STUDENT STATISTICAL LITERACY IN INDONESIA: SYSTEMATIC LITERATURE REVIEW

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ABSTRACT

The development of technology in the Era of Society 4.0 underlies the creation of a new era regarding the use of data, namely the era of big data. One of the skills that can be used to make effective use of big data is the ability to process, analyze, and draw conclusions from data, which is closely related to statistical literacy. This research attempts to conduct a systematic review focusing on the study of Statistical Literacy in Indonesia from 2017 to 2022 utilizing Google Scholar and the Publish or Perish program. A systematic Literature Review is the research methodology. There All are articles indexed by SINTA. The search strategy was tailored to the inclusion criteria and used the PRISMA protocol as a guide to determine the research instrument. This study includes as moderator variables the year of publication, the level of education, the research method, and the location of the research. The research sample consisted of 40 statistical literacy articles. The results showed that most articles were published in 2021. Most research was conducted at university levels and was carried out on the island of Java, namely Jawa Barat and East Java. The most widely used research method in this study is the qualitative method. Most of publications focused on two primary teaching methods: teacher-centered teaching and student-centered teaching.

Keywords: Systematic Literature Review, Statistical Literacy

INTRODUCTION

Education is necessary for progress in the twenty-first century and is readily available to all individuals and groups. This begins the digital era known as "Industrial Revolution 4.0." According to Setiawan (2019), various countries worldwide, including Indonesia, are facing the Industrial Revolution 4.0, marked by the simultaneous rapid development of sensor technology, connectedness, and data availability. This development underlies the creation of a new era regarding the use of data, namely the era of big data. According to Farouk, el, Gahi, & Amine (2020), Volume, Velocity, Variety, Veracity, Value, Variability, and Visualization are the seven 7Vs that are commonly used to define big data. 90 percent of the world's data was created in the last two years, and 2.5 trillion bytes of data are created daily (Marr, 2018).

Big data utilization in education has not yet become widespread (Supriyanto, et al., 2021). Big data technology was originally only related to collecting information from websites or often referred to as web mining (Lee, 2017). The Internet of Things (IoT), which is currently necessary for big data technology, is built on the fundamental assumption of connecting several devices to a network and exchanging data with other devices. According to Setiawan (2019), Due to the vast amount of data generated by the Internet of Things (IoT), big data technology can be applied to many aspects of human existence. The Internet of Things (IoT) has numerous

profound effects on government institutions, industry, health, and education.(Wilianto & Kurniawan, 2018).

One of the skills that can be used to make effective use of big data is the capacity to process, analyze, and draw conclusions from data, which is strongly related to statistical literacy. Also, Schield (1999), Statistical literacy refers to the ability to understand, assess, and use statistics as evidence to support arguments. Pamungkas and Khaerunnisa (2020) Statistical literacy is the capacity to generate, apply, and comprehend statistical data in a variety of settings. Rahmawati, Asikin, and Scolastika (2022) also mentioned that statistical literacy emphasizes understanding information from the data obtained.

According to Gal (2002), Indicators of statistical literacy include 1) Literacy abilities, which refer to the capacity to grasp the reading of a variety of non-prose writings, such as graphs, tables, or symbols; 2) Statistical concept understanding; 3) Mathematical proficiency. 4) Contextual awareness, or the ability to comprehend how statistical assertions fit within their context; 5) itcriticalhinking, or the ability to assess published findings.

Research on statistical literacy in Indonesia still needs to be completed. Prihastari, Sukestiyarno, and Kartono (2022) wrote a literature review article on the study of statistical literacy at the education level in Indonesia. Habibie and Hidayat (2022) analyzed the increase in student statistical literacy in educational statistics courses based on the statistical process. The findings of this study demonstrate that after participating in lectures for 16 meetings, high, medium, and low groups of aspiring primary school teachers improved their statistical literacy (one semester). Ratnawati (2020) The statistical literacy comprehension of the four individuals with high, moderate, and poor abilities did not provide sufficient evidence to assess the veracity of the researchers' statements. Irwandi, Roza, and Maimunah (2021) also mentioned that the percentage of statistical literacy ability of students still needs to be higher in each indicator.

