Statistical Literacy Analysis of Pre-Service Elementary Teachers Education

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Abstract. Statistics plays a very important role in various fields of human life. In the field of education, statistics are important for solving problems encountered in learning activities in class. Therefore, it is very important for the pre-service teachers to have statistical literacy skills. The basic indicator of statistical literacy is the ability of individuals to understand data displayed in tables and diagrams; presents data so that it is easy to understand and interprets the data correctly. The purpose of this study is to describe the statistical literacy of the pre-service teachers at departments of Elementary Teacher Education in the context of these three indicators. The subjects in this study were 28 students. Data collection is done by providing statistical literacy tests. The results showed 85.71% of students were able to understand the statistical data displayed in the form of line charts; 92.86% of students are able to present data in the appropriate diagram, and only 39.29% of students were able to interpret the data from a given case.

Keyword: Statistical literacy, Pre-service Elementary Teacher

1. Introduction

In the era of the industrial revolution 4.0, statistics had a very important role in various human activities. In the last three decades, statistics have become a major component of the mathematics curriculum [1]. There has been extraordinary enthusiasm for the field of Statistics Education. As indicated by late studies, there has been concentrated research with respect to statistical thinking, statistical literacy and statistical reasoning [2] [3] [4] [5] [6] [7]. The three ideas, statistical literacy, statistical reasoning and statistical thinking, are naturally fluffy and unambiguous in characterizing and segregating from each other [8].

Advances in technology and modern methods in conducting data analysis and increasingly easy access to information data, led to the development of material focused on introducing statistical concepts into the school curriculum since elementary school. NCTM even includes "Data Analysis and Probability" as one of the five content standards [9]. In the United States, Secretary's Commission on Achieving Necessary Skills [10], recommends that a measure be formed to inform statistical education at the secondary level as a provision for students in the workforce. Gal's [11] concern was about adults in society, as was that of Wallman [12], Moreno [13], Utts[14], and Scheaffer [15] . There is expansive understanding that in an undeniably quantitative world having a comprehension of factual data and having the option to decipher and follow up on that data is fundamental [16]. Petty even tried to describe the use of social media as a medium to convey messages about the importance of statistical literacy for students and the wider community [17][18].

In Indonesia, statistics is one of the materials that students must learn. Statistics are even studied at all levels of education, from primary education to higher education. In higher education, statistics are given to students as a provision of knowledge in the research process that they will do, starting from research planning, data collection process, data analysis, to making conclusions [19]. Statistics equips students to have the ability to think logically, critically, creatively, and systematically and produce individuals who are able to carry out research [20]. Statistics acts as a tool to handle quantitative data obtained from research [21]. In tertiary institutions, statistical learning aims to make students aware of the importance of understanding data; can understand the basic concepts of statistics and their terminology; have knowledge about how to collect data and the ability to describe it; have data interpretation skills; and as a basis for communication [22]. For pre-service teachers, statistics are important for solving learning problems in class. In education, statistics are needed starting from the activities in the laboratory, research to various activities in the management of learning [23]. Statistics are important to be understood by pre-service teachers so that they can respond, understand, analyze, interpret, and make conclusions about various information related to statistics and can give meaning to problems raised through statistical information in various literacy media [24]. Once the importance of the benefits of statistics for students, the understanding of statistics needs to be a concern. Students need to have statistical literacy skills, not only to complete their studies, more than that statistical literacy is needed when they enter the workforce.

Statistical literacy is an important component of statistics education [25]. This ability is useful for understanding statistical languages (words, symbols, and terms), interpreting graphs and tables, and reading and understanding statistics in news, media, polls, etc. [26], [27], [28]. Statistical literacy includes basic and primary skills that can be used in understanding statistical information or research results. These skills include being able to manage data, create and present tables, and work with different data interpretations. Statistical literacy also includes understanding concepts, vocabulary, and symbols, as well as an understanding of probability as a measure of uncertainty [29]. The ability of statistical literacy is needed by someone to deal with probability and statistical problems that arise in everyday life [30]. Statistical literacy includes making, assessing and utilizing items that use words, numbers, and diagrams together to convey messages. It includes skills in making and using these products [31]. The ability of statistical literacy will provide comfort in making quantitative decisions that arise on a job and other issues in life [32].

