Development of Geometry Teaching Materials Assisted Geogebra Android to Improve Mathematical Connection Ability

Sumarni*, Nuranita Adiastuty, Mohamad Riyadi, Nazma Yu'tika Fisabqi, Winayu Maulina Pritiya

Department of Mathematics Education, Universitas Kuningan, Kuningan, Indonesia

{sumarni@uniku.ac.id}

Abstract. This research aims to develop valid, practical, and effective geometry teaching materials with the help of GeoGebra android to improve students' mathematical connection abilities. The method used in this research is research and development. The developing process of teaching materials uses the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The analysis phase includes an analysis of the needs of learning resources, curriculum, and materials. The design phase includes making a framework of teaching materials, determining reference books, and preparing teaching materials assessment instruments. The development phase includes module development, expert validation, and revision of teaching materials. The implementation phase is the testing phase of teaching materials that are validated and revised to students. The evaluation phase is to analyzes the strengths and weaknesses of the teaching materials that have been tested. The criteria of quality of teaching materials are validity, practicality, and effectiveness. This teaching material is declared valid by assessing the material and media expert with an average of 89% and 85%, respectively. In addition, the module was declared practical by the results of the student response questionnaire, with an average of 78%. Furthermore, based on the results of the student's mathematical connection ability test, teaching materials are effective in helping students to understand geometrical material and improve their mathematical connection abilities. Based on these results, it can be concluded that the GeoGebra android-assisted teaching materials developed are valid, practical, and effective.

Keywords: Teaching Material; Geogebra; ADDIE Model

1 Introduction

The 2013 curriculum applied in Indonesia requires teachers to act as facilitators for student learning.

As a learning facilitator, the teacher has the most important task to develop teaching materials that can facilitate students to find mathematical concepts [1]. A teacher can develop good teaching materials if he/she has a good mastery of the material as well. Mastery of mathematical material is called mathematical content knowledge (MCK) [2], [3]. According to the National Council of Teachers of Mathematics (NCTM), MCK is "Mathematical content and discourse, including mathematical concepts and procedures and their interrelationships; some representations of mathematical concepts and procedures and ways to

UNISET 2021, December 02, Kuningan, Indonesia

DOI 10.4108/eai.2-12-2021.2320201

reason mathematically, solve problems and communicate mathematics effectively at various levels of formality [2].

Research [4], [5] state that the MCK for prospective teacher-students is still in the poor category. Research [4] states that the overall MCK for prospective teacher-students is not strong, and the two lowest-performing MCK areas are Geometry/Measurement and Probability/Statistics. Furthermore [5] states that the MCK for prospective mathematics teacher-students included in the poor category. Some of the mathematical materials are still not fully understood. One of which is geometry materials.

Geometry as a branch of mathematics is unity, hierarchical in its delivery and understanding. [6] states that teachers with strong MCK can present mathematics as a consistent and related structure. Therefore, MCK is described as mathematical content and discourse, including mathematical concepts and procedures and their interrelationships [2]. Thus, the teacher as a facilitator must be able to present mathematics as a consistent and related structure. According to [7], [8] the ability to relate or connect in mathematics is called mathematical connection ability.

Connection in mathematics learning is an essential ability [7]. Without a mathematical connection, students must learn and remember too many separate mathematical concepts and procedures [9]. Therefore, the ability to connect mathematically is one of the abilities that must be possessed by prospective teacher students to develop good teaching materials in an effort to create effective learning. efficient, fun so that it can realize the achievement of student competencies.

Research [10], [11] states that the mathematical connection ability of prospective teacher-students is included in the low category. Based on this, it is necessary to innovated mathematics learning in higher education so that it can take place optimally and can facilitate the mathematical connection abilities of prospective teacher students well.

As easier as access to technology for students, the integration of technology into teaching materials has the opportunities to enrich the student learning experience. Various technologies, such as dynamic and interactive media, can be used as additional features in teaching material. GeoGebra software is one of the dynamic and interactive technologies that can be used as additional features in teaching material [3], [12](Sumarni & Prayitno, 2016). GeoGebra can be used to introduce or explain a particular topic in greater depth through the construction process [3].

