learning geometry, especially for triangular material. Students are expected to construct their own learning based on the problems given by the teacher. In this way, the learning

process will shift from teacher-centered learning to student-centered learning. Some of the results as researchers attempt to obtain a practical module are as follows.

3.1. Revised Learning Module

The results of the development of a learning module are generated using GeoGebra on the topic of triangle after the revision as shown in Figure 1a and Figure 1b (the researchers only displays the cover and part of the module content).

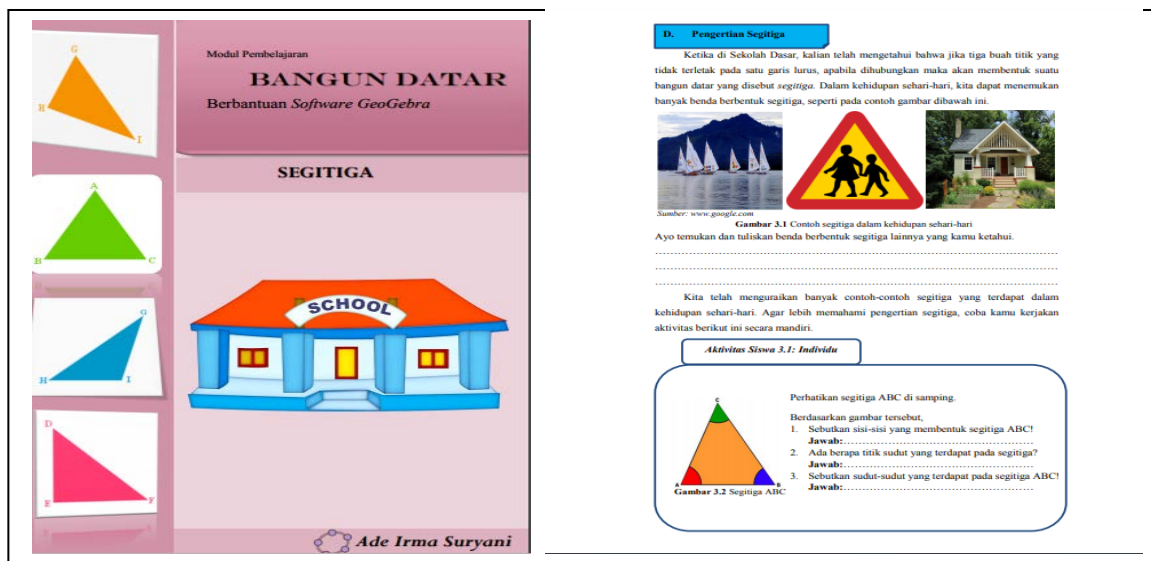


Figure 1a. The Cover and part of contents of the modul using manually

Learning modules that have been designed as shown in Figure 1a and Figure 1b validated by five validators. The instrument used to validate that the module validation is the module sheets. The criteria of valid module based on the assessment of experts, teachers, and peers. Based on the suggestions and comments of the validators, the module can be used for the pilot phase after minor revisions. The module is said to be valid if validator states that the module was developed based on a strong theoretical basis and the components of the learning modules are consistently associated with each other. The result of the validation performed on the learning module can be seen in Table 1.

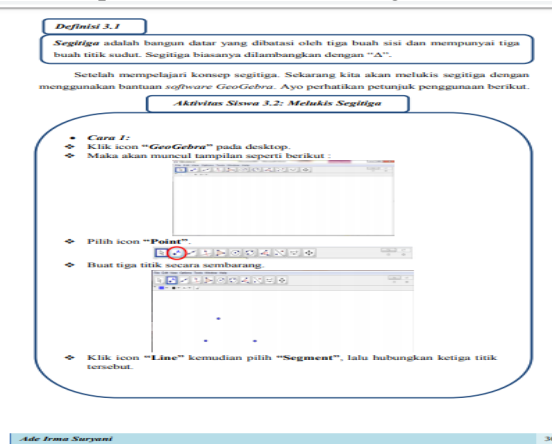


Figure 1b. The part of contents of the modul using GeoGebra
Table 1. The revised module assisted learning GeoGebra

