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Analisis Kemampuan Literasi Statistika Mahasiswa Pendidikan Sosiologi

Nur Hasanah Syarief[i], Maria Martini Aba[2], Ryan Nizar Zulfikar[3]
[1,2.3] Program Studi Pendidikan Matematika, Universitas Muhammadiyah Kupang, Indonesia
E-mail: nurhasanahsyarief@gmail.com[1], martiniaba11@gmail.com[2], rnzulfikar1993@gmail.com[3]

Abstrak

Penelitian ini bertujuan untuk mengidentifikasi kemampuan literasi statistika mahasiswa, dan jenis penelitian ini adalah deskriptif kualitatif. Subjek dalam penelitian ini terdiri atas 24 mahasiswa Pendidikan Sosiologi, Universitas Muhammadiyah Kupang yang mengikuti mata kuliah statistika pada tahun ajaran 2023/2024. Instrumen yang digunakan adalah penugasan yang terdiri atas 2 soal. Analisis data dilakukan dengan menganalisis dokumen jawaban siswa dalam menyelesaikan penugasan yang diberikan. Kemampuan literasi statistika mahasiswa diidentifikasi menggunakan lima kompetensi literasi statistika yaitu: pemahaman konsep statistik, wawasan aplikasi konsep statistik, keterampilan berhitung dan membuat grafik, kemampuan interpretasi, dan keterampilan visualisasi dan komunikasi. Hasil penelitian menunjukkan bahwa lebih dari 50% mahasiswa mampu memenuhi kompetensi literasi statistika seperti pemahaman konsep statistika, keterampilan berhitung, kemampuan interpretasi, dan keterampilan komunikasi. Kompetensi wawasan aplikasi konsep statistika dan kemampuan visualisasi mahasiswa kurang tidak memenuhi kompetensi karena kurang dari 50%. Kemampuan mahasiswa dalam kompetensi dasar literasi statistika masih perlu ditingkatkan karena sebagian besar mahasiswa masih memiliki keterbatasan dalam kompetensi tersebut.

Kata Kunci: analisis, kemampuan literasi, literasi statistika

Analysis of the Statistical Literacy Ability of Sociology Education Students

Abstract

This research aims to identify students' statistical literacy abilities, and this type of research is descriptive qualitative. The subjects in this research consisted of 24 Sociology Education students from Muhammadiyah University of Kupang taking statistics courses in the 2023/2024 academic year. The instrument used is an assignment consisting of 2 questions. Data analysis was done by analyzing students' answer documents to complete the assignments given. Students' statistical literacy abilities are identified using five statistical literacy competencies: understanding statistical concepts, insight into the application of statistical concepts, calculation and graphing skills, interpretation abilities, and visualization and communication skills. The research results show that more than 50% of students can fulfill statistical literacy competencies such as understanding statistical concepts, numeracy, interpretation, and communication skills. However, less than 50% of students do not meet competency in insight into the application of statistical concepts and visualization skills. Students' abilities in essential statistical literacy competencies still need to be improved because most students still have limitations in these competencies.

Keywords: *analysis; literacy ability; statistical literacy*

INTRODUCTION

Entering the era of Industrial Revolution 4.0, the flow of information is increasingly difficult to stem. Various information can be accessed easily and quickly, so people need to respond intelligently to information so as not to fall for false information. This condition encourages people to understand statistics to absorb and accurately communicate information (Hidayati et al., 2020). With statistical abilities, someone can read the data or information obtained and analyze it to make general predictions (Andriatna et al., 2021). Information or data is usually presented in numerical or graphic form (Mahmud & Pratiwi, 2019; Nadjamuddin & Hulukati, 2022).

Based on observations of Sociology Education students at the Muhammadiyah University of Kupang, information was obtained that students' statistical abilities were still relatively low. Some students face difficulties processing data, especially in representing information in various forms of data presentation, such as tables and graphs. Some students also experience difficulties in interpreting data. A person's ability to interpret data can be said to be a statistical literacy ability.

Statistical literacy is a person's ability to formulate, apply, and interpret mathematics in various contexts, including the ability to make statistical reasoning and use concepts, procedures, and facts to describe, explain, or predict an event (Wardhani & Rumiati, 2011). Statistical literacy is a person's ability to understand, interpret, and represent data in tables or graphs (Hafiyusholeh, 2015). Statistical literacy skills are essential for researchers who conduct official statistical analyses and for people with information to make everyday decisions (Tiro, 2018a).

