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Ageng Triyono[a*], Nurimani[b], Budiono[c]

[a]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia, ageng@stkipkusumanegara.ac.id

[b]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia

[c]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia

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Original Article

Elementary school students' ability to understand the elements and properties of simple flat shapes

Ageng Triyono[a*], Nurimani[b], Budiono[c]
[a]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia, ageng@stkipkusumanegara.ac.id
[b]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia
[c]Sekolah Tinggi Keguruan dan Ilmu Pendidikan Kusumanegara, Jakarta Timur, Indonesia

*Correspondence: ageng@stkipkusumanegara.ac.id

Abstract
This research aims to determine: (1) the level of understanding of third grade elementary school students regarding the elements and properties of simple flat shapes, and; (2) distribution of students based on their level of understanding. The research objectives were achieved using a descriptive qualitative research approach. The sample involved was 156 students taken from the population using saturated sampling techniques. Data collection was carried out using a test method which aims to measure students' competence in understanding the elements and properties of simple flat shapes. The collected data was analyzed by calculating the average percentage ($\bar{x}$) and standard deviation (SD), which were then converted into categories of student understanding level. The calculation result of the average percentage ($\bar{x}$) = 62.37%, and the standard deviation is 21.08. In general, students' level of understanding is in the "sufficient" category. The distribution of students based on their level of understanding is: 31 students are in the upper group; 100 students fall into the medium group, and; 25 students fall into the lower group. These findings can then be used as a basis for designing differentiated learning, according to students' level of understanding of geometry at the initial level.
Keywords: geometry, level of student understanding, simple flat shape

1. Introduction

One branch of mathematics that is widely applied in everyday life is geometry (Cherif et al., 2017; Rofii et al., 2018; Triyono et al., 2024). This underlies the accommodation of geometry material as much as 40-50% of all school mathematics material (Kemendikbud, 2018). Geometry material receives a large allocation due to the potential for large benefits for students who have studied it. Apart from having strong relevance to real life, through learning geometry students can also practice: visualizing abstract things, thinking critically, solving everyday problems, reasoning deductively, arguing logically, and thinking spatially (Budiarto & Artiono, 2019; Jupri, 2017; Seah, 2015; Suwito, 2018).

Before the learning process begins, teachers need to design learning in such a way that the targeted learning objectives can be achieved optimally. This also applies to mathematics teachers who will teach geometry material. Geometric materials should also be easily accepted by students, the reason is because there is support from geometric objects in the form of real objects in everyday life that are close to the students' environment, so that students are no longer unfamiliar with geometric content (Wulandari S, 2017; Fatihah et al., 2023; Sudirman et al., 2022; Sudirman et al., 2023). Geometric objects make the geometric materials taught by teachers easier for students to recognize starting from the elementary level (Wulandari & Hasanudin, 2024). However, to this day we still find many difficulties experienced by elementary school students when they are asked to solve geometry problems. The research results of Puspita Rini et al. (2023) concluded that 39.74% of class V students did not know what to do to answer questions in geometry questions, so students who were in this situation decided not to answer the questions. Other

research was conducted by Sonia et al. (2023) concluded that 44% of students still made conceptual errors, and 38.5% made procedural errors when solving geometry problems. A similar conclusion was also conveyed by Salsabilah et al. (2023), who stated that there are still many students who experience difficulties in determining data related to the topic of the area of flat shapes.

The conditions above show that there is still a need to make improvements to the geometry learning process on an ongoing basis. In order for the improvement process to be more effective, researchers consider it necessary to first map out the level of elementary school students' understanding of the geometry material they have received. The material that is the focus of the analysis is the most basic geometric material, namely elemental material and the properties of simple flat shapes. If students have this competency, they will be able to identify various flat shapes and be able to identify various types and sizes of angles (Zafirah et al., 2024). This ability will support them to understand the geometric concepts taught at the next level of education.

The results of the analysis of students' level of understanding obtained from this research can be used as material for consideration by teachers when designing a learning process. The design of the learning process in question is aimed at meeting students' needs based on different levels of understanding, or what we have known as the differentiated learning model. Through the implementation of the differentiated learning model, teachers will try to adapt the geometry learning process and materials according to students' level of readiness. So that improvements in understanding of geometry can be achieved in all students even though they have initial understanding at different levels.

