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STUDENTS' PROPORTIONAL REASONING IN MATHEMATICS THROUGH COVID-19 PANDEMIC CONTEXT

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Abstrak

Tujuan dari penelitian ini adalah untuk menggali penalaran proporsional siswa SMA dengan konteks pandemi COVID-19. Bagaimana alur pemikiran siswa ketika dihadapkan pada masalah yang membutuhkan penalaran proporsional? Penelitian ini merupakan penelitian campuran dengan pengumpulan data melalui pertanyaan pemecahan masalah kepada 253 siswa SMP di Muaro Jambi, Provinsi Jambi, Indonesia. Kegiatan pemecahan masalah didasarkan pada skenario dunia nyata dan membutuhkan penalaran yang proporsional dan relevan dengan konteks pandemi COVID-19. Karena pandemi COVID-19 yang sedang berlangsung, tes dikirim melalui aplikasi Whatsapp. Tanggapan siswa diperiksa secara rinci untuk memastikan kemampuan penalaran proporsional mereka. Hasilnya menunjukkan bahwa hampir semua siswa menjawab pertanyaan pertama dengan benar. Namun, hanya sebagian kecil siswa yang mampu menjawab dan membuat argumen yang benar untuk pertanyaan kedua. Menurut temuan ini, penting bagi guru matematika untuk menetapkan kegiatan pembelajaran dan tugas pemecahan masalah yang membantu siswa meningkatkan keterampilan penalaran proporsional mereka.

Kata kunci: COVID-19, Penalaran Proporsional, Pemecahan Masalah, Situasi Dunia

Abstract

The aim of this study was to ascertain high school students' proportional reasoning in the sense of the COVID-19 pandemic. How do students' thoughts flow when confronted with problems requiring proportional reasoning? This research is a mixed study by collecting data through problem-solving questions to 253 junior high school students in Muaro Jambi, Jambi Province, Indonesia. The problem-solving activities are based on real-world scenarios and require reasoning that is proportional and pertinent to the COVID-19 pandemic context. Due to the ongoing COVID-19 pandemic, the test is administered through the Whatsapp framework. Students' responses are examined in detail to ascertain their proportional reasoning skills. The results indicate that almost all students correctly answered the first question. However, only a small percentage of students were able to answer to and make the correct argument for the second question. According to the findings of this report, it is important for teachers of mathematics to establish learning activities and problem-solving tasks that help students improve their proportional reasoning skills.

***Keywords**: COVID-19, Proportional Reasoning, Problem Solving, Real-World Situations*

INTRODUCTION

The critical aspect of mathematics is that it makes sense. Students develop their ability to think logically when studying mathematics. Logic can help students develop their ability to think correctly (Cresswell & Speelman, 2020). Reasoning skill is a critical component of mathematics education. (National Council of Teachers of Mathematics, 2000) defines mathematical reasoning objectives as "real force." These objectives include (a) precise contact, (b) mathematical reasoning, (c) mathematical problem solving, (d) authentic relation, and (e) representation. Thus, one of the primary aims of education is to teach children to think correctly. Reasoning is a critical part of mathematical skill when it comes to studying mathematics. According to the (American Psychological Association, 2015), reasoning is the inductive or deductive character's method of drawing conclusions from facts or premises. The rationale is inextricably linked to how one draws conclusions based on both direct and indirect premises. The argument's essence lies in how one arrives at rational conclusions. Reasoning as a cognitive method is essential for problem solving (Kafadar, 2012). (Bronkhorst et al., 2020) define reasoning as the ability to create claims, evaluate them, and draw conclusions.

According to (Brodie, 2010), mathematical reasoning is the process of reasoning about and with mathematical artifacts. Reasoning can be described as the mental process by which established facts are connected to an inference or generalization (Bozkuş & Ayvaz, 2018; Mata-pereira & Ponte, 2017). Additionally, according to (Erdem & Gürbüz, 2015), mathematical reasoning can be described as a high-level thought process that entails deriving meaning from a problem or phenomenon by posing questions in the form of "why" and "how." A critical mode of reasoning, and one that is central to mathematics work, is to "prove" the allegations are valid. It's fascinating to observe how students attempt to demonstrate that a statement is always right (Ball & Bass, 2003). Mathematical thinking is a vital skill that students in schools must possess (Tshabalala, 2018). According to (Macbeth, 2012), mathematical logic can be used to illustrate, justify, and prove something.

