

# Statistical Literacy Analysis of Mathematics Education Students Through KKNi Assignments

Elfitra\*, T M Siregar

Department of Mathematics, Universitas Negeri Medan, Jl. Willièm Iskandar pasar V Medan 20221, Indonesia

\*[elfitra@unimed.ac.id](mailto:elfitra@unimed.ac.id)

**Abstract.** Statistical literacy is a person's ability to understand, interpret, and present data about basic concepts and statistical procedures. The purpose of this study was to determine the achievement of statistical literacy skills in Mathematics Education students through KKNi assignments, namely routine tasks, Critical Journal Report, and Critical Book Report. The samples in this study were students of semester five bilingual mathematics education. Data were obtained through questionnaires and evaluations of KKNi assignments to analyze statistical literacy. The results showed the average level of statistical literacy of students based on the percentage of the questionnaire described the category well. The statistical literacy analysis process supported by student assignment reports in the form of papers.

## 1. Introduction

In the industrial revolution 4.0 technology is undeniably overgrowing. Everything that considered a thing that can waste time, energy, and money, can now be overcome by the development of technology both in terms of tools and information systems. The industrial revolution 4.0 was marked by the development of the Internet of or for Things, which was followed by new technologies in data science, artificial intelligence, robotics, cloud, three-dimensional printing, and nanotechnology [1]. Inevitably this will affect all aspects of human life, including the development of Education.

In today's increasingly sophisticated age of knowledge and technology, mathematics and statistics play an essential role in human activities. Statistics and mathematics as twin brothers have played an important role in building quality Indonesian human resources. Both of these fields of science must work together to develop their respective areas of science. However, both have different ways of thinking: inductive-probabilistic statistics and deductive-deterministic mathematics. Because of this difference, that becomes the strength to be together complementary between statistics and mathematics. Also, it needs to be emphasized that statistics are not part of mathematics [2].

Related to this important role, then from the elementary school to the tertiary level, these two fields receive special attention. Based on the content and difficulty of the subject matter among some students, even students with mathematical and statistical views are difficult and less enjoyable. It was explained that the identification of learning difficulties in statistics and mathematics, namely the existence of phobias on mathematics and anxiety (statistics) statistics, resulting in a lack of interest in students to study both subjects so that it has an impact on the achievement of students' mathematical and statistical learning outcomes [3].



In higher education, including UNIMED, separate statistics are not integrated with mathematics, but the role of mathematics is crucial to the success of students in mastering the concept of statistics. Best and Khan, in their book, revealed that statistics are part of mathematical techniques related to the process of collecting, organizing, analyzing, and interpreting numerical data. [4] Statistics is an indicator of change and allows us to have the skills and ability to make meaningful comparisons (BPS, 2010).

Statistics defined as a collection of data, facts, generally in the form of numbers arranged in tables or diagrams that describe or illustrate a problem. Unlike the case with statistics which is a science of science relating to statistical data and correct facts or a scientific study with data collection techniques, data processing techniques, data analysis techniques, drawing conclusions, and making policies or decisions that are strong enough the reason is based on accurate data and facts. So, statistics as a tool to calculate or analyze data [5]

Statistics divided into two, namely descriptive statistics and inferential statistics. Statistics in the broadest sense is also called inferential statistics or inductive statistics or probability statistics that is a means of collecting data, processing data, drawing conclusions, making actions based on the analysis of data collected or statistics used to analyze sample data and the results are used (generalization) for populations [ 6]

UNESCO (2004) revealed that literacy (literacy) is the ability to understand, information, identify, interpret, communicate and count through sources obtained from print media and able to write in various contexts [7]. In simple literacy can be explained as the ability to read and write. Literati has a broad meaning when it is associated with the scope of science. So literacy can be interpreted as literacy, literacy towards mathematics, statistics, information, technology, sensitive to social, and responsive to the surrounding environment [8].

Statistics literacy in the world of higher education considered necessary, as Aoyama (2003) identified that the statistical literacy capabilities possessed by students could help them in extracting qualitative and quantitative information. It also recognized that the lack of statistical literacy skills was caused by the inability of students to apply it in their daily lives [9].

