Journal of Positive Psychology & Wellbeing http://journalppw.com
2022, Vol. 6, No. 1, 3606 – 3616 ISSN 2587-0130

Developing Student Statistical Literacy Through Scientific Approaches

Mumun Syaban[1 *], Nano Sukmana[2], Fahrudin Muhtarulloh[3]

[1,2]Universitas Langlangbuana, [3]Universitas Islam Negeri Sunan Gunung Djati
Email: mumun.syaban58@unla.ac.id

Abstract

The role of statistics is very important in recent life, because statistics can help us in making decisions based on facts or data needed so that the statistics literacy ability needs to be mastered by students. But the statistics literacy ability of students has didn't get the results expected because the students were having a hard time in describing and presenting research data in their thesis writing. One of the causes of the weak ability of statistical literacy in students is by the lack of variation in learning approaches. This study aims to determine the differences in statistical knowledge and statistical disposition between the scientific learning approach and conventional learning. This research is a quasi-experimental study by designing unequal PreTest and PostTest control groups. This research was conducted at one of the tertiary institutions in Bandung, West Java, Indonesia. The populations were students in the 3rd semester, totaling 12 classes; samples were taken randomly by 2 classes. The results of the study stated that there is a difference in Statistical Knowledge and disposition of statistics between students who use the scientific approach and those who use conventional approaches.

Keywords: Statistics Literature, Statistics Knowledge, Statistical Disposition, Scientific Approach

Introduction

In this era, the role of statistics is very important in daily life. Statistics helps us a lot in making better decisions, and can be used as a tool to control quality. Through statistics, it's possible for us to measure the chances of an event in the future that is always changing and uncertain. Therefore, good statistics literacy skills are needed.

Expected achievements in statistical learning at university is a student who recognizes the importance of understanding data. Understand the basic concepts of statistics and their terminology. Knowledgeable in collecting and present data; have data interpretation skills; and make conclusions. These factors are needed so that students can develop their skills as scientists through research using statistics.

Although in completing the final project many students do not use the scientific method themselves, it is difficult to imagine if a student will never find data or statistical results during a career in social life today. Statistics are involved in all aspects of the scientific method. Also, the statistics presented in our daily lives should be based on the use of appropriate or incorrect scientific methods (Rumsey, 2002)[1].

Statistics competence is important for students to help students respond to, understand, analyze, interpret, draw conclusions, and understand the issues posed by statistics in various media related to literacy. The ability of statistical literacy can help students to understand quantitative and qualitative data, so that in the process of presenting data, processing, analyzing, and interpreting, there will be no misinterpretation of research data. With the ability of statistical literacy, students can evaluate statistical information correctly.

As adapted from Aoyama & Stephens (2003) [2] and Kläre (2017) [3] which states that the statistical literacy abilities possessed by students can help them to extract qualitative information from quantitative information, therefore with statistical literacy skills, students can evaluate statistical information correctly. Statistical knowledge is a set of skills that enable students

to understand different statistical information collected in different media.

Statistical education is based on a process of interaction through knowledge and critical attitude. Knowledge elements consist of cognitive elements such as skills, statistical knowledge, mathematical knowledge, contextual knowledge, and important questions. (Gal, 2002) [4], (Nikiforidou, Z., Lekka, A., & Pange, J. 2010) [5].

The factor that contributes to the importance of developing statistical literacy in schools is the expectation to participate as citizens in accessing information related to data and driven by the importance of ability and skills in every possible decision making on research data (Watson 2003)[6].

The Burrill and Biehler 2011 National Council of Mathematics Teachers (NCTM) School Mathematics Principles and Standards document [7] has compelling reasons why statistics are important for learning mathematics in school. Many educators agree that it is important for students to acquire statistical abilities in the use and interpretation of data. This is part of having critical citizenship and meeting the need for statistical consideration and decision-making to support personal interests in the workplace and progress in other areas and areas (Franklin). et al., 2005) [8].

According to Wallman of Sashi Sarma (2017) [9], statistical literacy is the ability to understand and critically evaluate statistical results from everyday life. Next, Callingham (2007) [10] argues that such a definition requires the development of not only the mathematical skills necessary to understand statistical information, but also the daily life in which the data was collected. I am. In addition, statistical ability is described as the ability to interpret, critically evaluate, and convey information and statistical messages (Gal, 2002) [4]. Statistical literacy behavior is also said to be based on the mutual activation of interrelated knowledge (letter literacy, statistics, mathematics, context, critical thinking) and supportive tendencies and beliefs.