Proportional reasoning is one form of mathematical reasoning. Proportion is the equality of two ratios, and comparable problems include multiplication relationships that can result in the formation of the same two ates (Ben-Chaim et al., 2012). Proportional reasoning entails the "intentional" use of multiplication relationships to compare amounts and to forecast the value of a quantity based on other values (Brown et al., 2020; Pelen et al., 2016). Proportional reasoning is one of the reasons that mathematics is important to understand. Understanding fractions, percentages, ratios, decimals, scales, and algebra, as well as student opportunities, all require the ability to reason proportionally (Brown et al., 2020; Shelley Dole, 2008; Hilton et al., 2016; Hilton & Hilton, 2018; Im & Jitendra, 2020; Jacobson et al., 2018; Johar & Yusniarti, 2018; Norton, 2006; Ojose, 2015; Orrill & Millett, 2020; Pelen et al., 2016; Sawatzki et al., 2019). Additionally, much of mathematics includes proportional reasoning, including unity, statistics, algebra, opportunities, and social arithmetic. Due to the vast amount of mathematical material that requires proportional reasoning, students who lack a strong foundation in proportional reasoning will have difficulty learning mathematics.

Proportional thinking is critical to the primary school curriculum's primary objectives and serves as the basis for algebra and its application (Hilton et al., 2016; Sawatzki et al., 2019). Proportional reasoning entails the ability to comprehend multiplication relationships, while the majority of arithmetic concepts depend on the addition principle. According to (Van de Walle, 2007), proportional reasoning is a critical component of the 5-8 class curriculum. Proportional reasoning ability is a strong predictor of students' progress with advanced mathematical reasoning (Lamon, 2012; Parish, 2010).

Although proportional reasoning is essential for students, students' proportional reasoning has evolved. Some students improve their reasoning skills properly, while others do not. While this is a natural phenomenon, those who are disadvantaged are those with less defined proportional reasoning. Failure to establish proportional reasoning may result in a variety of problems, including inaccuracies in understanding the lessons taught, inaccuracies in understanding the meaning of the problem, and errors in answering questions. Mistakes in comprehending the problem's application will result in incorrect responses, resulting in low grades for students. Thus, it is important to improve students' proportional reasoning abilities in this situation. Via reasoning practice questions, students' proportional reasoning ability can increase and they can achieve a higher level of reasoning ability (Bentley & Yates, 2017; Knok, 2017).

In early March 2020, the Minister of Education and Culture of the Republic of Indonesia released a circular concerning online learning that can be conducted from the comfort of one's own home, dubbed study from home. Students are expected to remain at home to avoid a more widespread spread of COVID -19. The question then becomes how to facilitate students' online mathematics education. Secondary school teachers also struggle with teaching mathematics subjects that require proportional reasoning. According to (Van de Walle, 2007), proportional reasoning's fundamental concepts are ratio and proportion. A critical stage of growth is for students to begin thinking of rates as distinct entities from the two measures that comprise them. Ratios and proportions are computed using multiplicative rather than addition comparisons. Equivalent ratios are obtained by multiplying and dividing, not by adding and subtracting. Proportional reasoning can be developed by practices that include comparing and determining the equivalence of rates, as well as resolving proportions in a variety of problem-solving contexts and circumstances without the use of laws or formulas. In this scenario, secondary school mathematics teachers should incorporate COVID -19 into their online instruction. The context of a mathematical concept is a circumstance or natural phenomenon/event that is relevant to the mathematical concept. Mathematics studies begin with context. Context serves a dual purpose: as a source of information and as a vehicle or area for the application of mathematics.

As a theme of extensive study, pedagogy mediates real-world contexts (Omuvwie, 2015). (Verschaffel et al., 2000) characterize real-world contexts or circumstances as textual explanations of understandable conditions under which students can contextualize mathematical questions. In well-known international evaluation programs such as the Program for International Student Assessment (PISA), real-world contexts or cases are critical dimensions (OECD,

2013). Finding topics from real-world circumstances or backgrounds in mathematics is extremely fascinating and aids students in comprehending given mathematical problems, making concepts easier to grasp (Kacerja, 2012).

