ISSN 2303-0992
ISSN online 2621-3176
Matematika dan Pembelajaran
Volume 9, No. 2, December 2021. h. 15-30

ENHANCING STATISTICAL UNDERSTANDING THROUGH PjBL, VIRLENDA, AND WHATSAPP: A STUDY IN UNIVERSITAS PGRI ADI BUANA SURABAYA

Lydia Lia Prayitno[1], Ninik Mutianingsih[2]
[1,2]Mathematics Education, Universitas PGRI Adi Buana Surabaya

lydialia@unipasby.ac.id

Abstract

This study was motivated by the difficulties of students transforming the data into frequency tables and graphs and appreciate a group of data. This is envolve in low student understanding. Encounter this situation, researchers felt the need to carry out CAR to rise these problems through PjBL supported by Virlenda and Whatsapp due to the pandemic situation that did not allow offline learning. So, the purpose of this study is to enhance students' statistical understanding through PjBL supported by Virlenda and Whatsapp. The subject 10 students from the 2019-C class of mathematics education program, Universitas PGRI Adi Buana Surabaya. Data were collected through observation, documentation, and tests. The data were analyzed quantitatively and qualitatively. The indicators of this study are there is no statistical understanding of students in the category less than "Good Enough" and observation components such as the focus of attention, activity, interest in learning, and seriousness of at least 70% of students. The results of this study, (1) the statistical understanding of all students in the minimum category of "Good" in the second cycle; (2) The observation component to the focus attention, activity, interest, and seriousness in learning satisfy criteria. This shows that the practice of PjBL supported by Virlenda and Whatsapp can improve the statistical understanding of students of mathematics education class 2019-C.
Keywords: understanding; statistical; PjBL; virlenda; WhatsApp

Citation: Prayitno, L. L. & Mutianingsih, N. 2021. Enhancing Statistical Understanding through PjBL, Virlenda, and Whatsapp: A Study in Universitas PGRI Adi Buana Surabaya. *Matematika dan Pembelajaran*, 9(2), 15-30. DOI: http://dx.doi.org/10.33477/mp.v9i2.2387

INTRODUCTION

The COVID-19 pandemic has surged the world change the learning process at many levels. Learning in schools is normally face-to-face (offline) changed into a network (online). The online learning system is implemented through hardware connected to the internet network (Prayitno & Mutianingsih, 2021). The implementation of these activities is in repose the Declaration Letter of the Minister of Education and Culture of the Republic of Indonesia Number 4 of 2020 about the

implementation of Education policies in the emergency period of the spread of Corona Virus Disease (Covid-19).

Learning during the Covid-19 pandemic at Universitas PGRI Adi Buana Surabaya is still carried online. One of the bound subjects in the mathematics education study program is statistical. Mc Grath (2014) explains that the purpose of learning statistics is that students are expected to be able to evaluate research results by interpreting statistical results correctly. This is supported by the Indonesian Mathematics Educators Society (I-Mes), able to make appropriate decisions in the context of solving problems in their area of expertise based on the information and data analysis.

The facts in class 2019-C, students have problems transforming data into the frequency tables, graphs, reading them, and explaining their steps. From the researcher's documentation, it was obtained that only 40% of students had a good understanding of learning the statistical material. Discussion to the team teaching of the statistics course, several problems were identified related to student understanding. These problems are (1) students have not been able to transform the data into frequency tables or graphs, (2) difficulty appreciate data presented in the frequency tables or graphs, and (3) explaining the steps taken.

An urgent problem in the above situation, if it is ignored, of course, will inflict in students' understanding of the next material in interpreting tables and also hypothesis testing. This is necessary to get a solution take into account that the statistical course is the key for students to conduct research, scribe thesis, evaluation, and so on. Faced with this situation, the researcher felt the need to carry out classroom action research (CAR) to enhance students' understanding of statistical in the 2019-C class. In this CAR, researchers make serious efforts to enhance students' understanding of statistical through Project Based Learning (PjBL).

PjBL is a learning method that gives educators a start to manage learning by producing a product in the project classroom. PjBL is a learning process that contains complex tasks in a fixed period. Educators are responsible for monitoring

student activities when completing their projects, so they can develop ideas and produce satisfying results (Fathonah et al., 2020; Fitrina et al., 2016; Rahmazatullaili et al., 2017). The majority of PjBL can develop student responsibilities, increase problem solving ability through collaboration, increase management skills, and practice their critical thinking skills.