Mistake	Validator Suggestions
In the early part of the module is not listed KI and KD (learning competency)	Include KI and KD at the beginning of each module section
There are some words that are used in the module is not consistent	The words used in the module must be consistent
Presentation of the material on any part of the module is not consistent either manually or by using software	In each section of the module manually should the material presented in advance and use the software presented in small units to help students understand
There are no details on how the terms of GeoGebra software installed on Windows	Add on part II module requirements GeoGebra software installed on your PC or laptop

3.2. Students Response Questionnaire Results

At the time of the trial, the obtained assessment of students' learning modules developed through the assessment questionnaire. Here are the results of students' response to software-assisted learning modules mathematics GeoGebra (see Table 2).

Table 2. Results of student questionnaire responses in small groups

No.	Aspect	Indicator	The average score
1.	software usage commands	Steps of use GeoGebra is easy to understand. Measures to resolve questions whether all of the steps can be executed. The clarity of the language used in the manual explains the use of the software.	89%
2.	Matterial	The suitability of the material to the learning objectives. The preparation of the materials contained in the module is already compiled systematically. The role of sample questions given to make it easier to understand the material. Role in facilitating the software GeoGebra you to learn the material. GeoGebra software role in accelerating the process of resolving problems. The language used in describing the content of the module.	86%
3.	Presentation of picture	Suitability image to the module content. Instructions on the completeness of the picture. The level of clarity of the images presented. The picture quality is presented.	84%
4.	Presentation of test	Compliance is about the learning objectives. The clarity of the instructions in workmanship matter. The use of language on every item.	72%
Total Average			83%

Based on Table 2. the overall average assessment of students' learning modules is developed reaching 83%. This shows that the students' response to the learning modules that were developed included in the category of good or positive. This is consistent with the findings [13,14] that the students are very enthusiastic in completing each activity, has a high spirit, and was happy to follow any learning activities for software GeoGebra is dynamic and easy to apply by the students. In

addition, GeoGebra provides opportunities for teachers and students to work together through exploration and visualization so as to enable students to better understand concepts and achieve constructivist learning principles, this is in accordance with the findings [15,16]. In this trial also found several errors in the modules corrected by students such as typos, prepositions, and the use of upper and lower case letters that are not appropriate.

3.3. Implementation of Teaching and Learning

Comments observer on the sheet enforceability of learning, there is an increase in ratings of each meeting. Implementation of learning by using module makes students more active and independent (see Table 3). This was seen when individual students to help each other to resolve any existing activities on the module using the software GeoGebra. At the time of the trial, practitioner stating that the modules can be implemented in class and included in both categories, as well as the level of mathematics teaching module-assisted enforceability of software GeoGebra good category for an increase at every meeting.

Table 3. Increased levels of teaching and learning implementation

Criteria	Meeting 1	Meeting 2	Meeting 3
How to motivate by showing the benefits of students after the study material	Not to show the benefits	Already well and starting to show the benefits	Already showing benefits
How to provide reinforcement on each step presented in modules and asking questions and answers to get feedback from students	Reinforcement in the form of feedback to students is still lacking	Reinforcement in the form of feedback on students' own good	Reinforcement in the form of feedback to students already performing well
How to help students in reflection or evaluation	Reflection or evaluation is still lacking	Reflection or evaluation has been good	Reflection or evaluation has been good
Suitability of learning activities with RPP	Is appropriate, but it has not done well, there are steps that have not been delivered	Is appropriate, but it has not done well	Already performing well

Based on the comments on the implementation sheet of learning observer, there is significant progress of each meeting. Using the module also makes students more active and independent. This was seen when individual students to help each other to resolve any existing activities on the module using the GeoGebra. The same thing also expressed by [14,17] that the module can make the learning process more effective and interactive, increasing the understanding of the concept of learners, to increase the interest and motivation of learners in the learning process and help students to learn independently. The results of the study by [18] also showed that students could use modules without much intervention from the teacher so as to develop student self-confidence and independence. Based on the recommendations from the validator and the test results show that the module can be applied in class and included in either category. Meanwhile, the level of application of learning using the GeoGebra software-assisted mathematical module is categorized as an improvement at each meeting. From these results, it was found that the mathematics learning module developed using GeoGebra triangle material is included in the practical category and is suitable for use.