Statistical literacy focuses on reasoning, thinking, interpreting, and other statistical abilities (Khaerunnisa & Pamungkas, 2017). Statistical literacy also includes statistical knowledge, methods, and processes utilized in various contexts that inspire and open insight into thinking. Someone with statistical literacy skills will find it easier to make quantitative decisions arising from work and life issues (Hafiyusholeh, 2015). Statistical literacy skills include understanding statistical words, symbols, and terms; interpreting charts and tables; and reading and understanding statistics in the news, media, policies, and others (Utomo, 2021). According to (Tiro, 2018b, 2018a), the operational formulation of statistical literacy includes five essential competencies: understanding statistical concepts, insight into the application of statistical concepts, calculation and graphing skills, interpretation skills, and visualization and communication skills.

Several studies have been conducted on students' statistical literacy abilities. Research conducted by (Takaria & Talakua, 2018) aims to analyze differences in increasing students' statistical literacy regarding initial mathematical abilities. The research used a Quasi-Experimental method with a Non-equivalent Pretest-Posttest Control Group type. The research sample was 70 prospective elementary school teacher students. Research conducted by Jatisunda et al. (2020) focused on analyzing differences in statistical literacy abilities and the implications for the learning process. This research uses the Pre-Experiment method with the One-shot Case Study type. The population of this research is all public administration students at Majalengka University, with a sample of 60 people. The research conducted by Andriatna et al. (2021) focuses on describing the statistical literacy abilities of prospective Mathematics teacher students, which are linked to the SOLO taxonomy level of thinking. The research conducted by Utomo (2021) focused on describing and exploring the statistical literacy abilities of junior high school students in solving TIMSS problems. The research conducted by Khaerunnisa & Pamungkas (2017) focused on describing the statistical literacy abilities of mathematics education students using three indicators of statistical literacy, namely the ability to formulate problems, the ability to use concepts, facts, procedures, and reasoning, and problem-solving abilities.

Based on the previous explanation, no research has been found that examines the statistical literacy abilities of social science students, especially sociology education students, using the five essential statistical literacy competencies. Thus, this research will analyze the statistical literacy skills of Sociology Education students based on five essential statistical literacy competencies: understanding statistical concepts, insight into the application of statistical concepts, calculation and graphing skills, interpretation skills, and visualization and communication skills. This research aims to describe the level of statistical literacy of sociology education students.

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METHOD

This research is descriptive research with a qualitative approach, so this research is qualitative descriptive research. Qualitative descriptive research is a form of research aimed at describing phenomena in depth (Adlini et al., 2022). These phenomena can be forms, activities, characteristics, changes, relationships, similarities, and differences between one phenomenon and another (Rusandi & Muhammad Rusli, 2021). The primary goal of this study is to pinpoint students' statistical literacy ability so that descriptive qualitative research can be used to get precise data. The research was conducted on sociology education students at the Muhammadiyah University of Kupang who took the education statistics course in the even semester of the 2023/2024 academic year. The subjects in this research were 19 students who were able to complete the assignment. Research data was collected through assignments and interviews. The assignment consists of two questions related to descriptive statistics. The interviews conducted were semi-structured and open. The following is the assignment instrument used:

Table 1. Assignment Instrument

No	Question
1.	Berikut merupakan tabel Persentase penduduk usia 15 tahun ke atas menurut pendidikan tertinggi yang ditamatkan, wilayah dan jenis kelamin di Provinsi NTT, Tahun 2022

Deskripsi *Description*	Tidak/belum pernah sekolah No school	Tidak Tamat SD *not yet completed elementary school*	SD/ sederajat *Elementary school*	SMP/ sederajat *Junior high school*	SMA/ sederajat *Senior high school*	PT *Higher education*
Perkotaan *Urban*	1.08	8.59	18.29	24.28	31.73	16.03
Perdesaan *Rural*	5.17	18.22	34.18	19.30	15.46	7.67
Laki-laki *Male*	3.17	16.28	28.92	21.65	20.76	9.22
Perempuan *Female*	5.00	15.13	31.10	19.59	18.69	10.49
Total	4.10	15.70	30.02	20.61	19.72	9.86

Sumber: Badan Pusat Statistika (BPS), NTT (2022)

Total jumlah penduduk NTT yang berusia 15 tahun ke atas pada tahun 2022 adalah 3.860.000 orang, yang terdiri dari 1.912.909 orang laki-laki dan 1.947.091 orang perempuan. Berdasarkan data di atas tentukan jumlah penduduk yang tidak/belum pernah sekolah, tidak tamat SD, tamat SD, SMP, SMA dan PT. Sajikan data yang telah diperoleh ke dalam Diagram Batang.

