The Implementation of Learning Cycle in Fundamental Physics Lecture to Improve Comprehensionof Concept and Science Process Skills Prospective teacher of Physics

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ABSTRACT: This one group pretest-posttestquasi-experiment was aimed toimprove the comprehensionof concept and science process skills Prospective teacher of physics on the Fundamental Physics Lecture with using the learning cycle model. The subjects were selected using cluster random sampling from the teachers candidate of physics at UniversitasNegeriGorontalo. The instruments used to collect the data included pretest, posttest and questionnaires. The data were analyzed using the gain normalizedaverage. The results show that the implementation of the learning cycle model is effective to improve the comprehensionof concept and the science process skillsof the Prospective teacher of physics.

KEYWORDS: LearningCycle, Comprehension of Concept, Science Process Skills.

1. INTRODUCTION

Physicsas a part of science is based on the results of experimental observations and quantitative measurements ([1] ; [2]). Physics as well as a productssuch as facts, concepts, principles, theories, laws, models, and generalization, is also a process and scientific attitude ([3]; [4]).

In learning process, physics product is formulated to be an indicator of competencies achievement. The results of the observation and asking questiondemonstrate thatthe comprehensionof concept of the prospective teacher in the fundamental physics lecture is still low. Comprehension is the ability to capture the physical meaning of a material being studied ([5]). So that, the comprehension is the ability to recognize, interpret, explain, and conclusions from the information.

The comprehensionof concept is ability to back express an object specific on characteristicsbased. The concept can be interpreted as classifying objects, phenomena, processes, certain events on unique characteristicsbased. The concept is objects, events, situations that share certain characteristics and represented by the signs and symbols ([6]). The concept has a name, definition, attribute, value, and examples ([7]). So that, the concept is an abstraction or separation of objects, events, activities, relationships that have the same attribute.

The comprehensionof concept can be demonstrated by the ability to do the translation, interpretation and extrapolation ([7]). **Translation** is ability to translate or transfer of concept language into itself language, transfer of abstract concepts into a model or symbol to make it easier to learn ([8]). According Bloom ([7]) translation is ability to translate a relationship from the symbolic forms such as concept map, table, diagram, graph, mathematical equations, and formulas in the verbal form, or vice versa. Translation is change the section by section, consists of the ability to translate abstract form into the concrete, is ability to translate a symbol to other forms such as table, chart, or diagram. **Interpretation** is ability to understand a material or ideas, modified or arranged in the form of chart, concept map, table, and symbol ([8]). **Interpretation** is unification and restructuring, consists of ability to distinguish the necessary conclusions, understand the framework, and interpret of reading content. **Extrapolation** is ability to predict the tendency of data, concluded and stated more explicitly, and predict of consequences and implications ([8]). In other words, extrapolation is ability to re-expressed into another form that is easily understood, giving interpretations and is able to apply.

The comprehensionof concept in fundamental physics can be formed with good steady, among them using the learning process that provides an opportunity for learners to construct knowledge (student centered). Learning cycle is a learning model that uses student centered paradigm, theconsists of phases exploration, introduction of term, and concept application ([9]; [10]).

To find the productof physics required science process skills. The process skills is a way of thinking in science, the consists of basic science process skills and integrated science process skills ([11]). The basic science process skills includes observation, interpretation, prediction, commu-nication, classification, and inference or conclusions while the integrated science process skills includes the identification of variables, create tables, create graphs, describing the relationship between variables, acquisition and processing of data, investigative analysis, hypothesis formulation, operational definition of variables, design of investigation and experimentation ([12]).

2. METHOD

This research with quasi-experiment method used the One Group Pretest-PosttestDesign ([13]; [14]). This design of research is presented as in Table 1.

Table 1: Design of Research

Meeting	Pretest	Treatment	Posttest
1	T	X	T
2	T	X	T
3	T	X	T

This design, the research carried out three (3) meetings with the lecture material includes kinematics and dynamics. Subjects selected by cluster random sampling from the prospective teacher of physics population at Physics Education Program Faculty of Science Gorontalo State of University, as many as 30 prospective teacher of physics. Collected data with used understanding concept test, includes translation, interpretation and extrapolation aspects; and science process skills test includes planning and carrying out the experiment;forward hypotheses and questions; using the tools, materials and resources; applying the concept; and responses questionnaire prospective teacher of physics.

The implementationis begin with a pretest for each meeting. The post of learning,is given the posttest and questionnaire. Pretest and posttest aims to see the implementation effect of the learning cycle to the comprehension of concept and science process skills prospective teacher of physics, while the questionnaire aims to giving the feedback respons prospective teacher of physics on the implementation of learning cycle model.

The results of pretest and posttest were done by calculating the normalized gain average [15]. The value of the normalized gain average is categorized as in Table 2.