2. Method

This research aims to: (1) analyze the level of understanding of grade 3 elementary school students regarding the elements and properties of simple flat shapes, and; (2) knowing the distribution of students based on the level of understanding of the topic. The research carried out is included in the type of descriptive qualitative research, namely research that presents and analyzes data as it is without any other processing processes (Anggito & Setiawan, 2018). Data was taken from a sample of 156 students, who came from 6 elementary schools in the Kebumen_Central Java area. The sample was selected using purposeful random sampling, which is based on certain considerations in accordance with the desired criteria (Sugiyono, 2018). The instrument used to collect research data is a Competency Standard Mastery Test for Understanding the Elements and Properties of Simple Plane Figures which consists of 30 multiple choice questions and 15 essay questions. The test instrument has been assessed by experts and has been declared valid.

The data that has been collected is analyzed using the following steps (Sudjana, 2020): (1) calculate the percentage of scores obtained by students using the formula $P = \frac{R}{N} \times 100\%$, where: P = mastery, R = total scores, and N = sum of all scores; (2) create a frequency distribution table based on calculating the number and range of classes, and; (3) calculate the class mean ($\bar{x}$) and standard deviation *(SD)* using Excel. The results of calculating the class mean ($\bar{x}$) and standard deviation *(SD)* are then used to determine two things, namely: (1) determine the category of students' understanding of the topic of elements and properties of simple flat shapes and; (2) describe the boundaries of student groups according to that level of understanding. Categories of students' level of understanding are based on criteria as in Table 1.

Table 1. Criteria for Student Understanding Level On the Topic of Elements and Properties of Simple Flat Shapes (adapted from Arikunto, 2021)

Average Student Ability	Ability Criteria
80 – 100	Very Good
66 – 79	Good
56 – 65	Enough
40 – 55	Less
30 – 39	Fail

It can be seen in Table 1 that the criteria used are "Very Good" for a percentage of 80-100; "Good" for percentages 66-79; "Enough" for percentages 56-65; "Less" for percentages 40-55, and; "Fail" for percentages 30-39. The determination of the boundaries of student groups categorized based on their level of understanding can be seen in Table 2.

Table 2. Student Group Boundaries Based on Their Level of Understanding (adapted from Arikunto, 2021)

Group	Control Group Boundaries (P)
Upper	$P > \bar{x} + SD$
Currently	$\bar{x} - SD \leq P \leq \bar{x} + SD$
Lower	$P < \bar{x} - SD$

Information:
$\bar{x}$ = average
SD = standard deviation
P = student mastery/understanding

The results of data analysis will describe: (1) the level of students' understanding of the topic of elements and properties of simple flat shapes, and; (2) the number of students whose mastery level is in the upper, middle and lower group categories. The results of this analysis can later be used as a consideration for teachers when planning geometry mathematics learning, including when teachers plan differentiated learning on geometry material.

3. Results and Discussion

3.1 Results

Data on the results of the Standard Competency Mastery Test for Understanding the Elements and Properties of Simple Plane Figures from 156 students were collected and calculated to determine: (1) the score and percentage of students' understanding; (2) frequency distribution table, (3) mean and standard deviation, and: (4) student group boundaries according to their level of understanding. The results of the analysis from each stage of the research are as explained below.

Results of calculating scores and percentage of student understanding

The maximum score *(N)* obtained by students is 60, namely 30 from the multiple choice test results and another 30 from the test results in the form of essay questions. The score *(R)* obtained by the student is then converted into a percentage of student mastery, with the calculation P=(score $P = \frac{skor\ (R)}{N} \times 100\%$. A summary of the results of calculating scores and percentage of student mastery is presented in Table 3.