Mathematics teachers teach students using three real-world problems (Gainsburg, 2008), specifically the first problem word that students solve. Math issues with realistic backgrounds, written or orally submitted. This condition is either taken directly from a textbook or created by an instructor. Second, teacher presentations should include expected examples or references. When the instructor is presenting scientific knowledge, he or she makes correlations by demonstrating or explaining applications but does not suggest that students must solve problems. Thirdly, a project or lab is a broader endeavor that goes beyond solving algorithmic problems and incorporating the majority of the lessons taught, or multiple experiences.

The COVID-19 pandemic that is currently underway is an excellent opportunity to teach mathematical concepts related to proportional reasoning. According to the clarification above, this research question is how students' thought flows when confronted with 4 proportional reasoning problem. The aim of this study was to examine junior high school students' proportional reasoning abilities in light of the COVID-19 pandemic.

RESEARCH METHODS

This research is a cross-sectional sample with a single data collection point. As a result, determining the status of current participants (Fraenkel et al., 2012) and describing their accomplishments, solution methods, challenges, and the reasons for their difficulties with proportional reasoning takes little time. Due to the fact that the study was performed during the Covid-19 pandemic, proportional reasoning test questions were distributed through WhatsApp. Additionally, the answer to the question is returned via WhatsApp. Additionally, an in-depth study of multiple students' responses to problem-solving questions was conducted to corroborate the data gathered via problem-solving questions.

This research included students in the seventh, eighth, and ninth grades of junior high school. The sample size for this study was 253, with as many as 96 seventh-grade students (39.9 percent), 86 eighth-grade students (34 percent), and 71 ninth-grade students (28 percent). These students were randomly chosen from five schools in Muaro Jambi, Jambi Province, Indonesia. This sampling technique is the most widely used and dependable method of probability samping from a population (Creswell, 2014). In Sample Random Sampling, samples are randomly drawn from all members of the population without regard for population strata.

These students were given proportional reasoning tests and instructed to complete tasks clearly and fully. Students use the WhatsApp program to submit their responses to the questions. Following the collection of all student responses, the researcher performed an in-depth study of the responses of multiple students representing each class. Each class selects three student response sheets. Since the responses of each selected student can be used to represent the entire sample, it can be assumed that responses from students other than those selected will not provide additional details.

Two proportional reasoning problems are presented in the sense of the Covid-19 pandemic. They are related

to the concepts of ratio, proportion, and reasoning in general. Table 1 summarizes the issues. Prior to presenting the issue to students, the researcher consults with two experts from a mathematics education study program who are interested in mathematical reasoning or proportional reasoning. The two experts were asked to provide feedback on the quality and appropriateness of the questions, as well as the problem's meaning, completeness, and format. After completing the revision based on expert reviews, trials are conducted and the issue is updated based on the results.

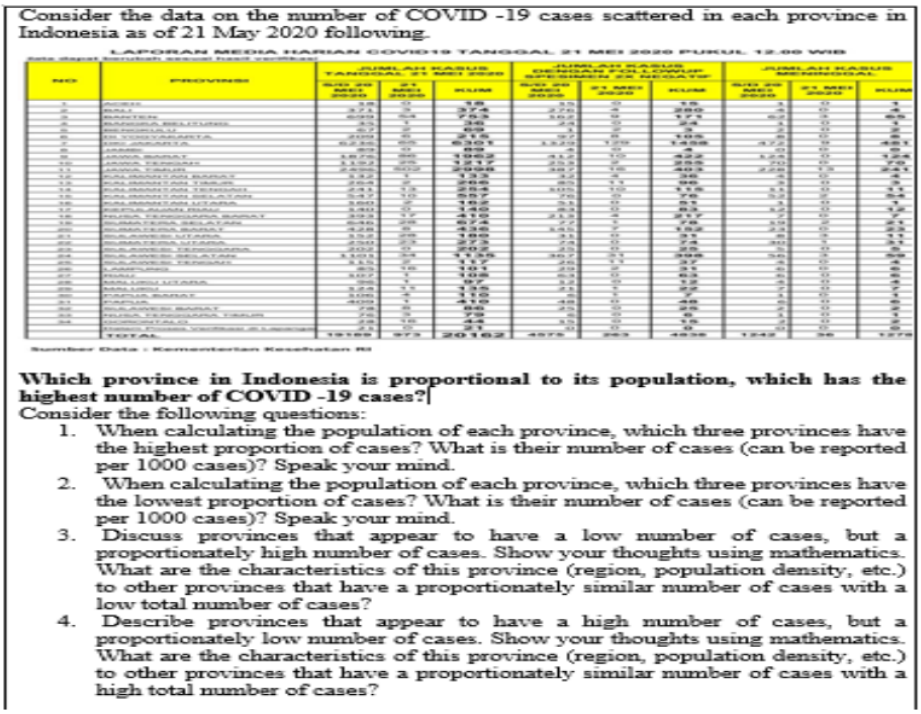
Table 1. Proportional Reasoning Problems Context of COVID-19