Several previous studies have stated that GeoGebra software can facilitate the improvement of students' mathematical abilities in learning geometry including [3], [13]–[20]. However, the limitation of media facilities, in this case, the number of laptops used, is one of the obstacles to the GeoGebra- assisted learning process.

In this study, we used the Android version of the GeoGebra software as a learning medium to overcome these obstacles. GeoGebra android has a relatively small storage capacity and can be operated without internet access (offline) [21]. And based on a survey, all students used android as a learning medium during the pandemic, so they are no matter by using GeoGebra android.

According to the background of these problems, this study aims to develop an Android version of GeoGebra-assisted geometry teaching materials to facilitate the mathematical connection abilities of prospective mathematics teacher students. Although there are many opportunities provided by GeoGebra-based teaching materials, there are still not many that emphasize the connection ability. Thus, the process of developing geometry teaching materials using the Android version of GeoGebra to facilitate the mathematical connection abilities of prospective mathematics teacher students along with their qualities

will be the focus of the discussion of this study. The quality of the teaching materials developed is measured based on the criteria of validity, practicality, and effectiveness [22].

2 Research Method

The type of research is research and development. The development model used is the ADDIE model [23]. The product developed from this research is a valid, practical, and effective GeoGebra-assisted geometry teaching material to improve students' mathematical connection skills. The research subjects were the first-year students at a private university in West Java in the 2020/2021 academic year, totaling 29 students. The process of developing these teaching materials follows the phases of the ADDIE model, namely analysis, design, development, implementation, and evaluation. The analysis phase is carried out to analyze the need for module development. The analysis carried out includes an analysis of learning resource needs, curriculum analysis, namely determining learning outcomes and indicators of competency achievement by the KKNI curriculum as well as material analysis, especially on geometry materials.

The design phase is carried out to design the writing of teaching materials based on the results of the analysis phase. The activities carried out are: making a framework of teaching materials; determining references related to spatial building materials; and compiling teaching materials assessment instruments. The development phase is the stage to realize the framework for the preparation of teaching materials that have been designed. In addition, at this phase validation and revision of teaching materials are also carried out, so that the developed teaching materials can achieve the expected goals. The fourth phase is implementation. This phase aims to conduct experiments of teaching materials that have been validated and revised.

The teaching materials were tested in a small group (limited test), namely on the first-year students at a private university in West Java. After testing the teaching materials, students were asked to give their responses to the teaching materials by filling in a questionnaire. This questionnaire aims to obtain data on the practicality of teaching materials. The evaluation phase is carried out to analyze the advantages and disadvantages of teaching materials that have been tested. The phase of analysis was carried out based on the results of the student response questionnaire. This activity is a means of improvement of the development process that has not been carried out optimally. In addition, the evaluation process is also carried out at every other stage to produce teaching materials that are by the research objectives.

The data collection techniques were (1) observation to find out things related to learning, including mathematics learning resources used by lecturers and students as well as student learning difficulties,especially related to geometry materials; (2) structured interviews to find out things related to the effectiveness of teaching materials in the learning process in terms of their usefulness and potential to improve mathematical connection abilities; (3) validation of teaching materials is used to measure the validity of the developed teaching materials, this validation is addressed to material experts and media experts; (4) the provision of questionnaires is used to determine the practicality of the teaching

2.1. Materials Developed.

The data collection instruments in this study were interview guidelines, teaching material validation sheets, and student response questionnaire sheets. The data analysis techniques in this study were analysis of the validity of teaching materials, data analysis of mathematical connection ability tests, and analysis of the practicality of teaching materials questionnaires. The data on the validity of teaching materials is obtained based on the results of the validation of teaching materials that have been carried out by the validator. The validation of teaching materials was measured using a four-scale

Likert scale, ranging from 1, strongly disagree, to 4, strongly agree. The scores that have been obtained based on expert judgment are then converted into percentages. This percentage is calculated using the formula (1).

$$\frac{\Sigma}{\Sigma}$$

where V is the percentage of module validity, Σx is the total number of expert judgments, and Σxi is the total number of ideal scores. After the percentage results are known, the level of validity of the developed teaching materials is then grouped into the product validity criteria as shown in Table 1.