In this study the framework used is (1) the Wallman Model in Sashi Sarma (2017)[9] about the use of Statistics in everyday life. (2) Watson's Model (2003)[6] about the usefulness of statistics in decision making and Model Gal (2002)[4] about the concept of statistical literacy and explaining its components.

The ability of knowledge and attitude or disposition about statistics is called the statistical literacy model. Gal (2002) [4] divides literacy into two components, namely the knowledge element and the dispositional elements. These components can represent the applied framework.

The components of knowledge consist of five indicators: (1) reading and writing skills required for statistics messages are delivered in oral or written text; (2) statistical knowledge, which means data can be produced along with the reasons for the need for the data. This is done to familiarize yourself with the basic terms and ideas of descriptive statistics by representing graphs and tables and their interpretations, as well as getting to know the basic notation of opportunity and knowing the conclusions that can be obtained from the concept of opportunity; (3) mathematical knowledge has a role to support not only statistical literacy, but also in statistical knowledge; (4) context knowledge is the source of meaning and the basis of interpretation the results of data analysis; and (5) critical questions are needed to critically evaluate statistical information.

Whereas the dispositional elements consist of (1) beliefs and attitudes towards the information obtained, and (2) critical stance regarding trust in the power to act critically.

Today, students' statistical abilities do not produce the expected results because it is difficult for students to describe and present research data in their dissertations. Insufficient basic statistical knowledge is due to lack of basic statistical knowledge and the inability of students to use statistics in their daily lives (Gal, 2002) [4].

One of the factors causing lecturers' success in improving their statistical literacy skills in students is the inaccurate approach used during lectures. The approach that is often used is the conventional approach where most of the student's learning time is spent recording material, memorizing formulas meaninglessly, and doing practice questions. In fact, statistics lectures should be able to improve students' abilities in statistical literacy and be critical.

One learning approach that is expected to be able to improve statistical literacy skills is the

scientific approach. The scientific approach is a scientific framework for learning that is adapted to the scientific process. This approach is seen as a golden bridge to developing student attitudes, skills and knowledge in the work process that corresponds to scientific standards.

To be called scientific, the method of investigation (method of investigation) must be based on evidence from observable, empirical, and measurable objects with specific principles of reasoning. Scientific methods generally include a series of data collection activities through observation or experimentation, information or data processing, analysis, and hypothesis formulation and testing.

The purpose of the scientific approach to learning is to improve students' thinking skills, formulate their ability to solve problems systematically, create learning conditions so that students feel the need for learning, and express ideas. Includes training students to improve their learning outcomes and the development of their personality (Ministry of Education and Culture, 2014) [11].

The learning process using a scientific approach is directed so that students are able to formulate problems (by asking lots of questions), not just solving problems by only answering. The learning process is directed to train students to think analytically (students are taught how to make decisions), not to think mechanically (routinely by merely listening and memorizing only). The learning process with a scientific approach consists of five major learning experiences. (2) Ask a question. (3) Collection of information/experiments. (4) Information allocation / processing. (5) Communication (Ministry of Education and Culture 2014) [11].

The linkage between the steps of learning with learning activities and learning outcomes (Ministry of Education and Culture 2014) [11] are as follows:

1. Observing, the learning activities are reading, listening, listening, looking to recognize phenomena, events, or problems. Learning outcomes are to train sincerity, accuracy, find information.
2. Questions, learning activities ask questions about what is observed and what is not understood (from factual questions to hypothetical questions). Learning outcomes include creativity, curiosity, the ability to form questions to form critical thinking, and the development of lifelong learning.
3. Information/experiment gathering, learning activities include conducting experiments, reading non-textbook sources, observing objects / events / activities, and interviewing information providers. The outcome of learning is to develop an attitude of honesty, conscience, discipline, obedience to rules, diligence, the ability to apply procedures, and the ability to inductively and deductively reason in reasoning.
4. Associating/Processing Information Learning activities consist of communicating conclusions from observations, experiments, and analysis results verbally, in writing, or in other media. The result of learning is to develop a critical attitude and be able to solve problems.
5. Communication, learning activities are oral, written, or other communication of the results of conclusions from observations, experiments, and analysis results. The outcome of learning is to develop an honest and sincere attitude, tolerance, the ability to think systematically, the ability to express short and clear opinions, and the ability to speak well and correctly.