No.	Question
1.	Indonesian citizens infected with the COVID-19 virus are shown in the figure below. (Image source from kompas.com, on May 11, 2020).  a. What is the ratio of the number of dead to recovered? b. What is the ratio of the number of healed to the treated? c. What is the ratio of the number of treated to all cases? d. What percentage is the number who died? e. What proportion is recovered? f. What is the ratio of the number of cases in West Java to DKI Jakarta? g. What is the ratio of the number of cases in West Java to East Java?
2.	Based on data on Monday (11/5/2020) at 12.00 WIB, there were 233 new cases of COVID -19 in the last 24 hours. The addition caused a total of 14,265 cases of COVID-19 in Indonesia, counting from the first case announced on March 2, 2020. If there continues to be an increase in the number of new cases, 233 cases occur each day. a. What is the predicted number of cases on May 20, 2020? b. Compare with the number of real instances that happen in the field (Find information through the official media https://covid19.go.id/). Is there a difference between the prediction of the case that you have calculated in part a). with which the number of real evidence in the field? c. If there is a difference, give your reason why that could happen?

Collecting and Analyzing Data

After collecting the students' responses, an examination of the responses is conducted to focus on the students' mathematical thought, evaluate the

relevance, generalizability, and efficiency of the students' mathematical ideas, and identify their conceptual difficulties. The research is focused on students' work on proportional reasoning problems. The aim of this study was to analyze the responses of nine students in order to ascertain their proportional thought and reasoning processes while they worked on previously completed achievement tests. Additionally, additional problems were assigned to students who were interviewed to further analyze their proportional reasoning. Additionally, additional problems were assigned to further explore their proportional reasoning. The solution to this problem is depicted in Figure 1. This dilemma is adapted from NCTM about middle school students' proportional reasoning.



Consider the data on the number of COVID -19 cases scattered in each province in Indonesia as of 21 May 2020 following.

LAPORAN MEDIA HARIAN COVID19 TANGGAL 21 MEI 2020 PUKUL 12.00 WIB

NO	PROVINSI	JUMLAH KASUS TANGGAL 21 MEI 2020			JUMLAH KASUS DENGAN FOLLOWUP SPESIMEN 2X NEGATIF			JUMLAH KASUS MENINGGAL		
		S/D 20 MEI 2020	21 MEI 2020	KUM	S/D 20 MEI 2020	21 MEI 2020	KUM	S/D 20 MEI 2020	21 MEI 2020	KUM
1	ACEH	19	0	19	15	0	15	1	0	1
2	BALI	371	3	374	270	4	280	4	0	4
3	BANTEN	693	14	707	542	17	559	60	2	62
4	BANGKA BELITUNG	23	0	23	24	0	24	2	0	2
5	BENGKULU	43	0	43	7	0	7	1	0	1
6	DI YOGYAKARTA	209	0	209	97	0	105	6	0	6
7	DKI JAKARTA	6.235	66	6.301	3.339	120	3.459	437	14	451
8	JAMBI	40	0	40	4	0	4	0	0	0
9	JAWA BARAT	1.875	88	1.963	512	10	522	124	2	126
10	JAWA TENGAH	1.157	28	1.185	233	2	235	70	0	70
11	JAWA TIMUR	2.000	112	2.098	337	16	403	228	13	241
12	KALIMANTAN BARAT	137	1	138	32	0	32	3	0	3
13	KALIMANTAN TIMUR	204	2	206	85	11	96	3	0	3
14	KALIMANTAN TENGAH	141	13	154	105	10	115	11	0	11
15	KALIMANTAN SELATAN	347	10	357	70	6	76	52	2	54
16	KALIMANTAN UTARA	100	0	100	51	0	51	1	0	1
17	KEPULAUAN RIAU	140	0	140	83	0	83	12	0	12
18	KALIMANTAN BARAT	213	0	213	213	0	213	7	0	7
19	SUMATERA SELATAN	648	26	674	72	4	76	19	2	21
20	SUMATERA BARAT	229	6	235	178	0	178	23	0	23
21	SULAWESI UTARA	332	28	360	31	0	31	11	0	11
22	SUMATERA UTARA	332	28	360	31	0	31	11	0	11
23	SULAWESI TENGGARA	101	0	101	29	0	29	6	0	6
24	SULAWESI SELATAN	1.101	34	1.135	345	51	396	56	3	59
25	SULAWESI TENGAH	117	0	117	11	0	11	6	0	6
26	LAMPUNG	93	10	103	29	2	31	6	0	6
27	RIAU	107	1	108	53	0	53	4	0	4
28	MALUKU UTARA	59	1	60	12	0	12	4	0	4
29	MALUKU	128	13	141	85	0	85	7	0	7
30	PAPUA BARAT	106	4	110	6	1	7	1	0	1
31	PAPUA	409	1	410	48	0	48	3	0	3
32	BENGKULU BARAT	78	8	86	25	0	25	2	0	2
33	NUSA TENGGARA TIMUR	79	0	79	8	0	8	2	0	2
34	GORONTALO	28	16	44	15	0	15	2	0	2
	Kasus Positif Validasi di Lapangan	21	0	21	0	0	0	0	0	0
	TOTAL	19189	973	20162	4979	263	4938	1243	36	1279