The description above shows that efforts are needed to improve statistical literacy and expand the scope of research to map statistical literacy at various levels in Indonesia. It is intended that a systematic review of studies on 'Statistical Literacy' will aid scholars in understanding the breadth of study undertaken on this topic. In addition, it is anticipated that the findings of this investigation would provide important information. In addition, it is hoped that the findings of this study would enable future researchers to employ other methodologies. In addition, the results that present the objectives of the prior study can assist future researchers with new insights.

The goal of this study is to conduct a systematic review that focuses on statistical literacy by publication year, level of education, research methods, and research location. Consequently, data collecting in the form of research results on statistical literacy is a crucial stage of SLR.

METHOD

Systematic Literature Review

A systematic Literature Review is the technique used to address research problems. This research approach is deemed suitable since it can contribute to a reliable and accurate synthesis of existing academic literature (Van Laar et al., 2017). Furthermore, this research method allows the application of elements of analytical criticism to the discussion of synthesis (Hart, 2018).

The collected information consists of primary research published in national journals. Sources of information registered with and indexed by Google Scholar, Semantic Scholar, ERIC, and direct URLs of national publications are used to collect data. The subsequent step is the extraction of

all discovered items. In the analysis phase, only pertinent articles meeting the inclusion criteria are included (Dadang Juandi & Tamur, 2020) (Jesson et al., 2011).

Research Instrumen

The research instruments consist of observation sheets or protocols about inclusion and exclusion criteria based on the study's year, duration, study level, and sample size.

Population Sample

All of the populations in this study are published experimental studies on Statistical Literacy. Based on a search using search engines, a sample of 40 relevant and meritorious experimental research was compiled.

Data Analysis

Additionally, themes and subthemes are suitably determined after reading the abstract and the complete article (in-depth). The author then compiles subthemes surrounding the typology's core themes. Reviewers use theme analysis to identify past study findings by grouping them according to similarity or significance and then classifying them. (Adams et al., 2021).

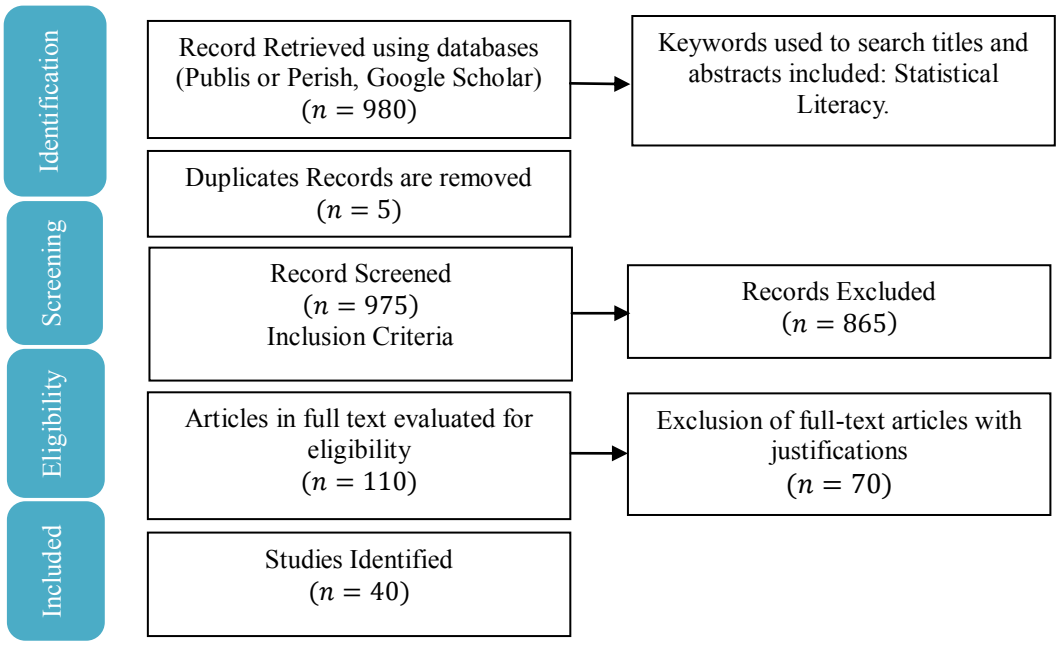

Figure 1. PRISMA Flowchart Describe the Process of Data Collection

Inclusion Criteria

Inclusion Criteria are criteria by which the research subject can represent the research sample that qualifies as a sample. At the same time, the exclusion criteria are criteria where the research subject cannot represent the sample because it does not qualify as a sample (Notoadmojo, 2002). The inclusion criteria presented in Table 1 are determined before the data search and applied during the filtering of text headings, abstracts, and the entire text.