2. Berikut merupakan data Jumlah penduduk berdasarkan kelompok umur di Kabupaten Nagekeo pada tahun 2020.

Kelompok Umur	Jumlah Penduduk
20 – 24	9.475
25 – 29	9.835
30 – 34	9.624
35 – 39	9.515
40 – 44	8.969

Tentukan Rata-rata, Median dan Modus data tersebut!

The data collection process begins with giving assignments to students. After that, the assignment results will be corrected. After all the data is collected, the data will be analyzed using indicators of statistical literacy skills. The indicators in this research were adopted from the five essential statistical literacy competencies developed by (Tiro, 2018a, 2018b). The following are indicators used to describe students' statistical literacy abilities.

Table 2. Indicators of Statistical Literacy Ability

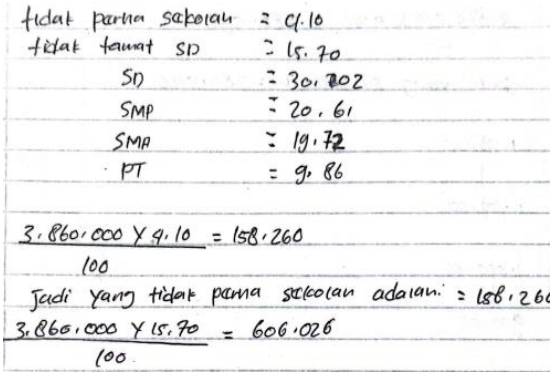
Statistical literacy competency	Indicator
Understanding of statistical concepts	• Able to read and understand the information contained in the questions • Able to understand basic statistical concepts such as average, median, and mode, including calculation formulas.
Insight into the application of statistical concepts	• Able to execute data processing according to strategy
Numeracy skills	• Able to perform real-number operations correctly.
Interpretation ability	• Able to write conclusions based on the problems given
Visualization and communication skills	• Able to create tables and graphs. • Able to communicate the results of the interpretation of the data obtained

RESULTS

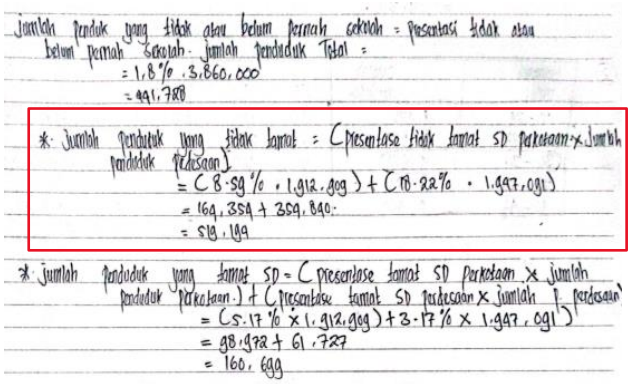
In this section, the statistical literacy abilities of 19 students will be described based on five literacy competencies: understanding statistical concepts, insight into the application of statistical concepts, numeracy skills, data interpretation skills, and visualization and communication skills.

Understanding of Statistical Concepts

Understanding of statistical concepts in terms of two indicators. First, students' ability to read and understand the information contained in the questions so they can write down the information they know correctly. Second, the ability to write formulas for statistical concepts correctly. Based on the data analysis results, 11 (58%) students were able to read the data and understand the information in the questions so they could write down the known information correctly. Meanwhile, 8 (43%) students were less precise in reading data and understanding the information in the questions, so they could not write down the information they knew correctly. Figure 1 shows S1 and S12's answers to writing down the information obtained.



S1 Correct Answer in writing information



Answer S12: Inaccurate in writing information.

