National Movement for Statistical Literacy in Indonesia: An Idea

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Abstract. The national movement of statistical literacy in Indonesia needs to be initiated and implemented. It is important to realize the noble ideals of the Indonesian nation to educate the nation's life. We cannot avoid reading statistical data presentation. Reading newspapers, magazines, and other papers will undoubtedly always find data presentation. Moreover, if we read scientific papers it is very difficult to avoid the presentation of data, both in the form of descriptive statistics and even in the form of inferential statistics. The need for the ability to read and interpret statistical data is not limited to a particular community, but to almost all communities within the nation. Therefore, the idea to promote the national movement for statistical literacy in Indonesia is presented in this conference forum.

Keywords: information literacy, statistical literacy, descriptive statistics, inferential statistics, nation’s life

1. Introduction
Director General of Primary and Secondary Education, Hamid Muhammad [1] says that “reading skills play an important role in our lives, because knowledge is gained through reading. Therefore, these skills must be mastered by the students well since the early state.” However, the reality shows that literacy test in reading that measures the aspects of understanding, using, and reflecting the results of reading in the form of writing has not been as expected. In PIRLS 2011 International Results in Reading, Indonesia ranked 45th out of 48 participating countries with a score of 428 from an average score of 500 [2]. Meanwhile, literacy test in reading PISA 2009 shows Indonesian students are ranked 57th out of 65 countries with score 396 (OECD 493 average score) [3], while PISA 2012 shows Indonesian students are ranked 64th out of 65 countries with a score of 396 (OECD 496 average score) [4]. The PIRLS and PISA data, particularly in reading comprehension skills, show that the competence of Indonesian learners is low.

Widiasana [5] said that the low skills proved that the education process has not developed the competence and interests of learners to knowledge. Education practices implemented in schools have also been shown that the school has not functioned as a making learning organization all citizens as lifelong learners.

Thus, the Directorate General of Primary and Secondary Education, the Ministry of Education and Culture initiated the Gerakan Literasi Sekolah (GLS) project (the School Literacy Movement) which its parent design was published in 2016. Ki Hadjar Dewantara in the Buku Saku Gerakan Literasi Sekolah [1] said: "Education is an effort to advance the growth of mind, attitude, and body of the child. They
can not be separated so that we can advance the perfection of our children's lives.” Therefore, literacy is the ability to access, understand, and use information intelligently.

In the Buku Saku Gerakan Literasi Sekolah [1], it is explained that the principles of school literacy are:

a. according to the developmental stages of the learner based on their characteristics;
b. implemented in a balanced manner; using a variety of texts and taking into account the needs of learners;
c. take place in an integrated and holistic manner in all areas of the curriculum;
d. literacy activities carried out on an ongoing basis;
e. involve oral communication skills;
f. considering diversity.

Thus, stakeholders Literacy Movement for Basic Education School includes the Ministry of Education and Culture, Education Office at the provincial, district/city, and Education and Community Unit.

We need to appreciate the government's initiative to initiate the School Literacy Movement. However, there is more specific literacy required by every citizen, that is statistical literacy. We can not avoid reading statistical data presentation. Reading newspapers, magazines, and other papers will undoubtedly always find data presentation. Moreover, if we read scientific papers is very difficult to avoid the presentation of data, both in the form of descriptive statistics and even in the form of inferential statistics. The need for the ability to read and interpret statistical data is not limited to certain communities, but to almost all communities within the nations. Therefore, an effort to roll the idea of the National Movement of Statistical Literacy in Indonesia through this paper.

2. What is the statistical literacy?

Basic Statistics is a compulsory subject in all S-1 study programs in FMIPA UNM. However, statistical learning today is still strongly influenced by traditional means for two reasons. First, there is still the assumption that statistics is a part of mathematics. Thus, statistical learning still tends to emphasize the prove of formulas and calculations, not statistical thinking. With a mathematical paradigm, statistics is taught as a technical method or procedure, without paying attention to the meaning behind the numbers generated from data analysis. This is a consequence of deductive-deterministic of mathematical thinking.