There is a growing recognition of the importance of statistical literacy in various aspects of daily life. In recent years, statistics educators have emphasized the place of statistical literacy in the reform of statistical education [10]. It was explained that among the various definitions of statistical literacy, perhaps the most widely cited was from Wallman (1993) in the president's speech of the American Statistical Association: Statistical literacy is the ability to understand and critically evaluate statistical results that permeate our daily lives - coupled with the ability to appreciate the contributions that statistical thinking can make in public and private, professional and personal decisions. (Statistical literacy is the ability to critically understand and evaluate the results of statistical analysis that permeates our daily lives - coupled with the ability to appreciate the contribution that statistical thinking can make public and private, professional and personal decisions.) [2].

Based on the research results of Tiro (2017), Tiro, Aidid, and Ahmar (2016 and 2018), Sudarmin, Tiro and Irwan (2015), and Tiro, Nusrang, and Ahsan, (2015), the operational formulation of Statistics Literacy includes five competencies basic: (1) understanding statistical concepts, (2) insight into the application of statistical concepts, (3) computational skills and making graphics, (4) interpretation skills, and (5) visualization and communication skills [2]. These five essential literacy statistics competencies explained as follows.

- 1) Understanding of statistical concepts. For example, the concept of the mean (standard) and standard deviation (standard deviation) include the calculation formula and the information delivered. This conceptual understanding guides the area of application of the concept in real life.
- 2) Insights into the application of statistical concepts. Knowing the situation and conditions can be used statistical values and in what circumstances a specific statistical value has or has no meaning. For example, calculating the average age value of a group of people, of course, the

results do not provide valid information. The average value of the group's income might provide useful information to illustrate the level of welfare of the group.

- 3) Counting skills and making graphics. Calculating skills such as average and other statistical values, as well as making graphics or drawings have gained a lot of ease with the presence of statistical packages in computers. However, after calculating certain statistical values, the concept and application of these values must be known.
- 4) The ability of interpretation. The results of the calculation of statistical values do not give meaning if they cannot be interpreted correctly. Likewise, explaining information from a graphic or image is an important capability that must be possessed in the information age today
- 5) Visualization and communication skills. No matter how good the results of the statistical analysis and interpretation, if it cannot be communicated properly to the stakeholders, it does not benefit. Visualization can be in the form of tables or graphs (Tiro & Ahmar 2014). Communication is successful if it gives influence to the person who provides information. The influence referred to here is a change in knowledge, attitudes, and behaviors that are getting better.

Efforts to improve student literacy statistics are important during the learning process. The ability of statistical literacy will improve students' critical thinking skills in solving problems in daily life [11]. Teachers must have a method for increasing statistical literacy by integrating it through KKN assignments assigned to students. This is in line with the Indonesian National Qualification Framework (KKN), that graduates equivalent to S1 must have several competencies, including: (1) Able to apply their expertise and utilize IPTEKS in their fields in problem solving and be able to adapt to the situation at hand, (2) Mastering theoretical concepts in a particular field of knowledge in general and the theoretical concepts of special sections in that field of knowledge in depth, as well as being able to formulate procedural problem solving, (3) Able to take appropriate decisions based on information and data analysis, and be able to provide guidance in selecting various alternative solutions independent and group, (4) Responsible for the work itself and can be given responsibility for the achievement of the work of the organization [12].

Another effort is to increase reading activities. Reading is the initial process to practice and improve oral skills so that they can develop writing skills [13]. Not just knowing statistics briefly through reading references but also being able to apply their knowledge to using statistical support software. To be able to produce information quickly, precisely, and accurately, the software is needed [14]. My experience as a lecturer found that students only understood the concept of statistics by existing material studies. Students only considered statistics to be important for taking a thesis but lacked in processing, especially by using statistical software and did not understand their applications in real life. Interest in reading and the ability to interpret statistical concepts in daily life are considered as the main causes.