This research formulates two hypotheses as follows:

1) There are differences in statistical knowledge among students who study using a scientific approach compared to students who use traditional learning.
2) There are differences in the nature of statistics among students who study using a scientific approach compared to students who use traditional learning.

Method

This study was a quasi-experimental study using the study design "Non-equivalent pretest and posttest control group design" (Creswell, 2019) [12]. This study uses two variables, an independent variable and a dependent variable. In this case, the independent variable is a scientific approach, and the dependent variable consists of two variables, statistical knowledge and statistical properties.

The survey was conducted at one of the universities in Bandung, West Java, Indonesia. The subjects of this study are students in the third semester of the 2018/2019 semester of the Faculty of Business Economics, with a total of 12 classes using simple random sampling from two classes as study samples. One class as an experimental group and another as a control.

Data collection was carried out through two techniques, namely (1) tests to measure statistical knowledge using the description test, and (2) questionnaires to describe the disposition of statistics using a Likert scale in the form of a Checklist. Tests and questionnaires are used after testing the validity and reliability of the device. Validity is done by three expert judgments regarding content, construct, and face (Creswell, 2016) [12], while to test its reliability using Cronbach's Alpha (Olaniyi, 2019) [13]. The results of the test show good

The data analysis for this study used the ANOVA test (ANOVA), the chi-square test (Montgomery, 2001) [12], and SPSS 24 for Windows. Before running the hypothesis test, the normality of the data distribution was tested with the Shapiro Wilk test, and the uniformity test of the variance between groups was tested with the Levene test.

Result

1. Statistics Knowledge Skills

The following is a description of the statistical knowledge of the pre-test results between the experimental class and the control class:

Table 1. Group Statistics

	Y	N	Mean	Std. Deviation	Std. Error Mean
X	Experiment	33	26.6970	7.07321	1.23129
	Control	29	27.1034	9.14699	1.69855

a. Test of Normality of Data Distribution

The test of normality of data distribution used in this study is the Shapiro-Wilk test. The results of the calculation of the test of normality of data distribution in the experimental and control groups are presented in table 2 below:

Table 2. Tests of Normality

	Y	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	Df	Sig.	Statistic	df	Sig.
X	Experiment	.171	33	.016	.939	33	.062
	Control	.151	29	.090	.937	29	.085

Table 2 shows that the significance or probability figures for the Shapiro-Wilk test in the experimental and control groups were more than 0.05. Thus it can be interpreted that the sample data coming from populations that are normally distributed.

b. Test of Homogeneity of Variance

Test of homogeneity of variance was performed with the Levene's Test for Equality of Variances. The calculation results of test of homogeneity are presented in table 3 below:

Table 3. Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
X	Based on Mean	2.775	1	60	.101
	Based on Median	2.542	1	60	.116
	Based on Median and with adjusted df	2.542	1	58.427	.116
	Based on trimmed mean	2.833	1	60	.098

Based on the Levene's Test for Equality of Variance in table 3, the significance value based on the average or median is greater than 0.05. This means that the sample data comes from populations that have the same or homogeneous variants.

c. Test of Difference in Average Pre-test Value of Statistics Knowledge

Because the pretest values for statistical knowledge in each trial and control group are normally distributed and the variance is uniform, the mean difference in pretest values for statistical knowledge between the experimental and control groups is an independent test. Use the sample Table 4 shows the test results of the mean difference of the values before the test of critical thinking skills.