It should be pointed out that the Statistics Department of FMIPA UNM has embraced the view that statistics is a part of liberal arts, not part of mathematics, nor applied mathematics. This attitude continues David S. Moore's view in his article: “Statistics among the Liberal Arts” presented to the Presidential Address, the American Statistical Association in Dallas, Texas, USA dated August 11, 1998 [6]. Moore states that “statistics is one of the liberal arts, which offers statistical applications for wider and more flexible views and reasoning.” Furthermore, Moore states that with this perspective and understanding will make the wise man grow wiser in every aspect of life and work. Reasoning about data, variations, and events is a flexible and widely applicable way of thinking. These characteristics are often given to the liberal arts. Thus, statistics by means of probabilistic-inductive thinking applied to a broad and flexible way of view and reasoning can be seen as part of liberal arts.

Second, statistical learning today is still a legacy of the traditional way of not utilizing information technology. With the presence of information technology such as computers, internet, and statistical software forcing the learning of statistics to change. This change needs to emphasize statistical thinking, and not spend much time on manual prove of formulas and calculation. Technology should be optimally utilized.

Muntashir [7] in his article entitled: “Standar Kompetensi Literasi Informasi Mahasiswa Ilmu Perpustakaan pada Perguruan Tinggi Agama Islam” introduced the term “information literacy as a generic capability that is a key competency to improve the ability to learn independently and to realize lifelong learning.” People of information literacy know for sure how to learn effectively and efficiently to complete the tasks and problems faced. Information literacy refers to a person's ability to
Effectively define, find, evaluate and use the information needed. Competency standards related to information literacy are widely developed by various library associations in some developed countries. Many renowned colleges have adopted the principles and standard of literacy for their needs. The information literacy movement within the university has also been supported by several university and higher education accredited bodies by applying the assessment standards related to the information literacy program to support the teaching.

Furthermore, it is explained that statistical literacy is part of the information literacy. Tiro [8] explains in more detail that statistical literacy includes five competencies, namely (1) understanding of statistical concepts, (2) insight into the application of statistical concepts, (3) numeracy and doing graph skills, (4) the ability of interpretation, and (5) visualization and communication skills. The five competencies of statistical literacy are described briefly as follows:

a. Understanding of statistical concepts. For example, the students should understand the concept of the average (mean) and standard deviation includes calculation formulas and information submitted. Conceptual understanding is guiding toward knowledge area of the concept application in real life.

b. Insight into application of statistical concepts. Getting to know the circumstances it can use statistical values and under what circumstances certain statistical value has no meaning. For example, somebody calculates the average value of the age group of people, the result does not give valid useful information. The average value of the group earnings may provide useful information to describe the level of welfare of the group.

c. Numeracy and doing graph skills. Skills such as calculating averages and other statistical values, as well as creating graphics or pictures have a lot of ease obtained by the statistical computer packages. However, after calculating the value of certain statistics, the concept and application of these values must be known.

d. Interpretation capabilities. Results of statistical calculation do not give meaning if it cannot be interpreted properly. Similarly, describes the information from a graph or picture is an important capability that must be possessed in today's information age.

e. Visualization and communication skills. No matter how the results of statistical analysis and interpretation if it cannot be well communicated to stakeholders do not give benefit. The communication succeeds if it gives effect to those who were given the information. Influence is meant the changes in knowledge, attitudes, and behaviors for the better life.

However, statistical thinking not only understands the idea or set of ideas precisely, but also like a mantra that evokes things understood at an intuitive level is vague. Statistical thinking is a statistical incarnation of common sense. We know something when we see it, or perhaps more honest, often something that is not visible. Most of us are the product of experience, war stories and intuition rather than formal instruction we have. Thus, we have shortage of literature on statistical thinking.