Table 2: Category of Gain Normalized

Hake's Equation	Nu.	Category<g>
$< g > = \frac{\langle X_f \rangle - \langle X_i \rangle}{100 - \langle X_i \rangle}$	1.	$< g > \geq 0,7 = \text{high}$
	2.	$0,3 \leq < g > < 0,7 = \text{Medium}$
	3.	$< g > < 0,3 = \text{Low}$

<X_f> = the score average of posttest

<X_i> = the score average of pretest

3. RESULTS AND DISCUSSION

The average ofthe pretest,posttest, and normalized gain the comprehensionof concept theProspective teacherof physics in the fundamental physics lecture to each meeting on translation aspects are presented as in Table 3.

Table 3: Score average pretest, posttes, normalizedgain on translation aspect

Meeting	Score Average of Translation Aspect		<g>	
	Pretest	Posttest	Value	Category
1	35,32	72,94	0,58	Medium
2	41,54	83,79	0,72	High
3	43,76	84,65	0,73	High

The exposure of the Table 3 shows an improved comprehension of concept on the prospective teachers of physics in the fundamental physics lecture for each meeting on translation aspect. In other words, the prospective teacher of physics has the better of ability to translate of the physics concepts from the graphic form to a forms of symbols, mathematical equations and formulas, or transfer of concept language into their own language.

Here, the average ofthe pretest, posttest, and normalized gain the comprehensionof concept theProspective teacherof physics in the fundamental physics lecture for each meeting on interpretation aspect are presented as in Table 4.

Table 4: Score average pretest, posttes, normalizedgain oninterpretation aspect

Meeting	Score Average of Interpretation Aspect		<g>	
	Pretest	Posttest	Value	Category
1	43,54	73,25	0,53	Medium
2	40,45	84,57	0,74	High
3	42,68	85,83	0,75	High

The analysis results in Table 4 shows the comprehensionof concept theprospective teacher of physics in the fundamental physics lecture for each meeting oninterpretationaspect is increasing. This means that the prospective teacher of physics have ability is better in the interpret or understand. and transforms into the form of chart, concept map, and symbol; or the ability to do the unification and restructuring, as well as interpret the content of the reading is increases.

The average ofthe pretest, posttest, and normalized gain the comprehensionof concept theprospective teacherof physics in the fundamental physics lecture for each meeting onextrapolationaspectare presented as in Table 5.

Table 5: Score average pretest, posttes, normalizedgain on extrapolation aspect

Meeting	**Score Average of Interpretation Aspect**		**<g>**	
	Pretest	Posttest	Value	Category
1	42,35	74,58	0,60	Medium
2	42,73	79,85	0,65	Medium
3	39,65	82,96	0,72	High

The Table 5 shows that the comprehensionof concept theprospective teacher of physics in the fundamental physics lecture for each meeting onextrapolation aspect is increasing. Thus, the prospective teacher of physics have ability very good to predicted the tendency of the data, conclude and declare more explicitly, exposing into another form that is easily understood, giving the interpretation and can be applied of concept to explain the various phenomena in everyday life.

The increase average the comprehensionof concept theprospective teacher of physics in the fundamental physics lecture on the aspectstranslation, interpretation and extrapolation are presented as in Figure 1.

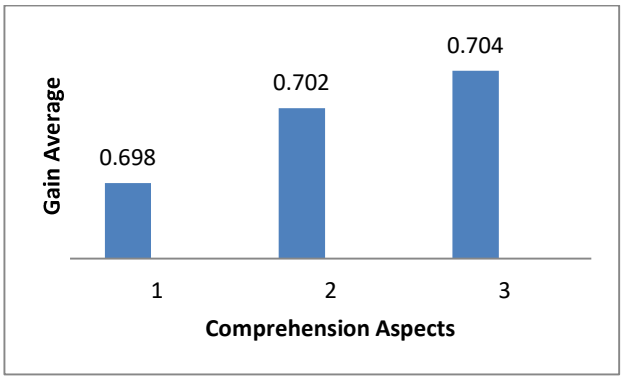

Figure 1: The gain average of comprehension of the concept

The analysis resultsin Figure 1 explained that the comprehensionof concept theprospective teacher of physics in the fundamental physics lectureexperienced an increase in the medium category. The translation aspect have increased very good. Thus, the prospective teacherof physics have the ability to translate the concepts of physicsin the fundamental physics lecture isa very good than aspects of interpretation and extrapolation. These results are in line with research results ([16]) who said that the comprehensionof the translation, interpretation and extrapolationaspectsare increasing on the Optic Wave lecture based computer simulation with the translation aspect that have increased very good. The other research result ([17]) said that there is a difference in the students' comprehension on the electrical circuit matter between students who learning experiencethrough Predict-Observe-Explain (POE) learning model with conventional learning model. The POE learning can improve comprehension of the concept and minimize misconceptions students on the material circuit.

