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The effect of optimization learning resource based on Planning, Organizing, Actuating, Controlling (POAC) on contextual learning to students' conceptual understanding of motion and force material

The effect of optimization learning resource based on Planning, Organizing, Actuating, Controlling (POAC) on contextual learning to students' conceptual understanding of motion and force material

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Abstract. The research purpose is to improve the students' concepts understanding of motion and force material through the optimization of learning resource based on planning, organizing, actuating and controlling (POAC) on conceptual learning. The researcher used quasi-experimental with the non-equivalent control group. The sampling technique was saturated sampling which used the population as a sample. The research sample was 40 students in Mathematics Education. The experimental group was taught the contextual learning with optimization learning resource based on POAC. The control group was taught the contextual learning without optimization learning resource based on POAC. The collecting data technique used observation, test, questionnaire, and documentation. The researcher used a t-test with independent sample test to compare the average of learning outcomes between the control and experimental group. The research results were: (1) there was an effect of optimization learning resource based on POAC to students' understanding concept that was showed by the significant value 0.00<0.05 , (2) the average of learning outcomes of the experimental group was higher than the control group, (3) the average of the experimental group's N-gain was 0.540 (medium category) which was higher than the control group was 0.274 (low category), (4) the learning resource based on planning, organizing, actuating, controlling (POAC) helped the students to be more active in optimizing some structured, qualified, and functional learning resource on motion and force material.

1. Introduction

A learning resource as important facilities for making effective learning because learning resource can stimulate the learning process and change the student's abilities. Seels and Richey classify the learning resources consist of the message, human, tool and materials, technique and environment [1]. Seventy eight per cent of the Mathematics Education students said that they had not been maximizing the utilization of various of the learning resource, they simply get information through the internet network, lecturer's presentation and discussions with friends. 28% of the students' said that availability of physics books in STKIP PGRI Nganjuk's library is not sufficient. Based on research of Maduretno [2] that the students consider dominant physics with calculation as mathematics so they are less interested in seeking a more in-depth reference about the concept of physics.

It can be minimized by utilizing the tools and materials that support, ask the students to visit the library in the region or from another campus. Seeking information from those who are competent in addition to lectures and discussions outside the classroom and attend public lectures, seminars, and workshop. According to Seels and Richey, the classification of learning resources includes messaging, materials, equipment, environment and engineering [3]. Meanwhile, according to Mulyasa [4], a grouping learning resource consists of human resources, message, materials, tools, equipment, and activities. Based on both the grouping above, researchers gave a discourse on the learning resources that can be used to update motion and force material as shown in Table 1.

Table 1. Classification of Learning Resources

Learning resources	Meaning	Example	
		By design	By utilization
Message	Ideas, meanings, and facts as the information submitted by certain people who master the desired scope of science	Information from teachers, professors, students, specialists or experts	Informants, respondents
Material	Something learning message that can be assessed as a source of information in the form of ideas of data, facts, and software	Books, charts, drawings, scientific papers, modules, handouts, slides, video, Internet and other computer applications	Lab materials
Tool	Equipment (hardware) used as its medium for information	LCDs, cameras, televisions, whiteboards, computers, smartphone	Tools practicum
Environment	The area can be used to interact with learning resources	Classrooms, microteaching, library, laboratory	Parks, open environment
Technique	Combination of learning techniques coherently with the material, the tools and learning environment	Lectures, discussions, simulations, lectures	Playing, spontaneous conversation

"The attainment of organizational goals in an effective and efficient manner through planning, organizing, leading, and controlling organizational resources" [5], the management is the achievement of organizational goals effectively and efficiently through the planning, management, leadership and control of organizational resources. According to George R.Terry in the book Principles of Management that management function consists of Planning, Organizing, and Controlling Actuating [6]. The explanation by George R.Terry management functions shown in Table 2.