Table 1. Inclusion and Exclusion Criteria

Type Criteria	Inclusion	Exclusion
Publication	Jurnal (SINTA)	
Topic	Statistical Literacy	-

Language	Indonesian & English	
Access	Online	Paper
Publication Period	2017-2022	Before 2017
Place of Publication	Indonesia	Non-Indonesian text
Context	All Education Level	

RESULTS AND DISCUSSION

By applying inclusion criteria to all relevant studies, they are further classified according to four moderate variables: study year, level of education, research method, and research location. Tabulated descriptive information is supplied in Table 1.

Table 2. The result of the Analysis Articles

Characteristic	Criterion	Frequency
Year of publication	2017	8
	2018	14
	2019	9
	2020	4
	2021	3
	2022	2
Level of Education	Elementary School	1
	Junior High School	13
	Senior High School	9
	University	15
Research Methods	Quantitative	9
	Qualitative	21
	Mix Method	2
Research Grounds	Banten	4
	Bengkulu	1
	Jakarta	2
	Jambi	1
	West Java	8
	Central Java	7
	East Java	8
	Central Kalimantan	1
	North Kalimantan	1
	Riau Islands	2
	South Sumatra	1
	North Sumatra	1
	Yogyakarta	1

Studies By Year of Publication

The classification based on the duration of the research is separated into five periods: 2017, 2018, 2019, 2020, 2021, and 2022. The following information was received within this time frame.

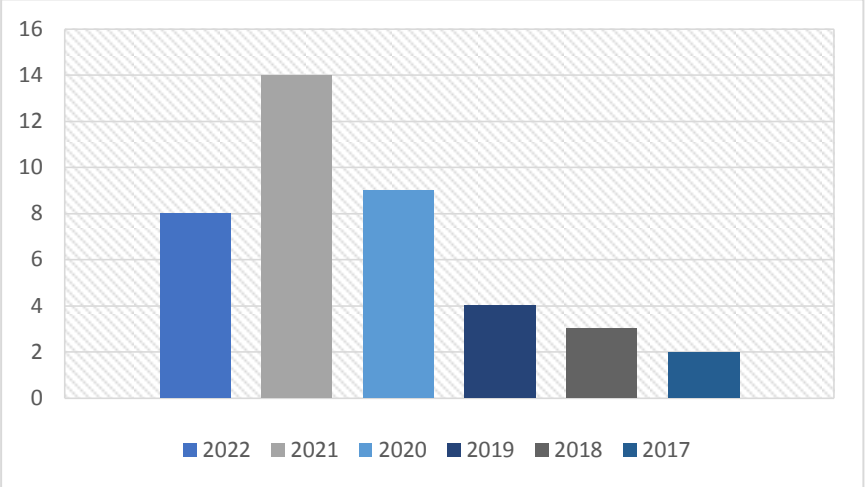

Figure 2. Data by year of publication

Figure 2 demonstrates that research on statistical literacy tends to increase over time, particularly after 2017-2021, but has declined in 2022.

Studies By Education Level

The classification by educational level is divided into four groups: elementary school, junior high school, high school, and university. Figure 3 illustrates the number of experimental investigations by educational level.