Figure 1. S1 and S12 answers in writing down the information obtained

In Figure 1, S1 can write down the information obtained correctly. It is because S1 wrote down data on the percentage of the total population, then used data on the total number of NTT residents aged 15 years and over to calculate the number of residents who did not/have never attended school, did not finish elementary school, finished elementary school, middle school, high school, and College. Thus, it can be concluded that S1 can read data and understand the information in the questions. S12 is not precise in writing information because S12 writes information relating to the percentage of the

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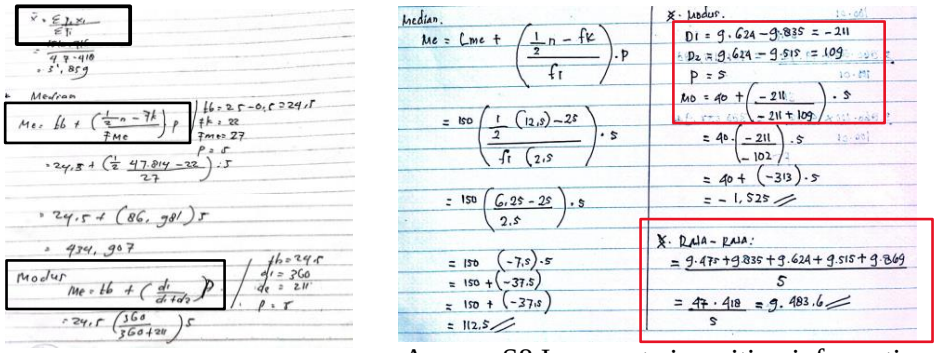
population living in urban areas and the number of male and female residents to calculate the number of residents who have not/never gone to school, have not finished elementary school, finished elementary school, middle school, high school, and PT. The information that will be calculated is the total population of East Nusa Tenggara Province aged 15 years and over in 2022. Thus, it can be concluded that S12 cannot read and understand the information presented in the questions.

The data analysis results also showed that 8 (42%) students could write the formula for the average, median, and mode of group data accurately and correctly. There were 8 (42%) students who were inaccurate in writing the formula for the mean, median, and mode of group data, and 3 (16%) students who were wrong or could not write the formula for the mean, median, and mode of group data correctly. Figure 2 shows S17 and S8's answers in writing formulas for mean, median, and mode of group data.



S17 Correct Answer in writing down information

Answer S8 Inaccurate in writing information

Figure 2. Answers to S17 and S8 in Writing the Formula for a Statistical Concept

In Figure 2, S17 wrote the mean, median, and mode formulas correctly. S17 wrote the formula for the group data's mean, mediạn, and mode. It is by the information in the question, namely data on the population of Nagekeo Regency based on age groups. It differs from S8, which is less precise in writing the average formula, medium, and group data modes. In calculating the mode value, S8 immediately writes the values obtained into the form of a calculation operation without writing the group data mode formula first. Also, S8 was not precise in writing the average formula because he used the single data average formula to calculate the group data average. S8 calculates the average by calculating the total population and dividing by the number of age groups.

Insight into the application of statistical concepts

Insight into the application of statistical concepts in this research can be seen from the student's ability to execute all the strategies used in data processing to complete the assignments given. Based on the results of data analysis, information was obtained that no student was able to execute all the strategies used in data processing to complete the assignment. 16 (84%) students could execute some of the strategies used for data processing, and some could not be executed well. Apart from that, 3 (16%) students made mistakes or could not execute data processing according to the strategy used to solve the questions. Figure 3 shows S16's answer to executing data processing according to the strategy used to solve the problem.

The Figure 3 above shows that the S16 can calculate the average and mode of group data correctly and according to the strategy specified. In calculating the average group data, S16 determines the midpoint of each class first, namely $22, 27, 32, 37$, and 42. Then, S16 multiplies the midpoint of each class by the frequency of each class and divides the sales results by the number of classes. S16 calculates the mode by determining the mode class first by looking at the class frequency with the most, namely the second class. Then, S16 determines the values. $d_1 = 360, d_2 = 211, c = 5$, and $tb = 24.5$, the values obtained are substituted into the formula and operated to obtain the data mode.

