

Statistical Literacy For Beginner Voter

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Abstract. Beginner voters are part of groups that have a right to vote in elections. Decisions made by beginner voter in general election, are often based on statistical surveys, polls, and experiments. It is therefore important that beginner voter have some understanding of just how appropriate were the statistics on which decisions are made. Moreover, beginner voter should know enough statistics to be able to read a newspaper and digital information intelligently. As statistics educators we are challenged to promote understanding of statistics and good practice in class room. The paper deals with a statistical literacy learning in class room.

1. Introduction

Statistics is a pure science as well as a tool that plays a role in organizing data so that it is easier to 'read'. No wonder statistics are so famous for the term "Speak with Data", because statistics work on data to produce a conclusion. In everyday life, so much data is found, it is not easy to read data, with certain methods and techniques of calculations that are 'complicated' new data can be interpreted into an information. In the information age, Statistics is used for certain interests. Statistika is used in the political stage of Indonesia. A survey institution can release a number that is much different from other survey institution, so the public began to hesitate to trust the results of the survey. Survey institution are no longer on the path of scientific statistical applications, but rather become a tool for certain parties to make a profit. During this time statistical data more often displayed to the public without the clarity of statistical processing process. Some data is not taken randomly so it is less representative to draw conclusions. For an average citizen today it is important to be informed about the issues related to public life, which is a personal culture of every man. The development of society and thus the lives of ordinary people are strongly affected by political decisionmaking. Evidence-based decision-making is becoming increasingly important as governments are publically held accountable for policy outcomes [1].

Engel in [2] stated that with the rise of a political culture in which public debate is framed by appeals to emotion disconnected from the details of policy, it is ever more important for citizens to be critical consumers of media reports, being aware of misuse of statistics and knowing effective ways to overcome them. Statistics students need to develop the capacity to make sense of the staggering amount of information collected in our increasingly data-centered world. Especially to beginner voters, who are part of groups that have a right to vote in elections. Number of beginner voters Indonesia in polls 2014 predicted to reach 40 percent of the overall number of voters. According to Law No. 8 of 2012 article 19 paragraph 1 explaining that beginner voters are citizens who on polling day fulfilled aged 17 years or more or have been married have the right to choose. Beginner voters would need knowledge to read statistic information in newspaper, social media before using the right to vote. The ability to read statistical information in the media is often called statistical literacy. Therefore, School systems have a crucial role in developing statistical literacy which enables students to understand any information in media reports.

2. Statistic literacy

Rumsey [3] in introduction this paper, say that many statistics educators agree that any introductory statistics course should raise students' awareness of data in everyday life and prepare them for a career in today's "age of information." To achieve this objective, in my view, we must work toward two overarching goals for our introductory statistics courses. First, we want our students to be good "statistical citizens," understanding statistics well enough to be able to consume the information that they are inundated with on a daily basis, think critically about it, and make good decisions based on that information. Some researchers call this "statistical literacy."

In Presidential Address to the American Statistical Association, [4] stated that 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. Another widely accepted description of statistical literacy was proposed by [5] define statistical literacy is a key ability expected of citizens in information-laden societies, and is often touted as an expected outcome of schooling and as a necessary component of adults' numeracy and literacy. Yet, its meaning and building blocks have received little explicit attention. Statistical literacy is portrayed as the ability to interpret, critically evaluate, and communicate about statistical information and messages. It is argued that statistically literate behavior is predicated on the joint activation of five interrelated knowledge bases (literacy, statistical, mathematical, context, and critical), together with a cluster of supporting dispositions and enabling beliefs.

Unece in [6] Statistical literacy, as a concept, includes the ability to read and interpret statistical data in daily and other media (newspapers, Internet, television channels etc.), and includes the same data shown through, for example, graphs, tables, statements, statistical surveys and studies. In line with this definition, [6] states that Statistical literacy represents an aspect of media literacy, especially due to a growing share of the statistical information in media reporting. Being statistically literate means being able to correctly interpret and correctly use statistical information available either through the media or through services of official statistics, for the purpose of personal development and direct or indirect effects on the development of institutions and the state.