Table 1. Criteria for material and media validity.

No	Criteria of Validity	Level of Validity
1		Very valid
2		Valid
3		Less valid
4		Invalid

The practicality data of the module was obtained based on the results of the student response questionnaire. The results of the questionnaire were measured using a four-scale Likert scale, namely strongly agree, agree, disagree, and strongly disagree. The student response questionnaire consists of positive statements and negative statements. For positive statements, the response strongly agrees is given a score of 4 and so on until the response strongly disagrees is given a score of 1. For negative statements, the score is the opposite of the score for positive statements. The module practicality score is calculated using formula (2).

$$\frac{\Sigma}{\Sigma}$$

where P is the percentage of the practicality of the module, TSe is the sum of all students' response scores, and TSh is the sum of the maximum possible scores of all students' responses. After the results are known, the results are then grouped into product practicality criteria. The product practicality criteria are presented in Table 2.

Table 2. Product practicality criteria

No	Criteria of Practicality	Level of Practicality
1		very practical
2		practical
3		less practical
4		impractical
		very impractical

3 Results and Discussion

3.1. Teaching Material Development Process

This research produces a product in the form of GeoGebra-assisted teaching materials on geometry material to develop students' mathematical connection abilities. The development of the module follows five phases in the ADDIE model. In detail, the phases taken are as follows.

Analysis

Analysis of learning resource needs is carried out based on the results of observations. Observation results show that in learning, lecturers and students use English-language electronic books as the main source. The book is considered not to lead to mathematical connection skills and is less constructivist because it does not explicitly focus on developing constructions about the relationship between concepts. In addition, the lecturers have prepared GeoGebra-based teaching materials, but due to computer facilitation that not all students have, efforts are needed to develop solid geometry teaching materials assisted by GeoGebra android software. In this pandemic period, all students use Android phones in learning, so the development of geometry teaching materials with the help of Android GeoGebra is claimed to be very relevant to the media owned by students. In addition, curriculum analysis was also carried out to find out the curriculum used and for the learning outcomes of learning in the solid geometry course

Design

Making a framework for the preparation of teaching materials based on guidelines for the preparation of teaching materials which includes a) introduction contain brief descriptions, learning outcomes, b) presentation contain material descriptions, sample questions, practice questions, interactive activities, summaries, and c) closing contain formative tests, answer keys, and bibliography. At this phase, the selection of reference books and the preparation of teaching materials assessment instruments were also carried out, consisting of teaching material validation sheets for material experts and media experts, student response questionnaire sheets, and interview guidelines.

Development

The teaching materials developed broadly include material descriptions that lead to mathematical connection abilities, interactive GeoGebra-based android activities, and

assignments in the form of learning videos. The teaching materials are then validated by material and media experts. In terms of material, the aspects assessed include the feasibility of the content, the feasibility of presentation, and the feasibility of language. In terms of media, the aspects assessed include the feasibility of graphics and electronic media. The validation process resulted in several suggestions from experts. The suggestions include (1) the worksheets that have been made are good because they are accompanied by steps to construct concepts using GeoGebra so that students find them themselves, but it needs to be accompanied by a capture of the GeoGebra menu icon, (2) adding problems that can develop mathematical connection abilities, (3) it is necessary to add the worksheets cover and bibliography, (4) attach a video link about giving an example of construction carried out by the lecturer. All of these suggestions are used to revise the developed teaching materials.