Studies on PjBL have been an interesting topic for the last five years (Angreanisita et al., 2021; Fitrina et al., 2016; Kurniawan et al., 2020; Rahmazatullaili et al., 2017; Warsito et al., 2020) and many others. The results of the study on PjBL that represented PjBL can improve student learning outcomes (Fauziah et al., 2019; Kurniawan et al., 2020; Warsito et al., 2020). In addition, PjBL can also increase students' interest in learning (Kurniawan et al., 2020), improve mathematical literacy skills (Angreanisita et al., 2021), creative thinking skills (Fitrina et al., 2016; Rahmazatullaili et al., 2017), interest in learning (Kurniawan et al., 2020), and their autonomy (Fathonah et al., 2020).

Previous studies above show that PjBL can enhance learning outcomes. Learning outcomes are measured from the understanding they have, as revealed by Nurhasanah & Sobandi (2016) that learning outcomes are a reflection of the knowledge that has been mastered and learned. The student's understanding is the acquisition of what has been strived during the learning process in the class. In addition, the study was carried out offline, so during the Covid-19 pandemic, this could not be done. This creates a gap for researchers to implement PjBL using a Learning Management System (LMS) to improve students' statistical understanding.

LMS became the second choice during the Covid 19 pandemic that surge the world which had an impact on education in the world. Universitas PGRI Adi Buana Surabaya has developed an LMS known as Virlenda. Virlenda abbreviation for the virtual learning environment of Adi Buana which uses Moodle type software. Through virlenda, students and lecturers, students and students can interact with the flexibility of place, time, and can be done synchronously or

asynchronously. If the indicator has not been achieved, the researcher will combine Virlenda and Whatspp.

Using Virlenda and Whatsapp, researchers wish to enhance students' understanding of statistical through PjBL in these CAR. So, that students can explain the process carried out to produce the data presentation, read them, and interpret them. In addition, Virlenda and Whatsapp were chosen as a means of asynchronous communication when students discussed with each other. Virlenda and Whatsapp were chosen for students to switch their opinions due to the Covid-19 pandemic situation in Surabaya which is at stage level 1, where there are still restrictions for face-to-face learning.

METHOD

This CAR to improve the statistical understanding of students of mathematics education class 2019-C through PjBL assisted by Virlenda and Whatsapp. CAR is an effort of teachers, lecturers, or practitioners in various activities to improve the quality of learning in the classroom (Kemmis & McTaggart, 2000; Miles & Huberman, 1994). This study uses the Spiral CAR model from Kemmis & McTaggart (2000) includes (1) planning, (2) implementation, (3) observation, and (4) reflection. This CAR process in this study as below

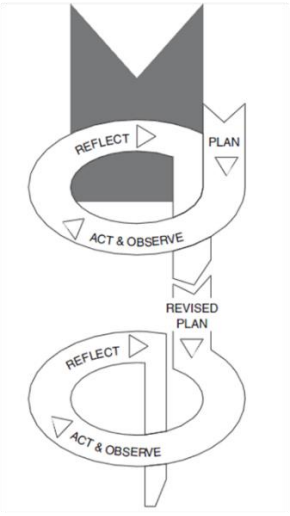

Figure 1. Spiral CAR from Kemmis & McTaggart

The indicator in this study is based on the statistical understanding and students' activity. The statistical understanding is based on (1) the ability to transform data into a frequency table, (2) the ability to transform data in the graphs, and (3) the ability to explain the steps taken. Student activities includes (1) focus of attention, (2) their activity, (3) their interest, and (4) seriousness in learning process.

The subjects of this study were active students of Mathematics Education 2019-C class, Universitas PGRI Adi Buana Surabaya, amount 10 students. Students of the 2019-C class are night class students who are taking statistics courses in the odd semester of 2021/2022. The data collection method used in this study is observation, documentation, and tests. The first indicator, documentation and test methods are used with project instruments carried out by students in groups and questions tests. While the second indicator used the method of observation and documentation with an instrument of observation sheets about (1) focus of attention, (2) their activity, (3) their interest, and (4) seriousness in learning.