## 2. Research Methods

The research design used is descriptive research with a quantitative approach. Descriptive study is research intended to gather information about the status of an existing symptom, which is the state of the symptom according to what it was at the time the study conducted. Research conducted does not provide treatment, manipulation, or alteration on the independent variables, but describes a condition as is [15]. The approach used is a quantitative description using size, number, or frequency.

This research was conducted in the bilingual mathematics department majoring in V, which took the eyes of inferential statistics. The method of collecting data using questionnaires and the assignment of CBR and JCR assignments as an analytical aid for achieving student statistical literacy indicators.

To make it easier for researchers, the following research paths designed by researchers are as follows:

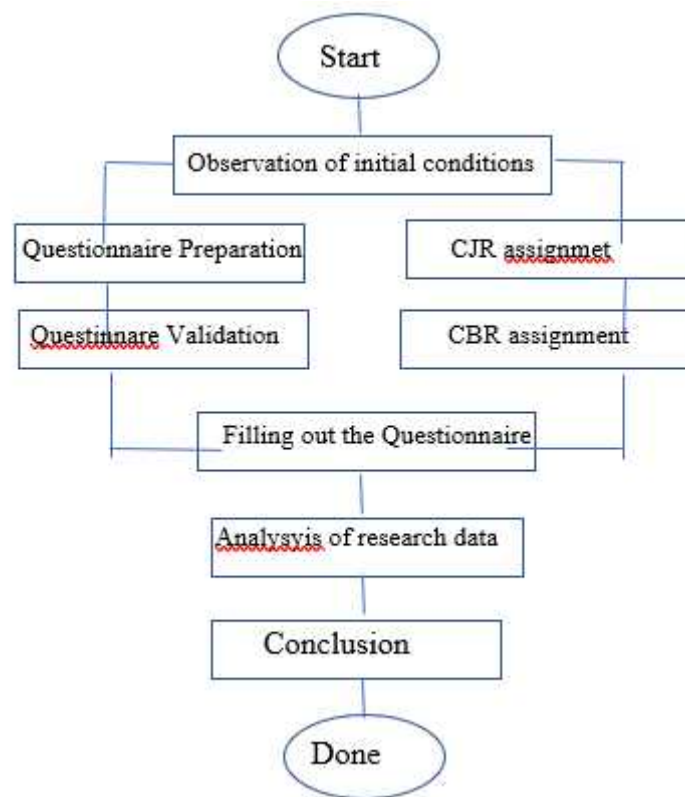


Figure 1. Research steps

This research was conducted in 3 stages. Each stage is structured by developing and carrying out six tasks of the KKNi so that they are synergistic through discourse learning. The research was conducted with the provision of questionnaires of interest in publications and inquiries in response to the relevance of 6 KKNi tasks in achieving learning objectives, namely articles obtained from the stages of developing six functions of the KKNi. Also carried out observations of students and the learning process to see symptoms of symptoms that inhibit student interest. The type of data obtained is qualitative data. Furthermore, the data collected will be integrated and described in a research result.

### 3. Result and Discussion

Inferential statistics courses are compulsory courses taken following descriptive statistics courses. The statistical literacy ability questionnaire was given to students at the 6th meeting after students went through 5 lecture meetings. The basis in preparing the questionnaire was taken from observations and questions and answers directly to students in sessions 1 and 2 of the lecture where there was still a lack of interest in reading students, the benefits, and implementation of statistical learning in daily life.

JCR assignments are given in the second week of study. The purpose of the JCR assignment is in addition to reviewing three selected journals, and students are expected to understand the statistical studies contained in the journal and describe them in a report. The CBR assignment was given in the 4th week of lectures. Students are required to review at least two statistics books by the material that has been determined. following the study of statistical developments in following the Industry 4.0 revolution into the report on week 6.

The questionnaire given at the end of the 6th meeting was a questionnaire to measure students' statistical literacy after the students took part in lectures and completed JCR and CBR assignments.

