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Effectiveness of Mobile Learning to Increase Collaborative Ability and Science Process Skills of Students

Dwikoranto Dwikoranto[1,*] Rahayu Setiani[2] Sri Tresnaningsih[3]

[1]*FMIPA, Universitas Negeri Surabaya, Indonesia*
[2]*FKIP, Universitas Bhenika PGRI, Indonesia*
[3]*FKIP, Universitas Terbuka, Indonesia*
[*]*Corresponding author. Email:dwikoranto@unesa.ac.id*

ABSTRACT
The mobile learning model designed to enhance collaborative ability and sciences process skills of students. This research aims to analyze the effectiveness of mobile learning model to improve sciences process skills and collaborative ability who were students programming statistics subject. One-group pretest-posttest design is used. Tests sciences process skills and collaborative ability is used collecting data. Analysed data using paired t-test and N_{gain}. The results of the research show that there was a significant increase in collaborative ability and student's sciences process skills with N_{gain} average of moderate category at $\alpha = 5\%$. Thus, the mobile learning model is effective for enhancing collaborative ability and sciences process skills of students.

Keywords: *Sciences process skills, Collaborative ability, Mobile learning.*

1. INTRODUCTION

The Work from Home policy for Lecturers launched by the government and Learning From Home for students will have an impact on changes in teaching patterns and learning outcomes that will be obtained by students. Physical distancing as a way to avoid the wider spread of the corona virus. Prevention Measures The spread of the corona virus has changed face-to-face lectures to be abolished and replaced by online lectures and still learning from home. This is not only positive but also creates new problems, namely not all students and lecturers are ready to take online lectures on certain subjects, especially those related to certain practices and analyses. The Statistics course in the Department of Physics Education also requires a data analysis stage. Controlling student activities, developing activities, training process skills, practicing collaboration skills are challenges for lecturers in statistics courses [1]. Need to find a solution to this problem. Therefore, the researchers implemented the Mobile model to improve process skills of students and collaboration abilities. Mobile Learning is implemented through the Zoom Meeting platform combined with WhattsApp Group, google drive, google forms which are structured with certain steps [2]. Through the platform that was built, the lecturer interacts with students synchronously and asynchronously by delivering Semester Lesson Plans, main teaching materials, discussions, student presentations, delivering assignments to students, assessing participation, delivering Mid-Semester Exams, and Final Exams as the estuary. end of class

Process skills are procedural, systematic scientific investigation skills and experimental, as the basis for scientific literacy. Process skills can be classified into integrated process skills and basic process skills [3]. Integrated process skills and basic process skills must be trained to students. The results showed that when initial science process skills were low [4], it would hinder the physics learning process. Science process skills is importance use in physics. Because it must be owned by prospective teacher students, it must be trained to students.

Students must have superior modern competencies, one of which is collaborative ability. Research results by [5] show that the learning of collaborative problem solving skills is driven, needed by students. Lecturers need to improve students' collaborative problem solving skills. The results of continuous problem solving research by PISA 2003, 2009, 2012, and 2015 PISA specifically assessed collaborative problem solving [7].

The 21st century HR qualifications show that the demand for routine cognitive skills shows a significant decrease, while the demands on higher order thinking skills and complex communication show a significant increase from year to year. Higher order thinking includes complex problem solving and communication skills in the form of collaborative skills which indicate it is very important for students to have as a provision in facing the competitive world of work [6] Collaborative problem solving is a conceptualization of a complex skill that requires social and cognitive competence [5]. Meaning Collaborative problem solving skills, namely the capacity of students to engage effectively in cognitive and social processes with other students in solving problems [5-7]. Participation, perspective taking, social regulation, learning and knowledge building, and task regulation are indicators this research [5-6]. Collaborative problem solving skills are used 1) equip students in facing globalization competition in the world of work, 2) alternatives to problem solving difficulties and 3) improve social skills in solving problems [5-9].