It was explained that learning statistics need to emphasize in statistical literacy in building statistical thinking. Of the various previous discussions (Tiro & Nusrang [9]; Sudarmin, Tiro, & Irwan, [10]; Tiro, Ahmar, & Aidid [11]), it can be said that literacy of statistics should be teaching starting from the early level of schools. Sudarmin, Tiro, and Irwan, [10] study especially the literacy of probability and random chance. Tiro, Aidid, and Ahmar [11] also examined table and graph literacy presented in the International Conference on Mathematics and Natural Sciences (IConMNS) 2017, September 6 - 7, 2017 at Harris Hotel and Residences Sunset Road, Bali.

With the conceptual definition of statistical literacy, we need implementation in operational form at all levels of society. This can be realized in the form of the National Movement for Statistical Literacy in Indonesia which is very important to be implemented to be part of the effort to educate the nation’s life. Before that, we have to know the teaching statistics in Indonesian schools today.

3. Fact about Teaching in Indonesia
In Indonesia, Ministry of Education and Culture is responsible to manage 279,368 schools. Besides that, Ministry of Religious Affair is responsible to manage 77,336 schools. Data from Indonesia Educational Statistics in Brief 2015/2016 give the information in the Table 1 (see Tiro, [8]).
TABLE 1 MINISTRY OF EDUCATION AND CULTURE

|                     | Public | Private | Total |
|---------------------|--------|---------|-------|
| Kindergarten (KG)   | 3,186  | 82,313  | 85,499|
| Special School (SS) | 521    | 1,441   | 1,962 |
| Primary School (PS) | 132,381| 15,155  | 147,536|
| Junior Secondary School (JSS) | 22,475 | 14,548  | 37,023|
| **Total**           | 158,563| 113,457 | 272,020|

We see in the table 1, there are 272,020+25,348 = 279,368 schools under the supervision of the Ministry of Education and Culture of Indonesia, where 158,563+9,675 = 168,238 public schools and 113,457+15,673=129,130 private schools.

TABLE 2 MINISTRY OF RELIGIOUS AFFAIRS

|                     | Public | Private | Total |
|---------------------|--------|---------|-------|
| Islamic Kindergarten (IKG) | 0      | 27,999  | 27,999|
| Islamic Primary School (IPS) | 1,686  | 22,874  | 24,560|
| Islamic Junior Secondary School (IJSS) | 1,437  | 15,497  | 16,934|
| Islamic Senior Secondary School (ISSS) | 763    | 7,080   | 7,843 |
| **Total**           | 3,886  | 73,450  | 77,336|

Therefore, in Table 2 there are 77,336 schools under the supervision of the Ministry of Religious Affair of Indonesia, where 3,886 public schools and 73,450 private schools. So, there are 279,368+77,336 = 356,704 schools in Indonesia. If we classify schools in terms of primary, junior secondary and senior secondary schools, there are:

147,536+24,560 = 172,096 primary schools,
37,023+16,934 = 53,957 junior secondary schools, and
25,348+7,843 = 33,191 senior secondary schools.

Today in Indonesia, there is no statistics teacher for all schools, because statistics is a part of mathematics. If we estimate that six teachers for every primary school, there are 6x172,096 = 1,032,576 primary school teachers. Suppose that we should have three statistics teachers for every junior secondary school, there are 3x53,957 = 161,871 statistics junior secondary school teachers should be created. Furthermore, suppose that we should have three statistics teachers for every senior secondary school, there are 3x33,191 = 99,573 statistics senior secondary school teachers should be created.

From the foregoing discussion (Tiro [12]), several conclusions can be drawn as the following:

a. the statistical learning that emphasizes the mathematical and procedural approach cannot empower learners to use its statistical knowledge in solving practical issue in daily life;
b. the statistics can be taught as a discipline, life skills, and profession;
c. statistics is not a part of mathematics, because statistical thinking is inductive-probabilistic, while mathematical thinking is deductive-deterministic;
d. the reform of statistical learning in Indonesian schools needs to be done to integrate matter of statistics, pedagogy, and information technology to produce learners who can use its statistical knowledge in solving practical problems in daily life;
e. statistics education programs need to be implemented to generate the teachers who teach literacy of statistics that encourage the growth of statistical thinking, active learners, utilization data, and the use of evaluation techniques that improve the quality of learning statistics.