The questionnaire was administered using a Likert scale. The achievement of overall statistical literacy ability obtained by calculating the average percentage of students who responded to the questionnaire containing positive and negative statements. The level of categories of each literacy component will be revealed using the following percentages [16]

| Category Level | Category Interval |
|----------------|-------------------|
| 85 % - 100 %   | Very good         |
| 70 % - 84,99 % | Good              |
| 60 % - 69,99%  | enough            |
| 50 % - 59,99 % | Less              |
| 0 % - 49,99 %  | Very Less         |

The results of statistical literacy competency achievements based on the distribution of questionnaires to 18 students are as follows.

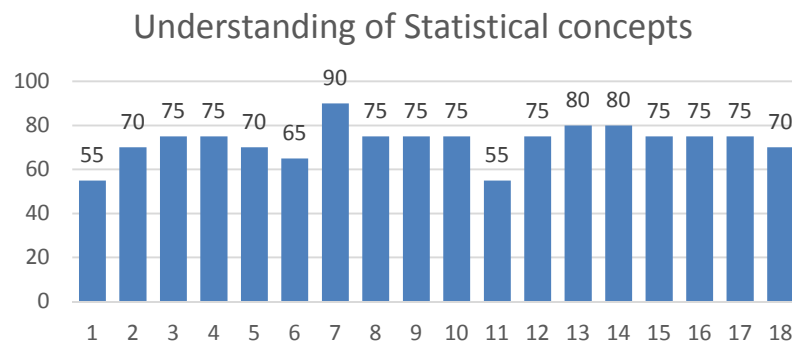


Figure 2. Achievement Competency Graph Understanding Statistics Concepts

Based on Figure 2, it can see that 18 students filled out the questionnaire. From the questionnaire, it is known that the average level of understanding of students' statistical concepts is 72.77% with a good category. As for the distribution of one person with a very good category, forty people with a good category and three people with enough categories.

Based on the analysis of research data from routine tasks, the ability to understand the concepts of statistics already looks better. This is because each student is required to read literature from more than one source so that they are able to complete the task well. Students are also able to explain or use accepted concepts. Students have understood and mastered the basic concepts in statistics, including the formula seen from observing daily routines in the learning process in class. CBR assignments also train students to dig deeper into statistical concepts from several reading sources. As we all know, in the effectiveness of the learning model, reading is the topmost cone in learning, which means that 10% of the effectiveness of learning is by reading [17]. Through CBR, the activity of reading a book aims to study through the chapters by a chapter of a textbook. Skillful reading activities will open up extensive knowledge, gates of deep wisdom, and expertise in the future.

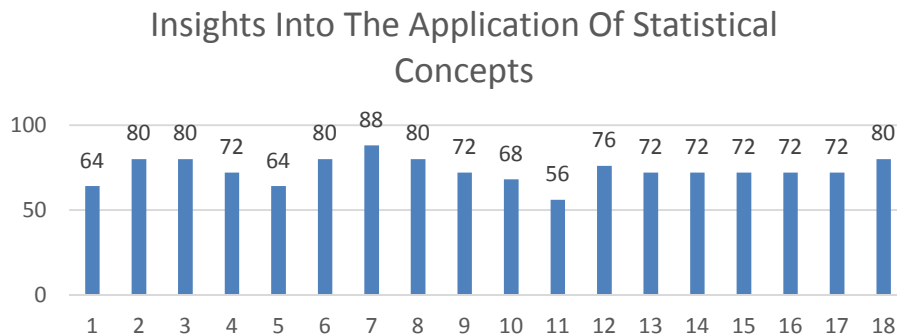


Figure 3. Achievement Competency Insights into the applications of statistical concepts

Based on Figure 3, it can see that 18 students filled out the questionnaire. From the questionnaire, it is known that the average level of competency of insight into the application of students' statistical concepts is 73.33% with a good category. As for the distribution of one person with a very good category, thirteen people with a good category and four people with enough categories. Based on the analysis of the KKNi student chassis, the achievement of competency insight into the application of statistical concepts is also trained to understand the application of statistical concepts that are right on target. Skillful reading activities will open up extensive knowledge, gates of deep wisdom, and expertise in the future. [17].