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Table 3. Results of calculating scores and percentage of student understanding

No	Sample Code Number	Score	Percentage of Student Understanding (P)
1	SDN.KD.1/001	12	20.00 %
2	SDN.KD.1/002	34	56.67 %
3	SDN.KD.1/003	42	70.00 %
4	SDN.KD.1/004	41	68.33 %
5	SDN.KD.1/005	37	61.67 %
6	SDN.KD.1/006	30	50.00 %
7	SDN.KD.1/007	31	51.67 %
8	SDN.KD.1/008	46	76.67 %
9	SDN.KD.1/009	42	70.00 %
10	SDN.KD.1/010	12	20.00 %
11	SDN.KD.1/011	45	75.00 %
...	...	...	...
...	...	...	...
...	...	...	...
152	SDN.KR.2/152	25	41.67 %
153	SDN.KR.2/153	26	43.33 %
154	SDN.KR.2/154	34	56.67 %
155	SDN.KR.2/155	38	63.33 %
156	SDN.KR.2/156	27	45.00 %

The data on the percentage of student understanding in Table 3 above will create a frequency distribution table. The aim is to make it easier to calculate the mean value and standard deviation.

Results of Preparing Frequency Distribution Tables

The frequency distribution list is compiled based on the steps: (1) determining the data range; (2) calculating many interval classes; (3) calculate the class length; (4) determine the interval class, and; (5) enter the percentage value of student understanding into class intervals. The results of compiling a frequency distribution list are presented in Table 4.

Table 4. Frequency Distribution Table

Class	Frequency (f_i)	x_i	$f_i . x_i$	x_i^2	$f_i . x_i^2$
11,67% - 22,66%	8	17,17	294,81	137,36	2358,48
22,67% - 33,66%	12	28,17	793,55	338,04	9522,6
33,67% - 44,66%	10	39,17	1534,29	391,7	15342,9
44,67% - 55,66%	25	50,17	2517,03	1254,25	62925,75
55,67% - 66,66%	26	61,17	3741,77	1590,42	97286,02
66,67% - 77,66%	35	72,17	5208,51	2525,95	182297,85
77,67% - 88,66%	25	83,17	6917,25	2079,25	172931,25
88,67% - 99,66%	15	94,17	8867,99	1412,55	133019,85
Jumlah	156			9729,52	675684,7

Based on the data in Table 4 above, the class mean ($\bar{x}$) and standard deviation *(SD)* will be calculated.

Class Average Calculation Results ($\bar{x}$) and Standard Deviation *(SD)*

Based on the results from Table 4, the class mean value can be calculated, $(\bar{x}) = \frac{9729,52}{156} = 62,37$. Next, the value of the standard deviation will be calculated, $(SD) = \sqrt{\frac{156(675684,7)-(9729,52)^2}{156(156-1)}} = 21,08$. The results of calculating the average value ($\bar{x}$) will be used as the basis for determining the general level of student ability categories. The results

of the standard deviation *(SD)* calculation will be used as a basis for determining the boundaries of student groups with upper, middle and lower level understanding categories.

Categories and Group Boundaries for Student Understanding Level

Based on the calculation results of the class mean ($\bar{x}$) = 62.37 and standard deviation *(SD)* = 21.08, it can be determined the category of level of understanding of grade 3 elementary school students regarding the elements and properties of simple flat shapes, as well as the distribution of students based on the level of understanding of the topic the. The calculation result of the class average ($\bar{x}$) is 62.37, which if converted into the Student Understanding Level Criteria Table (Table 1) is included in the "sufficient" category.

To find out the distribution of students based on their level of understanding, start by determining the boundaries of the student groups by referring to the provisions in Table 2. The sample will be divided into three groups, with boundaries for: (1) the upper group, namely: $P > \bar{x} + SD$ = 83.45%; (2) medium group, namely: $\bar{x} - SD \leq P \leq \bar{x} + SD$ = 41,29% $\leq P \leq$83.45%, and; (3) lower group, namely: $P < \bar{x} - SD$ = 41.29%. Furthermore, the percentage achievement of each student's level of understanding can be put into a group of levels of understanding according to the group boundaries formed. The recapitulation results show that the number of students included in: the upper group is 31; medium group of 100 students, and; the lower group is 25.

3.2 Discussion

Up to this stage, the researcher has been able to describe that of the 156 students who were the research sample, their overall level of understanding of the elements and properties of simple flat shapes is in the "sufficient" category, which is shown by the results of calculating the class average percentage ($\bar{x}$) which is 62.37. Furthermore, the distribution of 156 students is divided into three groups based on their level of understanding, namely 31 students are in the top group, 100 students are in the middle group, and 25 students are in the bottom group.