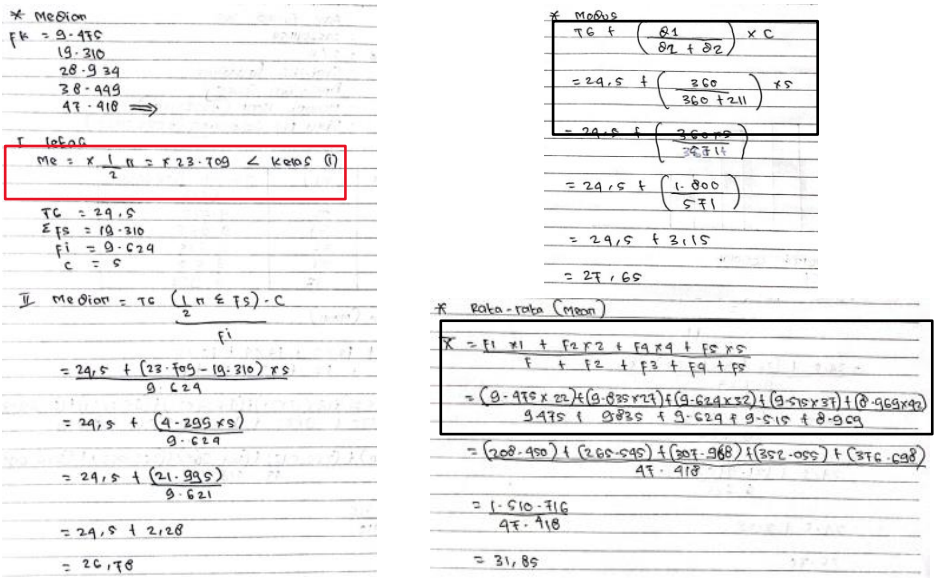
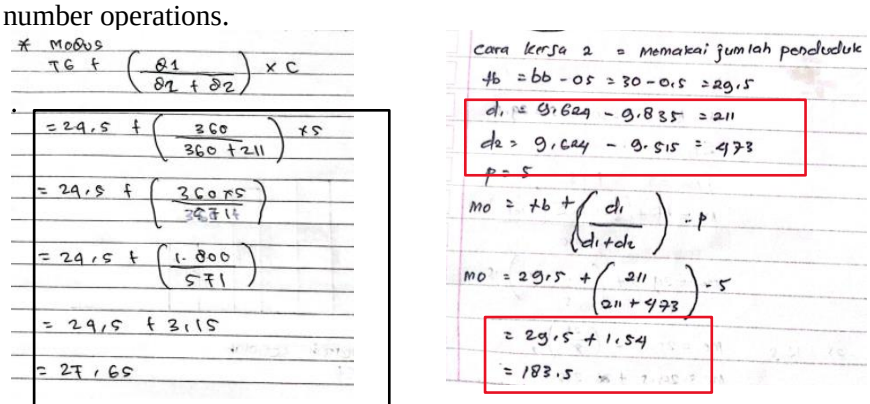


Figure 3. Correct S16 Answers in Writing Information

S16 incorrectly calculates the median because it cannot determine the median class correctly. The first step that S16 takes to calculate the median is to find the cumulative frequency of each class. The cumulative frequencies obtained in the first to fifth classes were 9,475, 19,310, 28,934, 38,449, and 47,418, respectively. The second step taken is to determine the location of the median class. S16 determines the location of the median class with the formula $\frac{1}{2} \times n = 23{,}709$. S16 concluded that this number was in class (1) from these results. It is incorrect because 23,709 is in the range of 19,310 to 28,934, so the location of the median class should be in class 3. Because S16 is not precise in determining the location of the median class, the values used to determine the median are also wrong. Thus, it can be concluded that S14 cannot execute all the strategies used in data processing.

Numeracy Skills

The students' numeracy skills in this study were viewed from the student's ability to perform actual number operations correctly. The results of the data analysis showed that there were 10 (53%) students who were able to carry out actual number operations correctly. There were 9 (47%) students who were inaccurate in carrying out actual number operations. Figure 4 shows the answers to S16 and S2 in actual number operations.



Answer S16 in carrying out actual number calculation operations correctly

Answer S2 is wrong in carrying out actual number calculation operations.

