

#### Edukatif: Jurnal Ilmu Pendidikan Volume 4 Nomor 1 Tahun 2022 Halm 1075 - 1082

### EDUKATIF: JURNAL ILMU PENDIDIKAN

Research & Learning in Education https://edukatif.org/index.php/edukatif/index



## Profile of Students' Difficulties to Learn Geometry of Mathematics Education Study Program

# Abdurrahman<sup>1⊠</sup>, Nofriyandi<sup>2</sup>

Universitas Islam Riau, Indonesia<sup>1,2</sup>

E-mail: abdurrahman@edu.uir.ac.id1, nofriyandi@edu.uir.ac.id2

#### **Abstrak**

Penelitian ini bertujuan untuk mendeskripsikan kesulitan belajar mahasiswa pendidikan matematika mahasiswa Program Studi Pendidikan Matematika pada perguruan tinggi di Provinsi Riau. Penelitian ini merupakan penelitian dengan metode campuran. Populasi dalam penelitian ini adalah mahasiswa Pendidikan Matematika Universitas Islam Riau. Teknik pengambilan sampel menggunakan pendekatan purposive dengan mengambil seluruh siswa yang aktif dan telah mempelajari geometri. Instrumen pengumpulan data dalam penelitian ini menggunakan angket dan pedoman wawancara. Analisis data menggunakan deskriptif kuantitatif dan deskriptif kualitatif. Hasil analisis menunjukkan bahwa 55,7% mengalami kesulitan mengingat konsep yang telah dipelajari (postulat, teorema, definisi, prinsip, prosedur/operasi, fakta). 41% mahasiswa mengalami kesulitan dalam memahami setiap materi kuliah geometri. 38,5% siswa tidak dapat memahami maksud atau masalah dalam soal geometri yang diberikan. 54,9% siswa tidak dapat menerapkan postulat/teorema/menyelesaikan masalah geometri. 41,8% siswa tidak dapat menentukan dan mengurutkan langkah-langkah dalam menyelesaikan masalah geometri. 36,9% siswa tidak dapat melakukan proses perhitungan yang berurutan, benar, dan lengkap dalam menyelesaikan masalah geometri. Terdapat 41% mahasiswa Program Studi Pendidikan Matematika Universitas Islam Riau yang kurang mampu teliti dan cermat dalam menyelesaikan masalah geometri.

Kata Kunci: kesulitan belajar, geometri, tingkat universitas.

#### Abstract

This study describes mathematics education students' learning difficulties of Mathematics Education Study Program students at Riau Islamic university in Riau Province. This research is mixed-method research. The population in this study was students of Mathematics education at the Islamic University of Riau. The sampling technique used was a purposive approach by taking all active students and have studied geometry. The data collection instrument in this study used a questionnaire and interview guidelines. Data analysis used quantitative descriptive and qualitative descriptive. The analysis results show that 55.7% have difficulty remembering the concepts that have been studied (postulates, theorems, definitions, principles, procedures/operations, facts). 41% of students have difficulty understanding any geometry lecture material. 38.5% of students cannot understand the intent or problem in the given geometry problem. 54.9% of students cannot determine and sequence the steps in solving geometry problems. 36.9% of students cannot carry out a sequential, correct, and complete calculation process in solving geometry problems. There are 41% of students of the Mathematics Education Study Program at the Islamic University of Riau who are less able to be thorough and careful in solving geometry problems.

**Keywords:** learning difficulties, geometry, university level.

Copyright (c) 2022 Abdurrahman, Nofriyandi

⊠ Corresponding author:

Email : abdurrahman@edu.uir.ac.id ISSN 2656-8063 (Media Cetak)
DOI : https://doi.org/10.31004/edukatif.v4i1.2102 ISSN 2656-8071 (Media Online)

Edukatif: Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022

p-ISSN 2656-8063 e-ISSN 2656-8071

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

#### INTRODUCTION

Geometry is a branch of mathematics taught at every level of education, from elementary school to college. Geometry material is not explicitly taught in elementary school or high school, while in college, geometry is one of the subjects taught in mathematics education study programs. Geometry is one of the crucial aspects of learning mathematics that students must understand in college because the concept of geometry is closely related to everyday life (Panaoura, 2021). Kutluca (2013) provides reasons why geometry is considered essential and needs to be taught in mathematics, namely: First, geometry is the only field of mathematics that can relate mathematics to physical forms in the real world. Second, geometry can only allow visualized mathematical ideas, and third, geometry can provide non-single examples of mathematical systems.