All of these arguments give strong support to promote the national movement for statistical literacy in Indonesia.

4. How is the Statistic Literacy National Movement Appearing?
The important actions in implementing the national movement for statistical literacy in Indonesia as the following.

4.1. Synchronize statistical learning in formal school from elementary to university
Statistics and mathematics as twin brothers have played an important role in building the quality of Indonesians human resources. Both these disciplines must work together to develop the field of sciences and technologies. However, both have different ways of thinking: statistics is inductive-probabilistic and mathematics is deductive-deterministic. The difference becomes the strength for mutual complementarity between statistics and mathematics. In addition, it should be emphasized that the statistics is not a part of mathematics, even statistics needs mathematics. Statistics has its own tools and ways of thinking, and statisticians are quite insistent that those of us who teach mathematics realize that statistics is not mathematics, nor is it even a branch of mathematics. In fact, statistics is a separate discipline with its own unique ways of thinking and its own tools for approaching problems.

Thus, learning statistics and mathematics requires attention at all levels of education. Learning statistics as part of mathematics is happening in Indonesian schools today, so this needs to be reconsidered. Statistical thinking that is different from mathematical thinking. The difference should be introduced from the lowest level primary schools up to higher education. Therefore, diversification of statistics and mathematics learning need to be conceived and implemented, starting from the bottom level of education.

Research in statistics education has prompted growing recognition of the differences between mathematical thinking and statistical thinking (Groth [13]; Hannigan, Gill, and Leavy [14]. For example, statistical thinking involves recognition of the need for data, the importance of data production, and the omnipresence of variability. This information can be seen in Franklin et al. [15].

To build a statistical learning relationship between primary and higher education, FORSTAT (Statistics Indonesia Higher Education Forum) needs to play a role in assessing statistical education courses in universities and statistical learning exercises for primary and secondary school teachers. This is an issue in “The Statistics Indonesia Workshop” on the theme of “The Future of Statistics in Indonesia”, Saturday, July 22, 2017 at Sebelas Maret University (UNS) in Solo. FORSTAT also realize that there is disconnected teaching statistics between higher education and elementary through secondary education. Because, teaching statistics at elementary through secondary schools view statistics as part of mathematics, while FORSTAT has the same view of Statistics Department of FMIPA UNM that is statistics has its own way of thinking. Therefore, teaching school students (both primary and secondary) and tertiary students (including university and vocational education students and teachers/lecturers) should be linked by special project to promote statistical literacy at all levels of educations. Produce a statistics teaching kit aimed at promoting statistical literacy among students.

Maria João and Valente Rosa [16] showed two ways to improve Statistical Literacy:
1) to reinforce the understanding of data by the general public, develop a large meta-information, with short, simple and clear explanations of all the main concepts involved in statistical indicators (e.g. GDP, risk of poverty);
2) to promote the ability to communicate statistical information and develop training sessions for journalists.
4.2. Building collective awareness amongst all statistical literacy stakeholders

Building collective awareness amongst all statistical stakeholders, among them the Central Bureau of Statistics, is starting from national, provincial and district/city levels. The Central Bureau of Statistics can provide true statistical information to the public, government, business people, and practitioners in education, health, environment, government and finance. Prepare and publish brief and easy-to-read leaflets and pamphlets on selected statistical series and activities for free distribution. The same and/or similar information shall be made available to statistical users in electronic format.

The business community and industry are the stakeholders who need to have statistical literacy so that their business can work maximally. Business people can improve their business performance; organize conferences, seminars and public discussions on selected statistical topics and/or compilations in order to better explain relevant subject areas and statistical outputs. Besides that, general community (including small business/ community groups) foster contacts with the business community by giving talks and presentations on statistical matters to members of the constituted bodies.