The data were analyzed using descriptive techniques based on the established indicators. For student understanding data was obtained from student answers, then determined based on the success criteria that apply at Universitas PGRI Adi Buana Surabaya as shown in Table 1 below.

Table 1 Grade Criteria at Universitas PGRI Adi Buana Surabaya

Grade	Criteria
85 – 100	Very Good
75 – 84	Good
60 – 74	Good Enough
40 – 59	Poor
0 – 39	Failed

The test results are presented in the quantitative and qualitative that is equipped analysis and based on the criteria of completeness in the academic guidebook that applies to statistical courses, which is a value of 75. Meanwhile, in student activities, percentages of participating students were observed. The activity is at least 70% of students are active during the learning process in class. Thus, the

success indicators of the implementation CAR in this study are (1) there are no students who are in the category less than "Good Enough" and (2) at least 70% of students are actively involved during the learning process in class.

RESULT AND DISCUSSION

The four stages that have been passed include planning, implementation, observation, and reflection. The results include test and non-test results from each cycle and are presented in the quantitative and qualitative data. While the results of the non-test are presented in a description through sentences according to the results of the observations made. Before describing the results of the study in cycle 1, the researcher will describe the results of the pre-cycle as follows.

1. Statistical Understanding Pre-Cycle

Students' statistical understanding of presenting data in the diagrams before the CAR is carried out. The results of statistical tests in the pre-cycle need to be analyzed to determine the initial conditions of student understanding in presenting data in the diagrams. The test is carried out in a diagram from a set of data presented. Aspects assessed are the ability to read a set of data, diagrams, and present them in various diagrams. The percentage of pre-cycle test results can be seen in Figure 2.

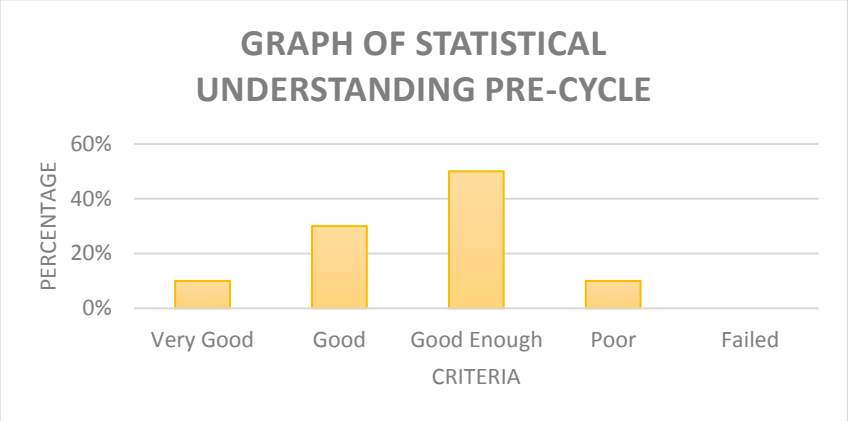

Figure 2 Graph of Statistical Understanding Pre-Cycle

In the figure above, it can be seen that students who scored less than 75 were 60% and score more than 75 were 40%. This showed that students' understanding of statistics is still lacking. Supported from the observations, most students experience

confusion in appreciate data and presenting them into the diagrams or graphic. The effect, students are pasive activity during the learning process.

2. The First Cycle

a. Planning

In the planning stage, researchers plan actions through the implementation of PjBL using virlenda. The lecturer prepared a google to meet link that will be used in learning statistical because learning at Universitas PGRI Adi Buana Surabaya is still carried out online. Then preparing teaching materials, Student Activity Sheets (SAS) that contains students' project, media in e-books that are linked on virlenda.

b. Implementation

In the implementation stage, the lecturer teaches using PjBL and virlenda. Learning statistical for frequency tables and presenting them in graphics. Each group was asked to compile a frequency table and present it in graphical according to the data collected in the previous project. After the learning process that lasted for 3 *x* 50 minutes, each student was given a test question to measure students' understanding of the frequency table, presented it in graphics, and explain them.

c. Observation

During the implementation, observers make observations on the learning process online. From the observations, the observer noticed changes in student attitudes and behavior during the learning process. The students were already actively from the beginning to the end of the lesson, but the discussion factor using virlenda turned out to be an obstacle. The obstacle faced by students is that they cannot directly respond to questions or feedback from other students in their group. The results of group discussions in Virlenda can be presented in Figure 3 below.