Understanding geometric material requires a relatively high visualization because of its abstract nature. For example, three-dimensional geometry is part of the geometry that discusses the form of space or three-dimensional shapes. Building space is called a three-dimensional wake because it contains three elements: length, width, and height (Vojkuvkova, 2012). Objects in three-dimensional geometry are abstract objects. These objects are points, lines, fields, cubes, blocks, spheres, all of which are objects obtained through abstraction and idealization from natural objects found in everyday life (Risnawati et al., 2019). If there are no teaching aids or learning media, of course, not all students can visualize it.

Based on the explanation above, if geometry learning is associated with learning theory, according to Piaget (Copeland, 1984)), children aged 11 or 12 years and over are in the formal operation stage or called the hypothetical deductive period. Children in this period can develop a statement to confirm or deny as a hypothesis and then prove the hypothesis by comparing deductive reasoning with the facts in their way of thinking. But in fact, based on the geometry lecture process for students of the Mathematics Education Study Program, Islamic University of Riau, students tend to have difficulty thinking abstractly and reasoning, so lecturers often explain repeatedly to help students understand the problem. In addition, students also experienced difficulties when completing assignments and exercises related to geometry. Student difficulties impact low mid-semester examination and end-of-semester scores.

The low ability of students to understand and master the geometry course material is indeed inseparable from the difficulties of students in learning it. Students' difficulty in learning and understanding geometry is a crucial problem because it affects students' abilities and understanding of subsequent mathematical material (Raj Acharya, 2017). If this problem is not a solution, it can make the ability and understanding of geometry in mathematics education students of Riau Islamic University low quality. This definition is in line with several studies related to the low readiness of mathematics education students in mastering geometry (Browning et al., 2014; Robichaux-Davis & Guarino, 2016; Shaame et al., 2020). Therefore, the problem of learning difficulties in geometry courses in the mathematics education study program is urgent. It is necessary to conduct a more profound study related to student learning difficulties in geometry courses and find factors as causes become material for reflection and evaluation.

The factors that cause learning difficulties consist of two kinds, namely internal factors (factors within students, such as interest, motivation, talent, and intelligence) and external factors (factors from outside students, for example, family, school)(Hamalik, 2015). An in-depth study is needed to solve these learning difficulties, especially for mathematics education students.

Before determining alternative solutions for student learning difficulties, lecturers are recommended to identify the phenomena that indicate these students' possibility of learning difficulties. Lecturers also find out specific characteristics or criteria of students who have learning difficulties, as stated by (Retnawati et al., 2017), namely showing low learning outcomes, results that are not following the efforts made, slow in completing the tasks of learning activities, and there is a learning achievement disorder. If one of the above

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

characteristics is owned by a student in the learning process, it can be said that the student is experiencing difficulties in learning.

Based on the above problems experienced by students of mathematics education at Riau Islamic University in geometry courses, it is essential to study the factors that cause students to experience difficulties in learning. Therefore, the researcher will research "Profile of Learning Difficulties of Students of the Mathematics Education Study Program Riau Islamic University in Geometry Course." This research will answer the problem formulation; 1) What learning difficulties do students of the Mathematics Education Study Program Riau Islamic University experience in geometry courses? 2) What factors cause learning difficulties for students of the Mathematics Education Study Program Riau Islamic University in the geometry course?

The purpose of learning geometry is to help students develop visualization skills, critical thinking, problem-solving, reasoning, intuition, and logical argument. Meanwhile, according to Jojo (2017), the purpose of learning geometry is to gain confidence in their mathematical abilities, become good problem solvers, communicate mathematically, and reason mathematically. Students can understand geometry better than elementary, middle, and high school students. The reason is that geometry material has been taught from elementary school to middle school.