Education and government practitioners can make decisions to make well educated people. The academics practitioners can make decisions to improve quality of teaching in schools. Education practitioners can change learning strategies for the better learning process. Stephanie Budgett and Maxine Pfannkuch [17] requires students to critically evaluate a statistically based opinion poll or sample survey study. Four journal articles or technical reports are presented, together with related media reports, from which they select one. They are expected to evaluate the study, give a judgment of the study, and critique the related media report.

Environmental practitioners can influence government policies to preserve environmental health. Juana Sanchez [18] suggest reasons why data would be collected on the following topics (and what that data mean): a) Burglaries, b) causes of death, c) climate, d) forests, e) immigration, and f) schools. Those topics would be irrelevant to a child. So an alternative way of assessing understanding of variation might be this example inspired by an activity in the UK Census At School project, described in the “Resources to start a Census for Children” page of the ISLP.

Opinion leaders (including journalists) organize seminars for members of the news media in order to improve their level of appreciation and understanding of statistics and their methodology and compilation processes. Particular attention will be placed on the use and misuse of statistics. Such activities aim to improve the type and quality of media reporting of official statistics. One needs to have an awareness of data sources, associated metadata, data availability and data accessibility when examining statistical claims. It is also important to understand that statistics is contextual.

Milo Schield [19] said that decision makers (including politicians, political advisors and government employees) evaluate information as a key element in information literacy, statistical literacy and data literacy. As such, all three literacies are inter-related. It is difficult to promote information literacy or data literacy without promoting statistical literacy.

Health and environmental practitioners can make good decisions to prevent people from sick. Health practitioners design programs to prevent disease transmission and address public health concerns. Health Practitioner Regulation National Law (Queensland) [20] stated that public health facility includes a public hospital and a public health, teaching or research facility. The National Board reasonably believes that (i) because of the registered health practitioner’s conduct, performance or health, the practitioner poses a serious risk to persons; and (ii) it is necessary to take immediate action to protect public health or safety.

Financial practitioners can minimize the risk of declining results of their operations. Rebecca Simson, Natasha Sharma and Imran Aziz [21] suggest that internal (or management) control systems are the policies and procedures put in place by the management of a government agency in order to ensure the agency achieves its objectives and complies with external laws and regulations. Such policies and procedures tend to cover financial accounting and reporting, performance monitoring, asset management and procurement.
5. Conclusion

National movement of statistical literacy is expected to be done by two major steps, namely:

A. Synchronize statistical learning in formal school

1) teachers who teach literacy of statistics in developing statistical thinking, should encourages to active learning by using the data and assessment to improve the quality of students learning outcomes;
2) statistics and mathematics should be teaching differently in schools and see statistics is a separate discipline with its own unique ways of thinking and its own tools for approaching problems;
3) teachers for teaching statistics at schools should be well prepared;
4) University should prepare education for teachers to teach statistics at schools;
5) FORSTA T (Statistics Indonesia Higher Education Forum) needs to play a role in assessing statistical education courses in universities and statistical learning exercises for primary and secondary school teachers.

B. Building collective awareness

Hopefully the following results of collective awareness among the stakeholders related to statistical literacy:

1) The Central Bureau of Statistics can provide true statistical information to the public, government, business people, and practitioners in education, health, environment, government and finance.
2) The business community and industry are the stakeholders who need to have statistical literacy so that their business can work maximally. Business people can improve their business performance; organize conferences, seminars and public discussions on selected statistical topics and/or compilations in order to better explain relevant subject areas and statistical outputs.
3) The academics practitioners can make decisions to improve quality of teaching in schools. Education practitioners can change learning strategies for the better learning process.
4) Opinion leaders (including journalists) organize seminars for members of the news media in order to improve their level of appreciation and understanding of statistics and their methodology and compilation processes. Particular attention will be placed on the use and misuse of statistics.
5) Health and environmental practitioners can make good decisions to prevent people from sick. Health practitioners design programs to prevent disease transmission and address public health concerns.
6) Financial practitioners can minimize the risk of declining results of their operations. The internal (or management) control systems are the policies and procedures put in place by the management of a government agency in order to ensure the agency achieves its objectives and complies with external laws and regulations.

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