Implementation

At the implementation phase, experiment of teaching materials that have been validated and revised is carried out. This experiment is intended to see the level of practicality of teaching materials. The experiment of teaching materials was carried out on the first-year students of a private university in West Java for the 2020/2021 academic year, totaling 29 students. After using the teaching materials, students were then asked to fill out a questionnaire. This questionnaire aims to see student responses to teaching materials that have been developed in terms of several aspects, namely ease, attractiveness, and efficiency. Furthermore, the effectiveness of teaching materials is seen based on the results of interviews with students. It includes the benefits of using teaching materials and the results of student work on these teaching materials.

Evaluation

The teaching materials that have been tested are then analyzed for their advantages and disadvantages. Analysis of teaching materials was carried out based on the results of student response questionnaires. The advantages of the developed teaching materials include: (1) construction instructions for geometry material concepts and sample questions on the developed teaching materials are easy to follow and understand, (2) the teaching materials developed are interesting and encourage students to carry out construction activities to find geometric concepts, and (3) can help study the solid geometry material. While the disadvantages of this teaching material are that some words are typos.

3.2. Quality of teaching materials

The quality of the teaching materials developed was analyzed based on the validity, practicality, and effectiveness of the teaching materials (Nesri & Kristanto, 2020). The results of the analysis based on each of these criteria are then presented as follows.

3.3. Validity of teaching materials

The validity of the teaching materials developed is based on the results of assessments carried out by experts. The results of the assessment from material experts on the aspect of content feasibility obtained a validity percentage of 82%, while in the presentation and language feasibility aspects, the validity percentages were 89% and 90%, respectively. The average score of these three aspects is 87%.

Therefore, in terms of material, the teaching materials that have been developed are very valid. The data on the validation analysis of teaching materials from material experts can be seen in Table 3.

Table 3. Material expert validation results

No	Aspects	Percentage	Criteria
1	Content feasibility	82%	Valid
2	Presentation feasibility	89%	Very Valid
3	Language feasibility	90%	Very Valid
	Average	87%	Very Valid

Furthermore, the results of the assessment of media experts on the feasibility aspect of graphics obtained a validity percentage of 82%, and on the feasibility aspect of teaching materials obtained a validity percentage of 89%. From these two aspects, an average score of 86% was obtained. Therefore, from media experts, the teaching materials that have been developed are very valid. Data analysis of the validation module from media experts can be seen in Table 4.

Table 4. Media expert validation results

No	Aspek	Persentase	Kriteria
1	Graphic feasibility	82%	Valid
2	Teaching materials feasibility	89%	Very Valid
	Average	86%	Very Valid

3.4. The Practicality of teaching materials

The practicality of the teaching materials developed was analyzed based on the results of the student response questionnaires. The practicality of teaching materials was reviewed for ease of use, attractiveness, and efficiency. In the aspect of ease of use, the percentage is 80%, in the attractiveness aspect, the percentage is 78%, and in the efficiency aspect, the percentage is 80%. From these three aspects, an average score of 79% was obtained. Therefore, it can be concluded that the modules developed are practical to be used by students. A comparison of the percentage of the practicality of teaching materials in each aspect is presented in Figure 1.

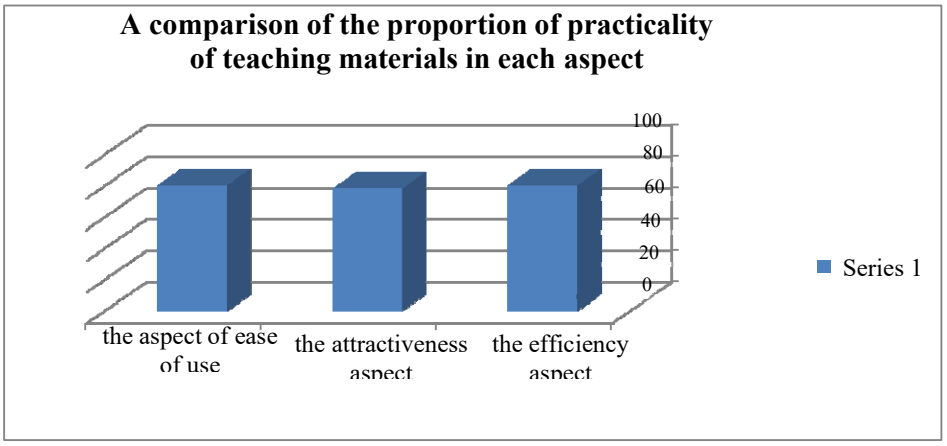

Figure 1. Comparison of the percentage of practicality of teaching materials in each aspect