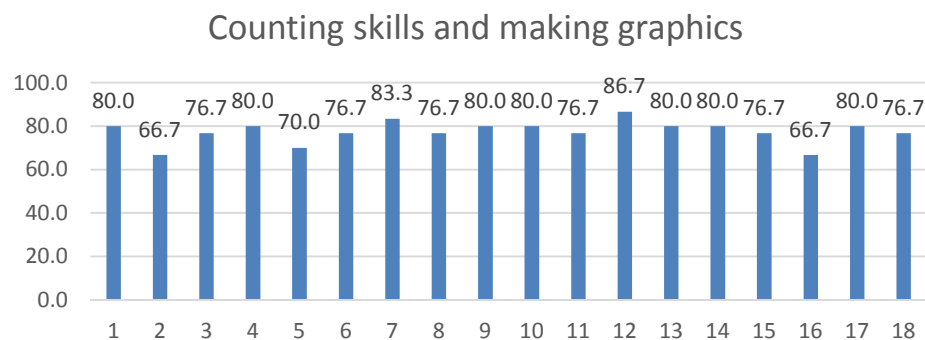


Figure 4. Achievement Competency Counting skills and making graphics

Based on Figure 4, there can see 18 students who filled out the questionnaire. From the questionnaire it is known that the average level of competence in numeracy skills and student graphics is 77.4% with a good category. As for the distribution of one person with a very good category, fifteen people with a good category and two people with enough categories.

An important process in statistics that is quantitative one of which is to calculate and present the count or data in graphical form. In addition to having an understanding of concepts and supervision in the application of statistical concepts, expertise is needed in counting and making graphics. For this study, software tools have been developed to support students. So that in routine student assignments, in addition to manual calculations, they are also asked to be able to solve them using at least one statistical software.

Research in the field of education (social science) today, is not solely directed to understand the phenomenon by only describing various interrelated things, also through hypothesis testing. Some students are not yet familiar with statistics, so it is not uncommon to find errors in the use of statistics devices. Such conditions, in turn, can lead to the inference of the results of hypothesis testing. On the other hand, the availability of various computer software such as Excel, Microstat, SPSS, R, Statcal,

and others, is very easy in helping to calculate and draw statistical data, but due to lack of understanding of the procedural requirements of the available devices, can cause errors in use [ 18].

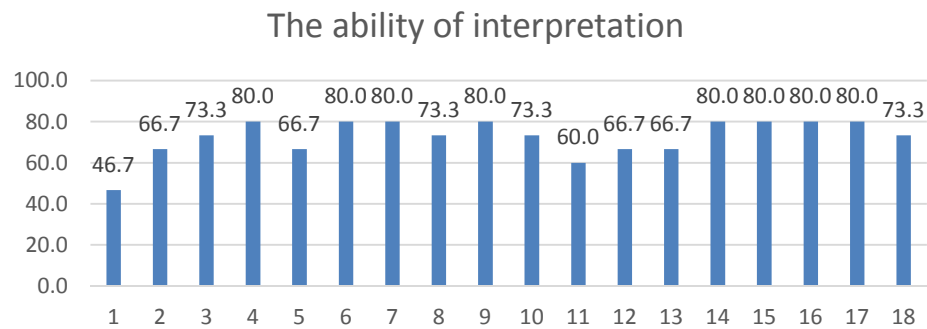


Figure 5. Achievement Competency The Ability of interpretation

Based on Figure 5, it can see that 18 students filled out the questionnaire. From the questionnaire, it is known that the average level of competence of students' interpretation ability is 72.6% with a good category as for the distribution of twelve people with good categories and six people with enough categories. The ability to interpret can see from the ability of students to explain the results of their calculations either on paper or presented. Based on the ability of students' statistical reasoning put forward by Garfield (2002) states that a way of giving reasons by using statistical ideas and giving meaning to the information is statistical reasoning. In line with Garfield, Dasari (2006) explains that understanding the concept of important ideas related to concentration, distribution, relationship (probability), probability, and sampling becomes part of the form of statistical reasoning. So the achievements in statistical reasoning one of which is the ability of interpretation [19]