PISA and TIMSS studies show the problem solving skills of Indonesian students belong to the lower level [7]. Indonesian students are generally still at the LOTs level of problem solving and have not yet fully achieved HOTs. Indonesia getting a lower level because the learning process is not in accordance with the test standards used by PISA and TIMSS. Need a material for valuation in the process of education. Physics students who will later become physics teachers play a role in this. This means that it is important to be equipped with these abilities during college. The results of a further literature review show that 1) basic and integrated science process skills are not in line with the expectations of the government standard curriculum and reference, 2) learning is only student-centered, 3) aspects of attitudes, knowledge, and skills overlap based on theoretical studies carried out. already exist, 4) collaboration skills, problem solving, critical thinking, and creative need to be emphasized in learning, and 5) collaborative problem solving skills have not been trained [10-12]. These results indicate the need for improvement and the need for innovation based on science process skills and being able to train 21st century skills, one of which is collaborative ability and process skills as supporters. The results of the initial study in Physics education undergraduate students about solving physics problems collaboratively showed that in general students were still low in using collaborative problem solving skills and science process skills [11]. Based on the results of interviews and observations obtained 1) limited time to develop learning tools and models, 2) science process skills are difficult to apply and physics multi-representation abilities in solving individual problems, and 3) students have difficulty working together to solve problems collaboratively. Characteristics of students from preliminary studies generally show that students lack respect for other people's opinions, are less skilled in cooperation when in groups they don't like, are less able to communicate and share the knowledge that students have into shared understanding [13-14]. The results of the initial research indicate the need for learning that emphasizes collaborative, science process skills in student teacher candidates.

The purpose this study was to describe effectiveness of the model in improving students' scientific process skills and collaborative abilities in Department of Physics Unesa. The benefits of this research as a way to maintain the competence of process skills and collaborative abilities and improve the competence of graduates.

2. METHODS

Design of research is a pre-experimental with a one group pre-test and post-test [15]. Research on application Mobile learning model with a certain platform that is expected to be effective in online lectures to improve collaborative ability and process skills. The research subjects for the application of lectures using the MobLen model were 30 students in Physics Department, FMIPA Unesa for the 2020/2021 academic year who took the Statistics course. Purposive sampling used in research. The time of this research is during the even semester of 2021. The place of research in the Department of Physics, FMIPA, Universitas Negeri Surabaya and homes of each student.

MobLen's effectiveness in online lectures is the success of the model to improve process skills and collaboration ability of students, in terms of an increase in process skills and collaboration abilities which are statistically significant at = 5%; and average N-gain of students' process skills and coppaboratif ability are categorized as minimally moderate [16].

To collect data of students' process skills and collaborative ability, before conducting lectures with model, students were given pre-test, after learning the students were given post-test. Instruments used in collecting data in this study include: collaborative ability test, science process skills test. Pre-test and post-test scores tested for normality and homogeneity and then analyzed using paired t-test. After there is a significant difference in pre-test scores and post-test scores, it is continued by calculating the average level of increase in pre-test scores and post-test scores using the calculation of normalized gain (N-gain).

3. RESULTS AND DISCUSSION

The effectiveness of the Mobile Leaning model in classrooms that program Statistics courses in terms of improving process skills [17], students' collaboration abilities [18] in the implementation of the model and its supporting tools in classroom implementation, the results are presented below

3.1 Process Skills

Process Skills measures the ability of students' science process skills. Process Skills indicators are in accordance with the science process skills taken, namely: 1) formulating hypotheses; 2) formulating problems; 3) defining operational variables; 4) identifying variables; 5) designing data tables; 6) designing experimental procedures; 7) analyzing data; 8) drawing conclusions. The results of the analysis of the value of Process Skills before and after students attend the Statistics course lecture process are presented in Table 1.

Table 1. Result of process skills

Indicator	Information	*Pretest*			*Posttest*		
		ΣS*	Completeness Indicator	$\underline{x}$	ΣS*	Completeness Indicator	$\underline{x}$
Formulate the problem	Complete	5	16.67	48.26	26	86.67	86.67
	Not Complete	25			4		
Formulating a hypothesis	Complete	8	26.67	32.16	27	90.00	88.33
	Not Complete	22			3		
Variable identification	Complete	7	23.33	20.50	28	93.33	84.00
	Not Complete	23			2		
Define operational variables	Complete	7	23.33	42.24	24	80.00	80.17
	Not Complete	23			6		
Designing data tables	Complete	6	20.00	30.52	27	90.00	85.50
	Not Complete	24			3		
Designing experimental procedures	Complete	4	13.33	23.62	26	86.67	80.83
	Not Complete	26			4		
Analyze data	Complete	10	33.33	52.81	27	90.00	88.16
	Not Complete	20			3		
Draw a conclusion	Complete	8	26.67	42.32	26	86.67	82.00
	Not Complete	22			4		

Inf.: $\underline{x}$ = average, ΣS* = sum of students

Based on Table 1, the Process Skills before participating in MobLen model lecture process are generally still low. Most students have difficulty applying process skills in solving science problems [18]. Application of the Mobile Learning model can improve completeness all indicators of science process skills, although some students still have difficulty in making precise indicator number (3) [1].Table 2 below showed value of n-gain and sensitivity of process skills items in the statistics class.