The practicality of these teaching materials shows that they are easy to use by students, attractive, and efficient. Ease of use refers to how well the organization of the materials and technology used in the teaching materials is. The material organization is an important element in facilitating learning [24]. In addition, student acceptance of the technology used in teaching materials will also affect how well students will learn [25]. The attractiveness of teaching materials is related to student learning motivation. When student motivation is high, the student tends to get optimal mathematics learning outcomes [3], [12]. The use of GeoGebra in the activity of constructing geometric concepts in teaching materials can increase student learning motivation [26]. Thus, the attractiveness of the teaching materials in this study will facilitate students to study the material well. This is also confirmed by the efficiency of the teaching materials in this study which are in the good category.

3.5. Effectiveness of Teaching Materials

The effectiveness of the teaching materials developed was analyzed based on the results of observations and interviews conducted and supported by the results of student work on activities in teaching materials. From the results of the interviews, it is known that the teaching materials developed can "help students in independent learning, and these teaching materials motivate students to practice more independently constructing the concept of the surface area of building space". In addition, students admitted that the teaching materials developed also included mathematical connection abilities and could potentially improve students' mathematical connection abilities. In the teaching materials, some sections guide students to construct the concept of definitions, formulas for area, and volume of each geometric and the relationships between the concepts. The results of the interview are reinforced by examples of student work activities which are shown in Figure 2. The activity of working on teaching materials shows that the learning activities provided in the teaching materials have facilitated students to construct and relate concepts in mathematics.

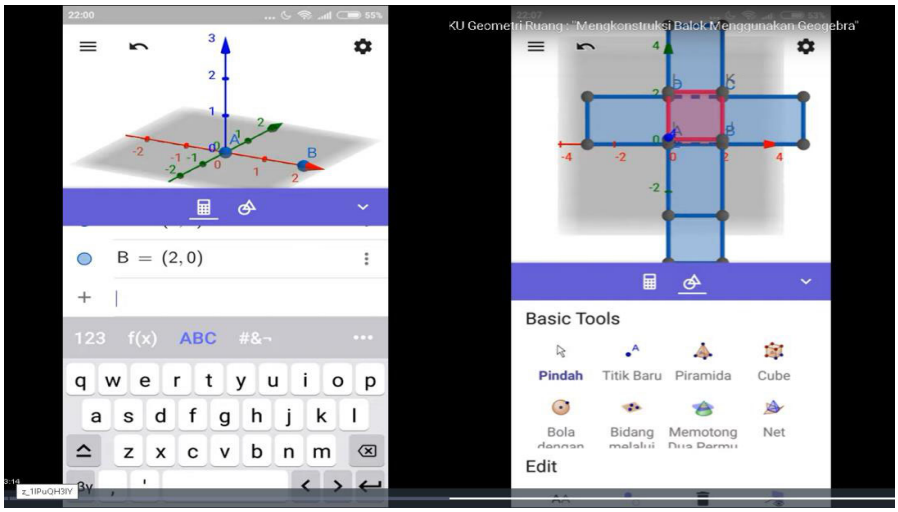

Figure 2. Results of student work activitie

According to the results of interviews and students' work, it can be concluded that the teaching materials developed have the potential to be effective in helping students understand geometrical material. Also, they have the potential to improve their mathematical connection abilities, through the activity of constructing concepts using GeoGebra. This is in line with research [3] which states that GeoGebra-assisted teaching materials can help students find mathematical concepts through construction activities.