Sumber Data : Kementerian Kesehatan RI

Which province in Indonesia is proportional to its population, which has the highest number of COVID -19 cases?

Consider the following questions:

1. When calculating the population of each province, which three provinces have the highest proportion of cases? What is their number of cases (can be reported per 1000 cases)? Speak your mind.
2. When calculating the population of each province, which three provinces have the lowest proportion of cases? What is their number of cases (can be reported per 1000 cases)? Speak your mind.
3. Discuss provinces that appear to have a low number of cases, but a proportionately high number of cases. Show your thoughts using mathematics. What are the characteristics of this province (region, population density, etc.) to other provinces that have a proportionately similar number of cases with a low total number of cases?
4. Describe provinces that appear to have a high number of cases, but a proportionately low number of cases. Show your thoughts using mathematics. What are the characteristics of this province (region, population density, etc.) to other provinces that have a proportionately similar number of cases with a high total number of cases?

Figure 1. Additional problems with proportional reasoning

Analyses of Data

Data analysis is the systematic search for and organization of data derived from observations and field notes. Other materials should be readily understandable, and the results should be shareable. Analyze unit data, synthesize it, organize it into patterns, determine which ones are significant and will be examined, and draw conclusions that can be shared with others. By comparing various data, we were able to determine students' proportional reasoning abilities and gain a full and detailed understanding of them. The two data sets

include students' work on the first test question and students' responses to the second test question, which were accompanied by field notes. The first step was to verify the answers to the problems assigned to students. The outcomes of students' efforts to solve correct and incorrect problems are then separated.

Additionally, a descriptive study was conducted by showing the data in Table 2 in order to categorize the number of students who correctly answered and those who still answered incorrectly. Finally, students who have given the correct response are asked additional questions to ascertain their approach to solving the issue.

RESULTS AND DISCUSSION

Analysis of Problem-Solving Question Number 1

Problem number 1 asks about ratio and percent. Problem part 1 (a, b and c) is the concept of the ratio of the number of cases in every province in

Indonesia affected by COVID-19, recovered, and died. From the answers given by Kimgrace (figure 2) to problem 1a, it appears that Kimgrace had tried to make a ratio between people who died versus those who recovered, 991: 2881. However, he then went through the process of sharing the data and got a result of 0.34. The same thing was also done for questions number 1 b and 1c, namely the ratio of people recovering compared to those treated, and the proportion of people being treated versus being positively confirmed.

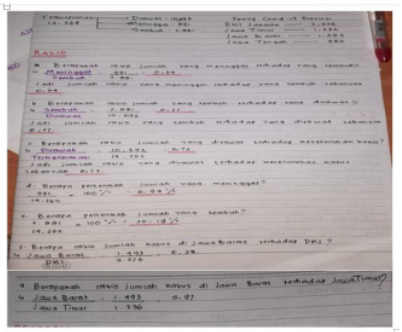


Figure 2. Kimgrace's Work

Kimgrace experienced confusion after writing the ratio of questions 1a, 1b, and 1c. Though this is a concept of the ratio which is part of the part, so, Kimgrace should simply make a comparison ratio by simplifying it to a simple form. Like the answer given by Nur Shahnas in figure 3. Nurshahnas answers for question 1a by streamlining the ratio to 1: 2.9 then rounding off (rounding is done because this data concerns the number of cases per person). Nur Shahnas made the comparison to 1: 3. The ratio between the number of people who died from COVID-19 compared to the number of people who recovered was 1: 3. Shahnas also used a similar method for questions 1b and 1c.