Learning difficulties translate English "Learning Disability," which means learning disabilities. Learning difficulties can also be interpreted as conditions in the learning process characterized by certain obstacles to achieving learning outcomes. These barriers can be psychological, sociological, or physiological in the overall learning (Callingham & Siemon, 2021; Riccomini et al., 2015). Someone who has learning difficulties will show the following characteristics, namely 1) showing low learning outcomes; 2) results that are not following the efforts made; 3) slow in completing the tasks of learning activities.

#### **METHODOLOGY**

This study uses a mix-method design that involves quantitative and qualitative descriptive research. The research population was all mathematics education students at the Islamic University of Riau, while the sample was some of the students of the Islamic University of Riau who were taken randomly. This research was conducted at the Mathematics Education Study Program, Riau Islamic University starting in the even semester. This study uses two data collection techniques, namely surveys, and interviews. The instruments used in this study were questionnaires and interview guidelines. The data analysis used in this study includes quantitative analysis using quantitative descriptive and qualitative analysis comprises several stages: 1) Data Reduction, the data simplification process which provides for summarizing activities, selecting the main things, focusing on the essential things, and creating clusters. 2) Data Display, data presentation is the next step that must be done, data presentation is in the form of unifying information that has been obtained in the field in the form of a narrative, and 3) Conclusion Drawing, concluding is the final step carried out in the research process

#### RESULT AND DISCUSSION

First, the researcher explained that a research questionnaire on the profile of learning difficulties of students of the Mathematics Education Study Program in the geometry course had been distributed to 122 students of the Mathematics Education Study Program consisting of (1) 92.6% female students and 7.4% male students. Male, and (2) 23% of second-semester students; 34.4% of 4th-semester students, and 42.6% of 6th-semester students in the 2019/2020 academic year. The description of the results of the analysis of the adopting instrument regarding student learning difficulties can be seen in Table 1.

Edukatif: Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022 p-ISSN 2656-8063 e-ISSN 2656-8071

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

Table 1
Students' Difficulties Description in learning Geometry

Learning difficulties aspects		Very Capable		Capable		Less Capable		No Capable	
<u>.</u>	F	%	$\mathbf{F}$	%	f	%	f	%	
Remembering the concepts that have been studied (postulates, theorems, definitions, principles, procedures/operations, facts)	2	1,7	52	42,6	67	54,9	1	0,8	
Understand every geometry lecture material [postulates/theorems/definitions/principles/proc edures (operations)/facts] that have been studied	1	0,8	71	58,2	49	40,2	1	0,8	
Able to understand the meaning or problem in the given geometry problem	2	1,7	73	59,8	47	38,5	0	0	
Able to apply postulates/theorems/definitions/principles/proc edures(operations)/facts in solving geometry problems	1	0,8	54	44,3	67	54,9	0	0	
Able to determine and sequence the steps in solving geometric problems	2	1,7	69	56,5	51	41,8	0	0	
Carry out the counting process in an orderly, correct and complete manner	4	3,3	73	59,8	45	36,9	0	0	
Solve the problem of geometry carefully and carefully	4	3,3	68	55,7	50	41	0	0	

Based on the data in Table 1 above, it is clear that many of the Mathematics Education Study Program students are less able to remember the concepts that have been studied (postulates, theorems, definitions, principles, procedures/operations, facts) related to solving geometry problems. This information explained that 55.7% of Mathematics Education Study Program students have difficulty remembering the concepts that have been studied (postulates, theorems, definitions, principles, procedures/operations, facts) that are related or used in solving geometry problems. There are 41% of students in the Mathematics Education Study Program. They lack and understand lecture material cannot every geometry [postulates/theorems/definitions/principles/procedures (operations)/facts] explained by the lecturer. 41% of Education Study Program students have difficulty understanding every geometry lecture material. There are 38.5% of students of the Mathematics Education Study Program who cannot understand the intent or problem in the given geometry problem. This means that 38.5% of students of the Mathematics Education Study Program FKIP UIR have difficulty understanding the intent or problem in the given geometry problem. There are 54.9% of students of the Mathematics Education Study Program who are less able to apply postulates/theorems/definitions/principles/procedures (operations)/facts in solving geometry problems. This means that 54.9% of the Mathematics Education Study Program students have difficulty applying postulates/theorems/definitions/principles/procedures (operations)/facts in solving the answers to the given geometry questions. There are 41.8% of students of the Mathematics Education Study Program who are less able to determine and sequence the steps in solving geometry problems. This also means they have difficulty determining and ordering the steps to solve geometry problems. There are 36.9% of students of the Mathematics Education Study Program who are less able to carry out an ordered, correct and complete arithmetic process in solving geometry problems. This means that they have difficulty in carrying out an orderly, correct, and complete calculation process when solving geometry problems. There are 41% of students of the Mathematics Education Study Program who are less able to be thorough and careful in solving geometry problems. This means that 41% of these students are experiencing difficulties, namely less able to