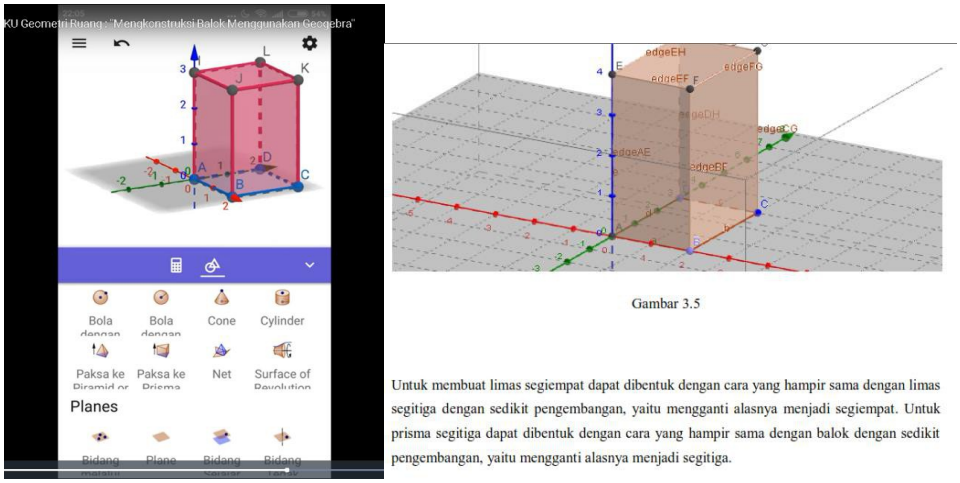

Figure 3. Examples of construction activities using GeoGebr

In Figure 3 students can construct a rectangular pyramid by using the instructions for constructing a triangular pyramid, triangular prism by using the instructions for constructing a rectangular prism. In addition, the developed teaching materials also contain examples of problems that can be solved using GeoGebra. Examples of problems and solutions using GeoGebra can be seen in figure 4. The example shows how activities developed in teaching materials facilitate students to solve problems given by using their thoughts by utilizing GeoGebra.

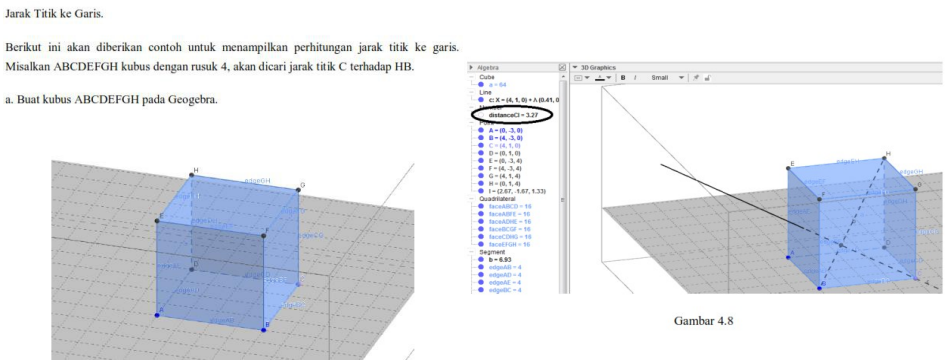

Figure 4. Examples of geometry problems and their solutions using GeoGebra

The teaching materials developed in this research have both practical and theoretical impacts. Practically, these teaching materials can be used by lecturers to facilitate students in learning the topic of solid geometry through activities that encourage the development of mathematical connection abilities. Furthermore, these teaching materials can be used by students to study independently because these teaching materials provide material construction instructions, examples of questions that can be solved using GeoGebra and manually. Theoretically, the process of developing teaching materials described in this article can be used as a reference for developing teaching tools with similar types and purposes.