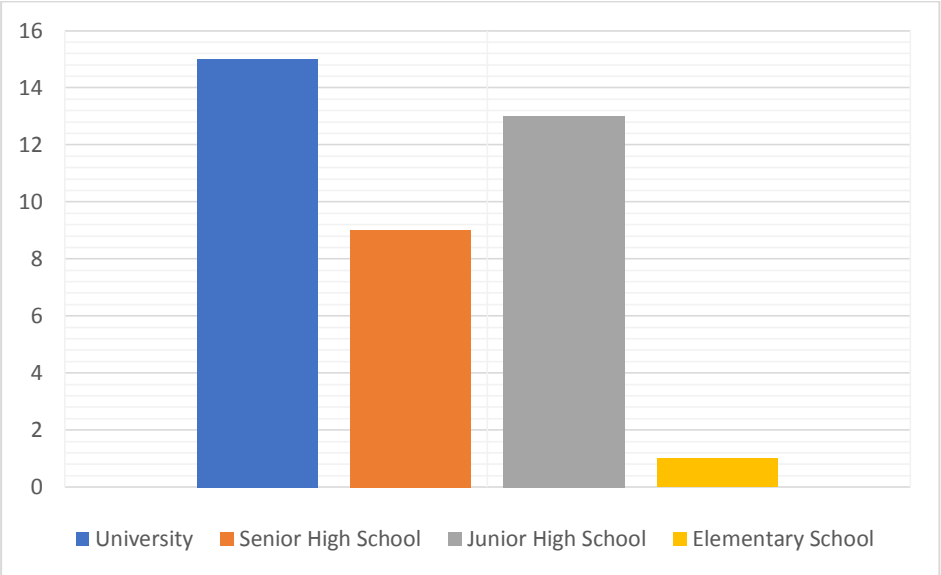

Figure 3. Data by Education Level

Figure 3 indicates that statistical literacy is studied more at the university level than in junior high and high school. In contrast, there is only one published elementary school literacy study. This is an issue because statistical literacy is a crucial skill that must be acquired early on.

Studies Based on Research Methods

Grouping according to research methodology is divided into seven categories: quantitative, qualitative, and mixed met methods. Figure 4 depicts the number of experimental research

conducted by educational level.

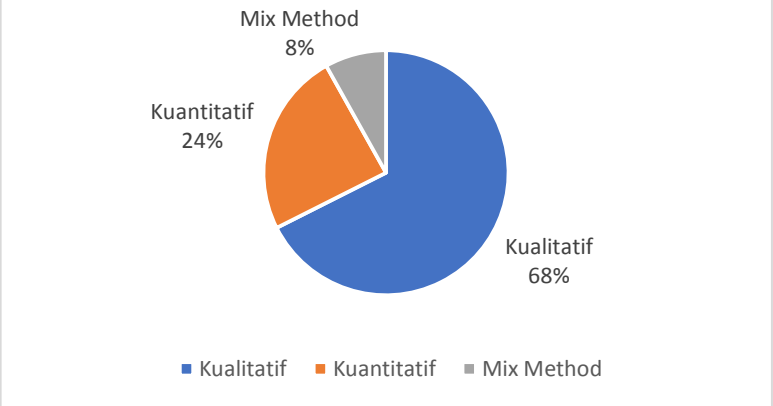

Figure 4. Data Based on Research Methods

From Figure 4, it can be concluded that the most widely used research methods in statistical literacy research are qualitative research methods, then positioned both quantitative methods, followed by mixed methods.

Studies Based on Research Sites

Indonesian provinces were grouped according to the location of statistical literacy studies. Figure 5 depicts the number of studies according to educational level.

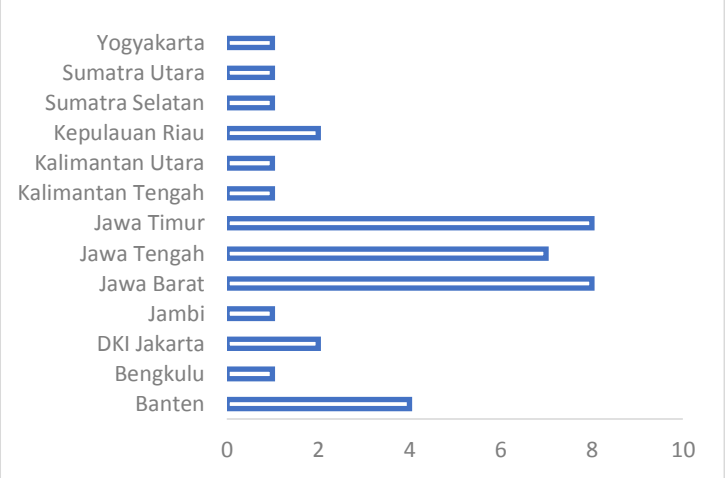

Figure 5. Data Based on Research Place

From Figure 5, it can be deduced that researchers gathered statistical literacy study data dominated by the Javanese islands of West Java, East Java, and Central Java. In addition, it is evident that other areas, like North Sumatra, North Kalimantan, Bengkulu, and others, have received little statistical literacy study from Palin. Thus, studies on statistical literacy must be conducted in several Indonesian provinces so that teachers can utilize appropriate approaches to enhance their systematic literacy.