Based on the results above, teachers need to pay more attention, especially to students whose level of understanding is in the lower group. One of the factors causing students' understanding to be in the lower group is because their understanding of the concepts and properties of flat shapes is still not strong (Fauzi & Arisetyawan, 2020; Hanan & Alim, 2023; Sholihah & Afriansyah, 2018). The findings of this research can be used as a basis for consideration for teachers who wish to carry out geometry lessons with subjects at the next level. With the level of understanding of students still found in the middle and lower groups, this shows that in further geometry learning there is still a need to differentiate according to the background level of students' understanding of elemental material and the nature of simple flat shapes. On the other hand, researchers also recommend that teachers use examples of concrete geometric objects to strengthen students' understanding of concepts.

4. Conclusion

Based on data analysis, it has been possible to describe the category of students' level of understanding of the elemental material and properties of simple flat shapes, namely the "sufficient" category, which is indicated by the class average score of 62.37. Furthermore, the distribution of the 156 students when viewed from the level of understanding is: upper group 31 students; the medium group is 100 students, and the lower group is 25 students. The results of this research can then be used as consideration for teachers in designing differentiated learning, which is based on differences in students' levels of understanding of elemental material and the properties of simple flat shapes.

5. References

Anggito, A., & Setiawan, J. (2018). *Metodologi Penelitian Kualitatif*. CV Jejak (Jejak Publisher).

Arikunto, S. (2021). *Dasar-Dasar Evaluasi Pendidikan Edisi 3*. Bumi Aksara.

Budiarto, M. T., & Artiono, R. (2019). Geometri dan Permasalahan dalam Pembelajarannya (Suatu Penelitian Meta Analisis). *JUMADIKA: Jurnal Magister Pendidikan Matematika*, *1*(1), 9–18. https://doi.org/10.30598/jumadikavol1iss1year2019page9-18

Cherif, A. H., Gialamas, S., & Stamati, A. (2017). Developing Mathematical Knowledge and Skills through theAwareness Approach of Teaching and Learning. *Journal of Higher Education Management 728 W. Jachson Blvd., Unit*, *8*(13). https://files.eric.ed.gov/fulltext/EJ1143971.pdf

Fatihah, J. J., Sudirman, S., & Mellawaty, M. (2023). Improving geometric thinking skills through learning cycles assisted by interactive geometry books. *International Journal of Mathematics and Sciences Education, 1*(2), 81-85.

Fauzi, I., & Arisetyawan, A. (2020). Analisis Kesulitan Belajar Siswa pada Materi Geometri Di Sekolah Dasar. *Kreano, Jurnal Matematika Kreatif-Inovatif*, *11*(1), 27–35. https://doi.org/10.15294/kreano.v11i1.20726

Hanan, M. P., & Alim, J. A. (2023). Analysis Of Mathematics Learning Difficulties of Elementary School Students of Grade VI on Geometry Materials. *AL-IRSYAD: Journal of Mathematics Education*, *2*(2), 59–66. https://doi.org/10.58917/ijme.v2i2.64

Jupri, A. (2017). From geometry to algebra and vice versa: Realistic mathematics education principles for analyzing geometry tasks. *AIP Conference Proceedings*, *1830*, 1–5. https://doi.org/10.1063/1.4980938

Permendikbud Nomor 37 Tahun Permendikbud. No 37 Tahun 2018 Tentang Perubahan Atas Peraturan Menteri Pendidikan Dan Kebudayaan Nomor 24 Tahun 2016 Tentang Kompetensi Inti Dan Kompetensi Dasar Pelajaran Pada Kurikulum 2013 Pada Pendidikan Dasar Dan Menengah (2018).