If examined more deeply, one of the goals of statistics courses is statistical literacy. Therefore, the purpose of this study is to provide an overview of how students 'literacy statistics analyze students' answers according to indicators of statistical literacy abilities that have been determined.

2. Method

This research is descriptive qualitative research, research that describes in full the social setting with the aim to explore and clarify about a phenomenon, by describing the measured variables [33]. This research is a case study of 28 students of Elementary Teacher Education department, Majalengka University, Indonesia. To obtain the validity of the data obtained, data triangulation was carried out The process of data analysis in this study refers to [34] which is carried out with the steps of data reduction, data exposure, and drawing conclusions and verification.

3. Results and Discussion

To analyze and describe the ability of statistical literacy of students in understanding statistical data, presenting statistical data, and presenting the results of statistical data processing are given statistical literacy tests that have been tested for validity and reliability. The recapitulation of student statistical literacy ability test results based on the indicators is presented in Table 1 below:

Table 1 Statistical Literacy Ability

Indicator	Percentage
Understanding statistical data	85.71%
Presenting statistical data	92.86%
Presenting the results of statistical data	39.29%

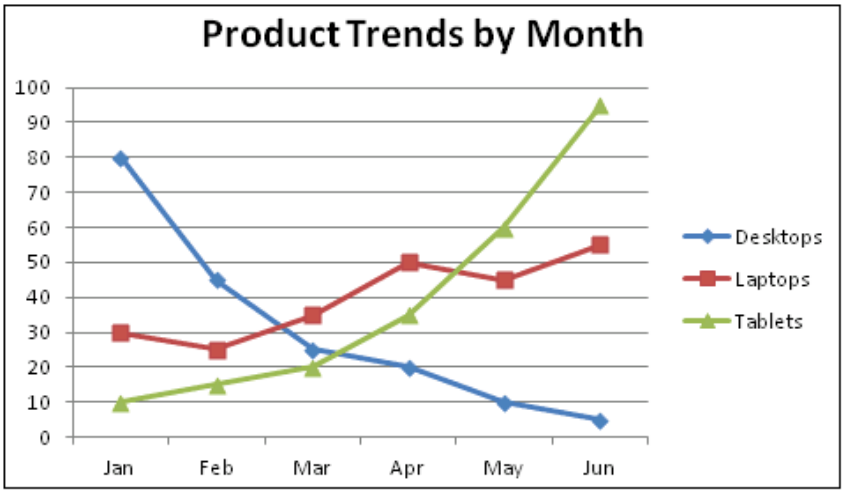
processing

From the above data, it appears that students who are able to understand statistical data as much as 85.71% and students who are able to present statistical data as much as 92.86%. Thus, it can be concluded that the statistical literacy ability of students on these two indicators can be considered quite good. However, students are still weak in presenting the results of statistical data processing, this can be seen from the data that shows only 39.29% of students who meet this indicator.

Understanding statistical data

In this statistical literacy indicator students are required to be able to describe the data displayed in a line diagram. This is to stimulate student communication skills in writing and develop the ability to describe data according to the graphical info provided. The following are the problems given in this indicator.

1. Diagram berikut menggambarkan perbandingan tren penjualan produk elektronik desktop, laptop, dan tablet dalam enam bulan terakhir



Bagaimana tafsiran saudara mengenai data di atas? Kesimpulan apa yang dapat ditarik?

Figure 1. Problem number 1

In problem number 1 above, students are given data about sales trends of three types of electronic products in the past 6 months. They are asked to make interpretations of the data presented in the graph and make conclusions.

From students' answers to question number 1, 85.71% of students were able to describe complete data starting from extreme data, which is maximum and minimum for each electronic product, to conclude the sales trends of the three products. This shows that students can communicate in writing well. The remaining 14.29% have not been able to provide analysis and conclusions. They only describe improvise, namely only describing tablets as electronic products that have the best sales trends without adding more detailed descriptions and analysis related to the data presented.