3. Statistical Literacy Components

Watson in [7] described "statistical literacy" as a set of competencies that adults need to manage "life" in the information society, which include literacy, mathematical and statistical skills, as well as knowledge of context and motivation. She considered three levels of increasing complexity: a) a basic understanding of statistical terms and language;; b) a more complete understanding of statistical language and the related concepts in the contexts where they are encountered; and c) a critical attitude and thinking ability to apply statistical ideas to analyse or debate statistical claims.

Statistical Literacy Components has been classified by different authors, starting from [8] who classified statistical literacy as either (1) chance-based (random sampling), (2) fallacy-based or (3) correlation-based (non-random assignment). Chance-based statistical literacy is concerned primarily with variation due to chance – random variation. Fallacy-based statistical literacy is concerned with mathematical/statistical fallacies or mathematical thinking. Correlation-based statistical literacy is concerned with analyzing arguments involving statistics as evidence where the statistics are obtained from observational studies. Gal in [5] divides statistical literacy in two component; (1) a knowledge component comprised of five cognitive elements: (a) literacy skills, (b) statistical knowledge, (c) mathematical knowledge, (d) context knowledge, and (e) critical questions and (2) a dispositional component comprised of two elements: (a) critical stance, and (b) beliefs and attitudes.

Garfield *et al* in [9] argues that *Statistical literacy* includes basic and important skills that may be used in understanding statistical information or research results. These skills include being able to organize data, construct and display tables, and work with different representations of data. Statistical literacy also includes an understanding of concepts, vocabulary, and symbols, and includes an understanding of probability as a measure of uncertainty.

Statistical literacy skills are vital for the informed use of statistics in decision-making and can be summarized in terms of four broad criteria, these are: (1) data awareness, (2) the ability to understand statistical concepts, (3) the ability to analyse, interpret and evaluate statistical information, and (4) the ability to communicate statistical information and understandings [1].

Gould in [10] feel that the basic SL goal of developing critical consumers of statistics produced by others is worthy (and necessary), but falls far short not only of what is required for life in modern democracies, but also in terms of what is possible for today's students to achieve. The needs of modern students has grown: all students should be educated to perform the dual role of statistical producer and consumer. Gould in [10] augment definition of SL that includes, at a minimum: (1) understanding who collects data about us, why they collect it, how they collect it; (2) knowing how to analyze and interpret data from random and non-random samples; (3) understanding issues of data privacy and ownership; (4) knowing how to create basic descriptive representations of data to answer questions about real-life processes; (5) understanding the importance of the provenance of data; (6) understanding how data are stored; (7) understanding how representations in computers can vary and why data must sometimes be altered before analysis; (8) understanding some aspects of predictive modeling.

4. Statistical Literacy skill for Beginner Voters

The number of graphs appearing in the mass media, such as elektabilitas charts, graphs of people's satisfaction levels, and other information that uses the term in statistics, certainly require a special ability to read and understand the process of making it. School as a place to transfer knowledge, must provide basic knowledge for students. In particular, statistics should provide information to students about understanding the political information displayed in statistical products. So that teachers need to know what knowledge, which required by beginner voter in understanding political information in the form of statistical products that exist in mass media. The following statistical literacy skills required by novice voters include:

a. Knowledge about population and sample differences

With this knowledge, students are expected to know the difference between realcount and quickcount. Quickcount results are not always appropriate because they are taken from the sample, while the realcount is a definite true result because it comes from the population. Teachers can prove by taking a case in the field that shows the difference between the quickcount results and the real count results.

b. Knowledge of the sampling process

General knowledge of sampling techniques is very important. This knowledge to provide a picture that the difference elektabilitas results issued by the survey agency can occur. Different samples produce different results.

c. Knowledge of the measure of centralization and dissemination

A centralized measure such as determining median, mode, and mean is important to know. In school practice, teachers often focus on median, mode, and mean calculation techniques, and pay less attention to students' understanding of the median, mode, and mean positions in the data. Likewise with the size of the deployment, teachers often focus on the techniques of calculation of variance and standard deviation, but less attention to students' understanding of the difference in the size of concentration and size of the spread in a data.

d. The ability to create and read graphs

After understanding about data and distribution of data, then students are taught process of graph interpretation and reading graph. Teachers can take samples of elektabilitas graph of a candidate from the survey conducted by the survey institution. But to maintain the neutrality of education, teachers should use props. In addition, students should also gain knowledge of statistical terms that often appear on the graph of survey results, such as the level of trust, sampling, and non-sampling.

