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Active Physics Learning with Contextual Teaching Learning Methods

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This research aims to clarify the problem of student inactivity when learning Physics. Contextual Teaching and Learning (CTL) methods are suggested. Students are given a scenario to actively learn, by connecting day-to-day activities on potential learning with previously owned knowledge. This class action research was conducted in two Cycles, each of which consists of two meetings. High and very high scores of class activeness were obtained using CTL; 42.2% in Cycle I at the first meeting and 67 % at the second meeting, and in Cycle II, 84.7%. Activeness increased 24.8% in Cycle I at the second meeting, compared to the first meeting, and by 22.3% in Cycle II compared to Cycle I at the second meeting. The conclusion is that the CTL method can increase student activity in learning Physics.

Key words: *Active Learning, Learning Physics, Contextual Teaching and Learning.*

Introduction

Active learning in Physics serves as an obligation to give students with predetermined competencies (BSCS, 2007). Learning Physics requires that students express themselves through speech, writing, or other relevant actions, to solve problems related to Physics in a realistic manner (Thorton, 2012). Thus, in learning Physics, less active and less participatory students are detected through the learning process. Students' inactivity in learning leads to their incapacity to master any Physics materials. It can be seen from this composition of gain in Physics subject scores that have not reached 80% for the B value and more.

Table 1: Composition of Physics Value Gain

Values	A	AB	B	BC	C
Number of students	7	8	8	11	3

Source: *Students in Class TT-41-06 on academic year of 2017-2018*

Based on Table 1, it is still necessary to improve college learning. In the given academic year, 16% of students' failed to pass Physics subject in the even semester. That is still 1% lower than the maximum ungraduated limit value of 15% for each course assigned by Telkom University.

The one-direction learning process of Physics is assumed to be a cause. Lecturing is the teaching method. Hardly any discussion occurs among fellow students. Classes are silent. Previous research has found that some students start to be sleepy when listening to lecturer explanations (Bates, 2003). Lecturers' course slides lead to students' inactiveness, and they understand the delivered materials less (Letrud, et al., 2018).

Also, lecturers do not lead their students to real life as faced by students, so they connect lecture material less to everyday life despite Physics having many correlations with everyday life which should be articulated so students can feel its meaningfulness (Watzka, 2011).

A lack of questions to the lecturers indicates a lack of student interest. Other factors in students' lack of interest include the absence of any disclaimers against lecturers' opinions, students' weakness in reasoning, the absence of discussion among fellow students in resolving any existing problems, and any failure by students to complete assignments given by lecturers. Generally, through the lecturing method, students memorize Physics formulas and laws more easily, but do not learn to understand concepts (Alex Amartei Marmah, 2014).

Facing problems about students' inactivity in learning Physics leads to a potential solution for lecturers; using a well-adjusted approach to student needs. One learning model is Contextual Teaching and Learning (CTL) (Neftyan, 2018, Ahmad & Ahmad, 2018). CTL assists lecturers to associate between any taught materials with real world situations, and encourages students to connect knowledge and everyday applications. Students are thereby expected to experience a more meaningful learning process in which they "experience" what they learn and do not only "remember" it (Bongancisco, 2016).\

Many researches on the application of CTL in learning by teachers to their students, or by teacher training lecturers with expertise in learning methods. The application of CTL carried out by physics lecturers at universities without teacher training major, is still very rare and very interesting to know the results. Especially by providing teaching experience as a professional educator who can improve and enhance the learning process.

Literature Review

Physics learning emphasizes the process of investigating carefully, so that students can learn and find ideas with attention, enthusiasm and fun (Zemelman, 1998; Suryawati, E., Osman, K., & Meerah, T. S. M., 2010). In this process, students must play an active role, so that they learn from what they have done and gain experience (Schelecty, 1997). Students are expected to be able to find their own material being studied, and not just transfer the knowledge of lecturers to students. Lecturers must act as facilitators, to broaden students' perspectives and make the material easy to understand (Parnell, 1995).

The concept of CTL will help lecturers associate subject material with real world conditions (Ahmad & Ahmad, 2019; Hudson and Whisler, 2013). Contextual learning is a teaching and learning concept that helps teachers to connect subject material content to real world situations, and then motivates students to connect knowledge to its application in their lives as family members, citizens and workers; as well as encouraging students to work hard in learning (Blanchard, Berns & Erickson, 2001; Johnson, 2002).