Based on the results of interviews with students who have difficulty with this problem, it was identified that they tend to be less active in class or in discussion groups. In addition, the mathematical ability factor that supports the acquisition of statistical concepts that are owned is still weak.

Presenting statistical data

In this statistical literacy indicator students are asked to understand information from the data displayed and present it again in the form of an appropriate graph. This process requires accuracy in

understanding the characteristics of the data. Whether the data presented is continuous or categorical data. Here is a matter of the statistical literacy indicator.

2. Tabel berikut merupakan data tentang proporsi populasi penduduk yang memiliki akses terhadap layanan sanitasi layak dan berkelanjutan menurut daerah tempat tinggal pada periode 2015 – 2018.

Daerah Tempat Tinggal	Proporsi Populasi Penduduk Yang Memiliki Akses Terhadap Layanan Sanitasi Layak Dan Berkelanjutan Menurut Daerah Tempat Tinggal (Persen)			
	2015	2016	2017	2018
Perkotaan	75.67	80.16	80.27	80.48
Perdesaan	47.38	53.57	53.15	55.74

Buatlah diagram yang sesuai dengan data yang disajikan di atas! Bagaimana pula interpretasinya?

Figure 2. Problem number 2

Problem number 2 above illustrates data on the proportion of Indonesia's population who have access to proper and sustainable sanitation services during the 2015-2018 period based on their residence (city and village). In this problem, students are asked to change the data presented in the table into a diagram and make an interpretation of the data provided.

From the results of student answers to problem number 2, 92.86% of students were able to present the data provided in the form of line charts. While 7.14% of students are still mistaken in presenting data in the appropriate diagrams. They make the mistake of presenting data through bar charts and pie charts. This shows that students are not careful in understanding the characteristics of the data. If referring to the data in the table given in the problem, the data shows continuity in terms of time, so that when it will be presented in the form of diagrams, the most appropriate diagram is to use a line diagram. Through the line diagram can be seen progress variables that are observed from time to time during a certain period.

Presenting the results of statistical data processing

To see this statistical literacy indicator, students are asked to provide logical arguments about the given case. To solve this problem students are asked to use various data sizes to arrive at the correct conclusion. The following question is given to measure this indicator.

3. Pak Amin adalah seorang pedagang yang menjual bakso dan es campus. Selama bulan Agustus rata-rata keuntungan penjualan bakso dan es campur berturut-turut adalah 725.000 dan 525.000 dengan simpangan baku masing-masing 55.000 dan 40.000. Pada tanggal 31 Agustus, pak Amin mendapatkan keuntungan 950.000 dari penjualan bako dan 700.000 dari penjualan es campur. Hasil penjualan manakah yang lebih baik pada hari terakhir bulan Agustus tersebut? Keuntungan bakso atau keuntungan es campur? Kemukakan alasannya!

Figure 3. Problem number 3

Problem number 3 above, begins with the story of Mr. Amin who sells meatballs and mixed ice. During August the average profit from selling meatballs and mixed ice was 725,000 and 525,000 with standard deviations of 55,000 and 40,000, respectively. On August 31, Mr. Amin made a profit of 950,000 from selling meatballs and 700,000 from selling mixed ice. In this problem, students are asked to determine the best sale between meatballs and mixed ice on that date with their reasons.

Based on student answers to question number 3, it is known that most students still have difficulty in answering these questions. As many as 60.71% of students incorrectly answered the questions above. From the results of examining students' answers, most of them have not been able to determine the correct statistical measure for the above case. Besides, some students have not been able to provide interpretations and draw conclusions from the results of their calculations. The remaining 39.29% of students were right in answering the questions above. The student can interpret the results and make conclusions based on the results obtained.

4. Conclusion

From the results of this study, it can be concluded that prospective students of Elementary Teacher Education have quite good statistical literacy on indicators of understanding statistical data, and presenting statistical data. But they have difficulty when asked to provide logical arguments about the statistical data provided.

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6. References

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