Table 2. N-Gain value and item sensitivity process skills

No	Indicator	[1]*N-Gain*		[2]Sensitivity	
		*Coefficient	*Information	*Coefficient	*Information
1	Formulate the problem	0.94	high	0.48	Sensitive*
2	Formulating a hypothesis	0.87	high	0.64	Sensitive*
3	Variable identification	0.61	medium	0.69	Sensitive*
4	Define operational variables	0.77	high	0.36	Sensitive*
5	Designing data tables	0.62	medium	0.52	Sensitive*
6	Designing experimental procedures	0.88	high	0.11	Not sensitive
7	Analyze data	0.78	high	0.39	sensitive
8	Draw a conclusion	0.89	high	0.48	sensitive

Table 2 shows that the improvement of Process Skills in terms of (1) formulating problems, (2) formulating hypotheses, (3) making operational definitions of variables, (4) designing experimental procedures, (5) analyzing data, and (8) drawing conclusions in high criteria, as well as identifying variables, (6) designing observation data tables, in medium criteria. The process skills used are generally good and sensitive to the learning process, except for designing experimental procedures that are not yet sensitive to the lecture process [2].

3.2 Collaboration Ability

Collaboration ability represents the ability of students to engage in cognitive and social processes effectively with others in solving problems [19]. Collaborative ability indicators: (1) participation, (2) perspective taking, (3) social regulation, (4) learning and knowledge building, task regulation [5]. The results of the analysis of collaboration skills before and after the lecture process are presented in Table 3 below.

Table 3. Results of collaboration ability

Indicator	Information	*Pretest*			*Posttest*		
		ΣS^*	Completeness Indicator	$\underline{x}$	ΣS^*	Completeness Indicator	$\underline{x}$
Participation	complete	9	30.00	50.23	27	90.00	91.60
	Not complete	21			3		
Perspective taking	complete	9	30.00	48.10	26	86.67	89.60
	Not complete	21			4		
Social Regulation	complete	12	40.00	48.20	26	86.67	88.49
	Not complete	18			4		
Learning and Knowledge Building	complete	10	33.33	44.32	25	83.33	89.10
	Not complete	20			4		
Task regulation	complete	13	43.33	50.27	25	83.33	84.34
	Not complete	17			5		

Inf.: $\underline{x}$ = average, ΣS^* = sum of students in course

Based on Table 3, the collaboration ability of students before attending the lecture process is generally still low because it has not been completed. participation and perspective talking with the lowest completeness. Some students have difficulty in learning and knowledge building. For perspective taking, social regulation, learning and knowledge building, task regulation requires more attention from lecturers [20]. Table 4 below explained the value of n-gain and sensitivity collaboration ability in Statistics lectures.

Table 4. N-Gain value and collaborative ability item

No	Indicator	*N-Gain**		Sensitivity*	
		Coefficient	Information	Coefficient	Information
1	Participation	0,87	High*	0,53	Sensitive
2	Perspective taking	0,83	High*	0,68	Sensitive
3	Social Regulation	0,81	High*	0,68	Sensitive
4	Learning and Knowledge Building	0,85	High*	0,58	Sensitive
5	Task regulation	0,58	medium	0,47	Sensitive

4. CONCLUSION

The Mobile Learning model developed is effective, due to the significant improvement in student process skills and collaboration abilities within the moderate criteria and students giving a positive response to the processes and learning tools that have been carried out as an alternative learning models during COVID-19 pandemic.

AUTHOR CONTRIBUTION

Dwikoranto: Data analysis and review the manuscript; Rahayu Setiani: Review manuscript and supervised the project; Sri Tresnaningsih: Data analysis and riviewer the manuscript.

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