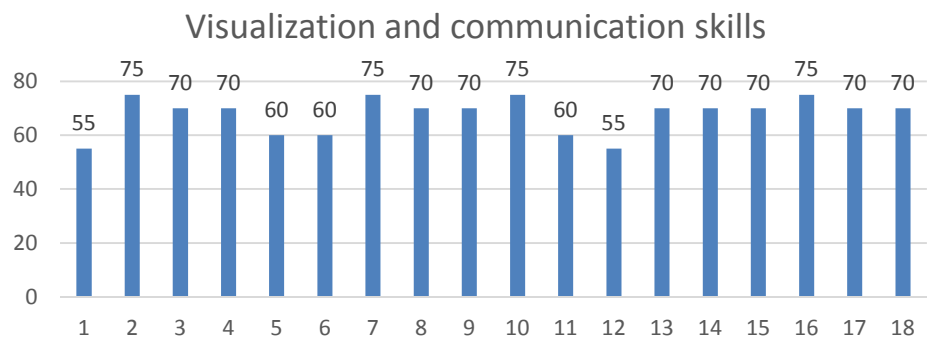


Figure 6. Achievement Competency Visualization and communication skills

Based on picture 6, it can see that 18 students filled out the questionnaire. From the questionnaire, it is known that the average level of competency in the visualization and communication skills of students is 67.8% with a sufficient category as for the distribution of thirteen people with good categories and five people with enough categories. From the overall competencies to be measured, it appears that the lowest competency of students' visualization and communication skills. From the JCR report, it can see that students have difficulty in understanding what researchers have conveyed. Likewise, when it can interpret research results from assignments or JCR, but it is not easily understood by listeners.

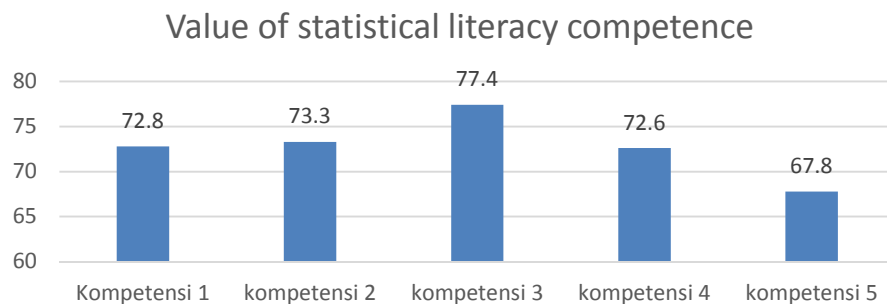


Figure 7. Value of statistical literacy competence

From the results of the average statistical calculation for the five statistical literacy competencies, it can be concluded that the level of statistical literacy of bilingual class students is 72.78% with a good category.

#### 4. Conclutions

From the research data and statistical calculations, it can see that the level of statistical literacy of students is at a percentage of 72.78% with the achievement of the "good" category. Literacy improvement can be made by giving KKN assignments in the form of routine tasks, JCR, and CBR. It aims to civilize students reading and pouring back in the form of exercises or reports. By reading it can improve students' interpretation abilities. Reading opens the discourse of science. With the broader scope of statistical development, students are increasingly interested in learning statistical software, which is considered very helpful in processing statistical data and drawing conclusions. Based on picture 5, it can see that 18 students filled out the questionnaire. From the questionnaire, it is known that the average level of competency in the visualization and communication skills of students is 67.8% with a sufficient category as for the distribution of thirteen people with good categories and five people with enough categories. From the overall competencies to be measured, it appears that the lowest competency of students' visualization and communication skills. From the JCR report, it can see that students have difficulty in understanding what researchers have conveyed. Likewise, when it can interpret research results from assignments or JCR, but it is not easily understood by listeners.

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