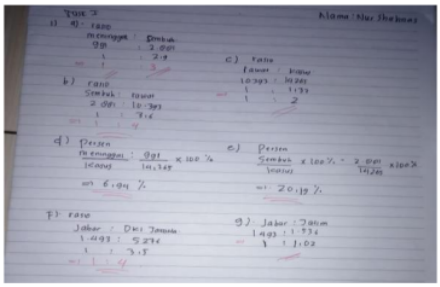


Figure 3. Nur Shahnas

Proportional Rasoning Problems		
Grade	Problem I	Problem 2

		a	b	c	d	e	f	g	a	b	c
7th grade	Blank	0	0	0	0	2	1	1	4	6	6
	Right	78	77	78	75	75	75	74	74	72	72
	False	18	19	18	21	19	20	21	18	18	18
8th grade	Blank	1	0	0	0	1	1	2	0	3	3
	Right	80	80	81	81	81	81	81	70	72	69
	False	5	6	5	5	4	4	4	16	11	14
9th grade	Blank	0	0	0	0	0	0	0	0	0	0
	Right	70	70	71	71	71	71	71	68	68	67
	False	1	1	0	0	0	0	0	3	3	4
Blank total		1	0	0	0	3	2	3	4	9	9
True total		228	227	230	227	227	227	226	224	212	208
Incorrect total		24	26	23	26	23	24	24	37	32	36

Table 2. Student achievement in proportional problems based on the level of difficulty

As for questions 1d and 1e, Kimgrace was able to do precisely that the percentage of people who died from COVID-19 was written as the number of deaths compared to the number of

positive confirmed cases multiplied by 100% at 6.94%. Likewise, the percentage of people who recover is the number of cases that are compared with the number of positive confirmed cases multiplied by 100%, which is 20.19%. A similar answer was given by Nur Shahnas and most students who were respondents. So, for questions, 1d and 1e students do not experience too many difficulties.

As for questions number 1f and 1g, Kimgrace returned the answer by carrying out the process of sharing the two data cases that were asked. Even though the ratio referred to should be the ratio of parts to parts. The rate of the number of cases in West Java to DKI Jakarta is 1: 9, not the ratio of parts to the whole, which is part of the percent concept. Likewise, the answer to question 1.f is that the ratio of the number of cases in West Java to East Java is 1: 1. So it should be enough to make a comparison just like what Nur Shahnas did in figure 3.

Analysis of Problem-Solving Question Number 2

For question number 2, most students can answer the question correctly—for example, the answer to a problem written by Iis (figure 4). IIS was able to answer the prediction of the number of cases on May 20, 2020, which was 16,362 cases. In solving this problem, Iis first predicted cases on May 20 by multiplying the number of additional cases on May 11, which was 233 cases and then multiplying by 9 (number of days from May 11 to May 20, 2020).

Furthermore, Iis wrote the number of real cases in the field, which was 19,189. Based on these answers, we can observe that Iis can understand the

problem well and can answer the question. Iis also stated that there was a difference in the number of real cases by looking for information through the official media https://covid19.go.id/ with a prediction of the number of cases assuming each day the addition remained at 233 cases. However, Iis did not put forward further reasons why the problem could occur.

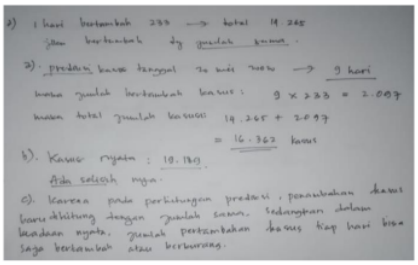


Figure 4. Iis's Work

Haris raised a similar answer. However, Haris also calculated the difference in the number of real cases in the field with the predicted number of cases (figure 5). Haris then stated the reason why there were differences in the prediction of cases with real cases because the number of cases every day was always different and not fixed.