Figure 4. Answers to S16 and S2 in carrying out actual number calculation operations

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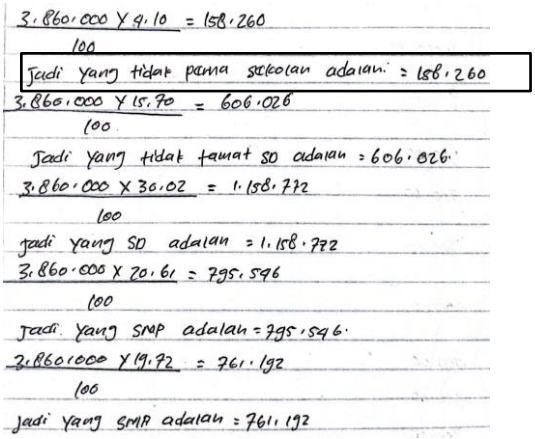
In Figure 4, it can be seen that the S16 can perform actual number operations correctly. S16 performs the addition operation of the numbers in brackets first, namely, $360 + 211 = 571$, then S16 performs the multiplication operation between $360 \times 5 = 1800$, and after that, S16 operates by dividing the number $1800 \div 571 = 3{,}15$. Finally, S16 operates by adding the numbers $24{,}5 + 3{,}15 = 27{,}65$. Thus, S16 obtains the mode value correctly.

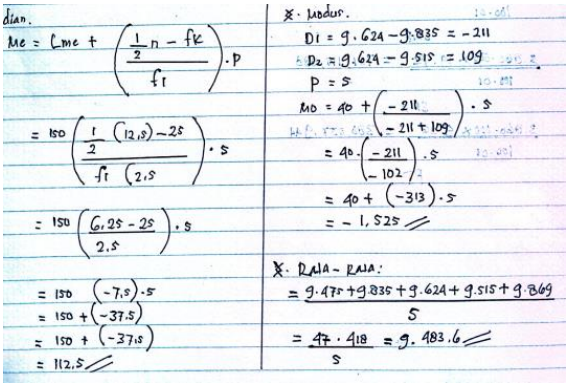
S2 made a mistake in carrying out real number calculation operations. S2 made an error in performing the integer subtraction operation. Subtracting the number 9,628 from the number 9,835 by S2 obtained the result 211, and subtracting the number 9,624 from the number 9,515 obtained the result 475. This result was incorrect. because $9624 - 9835 = -211$ and $9624 - 9515 = 109$. S2 also made a mistake in carrying out the operation of adding the number $29{,}5 + 1{,}54$.

Interpretation ability

Interpretation abilities in this research are viewed in terms of students' ability to write conclusions based on the assignments given. Based on the results of the data analysis, 11 (58%) students could interpret the data by writing conclusions. There were 8 (42%) students who did not write conclusions. In Figure 5, it can be seen that S1 has data interpretation abilities because he can write conclusions from each problem. However, S8 does not have good data interpretation capabilities because it does not write conclusions from the assignment questions. S8 solves the problem until the results are obtained but does not write a conclusion from the results obtained. Figure 5 shows S1 and S8's answers in interpreting the data.



S1 can write conclusions.



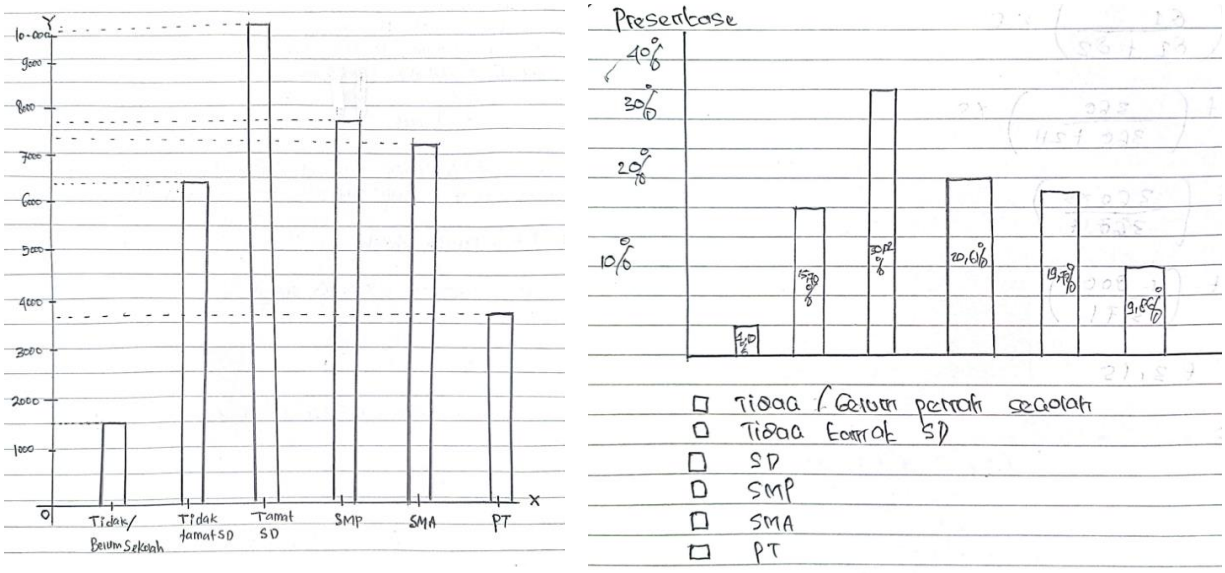
S8 does not write a conclusion.