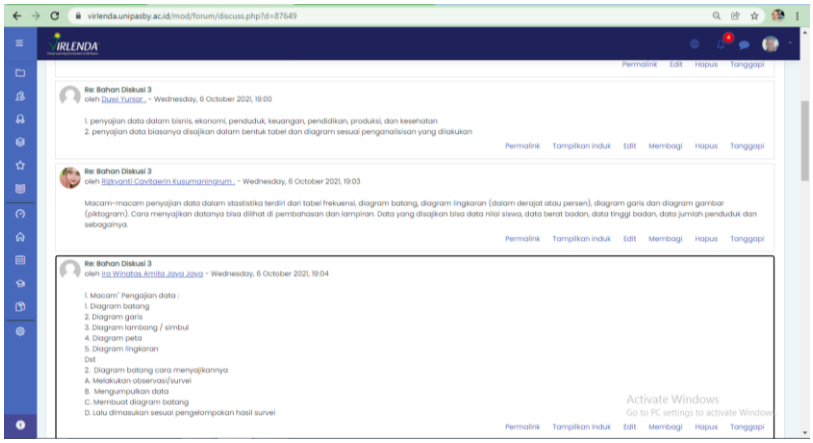

Figure 3 Group Discussion using Virlenda

Therefore, if the target in cycle 1 has been unfulfilled, the researcher will follow-up on actions in cycle 2 to overcome these obstacles. The students' understanding of the project and given the test, the following results were obtained.

Table 2 The First Cycle Students' Statistical Understanding

Grade	Criteria	Percentage
85 – 100	Very Good	0%
75 – 84	Good	60%
60 – 74	Good Enough	40%
40 – 59	Poor	0%
0 – 39	Failed	-

Based on Table 2 above, can be described in detail as in Figure 4 below.

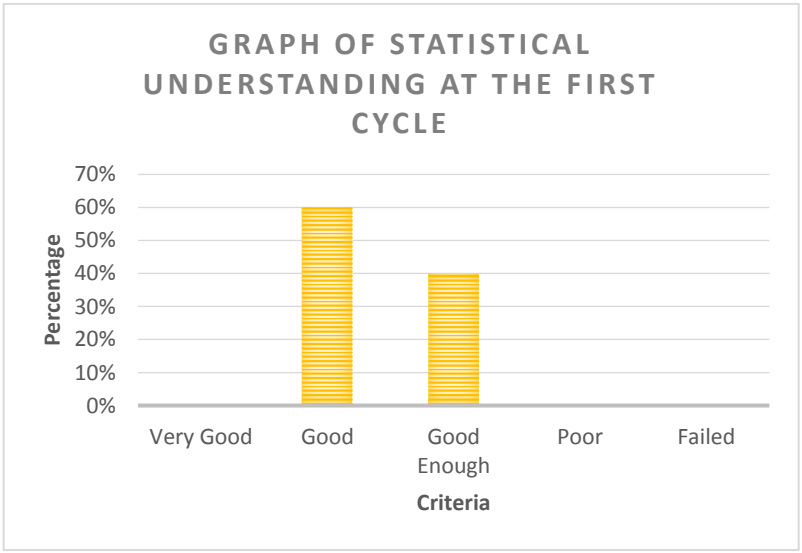

Figure 4 Graph of Statistical Understanding at The First Cycle

In Figure 4, it can be seen that 40% of students get a score less than 75. The number of students who get a score equal to or more than 75 is 60% and in the "Good" category. In this case, there was an increase in the number of students who were in the minimal category of "Good" in the pre-cycle there were only four students while in the first cycle there were six students. Supported from the observations, students are pasive activity during the learning process. This cause the students adaptation process in this learning activity.

d. Reflection

Students' statistical understanding viewed from the grade according to the standard statistical course, the researcher hopes that there no more students who get a score less than 75. It is hoped that all students can reach the minimum standards grade on the reading data presentations and graphs, then present it in a graph. Because it has not been achieved in the first cycle, it will be continued to the second cycle by re-identifying the obstacles encountered in the first cycle. The obstacle faced by students is that they cannot directly respond to questions or feedback from other students in their group. This is because the LMS Virlenda does not provide notifications of responses given by other students. So the researcher decided to continue to the second cycle by using a companion from Virlenda that is Whatsapp.