Table 4. Results of Test of Difference on Average Value of Statistics Knowledge

Pre-test Value	***t-test for Equality of Means***				
	t	***Df***	***Sig.(2-tailed)***	***Mean Difference***	***Std. Error Difference***
Equal variances assumed	-.197	60	.845	-.40648	2.06355

Based on Table 4, the mean difference test of the pretest values between the experimental and control groups received a significance of 0.40648. Ho is accepted because the significance number is greater than 0.05. In other words, there is no difference in statistical knowledge between the experimental group and the control group. Therefore, the statistical knowledge of the students in the experimental and control groups is the same as before treatment.

d. Hypothesis Testing

A description of the results of the statistical knowledge of the experimental class and the control class can be seen in table 5 below:

Table 5. Group Statistics

	Y	N	Mean	Std. Deviation	Std. Error Mean
X	Experiment	33	32.5758	5.60708	.97607
	Control	29	28.9655	6.99225	1.29843

Hypothesis testing for statistical knowledge uses the independent sample t-test. Hypothesis test results are presented in table 6:

Table 6. T-Test Results of Post-test Value on Statistics Knowledge

Pre-test Value	*t-test for Equality of Means*				
	t	***Df***	***Sig.(2-tailed)***	***Mean Difference***	***Std. Error Difference***
Equal variances assumed	2.254	60	0.028	3.61024	1.60139

Table 6 shows the significance value of 0.028 less than 0.05, then Ho is rejected. That is, there are differences in statistical knowledge between students who use a scientific approach and those who use conventional approaches to statistical learning. Thus, a scientific approach to statistical learning can improve students' statistical knowledge.

The average value of pretest-posttest critical thinking skills between the control group and the experimental group can be seen in the diagram below:

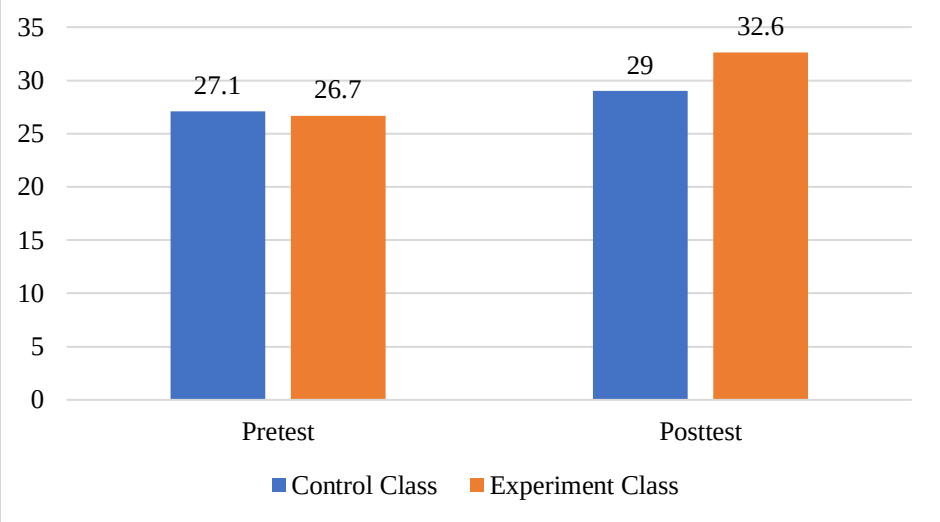

Figure 1. Graph of Pretest-Posttest Average Value of Statistics Knowledge

2. Statistics Disposition

a. The Test of Normality of Data Distribution

The shapiroWilk test is used to test the normality of the data distribution. Table 7 below shows the calculation results of the normality test regarding the distribution of pretest data for the environmentally friendly attitudes of the students in the experimental and control groups.

Tabel 7. Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
Y	Statistic	df	Sig.	Statistic	Df	Sig.

X	Experiment	.142	33	.091	.936	33	.051
	Control	.137	29	.172	.932	29	.062

a. Lilliefors Significance Correction

Table 7 shows that the significance or probability figures for the Shapiro-Wilk test in the experimental and control groups were more than 0.05. Thus it can be interpreted that the sample data coming from populations that are normally distributed.

b. Test of Homogeneity of Variance

Test of homogeneity of variance was performed using the Levene test. Homogeneity test calculation results are presented in table 8 below:

Table 8. Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
X	Based on Mean	.009	1	60	.924
	Based on Median	.007	1	60	.935
	Based on Median and with adjusted df	.007	1	59.971	.935
	Based on trimmed mean	.006	1	60	.936

Based on the Lavene test in table 8, the significance value based on the average and median is greater than 0.05. This means that the sample data comes from populations that have the same or homogeneous variants.