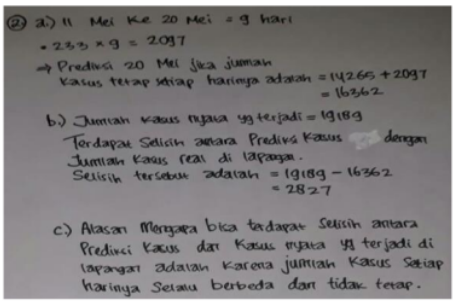


Figure 5. Haris's Work

Analysis of Problem-Solving Question Number 2 (additional questions)

Based on the answers given by Inaya (figure 6) for the additional questions given, it can be seen that in answering these further questions, Inaya only considers data on the number of positive cases cumulatively. Inaya does not search the total population in each province. For question 3a, Inaya directly determines three provinces with the most cases of COVID-19, namely DKI Jakarta, East Java, and West Java based on data on the additional questions (figure 6). The matter in question is related to the proportion of cases. When viewed from Inaya's answer, Inaya is not accustomed to finding data that is not available in the matter. So it is wrong to answer the question given.

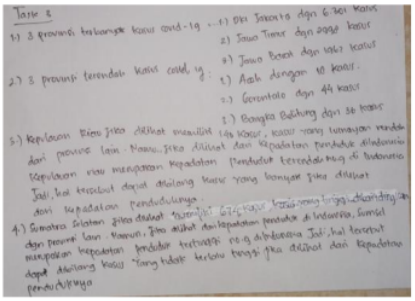


Figure 6. Inaya's Work

Nur Shahnas did different things. Nur Shahnas answered this additional problem by first taking into account the population of each Province in Indonesia by utilizing data from the Central Statistics Agency in 2018. Nur Shahnas calculated the highest proportion of cases in the Provinces of DKI, South Kalimantan, and South Sulawesi (figure 7). Although this answer is still not wrong, Nur Shahnas has tried to find and utilize data on the population of each province.

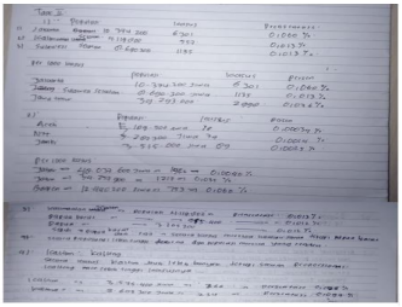


Figure 7. Nur Shahnas's Work

Referring to the population of each province, the highest number of cases of COVID-19 proportionally were East Java (0.076%), DKI Jakarta (0.061%), and North Kalimantan (0.023%). Conversely, the lowest case data are Aceh, Lampung and East Nusa Tenggara, namely 0,00035%, 0.0012% and 0.0014%.

Furthermore for additional questions in part 3, students are expected to be able to analyze provinces that appear to have a low number of cases, but a proportionately high number of cases. The correct answer is given by Indah (figure 8). Indah stated that North Kalimantan Province had the fewest population in Indonesia based on data from Statistics Indonesia in 2018, which was 691,100. The number of cases of people affected by COVID-19 in North Kalimantan is 162 cases. It means that North Kalimantan appears to have a low number of cases, but it is a proportionately high number of cases. Likewise, for the additional questions in section 4. Indah argues that the province of West Java has the third-highest number of cases in Indonesia based on the data on the problem. Still, proportionally when viewed from the highest population of West Java in Indonesia, amounting to 48,037,600 inhabitants, it can be said cases in West Java are classified as low cases.

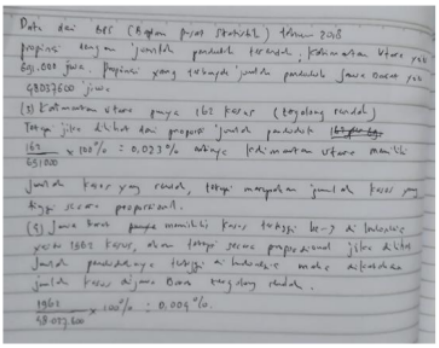


Figure 8. Indah's Work

Indah argues that several factors make the area considered the most vulnerable to coronavirus transmission. First, regional characteristics such as population density, air quality, and access to adequate housing. Second, the risks are related to the health conditions of the population. Examples are the number of people who smoke, the number of elderly citizens and residents who do not have health insurance. Third, risks are related to population mobility. From the measurements, it appears that West Java is one of the provinces most vulnerable to the coronavirus. It is because the province bears the risk of high population mobility, characteristics of areas with high population density, and poor air quality. Indah gave a more comprehensive answer supported by complete population data and good reason (figure 9). Indah's response and eight other students were then cross-checked through unstructured interviews. Task-based interviews were conducted on nine students to collect more comprehensive data and support the achievement test findings. The findings reveal that almost all students succeed in giving the correct answer to the first problem. Still, for the second problem, only the majority of students can answer and provide the right argument. In addition, more challenging problems are given to students plus

interviews, so that it illustrates the difficulties and strategies of students in determining how to solve them.