> Edukatif: Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022 p-ISSN 2656-8063 e-ISSN 2656-8071

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

be thorough and careful in solving geometry problems. Table 2 shows the achievement of mathematics education students at the Riau Islamic University.

Table 2
Average of Mid Exam Scores and Final Semester Exams for Geometry Courses

Average of which Exam Secrets and Pinal Semester Exams for Geometry Courses						
<b>Students Level</b>	Classes	Average of Mid Examination	Average of End Examination			
2017	1A	18,19	14,3			
	1B	16,03	11,3			
2018	1A	14,3	11,7			
	1B	14,6	12,2			
2019 —	1A	19,09	6,7			
	1B	19,62	14.74			
Total		101,83	70,94			
Combined Av	verage	16,97	11,82			

Table 2 explains that the average value of the mid-semester examination and end-semester examination of students of the Mathematics Education Study Program FKIP UIR class 2017 – 2019 in the geometry course is still deficient, with the combined average for UTS is 16.97 and for UAS is 11.82. The low average value of the mid-semester examination and end-semester examination certainly illustrates how low the students' ability of the Mathematics Education Study Program of Riau Islamic University in understanding and mastering geometry course material is so that it also affects the field and space analytical geometry course and transformation geometry.

Interviews were conducted with nine students of the Mathematics Education Study Program related to the factors causing students' difficulties in learning and working on geometry problems. The results of the interview obtained information that; 1) Lack of interest in learning geometry, 2) Having bad study habits in learning geometry, 3) Having a bad experience when learning geometry in school, namely not understanding/misconceptions of the geometry material taught by the teacher; 4) Having poor intellectual abilities/intelligence and good enough in learning geometry, 5) Having visual, hearing, and concentration impairments, 6) Learning facilities on campus (coursebook references) are not very helpful in learning geometry; 7) Solid/quite dense/slightly dense geometry material so that it is challenging to understand geometry courses; 8) The speed of the lecturer in teaching geometry so that students find it difficult to digest or respond to all of the lecturer's explanations; 9) the rigidity of the geometry lecturer when delivering the material so that the students fell asleep when the lecturer explained; 10) Family environment, community environment, and university/campus environment influence students in studying geometry.

The research results obtained information that students have difficulty remembering the concepts studied (postulates, theorems, definitions, principles, procedures/operations, facts) that are related or used in solving geometry problems. Students find it difficult to understand any geometry lecture material. Students find it difficult to understand the meaning or issues in the given geometry problem. Students have difficulty applying postulates/theorems/definitions/principles/procedures (operations)/facts in solving the answers to given geometry questions. Students find it challenging to determine and sequence the steps in solving geometry problems. Students have difficulty carrying out the arithmetic process in an orderly, correct, and complete manner when solving geometry problems. And students have difficulty working on geometry problems carefully to be thorough and careful in solving geometry problems.

The factor that causes students to have various difficulties in the learning process is that they are less interested in geometry courses taught by lecturers. Students have bad habits in studying; in this case, students do not use their time well to study and master the material. This is also due to the low motivation of students to learn mathematics geometry. Motivation is an essential factor that students must have to master geometry learning (Bartimote-Aufflick et al., 2016)). Learning motivation is the basis for a student to master all the

Edukatif : Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022 p-ISSN 2656-8063 e-ISSN 2656-8071

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

subjects he will study (Khan et al., 2019). Learning motivation will lead a student to master the material being studied because motivation is a stimulus to activate work in obtaining maximum results (Steen et al., 2006).