3. The Second Cycle

a. Planning

Following the obstacles faced in the first cycle, then proceed to the second cycle. The purpose is for the students can respond to each other in their group. The learning model used is still using PjBL and is still being implemented online. However, for the second cycle, the researcher used a combination of Virlenda and Whatsapp. Whatsapp was chosen because it provides an opportunity for group members to discuss through Whatsapp groups formed by each group.

b. Implementation

In the implementation stage, the learning of statistical after the first cycle is the making the frequency table, graph, and normal distribution test. Each group was

asked to compile a frequency table, represent it in a graph according to the existing data and continue with testing the normality of a group of data.

c. Observation

During the implementation, observations on the implementation of the online learning process using PjBL, Virlenda, and Whatsapp. The observer observed that students were used to being actively on statistical course, both used Google Meet to respond to lecturers' questions, virlenda to collect discussion results, and also Whatsapp for group discussion. The results of group discussions via Whatsapp are presented in Figure 5 below.

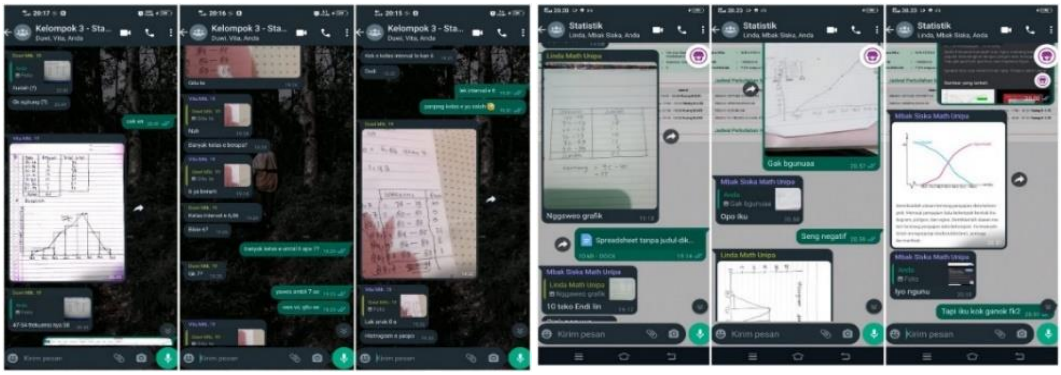

Figure 5 Group Discussion via WhatsApp

From Figure 5 above, communication between group members is well established because the conversation notifications appear. This makes it easier for group members to express their opinions and respond to statements and questions from their group mates. Meanwhile, to present the results of their group discussions, the virlenda is used where each group can download the results of the other group's work and can provide responses directly via google meet. An example of group project uploaded to the virlenda can be presented in Figure 6 below.

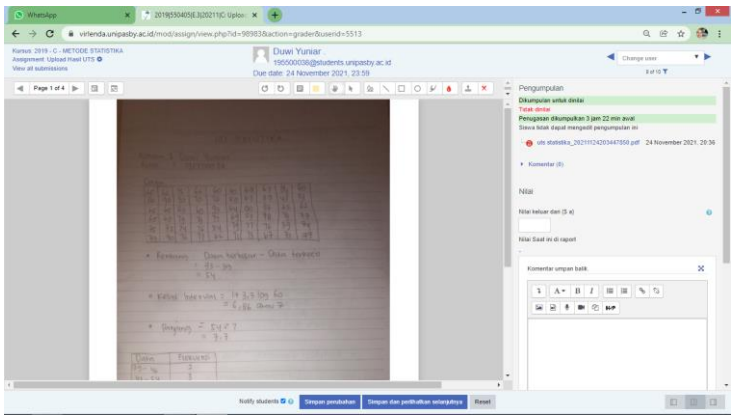

Figure 6 Group Project Uploaded to Virlenda

The students' statistical understanding during the project involved presenting data in the form of frequency tables and graphs, testing the normal distribution, they were then given a test in the second cycle. The results in the second cycle are presented in Table 4.

Table 3 The Second Cycle Students' Statistical Understanding

Grade	Criteria	Sum	Persentage
85 – 100	Very Good	2	20%
75 – 84	Good	8	80%
60 – 74	Good Enough	0	0%
40 – 59	Poor	0	0%
0 – 39	Failed	0	0%

Based on Table 4 above, can be described in detail as in Figure 7 below.