Pre-test of attitudes to care about the environment of each experimental and control group are normally distributed and the variance is homogeneous, so to measure the difference in the average pretest independent sample tests can be used between the experimental and control groups.

c. Test of Difference in Average Pretest Disposition Statistics

Table 9. Results of Test of Difference on Average Value in Statistics Disposition

Pre-test	***t-test for Equality of Means***				
	t	***df***	***Sig. (2-tailed)***	***Mean Difference***	***Std. Error Difference***
Equal variances assumed	-0,64	60	0,949	-.15493	2,43160

Based on Table 9, the mean difference test of the statistical scores of the preliminary test between the experimental group and the control group showed a significance of 0.949. No is allowed because the significance number is greater than 0.05. That is, there was no statistical difference

between the experimental group and the control group before treatment.

d. Hypothesis Test of Post-Test on Environmental Concern Attitudes

The post-test hypothesis of environmental protection attitudes between the experimental group and the control group was performed using an independent sample t-test. The results of the post-test environment hypotheses are shown in Table 10:

Table 10. T-Test Results for Post-test Environmental Care Attitude Score

Post-test		*t-test for Equality of Means*				
		t	***df***	***Sig. (2-tailed)***	***Mean Difference***	***Std. Error Difference***
Equal assumed	*variances*	7.432	60	0,000	30,11769	4,05241

Table 10 shows significance values less than 0.000 and less than 0.05, indicating that Ho was rejected. That is, there is a difference in statistical propensity between students who use scientific approaches and those who use statistical teaching methods. Therefore, it can be concluded that a scientific approach to mathematics education can improve students' attitudes towards the environment.

The averages of the statistical differences between the control and treatment groups can be seen in the following chart.

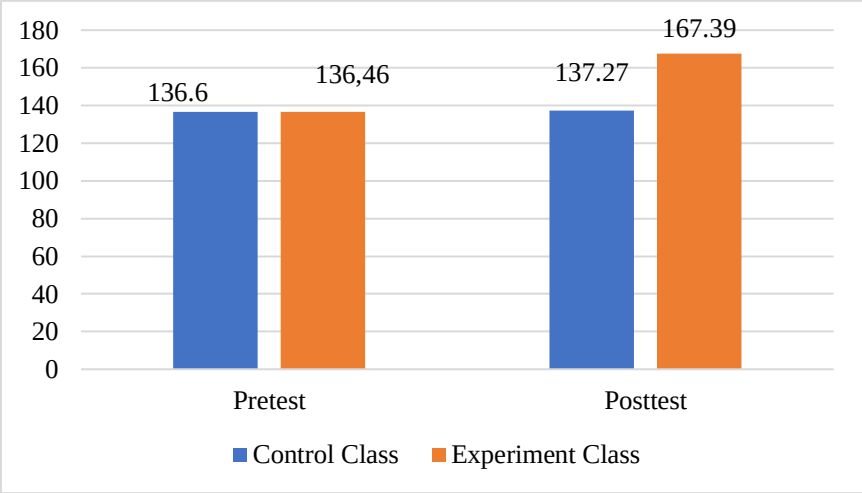

Figure 2. Graph of Average Pretest-Posttest Statistics Disposition Score

Discussions

1. Statistics Knowledge

Based on the hypothesis testing of statistical knowledge using ANOVA, it shows that there is a difference in statistical knowledge between students using a scientific approach and a traditional approach. The difference lies in the fact that the scientific approach involves the active development of students' thinking potential. This builds the ability to systematically

solve problems, create a learning environment in which learners feel that learning is essential, educate them to express their ideas, improve learning outcomes, and develop learner character (Hosnan, 2014)[15].

In addition, with the scientific approach process, students can be directed to be able to formulate problems (with many questions), not just solve problems by answering only. It can also train students to think analytically (students are taught how to make decisions) not to think mechanically (routinely by merely listening and memorizing only (Majid, 2014) [16].

The scientific approach emphasizes research activities through learning stages that include observation, questioning, information gathering/experimentation, networking, and communication. These learning stages can improve students' higher-order thinking (one of the statistical knowledge) by providing them with opportunities to develop their thinking skills and build their own knowledge. Scientific learning contains material elements consisting of factual material, concept material, material material, procedure material, and attitude (Abdul Gafur, 2013: 8-9) [16].