Table 2. Management Function

Management Function	Description
Planning	Formulating and planning activities needed to achieve the desired individual/ group.
Organizing	Determining, grouping and preparing activities required to achieve the goal.
Actuating	Implementation to achieve the appropriate planning and organizing effort to arouse and encourage all members.
Controlling	The process of determining what should be achieved, if not according to plan then the need for improvement.

The contextual learning is learning that provides the flexibility for students to explore their abilities independently or in groups. Seven pillars of contextual teaching and learning according to the Ministry of Education [7] in Table 2.3.

Table 3. Pillar of Contextual Teaching and Learning

Number	Pillar of Contextual Teaching and Learning	Description
1	Constructivism	Learners are expected to build their own knowledge.
2	Inquiry	Learners can find themselves through the facts are there.
3	Questioning	Learners have high curiosity by asking, gather information from various sources and confirming what they already know.
4	Learning Community	Creating learning groups so that learners can discuss with friends, cultivate sympathy, empathy and mutual appreciation.
5	Modeling	Learning is supported by models such as people and objects that can provide insight into students
6	Reflection	Learners are expected to reflect on themselves while learning.
7	Authentic Assessment	Actual assessment on the development of learners of concrete activities that are undertaken by learners during a learning process.

The learning resource helping the students is better to understand the concept, principles, procedures correctly [8]. It is also supported by Mariati [9] stated that the understanding that is owned by the students can be found by their knowledge. With their activities to find information from the selected learning resource, their knowledge is improved to conceptual understanding and solve the applied problems in daily life which cannot always be solved mathematically. Based on the statement above, the understanding concept is the aspects which are needed to be assessed in research as a benchmark for the success of the students in Motion and Force Materials.

2. Research Methods

The research used a quantitative approach which quasi-experimental with nonequivalent control group design. The sampling technique was saturated sampling which used the population as a sample. The research sample was 40 students in Mathematics Education. The population is divided into the experimental and control group. The experimental group was taught using contextual learning with optimization learning resource based on POAC. The control group was taught using contextual learning without optimization learning resource based on POAC. The collecting data technique used observation, test, questionnaire, and documentation. The researcher used t-test with independent sample test to compare the average of learning outcomes between the control group and the experimental group.

3. Results and Discussion

The research had purposed to improve the students' concepts understanding of motion and force material through the optimization of learning resource based on planning, organizing, actuating and controlling (POAC) on conceptual learning. Before the e-learning process, the students got pre-test and after the learning process, they got post-test.

3.1. *Description of Data*

The students' concepts understanding is measured through the pre-test and post-test as Table 4.

Table 4. The Student' Understanding Concept

	An average of pre-test	An average of post-test	Gain	Category
Control group	48.53	62.47	0.274	Low
Experiment Group	49.10	76.75	0.540	Medium

3.2. *Testing of Hypothesis*

Table 5 shows the result of the t-test analysis of students' understanding concept.

Table 5. t-test of Understanding Concept

		Independent Samples Test								
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
The Students' Concept Understanding	Equal variances assumed	.635	.430	5.176	38	.000	14.90000	2.87887	9.07203	20.72797
	Equal variances not assumed			5.176	37.223	.000	14.90000	2.87887	9.06803	20.73197

3.3. *Discussion*

Table 4 shows the experimental group had 76.75 and the control group had 62.47 for the average learning outcomes of post-test. Both of them had a low difference for learning outcome because some student of the control group had good understanding concept for motion and force. So their learning outcome was not too different. N-gain of the experimental group had 0.54 as a medium category and the control group had 0.274 as a low category like as Figure 1. The experimental group had more idea to develop their concept because they applied the planning, organizing, actuating and controlling to look for some references until making a report and presentation.

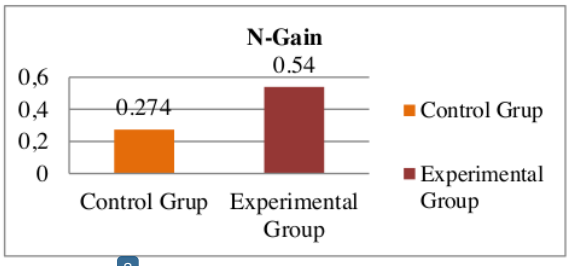


Figure 1. N-gain of the experimental and control group

The effect of optimization learning resource based on POAC to students' understanding concept that was showed by the significant value of 0.00<0.05. Its effect was that students' understanding concept improved with N-gain of an experimental group was higher than a control group. The management of learning resource improved the knowledge of students so their achievement was higher than before [1].