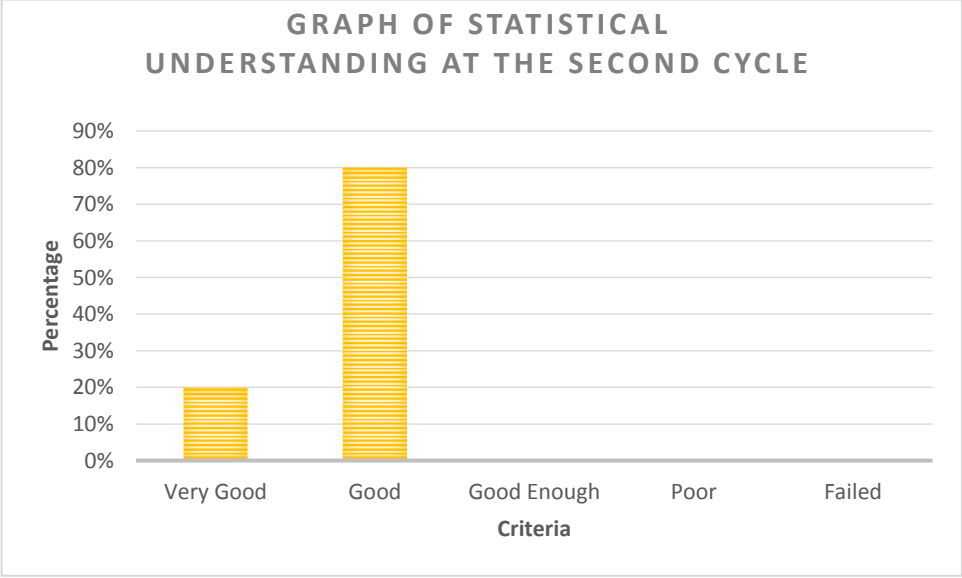

Figure 7 Graph of Statistical Understanding at The Second Cycle

In Figure 7 above, the students who get scores equal to or more than 75 are 100%. This means that all students reach a minimum standard score of 75. In this case, there is an increase in the number of students who are in the minimum category of "Good" where in the first cycle there are only six students but in the second cycle, it becomes 10 students. This shows an increase of 40% from the previous cycle.

d. Reflection

Students' statistical understanding viewed from the value to be achieved according to the standard of the statistical course shows that 100% of students reach the minimum standard on the reading data presentations, graphs, presenting data in graphs, and testing the normal distribution. This shows that the collaboration between PjBL with Virlenda and Whatsapp can be said to be successful. It is evident from all the 2019-C students who have been able to exceed the minimum score standard for statistical methods courses.

From the results above, there are factors that influence the accession, such as students being active during the learning process in class. This makes students interested in learning and discovering information that are carried out online (Kurniawan et al., 2020). Details on enhancing statistical understanding starting from the pre-cycle to the second cycle are presented in Table 4 as follows.

Table 4 Comparison of Pre Cycle Test Results, Cycle 1, and Cycle 2

Grade	Criteria	Total Students		
		Pre-cycle	1st Cycle	2nd Cycle
85 – 100	Very Good	1	0	2
75 – 84	Good	3	6	8
60 – 74	Good Enough	5	4	0
40 – 59	Poor	1	0	0
0 – 39	Failed	0	0	0

To see the comparison in detail, it can be described in the following graph.