Learning with a scientific approach begins with observing steps. Students first observe the images or objects that are around them or the text as discussion material. Observing activities will encourage high curiosity in students. Curiosity will raise various questions or guesses in the minds of students' minds, thus encouraging them to ask questions or make hypotheses. The questioning activity will improve the ability of students to form questions to form critical thoughts and lifelong learning (Ministry of Education and Culture 2014) [11].

Students are then invited to find answers through activities to collect data or information/experiments. Examples of activities gathering information/experiments in this study are students trying to find their own answers to statistical problems using observational data. Information gathering activities encourage students to think more actively. Students participate in exploring problems or symptoms by observing objects and conducting self-tests so that they can analyze, synthesize, draw conclusions, and evaluate information gathered or obtained through observation and experimentation. Information gathering activities are also carried out through group discussions and reading activities. The activity will provide new ideas, and expand basic knowledge and experience as important prerequisites to improve their thinking (Daryanto, 2014) [17].

Various informations obtained then processed through the activities associated/processing information. Associate activities in statistics carried out through the completion of practice questions. The associate activity aims to increase the breadth and depth of the material, and find solutions from various sources. Through this activity, new experiences will relate to and interact with previous experiences. Associating/processing information activities can develop skills in applying procedures and skills in inductive and deductive thinking in conclusions (Daryanto, 2014) [17]. These skills are indicators of critical thinking skills.

The final step in the scientific approach is communication. This exercise develops systems thinking skills and allows you to express your opinions concisely and clearly (Ministry of Education and Culture, 2014) [11]. Students' work can add depth to their thinking. Students discuss exercise results under the guidance of the instructor.

Based on the above description, it is clear that the faculty's teaching milestones, which include observation, questioning, information gathering/experimental, scientific method connection and communication, can improve students' critical thinking skills.

2. Statistics Disposition

The results of hypothesis testing using independent sample t-tests indicate that there are differences in statistical dispositions between students who use a scientific approach and those who use conventional approaches in statistics lectures. By understanding and applying statistical concepts and principles, students will have the ability to investigate scientifically, so

that they have the ability to think realistically and rationally to interpret and evaluate all information submitted by others (Hayes, 2005) [18]. Thus, the application of a scientific approach in statistics courses encourages the formation of statistical dispositions.

Students who have statistics knowledge will be good at detecting problems, starting from collecting data, presenting data in the form of table diagrams or pictures. Then they can analyze the data, so they can conclude the problem. Thus, students can construct and improve their thoughts so that they can behave and act more precisely including a positive attitude towards the usefulness of statistics.

The scientific approach actively involves participants in investigating phenomena to find answers to events or situations. The results of the investigation will provide meaningful experiences to students. Students gain new knowledge and actively correct and integrate prior knowledge. Knowledge (cognition) possessed by students will affect the affection (pleasure or displeasure) of students towards statistics (Azwar, 2010) [19].

Through a scientific approach, students will be able to evaluate the merits of a situation or condition. Thus, students will be more pleased with things that have a positive influence on their lives. Furthermore, affection will encourage someone to do certain activities or conations (Azwar, 2010) [19]. In this case, students will have a tendency to do a variety of positive activities, so that scientific steps will be applied which include finding problems, formulating problems, proposing hypotheses, collecting data, analyzing data, and drawing conclusions (Daryanto, 2014) [17].

Cognition, affection, and conation are three important aspects of forming a complete attitude (Myers in Sudjana, 2014) [20]. The success of developing critical thinking skills and caring attitude towards the environment is very dependent on the competence of teachers in managing learning. This is in line with what was stated by Loughran and Russel (1997) [21] that how a teacher teaches is part and package of what is taught. In connection with this study it can be concluded that the application of a scientific approach in statistics lectures can improve attitudes or dispositions towards statistics.

Conclusion And Suggestion

Based on the description above it can be concluded that statistical literacy consists of knowledge ability and disposition ability which are very important for lecturers in order to guide their students in writing scientific papers. The conclusions from the results of this study are:

a. There is a difference in statistical knowledge between students who use a scientific approach and those who use a conventional approach to statistics lectures.
b. There is a difference in disposition to statistics between students who use a scientific approach and those who use the conventional approach to statistics lectures.