4. Conclusion

This study generated a practical module has of a triangular material using GeoGebra. The practicality can be seen from the results of consideration and comment validator which indicates that the module is included in a valid category, and from the test results showed that the module can be applied in the

classroom. In addition, the level of implementation teaching and learning by using module increased in every meeting and included in good category. Therefore, because of the module has fulfilled the practical criteria, it can be used in teaching and learning mathematics.

References

- [1] Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia 2014 *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia, Nomor 68, Tahun 2014, tentang Peran Guru Teknologi Informasi dan Komunikasi dan Guru Keterampilan Komputer dan Pengelolaan Informasi dalam Implementasi Kurikulum 2013* (Jakarta: Depdikbud)
- [2] Wena M 2013 *Strategi Pembelajaran Inovatif Kontemporer: Suatu Tinjauan Konseptual Operasional* (Jakarta: Bumi Aksara)
- [3] Sukiman 2012 *Pengembangan Media Pembelajaran* (Yogyakarta: Pedagogika)
- [4] Nurlaini 2017 *Pengembangan Modul Kalkulus II Berbantuan Software WxMaxima di Program Studi Pendidikan Matematika Universitas Syiah Kuala* Thesis
- [5] Rahayuningsih R 2016 *Pengembangan Modul Pembelajaran Berbantuan Software GeoGebra untuk Mendukung Hasil Belajar dan Motivasi Belajar Siswa pada Materi Segitiga di Kelas VII SMPK Kemasyarakatan Kalibawang Tahun ajaran 2015/2016* Thesis
- [6] Anwar and Rofiki I 2018 Investigating students' learning trajectory: A case on triangle *Journal of Physics: Conference Series* **1088** 012021
- [7] Tomic M K 2013 Mathematical software in croatian mathematics classrooms-a review of GeoGebra and Sketchpad *Croatian Journal of Education* **15** 197-208
- [8] Baltaci S and Yildiz A 2015 GeoGebra 3D From the perspectives of elementary pre-service mathematics teachers who are familiar with a number of software programs *Cypriot Journal of Educational Sciences* **10** 12-7
- [9] Mwingirwa I M and Miheso-O'Connor M K 2016 Status of teachers technology uptake and use of GeoGebra in teaching secondary school mathematics in Kenya *International Journal of Research in Education and Science* **2** 286-94
- [10] Sari F K, Farida and Syazali M 2016 Pengembangan media pembelajaran (modul) berbantuan GeoGebra pokok bahasan Turunan *Al-Jabar Jurnal Pendidikan Matematika* **7** 135-52
- [11] Plomp T 2013 Educational Design Research: An Introduction *An Introduction to Educational Research* (Enschede: SLO Netherlands Institute for Curriculum Development) pp 9-36
- [12] Nieveen 1999 *Prototyping to Reach Product Quality* (The Netherlands: University of Twente)
- [13] Sandir H and Aztekin S 2016 Pre-Service Math teachers opinions about Dynamic Geometry softwares and their expectations from them *Academic Publishers* **11** 421-31
- [14] Ramadhana R and Hadi A 2018 Pengembangan modul pembelajaran Matematika Berbasis Learning Cycle 7E dengan pendekatan saintifik *Jurnal Ilmiah Pendidikan Matematika EQUALS* **1** 45-52
- [15] Shadaan P and Eu L K 2016 Effectiveness of using Geogebra on students' understanding in learning Circles *The Malaysian Online Journal of Educational Technology* **1** 1-11
- [16] Akkaya A, Tatar E and Kagizmanli T 2011 Using dynamic software in teaching of the Symmetry in Analytic Geometry: The case of Geogebra *Procedia Social and Behavioral Sciences* **15** 2540-4
- [17] Dhamija N and Kanchan 2014 Effectiveness of Self Learning Modules on the Achievement and Retention of Undergraduate Students in Commerce *Educationia Confab* **3** 26-32.
- [18] Nardo T B 2017 Modular Instruction Enhances Learner Autonomy. *American Journal of Educational Research* **5** 1024-1034.