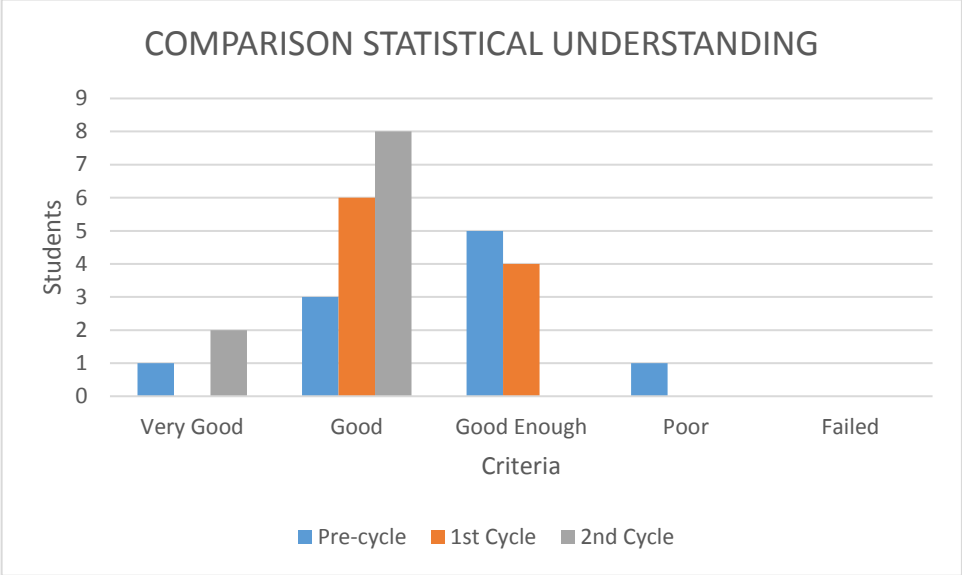

Figure 8 Comparison Statistical Understanding at Pre-cycle, the first cycle and Second cycle

From the comparison above, it can be seen that there was an increase in the number of students who obtained the "Good" and "Very Good" criteria. In the pre-cycle and the first cycle, students' activities were still found in the "Enough" and "Poor" categories. This situation is caused because students are still focused on discourse by lecturers so that they feel bored. This situation is in line with the study (Kurniawan et al., 2020; Miller et al., 2021; Syakur et al., 2020) that teaching patterns also affect the responses of students.

Statistical understanding we found that the minimal category of "Good" in cycle 1, only 60% and an increase of 20% from pre-cycle. While in cycle 2 it reached 100% and showed an increase of 40% from cycle 1. This shows that the implementation of PjBL, Virlenda, and Whatsapp is effective in improving the statistical understanding of 2019-C students. The results of this study are in line with the implementation of PjBL by a previous studies (Fauziah et al., 2019; Kurniawan et al., 2020; Warsito et al., 2020). Each researcher has the same experience that PjBL can improve student learning outcomes. The observations revealed that lecturers actively monitor student activities while developing their projects. The activity of monitoring enables students to develop their ideas to

satisfaction works for their group members (Fathonah et al., 2020; Fitrina et al., 2016; Rahmazatullaili et al., 2017; Syakur et al., 2020).

The results of this study are in line with the previous study (Kurniawan et al., 2020; Miller et al., 2021; Wibowo, 2014) that PjBL can increase students' interest in learning. In addition, the increase in students' understanding in learning statistical is due to improvements made based on reflections from previous actions. With the increased understanding of statistics in the implementation of research actions, it is proven that the PjBL assisted by Virlenda and WhatsApp in statistical lectures has achieved the expected results.

At the pre-cycle stage, students tend to be passive during the online learning process. However, this is the opposite when given project tasks that must be solved in groups. Students seem enthusiastic in responding to every statement submitted, focusing attention, their interest in learning (Angreanisita et al., 2021; Fathonah et al., 2020; Fauziah et al., 2019; Kurniawan et al., 2020; Wibowo, 2014) also always increases from each cycle, including their seriousness in participating in learning. In addition, the increase in students' understanding in learning statistical is due to improvements made based on reflections from previous actions. With the increased understanding of statistics in the implementation of research actions, it is proven that the implementation of PjBL, Virlenda, and WhatsApp in statistical has achieved the expected results.

CONCLUSION

Based on the results of the study and discussion, it can be concluded that the application of PjBL, virlenda, and Whatsapp, can improve the statistical understanding of students of Mathematics Education class 2019-C. This is shown that the statistical understanding that is in the minimum category of "Good" in cycle 1 is only 60% and has increased by 20% from the pre-cycle. While in the second cycle it reached 100% and showed an increase of 40% from the first cycle. The observation component of the focus of attention, activity, interest, and seriousness meets the criteria has increased and meets the specified criteria.

The researcher gave the following suggestions, that is (1) use of the LMS and Whatsapp can be used as an alternative as learning media, especially those involving projects or works; (2) PjBL, Virlenda, and Whatsapp can be used as an alternative to deliver lectures on statistical course; and (3) this is an input that can be used as additional insight and feedback in the implementation of the next learning process.