4 Conclusions

From the results of research and development of GeoGebra android-assisted teaching materials that have good quality to develop students' mathematical connection abilities. The teaching materials developed in this study were valid, practical, and effective. Based on the assessment of material and media experts, the teaching materials have an average validity score of 87% (very valid) and 86% (very valid). Based on student assessments, the practicality of the module has an average score of 79%, so it can be concluded that the teaching materials are practical. Finally, based on student responses as users and supported by the results of student work, the teaching materials developed are also effective. Although these teaching materials have gone through the validation and experiment steps, it must be acknowledged that the development of these teaching materials still has limitations. Conclusions regarding the validity, practicality, and effectiveness of the module in developing students' mathematical connection abilities are still limited to the subject of this research and its context. Therefore, it is recommended for other researchers to investigate the effect of these teaching materials on students' mathematical connection abilities by using different research designs, such as experimental research, and with more research subjects.

5 Acknowledgments

Special thanks to LPPM, Universitas Kuningan that has provided financial support for this study.

References

[1] S. Sumarni, D. Darhim, and F. Siti, ‘Profile of mathematical knowledge for teaching of prospective mathematics teachers in develop the lesson plan’, *Journal of Physics: Conference Series*, vol. 1157, no. 4, 2019.

[2] K. E. Leong, C. M. Chew, and S. S. A. Rahim, ‘Understanding Malaysian Pre-Service Teachers Mathematical Content Knowledge and Pedagogical Content Knowledge’, *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 11, no. 3, pp. 363–370, 2015.

[3] Sumarni, Darhim, S. Fatimah, S. A. Widodo, and M. Riyadi, ‘Mathematics Content Knowledge Prospective Teachers Through Project-Based Learning Assisted By Geogebra 5.0’, in *ICSTI 2018*, 2018, pp. 1–11.