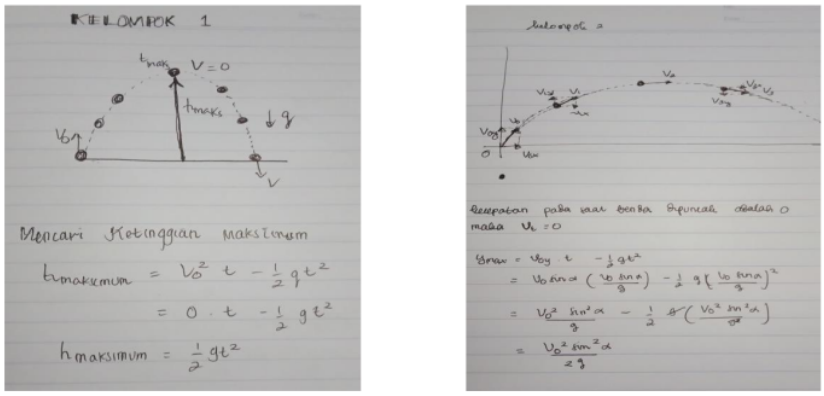
He also said that the learning resource had more function to (1) improve the productivity of education; (2) give the students opportunity to study with their skill; (3) held a systematic learning process and (4) give a direct knowledge.

The researcher used contextual learning on the control and experimental group. But, the experimental groups did planning, organizing, actuating and controlling. When the process of contextual learning, the experimental groups did:

1. Planning: they wrote learning resource to get information about motion and force
2. Organizing: they organize task for each person to get some reference and made a schedule for their activities.
3. Actuating: they discussed with their teacher and visited some location of the library, playground and the others. Besides, they browsed motion and force in internet
4. Controlling: they control this material from some references to get valid information so they understand this concept and they evaluated their self by questionnaire.

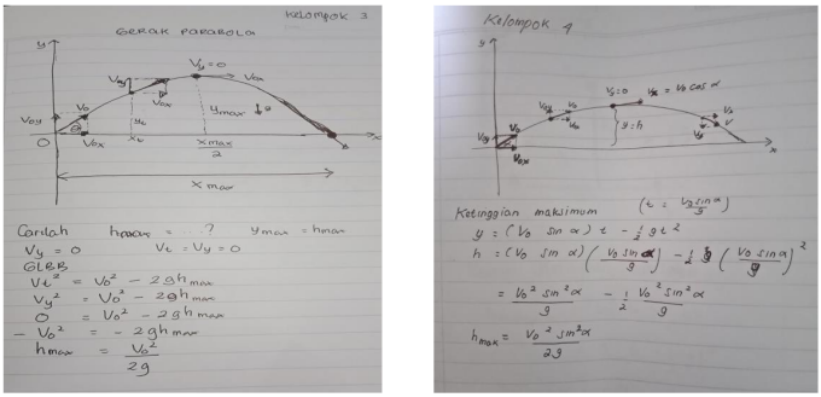
There is research that implemented POAC in physics learning is more realistic than scientific research and its students can be more independent and cooperative [10]. Contextual learning process consists of (1) constructivism: the students planned the learning resources which were used; (2) inquiry and question: the students organized the group to search the materials that were exactly needed; (3) learning community and modeling: the students did search learning resource from learning community and modeling like interview with their teacher and visit some location; (4) Reflection and Authentic Assessment: the students controlled the matters that were gotten and knew to improve on students' learning outcomes.