What is the level of trust, sampling, and non-sampling? how to read numbers that indicate the level of trust, sampling, and smoothing.

e. Knowledge of decision making

The end result of reading ability is to make informed decisions. Nevertheless the statistical data is not a major factor in decision making. But at least the students know about the statistics in reading statistical information in the media, especially for novice voters in making decisions. In today's knowledge- and information-driven societies, the need for attaining at least the level of being a good "statistical citizen" is indisputable. Young people lacking the attainment of this competence are more likely to be left in dead-end jobs. Hence, educational programs are needed to enable the citizens, in particular the young generation, to understand and to properly deal with the ubiquitous statistical information. Nowadays, the importance of statistical literacy as a key qualification for employability is widely recognized and policy makers and educational institutions have launched actions that aim at promoting it [11].

5. Developing statistical literacy for beginner voter in schools

Watson in [12] stated that several factors contribute to the importance of students developing statistical literacy skills at the school. First is the expectation for participation as citizens in an information and data driven age where decision-making is likely to be based on critical skills from the realms of statistical literacy. Out-of-school experiences, however, place basic statistical ideas in many and varied contexts. The traditional divisions of the school curriculum into different subjects, particularly at the secondary level, have worked against integrating the ideas of chance and data across the curriculum into subjects such as science, social science, or health. For example, sampling, graphing, data reduction and inference, form the foundation for building sophisticated thinking skills. Collectively these topics are the second factor contributing to the development of statistical literacy at school.

François and Bendegem in [13] argues say that Today statistical educators are challenged to make students literate to understand basic information about themselves and the world surrounding them. statistical literacy should enable them to do more than just to read the data but should allow them to criticize and propose alternative interpretations to a given set of data. Therefore, School systems have a crucial role in developing statistical literacy which enables them to understand why and how statistics is a way of describing the world. Krishnan in [14] state that statistical literacy can be fostered by creating a significant learning experience for the students through an integrated statistics course. An integrated statistics course will be ideal in creating individualized significant learning experience for the students so that all students are included in the learning process towards fostering statistical literacy. Prodromou in [15] add that the teachers of statistical literacy have to marshal many facets of visualisation as a result of significant developments in information technology. All of these facets seek elicitation of patterns and salient pictorial representations of a particular specified context. The production of contextual meaning and interpretation involves familiar cognitive strategies.

Tishkovskaya and Lancaster in [16] implemented some of the reform-based principles in a specially designed unit of work aimed at encouraging students to learn statistics and become critically thinking consumers of statistical information. They have developed material, which has the following features. 1. The developed material can be used as a 'taster' within introductory statistics course and may be used with high school students, pre-university students or adults to encourage statistical thinking. 2. The material is centred not only on the teaching of statistics but aims to give students a lasting appreciation of the value of statistics in their everyday, civic and professional lives. 3. We use only very simple statistical methods and terminology that can be grasped by students with a very limited statistics background. 4. To develop critical thinking we use examples of incorrect analyses, as a warning to those who do not think critically. they emphasised that Motivation is the key point.

Teaching statistics to student senior high school in diverse fields is a challenging and important task. Specially, beginner voter will require some statistical knowledge for understanding

politic information, which are published in media with graphs and tables. Some students will go on to become “data consumers” where they will need statistical literacy, portrayed as the ability to interpret, critically evaluate, and communicate about statistical information and messages. The above three models of learning can be implemented for example when the school is conducting the election of OSIS chairman, the teacher can divide the students in several groups. Each group was given the task of conducting electability surveys of candidates for OSIS chairman, election survey of candidate for OSIS chairman by gender, survey of school residents' response to work program of OSIS candidate chairman, and others. After conducting a survey each group was asked to display the survey results in graphical form. Furthermore, when the election of the head of the OSIS took place each group was asked to perform the Quick Count results of the election of the chairman of the OSIS. In the end each group is asked to display Real Count results counting of votes in the form of tables, graphs, and diagrams. However, before this practicum learning is done first the teacher provides material on the basics of statistics such as data, data collection, data presentation, and so forth.

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