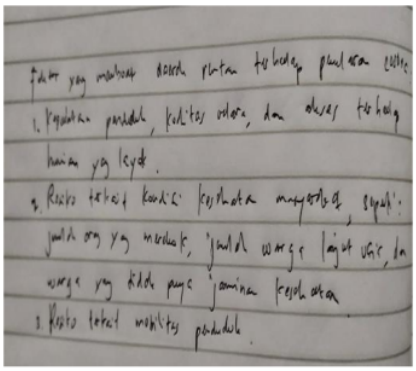


Figure 9. Indah's Argumen

Discussion

Based on the research results obtained, it appears that students have reasonably good proportional reasoning with the context of the problem given concerning the real situation of the COVID-19 pandemic that is currently happening almost all over the world. This COVID-19 pandemic is a real condition that is truly experienced by nearly all students in Indonesia. It is appropriate that the learning of mathematics and the mathematical problems given relate to real-day examples. Mathematical learning concepts that only tend to be theoretical will make students bored and less motivated to solve questions that are interesting and useful as tools to hone thinking logic. Mathematics must be able to tickle students to explore, find solutions, and continuously want to know to solve problems. The concept of mathematics learning is expected to be able to encourage students to continue to explore new material that is engaged in the field and felt like a new issue nowadays.

Based on students' problems and answers, numbers 1 and 2 related to ratio and proportion. Rates appear in various contexts. Part of proportional reasoning is the ability of students to recognize ratios in multiple situations. For students at the beginning of developing an understanding of ratios and proportions, different contexts or situations seem like different ideas even though they are the same from a mathematical point of view. The teacher must be able to use the context to create problems that will train students' proportional reasoning abilities. When students work on questions number 1 and number 2, students are led by their understanding to be able to answer questions about ratios and proportions. Besides, additional questions adapted from NCTM questions greatly assist students in stimulating their proportional reasoning. Students' proportional reasoning ability will develop if students are given stimulus questions related to ratio and proportion (Lamon, 2012; Langrall & Swafford, 2000). number 3, students are also asked to find data in the field related to population in Indonesia and determine which provinces have the highest and lowest number of cases proportionally and provide arguments for why this can occur. There are difficulties and strategies when students try to work on given problems.

The difficulty of students in working on proportional reasoning assignments has led to demands to include proportional reasoning abilities in the curriculum (Shelly Cole et al., 2015; Lamon, 2012). Also, research has been conducted to determine how students think in doing proportionality assignments and determine whether developmental or teaching factors are related to proportional reasoning (Bright

et al., 2003; Shelly Dole et al., 2015; Hilton et al., 2012).

In the end, we can make students understand proportional reasoning well by utilizing real context in student life. These contexts can help students achieve higher proportional reasoning abilities, which in turn can improve other mathematical skills in general. It should be in the context of the Industrial 4.0 era, mathematics teachers to continue to be creative in analyzing and linking the ingredients of learning following the context and elements of life as well as the technological challenges that develop. Teachers must be competent in elaborating teaching material from students' real lives, to create a classroom atmosphere that will form an atmosphere of discovery learning. A must-have a pleasant learning atmosphere because the teacher, as a facilitator, puts students as the center of attention while providing the freedom to find answers to problems independently. The teacher must be able to present new contexts and issues in classroom learning. In the end, the mathematics teacher must be able to involve the experiences or daily situations experienced by students in learning mathematics in class so that the abilities expected to emerge in students can be achieved.

CONCLUSION AND SUGGESTION

Based on the above explanation, several conclusions can be drawn as follows:

1. The teacher can make the task in the form of problems that are based on the context under the real situation experienced by students.
2. The context of the COVID-19 pandemic helps make it easier for students to understand the problem of proportional reasoning more easily and interestingly.

This study provides a positive impact in stimulating proportional reasoning with the context of the real pandemic COVID-19. It is hoped that in the future, there will be many researchers researching the field of education, especially utilizing the context under the actual situation that is happening in the daily lives of students.

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