Figure 5. S1 and S8 answers in interpreting data

Visualization and Communication Skills

Visualization and communication skills in this research were reviewed from two indicators. First, students' ability to make graphs or diagrams. Second, students' ability to communicate calculation results. Based on the results of the data analysis, there were 7 (37%) students who were able to draw graphs accurately and correctly. There were 12 (63%) students were inaccurate in drawing graphs. Figure 6 shows S15 and S2's answers to drawing bar charts.

Based on Figure 6, it can be seen that the S15 can draw graphs correctly. On the x-axis or horizontal line, S15 provides information on the population who have not attended school, not very elementary school, finished elementary school, middle school, high school, and college. Meanwhile, the y-axis explains the frequency of each category. The distance between frequencies is consistent, namely a difference of 1000.



S15 can draw bar chart S2 cannot draw bar charts.

Figure 6. Answers to S15 and S2 in drawing bar charts

S2 is not able to draw graphs correctly. S2 does not label the x-axis. S2 describes the graph created. The information made is also in the same form, so it can cause readers to experience errors in reading the data. The y-axis explains many frequencies, but these frequencies are still in presentation form, which means that S2 has not changed the percentage form to an integer. The distance between each frequency is not consistent. Thus, it can be concluded that S2 cannot draw graphs well.

Furthermore, 10 (53%) students could communicate the results well. 9 (47%) students could not communicate the results of their work well. Figure 7 shows S16's answer to communicating the results of his assignment.

