



# Statistical Literacy of Indonesia Sport Science Students When Solving Sport-Based Statistical Problems

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**Abstract.** The practice of teaching and learning of statistics so far conducted within direct teaching method, an explanation of the concepts and the formulas becomes less effective for sports science students. If this continues then it is hard that someday we will have graduates from sport sciences department who have the competence expected. Therefore, statistical learning for sports science students requires in-depth study on the factors that influence students' learning activity in statistics class to determine effective learning solutions. Based on that idea, this study discusses and analyzes about statistics literacy skills of sports science students in understanding of sports data. This becomes especially important as the initial basis in developing effective and engaging statistics learning practice for sports science students, especially those in the Sports Science Study Program, Universitas Negeri Makassar.

**Keywords:** Statistical literacy, Sport science students, sport-based data.

## 1 Introduction

In essence, statistics, which studies data, has a very important role in sports science. Data about players who are competing in a match, records of meetings with opponents (head to head), or the performance of opponents over a certain period of time are very important things to consider and study by every sports stakeholder such as players, coaches, referees and others. The data also becomes a benchmark for the team's performance against the opponents they will face in the match. Because with open data, sports matches become more interesting.

According to Albert & Koning (2008) there is a very close relationship between sports and statistics. In most sports, players and teams are measured by various statistics, and a review of these statistics is used to rank players or teams in a game or competition. A sports phenomenon that is currently popular is match simulation in which participants form teams of players by considering their games, wins and losses, based on actual statistical information. One of the reasons for the close relationship between statistics and sports may be due to the large amount of data available and used in sports. This can be seen from the match scores which are saved as a basis for the next match or an athlete's individual abilities which are measured and analyzed from time to time. The

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advent of the internet may have helped in distributing sports data to an even wider group of researchers. Apart from that, sport is also a familiar and easy context to use in learning new statistical methods.

In accordance with the very important role of statistics in the field of sports, within the scope of higher education, there is a very basic problem after sports science is stated in the scientific sciences group, namely how to educate sports science students to have statistical literacy. This is based on the fact that in general sports science students come with the initial perception that studying at the sports science faculty is only for practicing sports, not for studying science (Science, Mathematics, Statistics) which has often been considered a very difficult subject when studying at high school level (Erman, 2012). Students tend to rely more on their muscle abilities and hope to be trained according to the sport they are interested in. This wrong perception is then exacerbated by the fact that statistics lecture activities are theoretical and sports lectures in the field do not apply scientific knowledge, especially statistics. This then causes statistics to have no relevance to the field of sports and seems abstract and therefore uninteresting for students. A less conducive academic atmosphere where sports stakeholders generally have the wrong perception about sports is also an inhibiting factor in improving students' statistical literacy skills. In general, sports stakeholders have the wrong understanding that sport is viewed more in terms of physical and kinesthetic abilities, not in terms of sports science which is based on logic and mathematical abilities. So that sports achievements that show physical and kinesthetic abilities are more prominent and even very dominant in the academic environment on campus than sports as a science.

This then has an impact on the low learning outcomes of sports science students in statistics courses with an average mastery level of less than 25%. Based on the statistics course grades obtained by students in the previous few semesters, in each year of studying statistics, less than 10% of students get an A, and less than 20% of students get a B. In general, students get a C, even D or E. Several factors for the low achievement of student grades include the lack of student motivation to study statistics and science, low basic mathematics skills, and students' reluctance to pay attention to lecturers' explanations and read supporting literature including the teaching materials that have been prepared.

The facts above show that the study of statistics so far has been carried out using lecture methods, explanations of statistical concepts and formulas have become less effective for students. If this continues, it is difficult to hope that in the future we will get sports science study program graduates who have the expected competencies. Therefore, learning statistics for sports science students requires an in-depth study of the factors that influence students' statistics learning activities to determine learning solutions.

## 2 Methods

The research method used was a de facto descriptive method. This research method is used to describe symptoms that occur without any treatment or manipulation of variables. The symptom that is the object of research is the statistical literacy ability of sports

science students in understanding sports data which is measured through a description test with an assessment rubric adapted and developed from the Guidelines for Assessment and Instruction in Statistics Education (American Statistical Association, 2005).

In this study, researchers only measured students' statistical literacy abilities and the factors behind these abilities without providing any treatment. The population in this study were all students of the Sports Science Study Program, FIK UNM. From this population, the data source is determined in the form of a sample, namely some members of the population who are used as data sources.

## **2.1 Research Instruments and Data Collection**

The data in this study was collected using indirect observation techniques on symptoms of students' statistical literacy abilities in understanding sports data. The instrument used to collect data is in the form of essay test questions used to measure students' statistical literacy achievement using the written method. This test consists of questions related to statistical concepts which are directed at indicators of statistical literacy abilities which were adapted and developed based on the statistical literacy assessment rubric from the American Statistical Association (2005).

The following are the steps for conducting research:

1. Develop and validate statistical literacy test instruments.
2. Select students from the Sports Science Study Program at FIK UNM using purposive random sampling technique.
3. Give written tests to students of the Sports Science Study Program at FIK UNM who were selected as samples.
4. Analyze the research data to reveal the statistical literacy skills of sports science students in understanding sports data.