Puspita Rini, C., Amaliyah, A., Dwi Hartantri, S., & Ari Nur Istiawanti, R. (2023). Analisis Kesalahan Mengerjakan Soal Matematika Materi Geometri Siswa Kelas V (Penelitian Kualitatif di SDN Doyong 2 Periuk Kota Tangerang). *JTIEE (Journal of Teaching in Elementary Education*, *7*(2), 125–133. https://doi.org/10.30587/jtiee.v7i2.7062

Rofii, A., Sunardi, S., & Irvan, M. (2018). Characteristics of Students' Metacognition Process At Informal Deduction Thinking Level in Geometry Problems. *International Journal on Emerging Mathematics Education*, *2*(1), 89. https://doi.org/10.12928/ijeme.v2i1.7684

Salsabilah, A. S., Afifah, N. P. N., Herdiansyah, R. F. P., & Komariah. (2023). Analisis Kesulitan dalam Menyelesaikan Soal Luas Bangun Datar Gabungan Siswa Kelas IV SD. *Journal on Education*, *06*(01), 2601–2608. https://doi.org/10.31004/joe.v6i1.3290

Seah, R. (2015). Reasoning With Geometric Shapes. *Australian Mathematics Teacher*, *71*(2), 4–11. https://files.eric.ed.gov/fulltext/EJ1093213.pdf

Sholihah, S. Z., & Afriansyah, E. A. (2018). Analisis Kesulitan Siswa dalam Proses Pemecahan Masalah Geometri Berdasarkan Tahapan Berpikir Van Hiele. *Mosharafa: Jurnal Pendidikan Matematika*, *6*(2), 287–298. https://doi.org/10.31980/mosharafa.v6i2.317

Sonia, A., Suanto, E., Kartini, & Maimunah. (2023). Analyzing Students Errors Based On Kastolan Theory In Solving AKM-Numeration Type Questions In Geometry Domain. *AXIOM: Jurnal Pendidikan Dan Matematika*, *12*(1), 34–35. https://doi.org/10.30821/axiom.v12i1.15549

Sudirman, S., Kusumah, Y. S., Martadiputra, B. A. P., & Runisah, R. (2023). Epistemological Obstacle in 3D Geometry Thinking: Representation, Spatial Structuring, and Measurement. *Pegem Journal of Education and Instruction*, *13*(4), 292-301.

Sudirman, S., Rodríguez-Nieto, C. A., Dhlamini, Z. B., Chauhan, A. S., Baltaeva, U.,

Abubakar, A., ... & Andriani, M. (2023). Ways of thinking 3D geometry: exploratory case study in junior high school students. *Polyhedron International Journal in Mathematics Education*, *1*(1), 15-34.

Sudjana, N. (2020). *Penelitian dan Penilaian Pendidikan*. Sinar Baru Algensindo.

Sugiyono, S. (2018). *Metode Penelitian Kuatitatif, Kualitatif dan R & D Edisi 15*. Bandung: Alfabeta.

Suwito, A. (2018). Analisis Berpikir Secara Geometri Dalam Menyelesaikan Masalah Aljabar Pada Kelas VIII. *Prosiding Seminar Nasional Etnomatnesia*, 64–69. https://jurnal.ustjogja.ac.id/index.php/etnomatnesia/article/view/2294

Triyono, A., Nuary, R. H., Permatasari, N., Yuni, Y., & Wibowo, T. (2024). The Level of Effectiveness of TPS and Conventional Methods Judging from Students' Geometry Learning Results Using the N-Gain Test. *AlphaMath : Journal of Mathematics Education*, *10*(1), 142–156. https://doi.org/10.30595/alphamath.v10i1.21530

Wulandari, D. N. A. K., & Hasanudin, C. (2024). Mengenal Konsep Dasar Geometri untuk Matematika Sekolah Dasar. *Seminar Nasional Dan Gelar Karya Produk Hasil Pembelajaran*, 529–539. https://prosiding.ikippgribojonegoro.ac.id/index.php/SNGK/article/view/2477

Wulandari S, C. (2017). Installing The Concept of Geometry Form (Two-dimentional Figure). *Jurnal Pengabdian Masyarakat Ipteks*, *3*(1), 1–8. https://doi.org/10.32528/pengabdian_iptek.v3i1.992

Zafirah, A., Gistituati, N., Bentri, A., Fauzan, A., & Yerizon, Y. (2024). Studi Perbandingan Implementasi Kurikulum Merdeka dan Kurikulum 2013 Pada Mata Pelajaran Matematika: Literature Review. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *8*(1), 276–304. https://doi.org/10.31004/cendekia.v8i1.2210