Furthermore, the average of pretest, posttest, and normalized gain the science process skills (SPS) the tandidateteacher of physics in the fundamnetal physics lecture arepresented as in Table 6 to Table 8.

Table 6: The score average of pretest, posttes, normalizedgain of scienceprocess skills at the meeting-1.

Aspects	Pretest	Posttest	<g>	Category
Planning and conducting of experiments	37,25	81,30	0,70	High
Hypothesize	35,82	78,85	0,67	Medium
Questioning	32,54	80,76	0,71	High
Using the tool, material, and resource	35,58	82,15	0,72	High
Implemention of concept	34,97	79,38	0,68	Medium

The analysis result in the Table 6 explains that the science process skills of the Prospective teacher of physics iaincreased with higher category, except hypothesize and implementionof concept is medium category.

Table 7: The score average of pretest, posttes, normalizedgain of scienceprocess skills at the meeting-2.

Aspect	Pretest	Posttest	<g>	Category
Planning and conducting of experiments	35,24	79,22	0,68	Medium
Hypothesize	33,87	81,53	0,72	High
Questioning	32,48	80,37	0,71	High
Using the tool, material, and resource	35,25	81,44	0,71	High
Implemention of concept	35,27	80,23	0,69	Medium

The analysis result in the Table 6 explains that the science process skills of the Prospective teacher of physics isincreased with high category, except implementionof concept is medium category.

Table 8: The score average of pretest, posttes, normalizedgain of scienceprocess skills at the meeting-3.

Aspect	Pretest	Posttest	<g>	Category
Planning and conducting of experiments	36,35	81,52	0,71	High
Hypothesize	34,68	80,37	0,70	High
Questioning	31,85	79,65	0,70	High
Using the tool, material, and resource	37,25	82,74	0,72	High
Implemention of concept	27,92	78,25	0,69	Medium

The analysis result in the Table 8 explains that the science process skills of the Prospective teacher of physics isincreased with high category, except implementionof concept is medium category.

The increase average the science process skillsof theprospective teacher of physics in the fundamental physics lectureare presented as in Figure 2.

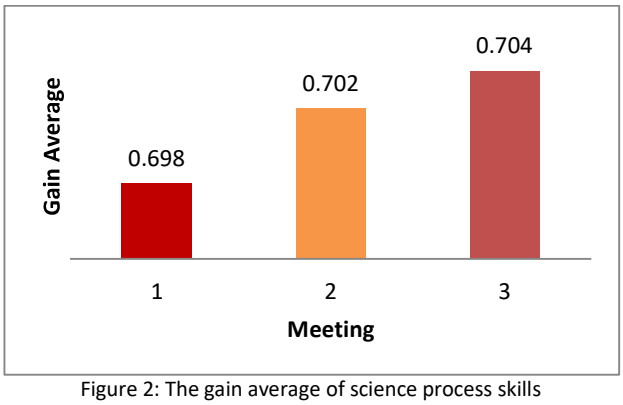

Figure 2: The gain average of science process skills

The Exposure in Figure 2 explains that gain averagethe science process skills of the Prospective teacher of physics is increasing. This increase is predict to occur because the fundamnetal physics lecture with learning cycle model is also supported by practical activities carried out on scheduled basis in the laboratory. These findings reinforce the theory that the laboratory work is to put science as a way of investigating and thinking ([7]). The mental processes associated with laboratory work called science process skills.

Table 9: The response of prospective teacher

Nu.	Statements in Questionnaire	Agree (%)
1.	Lecture with learning cycle model is challenging and paradigm-oriented studentcentered	100
2.	Through the implementation of learning cycle model, my ability to explore the material lecture is increases	93
3.	Through the exploration , I can express dissatisfaction, finding and identi-fying patterns in a phenomenon of physics	90
4.	Through the termintroduction , I can explain the relationship between the quantities of physics	100
5.	Through the application of concept, I can combine of patterns and terms to formed of concepts and examples enrich in life.	90

The responsesof the Prospective teacher of physics foreach questionnaire statement showed that all of the Prospective teacher stated that the fundamnetal physics lecture with the learning cycle model is challenging and oriented to student centeredparadigm, and be able to explain the relationship between the quantities of physics. Almost all of the Prospective teacher stated that anincreased of ability to explore; expressed dissatisfaction,

finding and identifying patterns in a phenomenon of physics; and combining patterns and terms to formedof concepts and examples enrich in life.

4. CONCLUSION

The results of this research showed an increased comprehension of concept the Prospective teacheron the aspects of translation, interpretation and extrapolation post the implementation learning cycle modelin the fundamental physics lecture. The lectureswith learning cycle model can also improve science process skills on the aspects of planning and carrying out experiments; Hypothesize; asking of questions; using the tools, materials, and resources; and apply of the concepts. This research is recommended to be implemented in the mathematics and science lecture to the consistency test of the findings of the research previous in an effort to improve the quality of lectures.

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