Based on the results of this study, a number of suggestions can be made as follows:

a. For lecturers, a scientific approach can be used as an alternative approach to lectures in order to improve the quality of lectures and student competencies, especially knowledge and statistical dispositions,
b. For students, it is necessary to increase knowledge and disposition of statistics so that they can solve good problems related to reading data, presenting data, analyzing data and concluding it.
c. For future researchers, this study serves as a reference for further research.

REFERENCES

[1] Rumsey, D. J. (2002). Statistical literacy as a goal for introductory statistics courses. Journal of Statisties Education, 10(3), 1-12.
[2] Aoyama, K., & Stephen, M. (2003). *Graph interpretation aspects of statistical literacy*: A Japanese perspective. Mathematics Education Research. Journal, 15(3)3, 207-225
[3] Kläre. C. (2017). *Quantitative Information literacy*: Designing an online course at the

interface between information literacy and statistical literacy. Das Offene BibliotheksJournal, 4(1), 117-131 .

[4] Gal, I. (2002). *Adults' statistical literacy*: Meanings, components, responsibilities. International Statistical Review, 70(1), 1-51.

[5] Nikiforidou, Z., Lekka, A., & Pange, J. (2010). *Statistical literacy at university level*: The current trends. Procedia Social and Behavioral Sciences, 9, 795-799.

[6] Watson J.M. (2003). *Statistical Literacy at the School Leve*l: What Should Students Know and Do? in the Bulletin of the International Statistical Institute 54th Session (Volume LX, Book 2, Invited Papers, pp. 68-71). Berlin: ISI.

[7] Burrill G and Biehler R.(2011) , *Teaching Statistics in School* 57 *Mathematics-Challenges for Teaching and Teacher Education: A Joint ICMI/IASE Study*, DOI 10.1007/978-94-007-1131-0_10, © Springer Science+Business Media B.V. 2011.

[8] Franklin, C., Kader, G., Mewborn, D. S., Moreno, J., Peck, R., Perry, M., & Scheaffer, R. (2005). *Guidelines for assessment and instruction in statistics education* (*GAISE*) *report*: *A pre-K-12 curriculum framework*. Alexandria, VA: American.

[9] Sashi Sharma (2017) *Definitions and models of statistical literacy:* a literature review, Open Review of Educational Research, 4:1, 118-133, DOI: 10.1080/23265507.2017.1354313

[10] Callingham, R. (2007). *Assessing Statistical literacy:* A question of interpretation. ICOTS 7.

[11] Ministry of Education and Culture (2014). *Materi Pelatihan Guru Implementasi Kurikulum 2013*. Jakarta: Badan Pengembangan SDM dan Penjamin Mutu Pendidikan.

[12] Creswell, W.,J (2019), Research Design, Jogyakarta: Pustaka Ilmu

[13] Olaniyi A., A. (2019). *Application of Likert Scale's Type and Cronbach's Alpha Analysis in an Airport Perception Study*. Scolar Journal of Applied Sciences of Research. Journal, 2(4), 01-05.

[14] Montgomery D.C. (2001) Design and Analysis of Experiments (5^{th} Ed.) John Wiley & Sons Inc., New York

[15] Hosnan, M. 2014. ***Pendekatan Saintifik dan Kontekstual dalam Pembelajaran Abad 21***. Bogor: Ghalia Indonesia.

[16] Majid, Abdul. (2014). ***Pembelajaran Tematik Terpadu***. Bandung: Remaja Rosdakarya.

[17] Daryanto. 2014. ***Pendekatan Pembelajaran Saintifik Kurikulum 2013***. Yogyakarta: Penerbit Gava Media.

[18] Hayes F. Andrew (2005). *Statistical Methods for Communication Science*. Lawrence Erlbaum Associates, Publishers. Mahwah, New Jersey London.

[19] Azwar (2010). *Modul Psikologi Umum 2*. Jakarta: Fisip Gunadarma.

[20] Sudjana, Nana. 2014. *Penilaian Hasil Proses Belajar Mengajar*. Bandung: PT Remaja Rosdakarya.

[21] Loughran, J., & Rusell, T. (Eds.). (1997). *Teaching about teaching: purpose,passionand pedagogy in teacher education*. London: Falmer Press.