[4] W. Lim and P. Guerra, 'Using a Pedagogical Content Knowledge Assessment to Inform a Middle Grades Mathematics Teacher Preparation Program', *Georgia Educational Researche*, vol. 10, no. 2, pp. 1–15, 2013.
[5] S. S. Abdullah, 'Kesiapan mahasiswa LPTK swasta di Semarang menjadi guru matematika yang profesional', *PYTHAGORAS: Jurnal Pendidikan Matematika*, vol. 12, no. 1, p. 87, 2017.
[6] H. C. Hill, S. G. Schilling, D. L. Ball, H. C. Hill, S. G. Schilling, and D. L. Ball, 'Developing Measures of Teachers' Mathematics Knowledge for Teaching', *The Elementary School Journal*, vol. 105, no. 1, pp. 11–30, 2004.
[7] S. Sumarni, 'Tinjauan Korelasi Antara Kemampuan Koneksi Matematis Dan Self-Regulated Learning Matematika Siswa Yang Pembelajarannya Melalui Learning Cycle 5E', *JES-MAT (Jurnal Edukasi dan Sains Matematika)*, vol. 2, no. 1, pp. 83–98, 2016.
[8] Lesmana, A. T. Prayitno, and Sumarni, 'Penerapan Model Learning Cycle 5E untuk Meningkatkan Koneksi Matematis Siswa', in *Seminar Nasional Pendidikan Matematik, 05 September 2017 Tema "Inovasi Pembelajaran Berbasis Mulitmedia"*, 2017, vol. 1, no. 1, pp. 109–124.
[9] NCTM, *Principles and Standards for School Mathematics*. Reston, VA: The National Council of Teachers of Mathematics, Inc., 2000.
[10] R. Marsitin, 'Koneksi Matematis dan Berpikir Kreatif dalam Pembelajaran Matematika dengan Teori APOS', *Al-Khwarizmi: Jurnal Pendidikan Matematika dan Ilmu Pengetahuan Alam*, vol. 5, no. 1, pp. 87–100, 2018.
[11] N. Rachmani, 'Kemampuan Koneksi Matematis Mahasiswa Calon Guru pada Brain- Based Learning Berbantuan Web', *Kreano: Jurnal Matematika Kreatif-Inovatif*, vol. 9, no. 2, pp. 204–214, 2018.
[12] S. Sumarni and A. T. Prayitno, 'Kemampuan Visual-Spatial Thinking Dalam Geometri Ruang Mahasiswa Universitas Kuningan', *JES-MAT (Jurnal Edukasi dan Sains Matematika)*, vol. 2, no. 2, 2016.
[13] A. Amam and A. T. Fatimah, 'GeoGebra Assist Discovery Learning Model for Problem Solving Ability and Attitude toward Mathematics GeoGebra Assist Discovery Learning Model for Problem Solving Ability and Attitude toward Mathematics', 2017.
[14] S. Jelatu, Sariyasa, and I. M. Ardana, 'Effect of GeoGebra - Aided REACT Strategy on Understanding of Geometry Concepts', *International Journal of Instruction*, vol. 1no. 4, pp. 325–336, 2018.
[15] I. Kepceoğlu and I. Yavuz, 'Teaching a concept with GeoGebra : Periodicity of trigonometric functions', *academic Journals*, vol. 11, no. 8, pp. 573–581, 2016.
[16] A. Rosyid, 'Implementasi Model Pembelajaran Missouri Mathematics Project Berbantuan GeoGebra Untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa SMP', vol. 2, no. 2, pp. 84–89, 2018.
[17] P. Seloraji and L. K. Eu, 'Students ' Performance in Geometrical Reflection Using
[18] GeoGebra', *Malaysian Online Journal of Educational Technology*, vol. 5, no. 1, pp.65–77, 2017.
[19] E. Sudihartinih and T. Purniati, 'Using Geogebra to Develop Students Understanding on Circle Concept', *Journal of Physics: Conference Series*, vol. 1157, pp. 1–7, 2019.
[20] A. Yildiz, 'The Geometric Construction Abilities of Gifted Students in Solving Real- World Problems: A Case from Turkey', *Malaysian Online Journal of Educational Technology*, vol. 4, no. 4, pp. 53–67, 2016.
[21] H. Zulnaidi and S. N. A. S. Zamri, 'The Effectiveness of the GeoGebra Software : The Intermediary Role of Procedural Knowledge On Students ' Conceptual Knowledge and Their Achievement in Mathematics', *EURASIA Journal of Mathematics Science and Technology Education*, vol. 8223, no. 6, pp. 2155–2180, 2017.
[22] F. Fitriani, S. Suddin, and A. Abdullahi, 'Pembelajaran Geometri Menggunakan
[23] Aplikasi Geogebra Versi Android', *Jurnal SOLMA*, vol. 9, no. 2, pp. 270–277, 2020. [22] F. D. P. Nesri and Y. D. Kristanto, 'Pengembangan modul ajar berbantuan teknologi

[24] untuk mengembangkan kecakapan abad 21 siswa', *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, vol. 9, no. 3, pp. 480–492, 2020.
[25] M. M. Grant and R. M. Branch, 'Project-Based Learning In a Middle School : Tracing Abilities Through The Artifacts of Learning', *Journal of Research on Technology in Education*, vol. 38, no. 1, pp. 65–98, 2005.
[26] G. Williams, 'Building Optimism in Prospective Mathematics Teachers Pedagogy', in *Constructing Knowledge for Teaching Secondary Mathematics*, O. Zaslavsky and P. Sullivan, Eds. Deakin: Springer Science+Business Media, 2011, pp. 307–323.
[27] C. Shieh and L. Yu, 'A Study on Information Technology Integrated Guided Discovery Instruction towards Students ' Learning Achievement and Learning Retention', *Eurasia Journal of Mathematics, Science and Technology Education*, vol. 12, no. 4, pp. 833–842, 2016.
[28] S. Sumarni, A. T. Prayitno, and M. Nurpalah, 'Pengembangan Bahan Ajar Matematika Ekonomi Berbasis Learning Cycle Berbantuan Software Geogebra Untuk Meningkatkan Hasil Belajar Mahasiswa', *JES-MAT (Jurnal Edukasi dan Sains Matematika)*, vol. 3, no. 2, p. 139, 2017.