Focused Research on Instructional Methods Influencing the Growth of Statistical Literacy

In this study, some significant findings may be drawn from the analysis of forty papers. Based on research issues about the impact of educational approaches on the development of statistical

literacy, the analysis was undertaken. The majority of publications focused on teacher-centered and student-centered instruction. Seven articles focused on student-centered methods of instruction, whereas just one focused on the teacher.

The study discovered only one paper focusing on teacher-centered instructional strategies. Habibie & Hidayat (2022) Discussed the statistical analysis of enhancing student statistical literacy in educational statistics courses based on the statistical procedure. After attending statistics classes, the statistical literacy of elementary education majors in the high, middle, and low groups increases, as shown by the results of this study. The majority of publications focused on two fundamental teaching strategies: teacher-centered and student-centered instruction. Seven articles focused on student-centered instructional strategies, whereas just one article emphasized the teacher.

Seven of the 40 publications evaluated concentrated on student-centered approaches to teaching statistical literacy. Three forms of student-centered instruction are utilized in the teaching of statistics: modified project-based learning, self-organized learning environment, Treffinger learning, mathematics learning with a rigorous mathematical thinking approach, mathematics learning with an Indonesian realistic mathematics education approach, and collaborative problem-solving. The analyzed publications imply that modified project-based learning can aid in enhancing students' statistical literacy (Priyambodo & Maryati, 2019; Oktaviani, et al, 2020). In their research, for example, they used modified project-based learning and discovered that the achievement and improvement of statistical literacy abilities of students who received modified project-based learning were superior to those of students who received conventional learning; increased statistical literacy skills of students with modified project-based learning had moderate interpretation, whereas increased statistical literacy skills of students with conventional learning had greater interpretation (Oktaviani, Waluya, & Zaenuri, 2021). To improve statistical literacy, modified project-based learning can be used as an alternate learning technique (Priyambodo & Maryati).

In addition, this study focuses on enhancing students' understanding and application of statistical ideas in the classroom and argues that the adoption of alternative learning models will facilitate the development of students' statistical literacy abilities. Utilizing model-based learning techniques such as self-organized learning environments (Rahmawati, et al, 2022), Treffinger learning (Emilia & Amir, 2022), learning mathematics with a rigorous mathematical thinking approach (Fardillah, et al, 2018), learning mathematics with the Indonesian realistic mathematics education approach (PMRI) (Ratnawati, et al, 2020), and collaborative problem-solving (Fakhmi, et al, 2021). This research has also contributed to the improvement of students' statistical literacy.

CONCLUSION

The purpose of this systematic literature review was to evaluate students' statistical literacy difficulties. Examined are the factors that influence the development of statistical literacy in students and the instructional strategies that influence the development of statistical literacy in students. The selection of forty publications for analysis was based on these two topics, which served as study guidelines. In recent years, particularly in 2017 and 2021, despite a drop in 2022, statistical literacy research has gained significant attention. The majority of this research was undertaken at universities. In addition, the Java region, specifically West Java and East Java, dominated the study. It was also revealed that the bulk of publications focused on teaching methods, which refer to the instructional materials utilized by instructors and the teaching styles they chose when conducting statistics courses. The results of this study reveal that there are two

typical approaches to teaching statistics: teacher-centered and student-centered. The majority of research focuses on the impact of student-centered instruction on the development of statistical literacy.

This study demonstrates the necessity of teacher planning in teaching statistics at the primary, secondary, and university levels to meet learning objectives, specifically the development of statistical literacy, as a whole. Referring to instructional strategies, this study reveals that teachers must not only possess great statistical expertise but also select engaging learning resources for students. As part of a well-organized and intelligent society, it is crucial to develop statistical literacy abilities so that statistical information can be used to the solution of everyday problems. Importantly, this systematic literature review included only studies that focused on developing statistical literacy among elementary, secondary, and university students in formal situations, particularly during the teaching and learning process. It is possible to conduct follow-up studies to establish the community's statistical literacy level and how these skills are employed in daily life.

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