Students have difficulty mastering biology learning due to the lack of learning facilities on campus and at students' homes. Learning facilities have not accommodated all the needs of students in learning Geometry. Teaching facilities are essential in supporting student teaching and learning activities (Nuraen & Retnawati, 2016). Learning facilities make it easier for students to adapt to learning to find information about the material being taught (Byers, 2017; Schleppegrell, 2014; Thomas et al., 2015). Complete learning facilities will support students to learn optimally in managing learning in the classroom (Panadero et al., 2017; Retnawati et al., 2017). Learning facilities that are appropriately fulfilled will help students achieve their goals to succeed in the learning process.

#### **CONCLUSION**

Based on the results of the analysis of research data in Chapter 4, it can be concluded as follows: The difficulties of students of the Mathematics Education Study Program Riau Islamic University in learning geometry courses includes 55.7% of students having difficulty remembering the concepts that have been studied (postulates, theorems, definitions, principles, procedures/ operations, facts). 41% of students have difficulty understanding any geometry lecture material. 38% of students have difficulty understanding the intent or problem in the given geometry problem (38%). 54.9% have difficulty applying postulates/theorems/definitions/principles/procedures (operations)/facts in solving the answers to the given geometry questions. 41.8% of students have difficulty determining and ordering the steps in solving geometry problems. 36.9% have difficulty carrying out the calculation process correctly and entirely according to the procedure when solving geometry problems. 41% of students have difficulty working on problems carefully and carefully in solving geometry problems.

The factor causing students' difficulty in the Mathematics Education Study Program at the Islamic University of Riau in learning geometry courses is their lack of interest in biology. Has poor study habits in geometry and has a bad experience when learning geometry at school, namely not understanding/misconceptions of the geometry material taught by the teacher. Having poor intellectual abilities/intelligence and currently studying geometry. Has impaired sense of sight, hearing, and concentration. Learning facilities on campus (coursebook references) are not very helpful for students learning geometry and assuming solid/fairly dense/slightly dense geometric material when it is not so. The difficulty is not taking advantage of the family, community, and university/campus environments to study geometry. Even these students say they often feel unaware of their surroundings.

#### **ACKNOWLEDGEMENTS**

First and foremost, we would like to thank the Universitas Islam Riau who had provided financial assistance to complete this research. Hopefully, this research can provide great benefits for Universitas Islam Riau and the development of education in Indonesia.

#### **REFERENCES**

Bartimote-Aufflick, K., Bridgeman, A., Walker, R., Sharma, M., & Smith, L. (2016). The study, evaluation, and improvement of university student self-efficacy. *Studies in Higher Education*, *41*(11), 1918–1942. https://doi.org/10.1080/03075079.2014.999319

Browning, C., Edson, A. J., Kimani, P. M., & Aslan-Tutak, F. (2014). Mathematical content knowledge for teaching elementary mathematics: A focus on geometry and measurement. *Mathematics Enthusiast*, 11(2), 333–383. https://doi.org/10.54870/1551-3440.1306

Byers, T. (2017). Evidence concerning the impact of classroom design on teacher pedagogy, and student

Edukatif : Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022 p-ISSN 2656-8063 e-ISSN 2656-8071