## **2.2 Data Analysis**

This research uses descriptive and inferential statistical analysis in analyzing the data obtained. Although the method of calculating the number of correct and incorrect answers in analyzing data obtained from essay tests can be used, this cannot properly describe the statistical literacy abilities of FIK UNM Sports Science students. Therefore, a method was created and used in this research, where each answer choice in each question item will be identified as correct or incorrect statistical reasoning.

## **2.3 Participants**

The subjects involved in this research were students of the Sports Science study program, Faculty of Sports Science, Makassar State University. More specifically, there are 20 students from the 3rd semester of the Sports Science study program.

This research will be carried out for 3 (three) months starting from the second week of April 2016 to the first week of July 2016, taking place in the lecture hall of the Sports Science Study Program, FIK UNM, Banta-Bantaeng Campus.

### 3 Results and Discussion

To measure the statistical reasoning abilities of sports science students, researchers used an instrument in the form of questions adapted and compiled from the book *The Language of Functions and Graphs* published by the *Shell Center for Mathematics Education, University of Nottingham*. The test that has been adapted and used in this research is a description test with 3 question items, taking into account that the students who are the sample in this research are sports science students who only studied statistics courses for 1 semester during their undergraduate studies. Each question item used in this research provides statistical graphic problems with several possible solutions, both correct and incorrect. From the test results that were compiled and given to 24 sports science students as samples in this research, the following research results were obtained:

#### Students' understanding of dot diagrams (scatter plots) is still low

Question number 1 in the test asked the respondent to match each person in the picture with a point in the diagram according to the person's age and height, as seen in Figure 5.1 below:

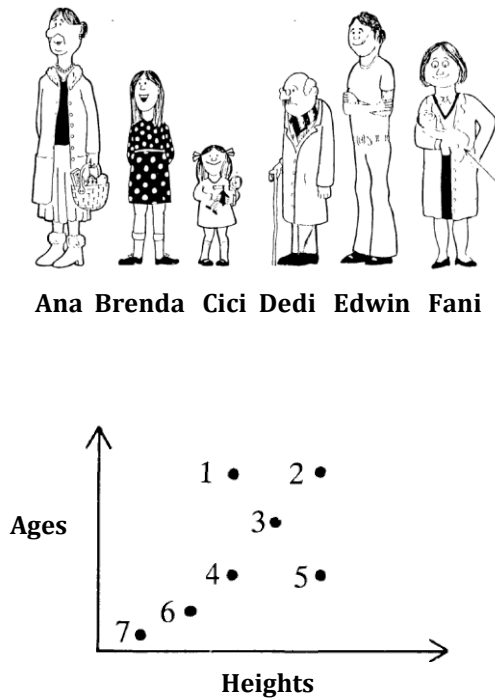


Fig. 1. An example of statistical problems given to the participants

This question aims to provide an overview of the statistical literacy skills of sports science students, especially regarding dot diagrams or scatter plots. Of the 24 students who participated in answering this question, it appeared that only 3 people or 12.5% of sports science students chose the correct answer. A total of 14 students or more than 50% of the research subjects incorrectly predicted Cici's age and height on the test given, even though Cici was the shortest and youngest among the others. This shows that more than 50% of sports science students in this study were unable to predict well and see data with the most extreme values.

Apart from that, as many as 4 students or 16.67% of the research subjects were wrong in predicting Dedi's age and height on the test given, even though Dedi was the oldest person among the others. This error shows that they are not aware of the importance of paying attention to outlier data when understanding a diagram or in other statistical analysis.

### **Students' understanding of interpreting line diagrams is still lacking**

Question number 2 in the test given discusses the interpretation of a line diagram which shows the different speeds of a racing car driving for one full lap on a circuit with a length of 3 km.

In this question, respondents are asked to determine the lowest speed of the car and choose the circuit shape that best fits the car's speed graph. For the first question, namely determining the lowest speed of the car shown in a diagram or graph, there were 5 people out of 24 respondents in this study who had the wrong answer. A total of 19 students or 79.17% gave the correct answer to this question. This shows that some sports science students in this study were still unable to read and interpret diagrams or line graphs correctly. Apart from that, for the second question in this question, namely about the image or shape of the circuit that matches the speed graph of the respondent's car, there were only 7 students who chose the correct answer, namely circuit B and no one chose circuit D as the answer to this question. Another interesting thing about this question is that there were 7 students who chose circuit E as their answer on the grounds that the shape of circuit E was the same or similar to the shape of the diagram or graph given. This shows that some respondents in this study did not know how to analyze and interpret graphs or line diagrams correctly. They only focus on the shape of the graph without understanding the elements of the graph. Apart from that, 11 students chose the answers circuit A and circuit C, which shows that those who chose these answers were wrong in interpreting graphs or line diagrams.

## **4 Conclusion**

Based on the research results presented above, it can be concluded that UNM sports science students' ability to understand statistical graphs in understanding sports data is still low. This can be seen from the low ability of students to understand and interpret point diagrams, line graphs and bar graphs.

Based on the research results that have been discussed, the researcher provides several suggestions to related parties. Suggestions for lecturers are that they are expected to pay special attention to the basic statistical skills of UNM sports science students, especially regarding graphs and diagrams by providing tutorials on basic statistical material. The suggestion for future researchers who are interested in researching the same topic is that future research can examine other aspects of statistical literacy, especially those related to sports science.

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