This research found that the control group said that there was velocity in the maximum height of parabolic motion. But they had not a specific statement for x-axis or y-axis. The experimental group was not said it because they knew that an object only had velocity in x-axis but it has not velocity in y-axis Beside, there were the different answer when they define the maximum height like this figure 2. It is can be seen below:



(a) (b)

Figure 2. The answer to the parabolic motion concept of the control group, (a) the first group, (b) the second group.



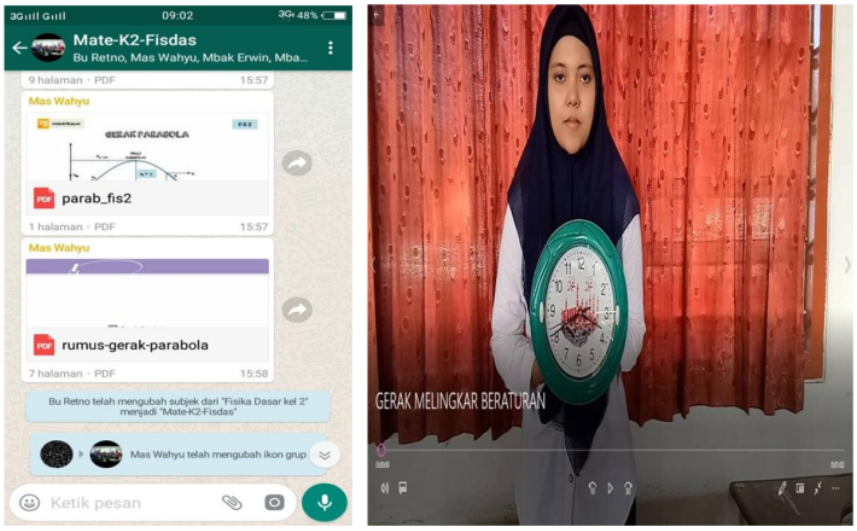
(a) (b)

Figure 3. The answer about the parabolic motion concept of the experimental group, (a) The third group, (b) the fourth group

From the students' answer on the maximum height, the first group as the control group wrote that the initial equation equals zero but it was not true because in this case, the initial velocity had a position that was lower than the maximum height. And another answer from the second, third and the fourth group was correct but the third group had to complete and describe the initial velocity in the y-axis like equation 1 and the initial velocity in the x-axis likes equation 2:

$$v_{0y} = v_0 \sin\theta \quad (1)$$

$$v_{0x} = v_0 \cos\theta \quad (2)$$



(a) (b)

Figure 4. The control and experimental group search the learning resources for motion and force, (a) the control group, (b) the experimental group.

Another concept state that the control and experimental group have a different concept for the relation of normal force and weight force in the flat plane and the inclined plane. The control group shows that the normal force is always same with weight force, while the experimental group shows that the normal force is not always same with weight force because their relationship depends on their plane, for example in the flat plane and inclined plane. In the flat plane, the normal force is same with weight force while the in the inclined plane is affected with the slope angle likes equation 1.

$$w \cos \theta \quad (1)$$

It can happen because the control group does not do the organization and controlling so they only planning and actuating and it could be they misunderstanding or misconception. While the experimental group planned one by one what the learning resource was needed, they organize each person in the group to search each concept from many kinds learning resources, then they actuate accordingly their task and then they control all material about motion and force from learning resources. The learning resources referred to as facilities and important for effective learning because the learning resources stimulate learning and foster development at desirable changes behavior of the student [11].

Conclusion and Suggestion

The experimental group had higher learning outcome than the control group. The management functions such as POAC (planning, organizing, actuating and controlling) had an effect to optimize the learning resources for motion and force materials. It can be concluded that the research improves the conceptual understanding for students, especially for the experimental group. The learning resource based on planning, organizing, actuating, controlling (POAC) helped the students to be more active in optimizing some structured, qualified, and functional learning resource on motion and force material. The suggestions are (1) the students can use planning, organizing, actuating, controlling to search many learning resources, (2) the lecturer can make a book or learning media about physics for mathematics education TO support its learning process, (3) the lecturer can control the students' activities when they do the function management.

5. Acknowledgment

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