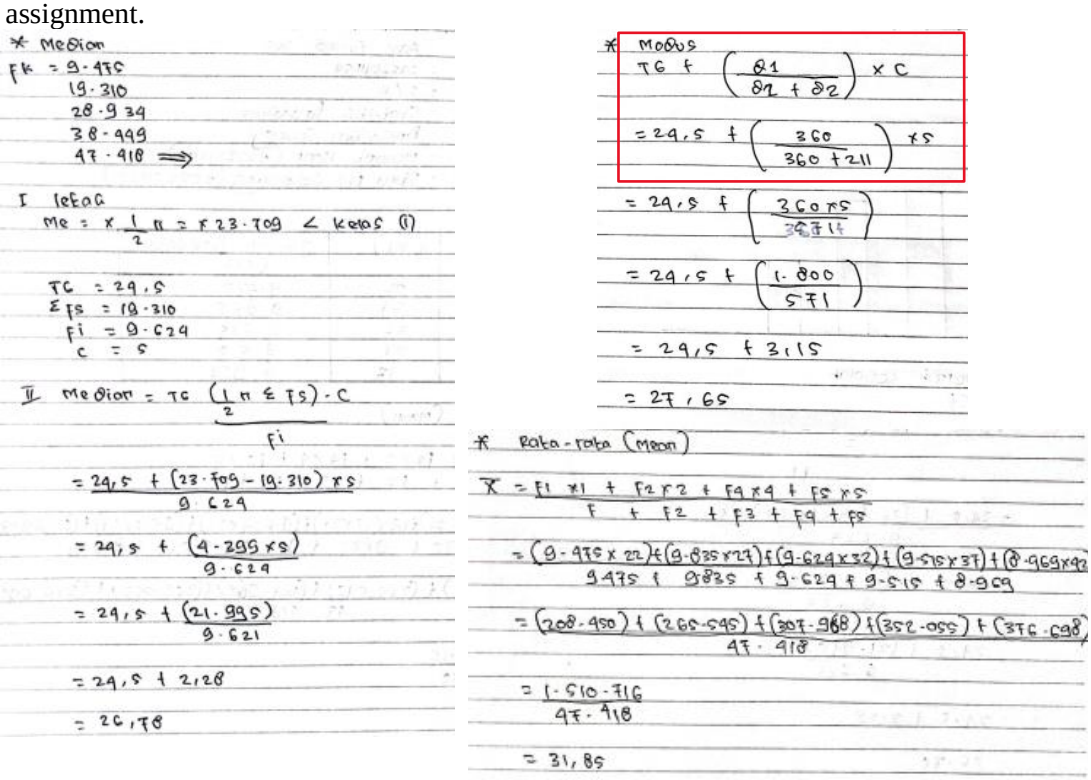


Figure 7. S16's answer to communicating the results of his assignment

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In Figure 7, it can be seen that S16 could not communicate his answer well. S16 is incomplete in writing down the information used in solving the problem. In finding the mode of the data, S16 does not explain how to obtain the values d_1, d_2, tb, and c. S16 immediately substitutes these values into the formula that has been written. S16 is incomplete in writing some symbols. For example, when writing the median formula and the location of the median class.

DISCUSSION

The results of the data analysis show that more than 50% of students can fulfill several numeracy literacy competencies, including understanding statistical concepts, numeracy skills, interpretation skills, and communication skills. However, less than 50% of students do not meet the competency of insight into applying statistical concepts and visualization skills. The results of research conducted by (Andriatna et al., 2021) also show that students are still less than optimal in reasoning about statistical concepts, impacting their less-than-optimal data interpretation abilities.

Student's ability to understand statistical concepts can be said to be quite good because 58% of students can read data and understand the information in the questions, so they can write down the information they know well. Andriatna et al. (2021) research shows that the average student can reason based on data and statistical results. The research results show that students are less precise in reading data and understanding the information in the questions because the data presented is quite complex. Hence, they have difficulty determining which data should be used. Rong & Mononen (2022) said that students have difficulty understanding information when reading information from graphs, tables, long texts, and other sources, resulting in conceptual errors. Students still misinterpret data from graphs to tables because their knowledge about interpreting data is still lacking (Putri et al., 2023), 42% of students could write the formula for the average, median, and mode of group data accurately and correctly. Some students incorrectly write the formulas for mean, median, and mode. It is caused by two things. First, students cannot differentiate between the use of formulas to calculate single data or group data. Second, students are incomplete in writing formulas. Difficulties in applying formulas are also caused by a lack of understanding of concepts (Agustiva et al., 2016).

Students have poor insight into the application of statistical concepts. It is because students cannot execute all the strategies used to complete the assignments given. There are still many students who make mistakes in applying statistical concepts. Research by Andriatna et al. (2021) states that reasoning regarding basic concepts and statistical terms is still lacking. Students do not understand statistical concepts well, so they give answers that are not basic (Sari et al., 2022).The research results show that some students have poor numeracy skills. It happens because students are not careful or careless in completing assignments and do not double-check the correctness of the calculations made (Amalia, 2020; Sari et al., 2022).

Students have good data interpretation skills because 58% can write conclusions from the assignments. However, research results also show that some students forget to write conclusions (Suratih & Pujiastuti, 2020). Students have poor visualization and communication skills. Written mathematical communication skills can include expressing mathematical ideas through pictures, graphs, tables, equations, or in the student's language (Hodiyanto, 2017). Students can understand and express mathematical ideas and use mathematical language approaches (notation, terms, and symbols) to express mathematical information. However, students cannot yet use mathematical representations (formulas, diagrams, graphs, and models) to express mathematical information and change and interpret mathematical information in different mathematical representations (Ulyawati et al., 2020).

CONCLUSION

Based on the results of the data analysis on statistical literacy skills, it can be concluded that most students can fulfill several essential statistical literacy competencies, such as understanding statistical concepts, numeracy skills, interpretation skills, and communication skills, with a percentage of more than 50%. However, less than 50% of students do not fulfill statistical literacy competencies,

including insight into applying statistical concepts and visualization skills. Students' ability to understand statistical concepts is quite good, but they still experience difficulties in reading and understanding complex information. Insight into applying statistical concepts, calculation, and data interpretation skills still needs improvement. Even though some students can write conclusions, some still forget. The ability to visualize and communicate mathematically in writing needs to be improved because most students still have limitations in using mathematical representations to express mathematical information.

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