REFERENCES

Angreanisita, W., Mastur, Z., & Rochmad. (2021). Mathematical Literacy Seen from Learning Independency in Blended Learning with Project Based Learning Assisted by Moodle. *Unnes Journal of Mathematics Education Research*, *10*(2), 155–161.

Fathonah, I. A., Mariani, S., & Sukestiyarno. (2020). Mathematics Connections Based on Self Regulated Learning Through Project Based Learning with Ethnomathematics Nuances and Independent learning with assisted of Module and Whatsapp. *Unnes Journal of Mathematics Education Research*, *10*(1), 90–96.

Fauziah, E. L., Sunarsih, E. S., & Siswanto, B. (2019). Penerapan model pembelajaran project based learning untuk meningkatkan keaktifan dan hasil belajar siswa pada mata pelajaran gambar interior dan eksterior bangunan gedung kelas XI TGB SMK Ganesha Tama Boyolali Tahun Ajaran 2017/2018. *IJCEE*, *5*(1), 1–9.

Fitrina, T., Ikhsan, M., & Said., M. (2016). Peningkatan Kemampuan Berpikir Kreatif dan Komunikasi Matematis Siswa SMA melalui Model Pembelajaran Project Based Learning Berbasis Debat. *Jurnal Didaktik Matematika*, *3*(1).

Kemmis, S., & McTaggart, R. (2000). Participatory Action Research. In *Handbook of Qualitative Research* (pp. 567–595). SAGE Publications, Inc.

Kurniawan, D. P., Istiandaru, A., Sulistiowati, E., & Dahlan, A. (2020). *Peningkatan Minat Dan Hasil Belajar Siswa Kelas 4 Sd N Tegalombo 02 Melalui Pembelajaran Project-Based Learning Berbantuan Powerpoint Interaktif*. 1581–1591.

McGrath, A. L. (2014). Content, Affective, and Behavioral Challenges to Learning: Students' Experiences Learning Statistics. *International Journal for the Scholarship of Teaching and Learning*, *8*(2), 1–21.

Miles, M. B., & Huberman, M. A. (1994). *Qualitative Data Analysis: A Sourcebook of New Methods*. SAGE Publications, Inc.

Miller, E. C., Severance, S., & Krajcikc, J. (2021). Motivating Teaching, Sustaining Change in Practice: Design Principles for Teacher Learning in Project-Based Learning Contexts. *Journal of Science Teacher Education*, *32*(7), 757–779.

Nurhasanah, S., & Sobandi, A. (2016). Minat Belajar sebagai Determinan Hasil belajar Siswa. *Jurnal Pendidikan Manajemen Perkantoran (JPManer)*, *1*(1), 128–135.

Prayitno, L. L., & Mutianingsih, N. (2021). Penggunaan SPADA Selama Masa Covid-19: Studi Kasus di Universitas PGRI Adi Buana Surabaya. *Wahana: Tridarma Perguruan Tinggi*, *73*(1), 99–107.

Rahmazatullaili, Zubainur, C. M., & Munzir, S. (2017). Kemampuan berpikir kreatif dan pemecahan masalah siswa melalui penerapan model project based learning. *Jurnal Tradis Matematika*, *10*(2), 166–183.

Syakur, A., Junining, E., & Sabat, Y. (2020). The Implementation of Project Based

Learning (PBL) Model Towards the Result Student ' s TOEFL in 7th semester of Brawijaya University. *Journal of Development …*, *4*(May), 41–46. http://journal.unublitar.ac.id/jdr/index.php/jdr/article/view/97

Warsito, Maryani, I., & Purwanto. (2020). Penerapan model project based learning (pjbl) dalam Pembelajaran daring untuk meningkatkan aktivitas dan hasil belajar IPA kelas VI SDIT Salsabila 3 Banguntapan. *Prosiding Pendidikan Profesi Dosen Fakultas KeDosenan Ilmu Dan Pendidikan. Universitas Ahmad Dahlan*, 1–9.

Wibowo, W. S. (2014). Implementasi Model Project-Based Learning (PJBL) dalam Pembelajaran Sains Untuk Membangun 4CS Skills Peserta Didik Sebagai Bekal Dalam Menghadapi Tantangan Abad 21. *Seminar Nasional IPA V*, 275–286.