- 1081 Profile of Students' Difficulties to Learn Geometry of Mathematics Education Study Program Abdurrahman, Nofriyandi DOI: https://doi.org/10.31004/edukatif.v4i1.2102
  - engagement and performance in mathematics. Learning Environments Research, 20(1), 139–152.
- Callingham, R., & Siemon, D. (2021). Connecting multiplicative thinking and mathematical reasoning in the middle years. *Journal of Mathematical Behavior*, 61(December 2020), 100837. https://doi.org/10.1016/j.jmathb.2020.100837
- Copeland, R. W. (1984). How children learn mathematics, teaching implications of Piaget's research. The Macmillan Compan.
- Hamalik, U. (2015). Metode belajar dan kesulitan-kesulitan belajar. Tarsito.
- Jojo, Z. (2017). Disrupting a learning environment for promotion of geometry teaching. *Africa Education Review*, 14(3–4), 245–262. https://doi.org/10.1080/18146627.2017.1314175
- Khan, T., Johnston, K., & Ophoff, J. (2019). The Impact of an Augmented Reality Application on Learning Motivation of Students. *Advances in Human-Computer Interaction*, *3*(1), 1–14. https://doi.org/10.1155/2019/7208494
- Kutluca, T. (2013). The Effect of Geometry Instruction with Dynamic Geometry Software; GeoGebra on Van Hiele Geometry Understanding Levels of Students. *Educational Research and Reviews*, 8(17), 1509–1518. https://doi.org/10.5897/ERR2013.1554
- Nuraen, Z., & Retnawati, H. (2016). The Post-Certification Performance of Mathematics Teachers. *The Online Journal of New Horizons in Education*, 6(2), 143–154.
- Panadero, E., Jonsson, A., & Botella, J. (2017). Effects of self-assessment on self-regulated learning and self-efficacy: Four meta- analyses Ernesto. *Educational Research Review*, 22, 74–94.
- Panaoura, R. (2021). Parental Involvement in Children's Mathematics Learning Before and During the Period of the COVID-19. *Social Education Research*, 2(1), 65–74. http://ojs.wiserpub.com/index.php/SER/
- Raj Acharya, B. (2017). Factors Affecting Difficulties in Learning Mathematics by Mathematics Learners. *International Journal of Elementary Education*, 6(2), 8. https://doi.org/10.11648/j.ijeedu.20170602.11
- Retnawati, H., Munadi, S., Arlinwibowo, J., Wulandari, N. F., & Sulistyaningsih, E. (2017). Teachers' difficulties in implementing thematic teaching and learning in elementary schools. *New Educational Review*, 48(2), 201–212. https://doi.org/10.15804/tner.2017.48.2.16
- Riccomini, P. J., Smith, G. W., Hughes, E. M., & Fries, K. M. (2015). The Language of Mathematics: The Importance of Teaching and Learning Mathematical Vocabulary. *Reading & Writing Quarterly*, *31*, 235–252. https://doi.org/10.1080/10573569.2015.1030995
- Risnawati, Andrian, D., Azmi, M. P., Amir, Z., & Nurdin, E. (2019). Development of a definition maps-based plane geometry module to improve the student teachers' mathematical reasoning ability. *International Journal of Instruction*, 12(3), 541–560. https://doi.org/10.29333/iji.2019.12333a
- Robichaux-Davis, R. R., & Guarino, A. J. (2016). Assessing elementary pre-service teachers' knowledge for teaching geometry. *International Journal of Mathematics and Statistics Invention*, 4(1), 12–20. www.ijmsi.org
- Schleppegrell, M. J. (2014). Overcoming Learning Difficulties The Linguistic Challenges of Mathematics Teaching and Learning: A Research Review. *Reading & Writing Quarterly*, 23(2), 37–41. https://doi.org/10.1080/10573560601158461
- Shaame, A. A., Osaki, K. M., Anatory, J. R., & Mrutu, S. I. (2020). Exploring a Learning Management System as a Way to Improve Students' Understanding of Geometry in Secondary Schools. *Africa Education Review*, 17(4), 17–40. https://doi.org/10.1080/18146627.2020.1868070
- Steen, K., Brooks, D., & Lyon, T. (2006). The Impact of Virtual Manipulatives on First Grade Geometry Instruction and Learning. *Jl. of Computers in Mathematics and Science Teaching*, 25(4), 373–391.
- Thomas, C. N., Van Garderen, D., Scheuermann, A., & Lee, E. J. (2015). Applying a Universal Design for Learning Framework to Mediate the Language Demands of Mathematics. *Reading and Writing*

DOI: https://doi.org/10.31004/edukatif.v4i1.2102

Quarterly, 31(3), 207–234. https://doi.org/10.1080/10573569.2015.1030988

Vojkuvkova, I. (2012). The van Hiele Model of Geometric Thinking. WDS'12 Proceedings of Contributed Papers, 1, 72–75.

Edukatif : Jurnal Ilmu Pendidikan Vol 4 No 1 Tahun 2022 p-ISSN 2656-8063 e-ISSN 2656-8071