In applying CTL, lecturers can integrate five strategies to produce a clear understanding of a physics concept, namely: inquiry learning, problem based learning, cooperative learning, project based learning, and authentic assessment (Johnson, 2002; Sears, 2002; Glynn, SM, & Winter, LK, 2004). CTL can be implemented in seven principles, namely: constructivism, inquiry, questioning, learning community, modelling, reflection, and authentic assessment (Suryawati, E., et al, 2010). In the practice of learning physics through CTL, lecturers perform learning with strategies as to knowledge namely; relating, experiencing, applying, collaborating, and transferring (Crawford, 2001; Singh, H., Tulsi, PK, Dutt, S., & Dalvi, G., 2012).

CTL engages students fully in the learning process (Crowford, 2001). They are encouraged to study learning material according to the topic. Learning in that context is not just listening and taking notes, but a process of direct experience, thus making learning more meaningful (Suryawati, E., et al., 2010). The application of the CTL method actively increases student engagement and can improve learning achievement. In other words, active learning helps the process of improving learning outcomes and quality (Fadilurrahman, Muhammad., Ismaniati, Ch., and Mustadi, Ali., 2019). CTL can increase activeness because it will encourage students to establish cooperation; help each other; study in a manner that is fun and not boring; study with enthusiasm; integrate learning; use various sources of teaching materials; activate students in the learning process; share knowledge with friends; be critical students; and it will also encourage lecturers to be creative (Fadilurrahman, M., et al., 2019).

Research Methods

Class action research was conducted in the even semester of 2018/2019 academic year in two Cycles. Each Cycle consists of three meetings, for 2 x 50 minutes (2 credits). Involved in this research are (1) Two researcher lecturers as planners, implementers and observers of students' activeness in the learning process, and as companions; (2) 37 Telecommunication Engineering students.

The Cycle I planning consists of: 1) discussions with lecturers in charge of Physics, about common teaching methods, learning outcomes obtained by students and any learning obstacles; 2) Examining the Semester Learning Plan (SLP) of Physics including learning implementation plans, allocating time by adjusting available time in the SLP to the research time; 3) Making observation sheets of overall student activities at action implementation time; 4) Making learning implementation plans by a contextual approach; 5) Making evaluation questions of student learning outcomes; 6) Consultation with advisor lecturers.

The action implementation stage of Cycle one is the learning with a contextual approach, based on prepared scenarios in a Cycle which is: 1) Lecturers explain plans of activities to be performed; 2) Lecturers divide students into several heterogeneous groups; 3) Lecturers guide students to associate the discussion theme of kinematics 1 Dimension and kinematics 2 Dimensional with the knowledge they already have, by providing day-to-day questions before the lecturers explain the materials in more detail; 3) Lecturers give questions to the students in groups to reinforce the discussion. In small groups, students are required to discuss any related problems to the discussion theme and their surrounding environment; 4) After completing group discussions, representatives of each group discussion then present results of their discussion in front of the class. The lecturers guide the presentation, so that it can improve students' activeness by giving opportunities to other students who want to express their opinions and disclaimers; 5) At the end of the presentation, the lecturers give awards for group value, as well as giving conclusions on the discussion theme; 6) At the end of Cycle I, lecturers give individual tests as post-tests.

The observation stage of Cycle I is to observe students' activeness during the implementation of the class action research. Six indicators are answering questions given by lecturers, collaborating with the group, presenting discussion results, proposing questions, expressing ideas or opinions, and working on the questions. In the Reflection stage, there is a review of the class action, based on the results of observation and evaluation during the learning process. Meeting in Cycle II is performed by the same mechanism as in Cycle I, but there are already effects given by the reflection results.

In Cycle II, materials on Wave Interference are submitted. There are changes to the stages. Groups are divided according to value acquisition in Cycle I. When completing the learning process through the two Cycles, qualitative Data in the form of students' activeness with the application of CTL learning method and results of field notes are analyzed by qualitative descriptive analysis. The qualitative data is presented in categories of very high, high, low, and enough, to obtain conclusions.

Results

The results of students' learning activeness in Cycle I, at the first meeting, with the discussion theme of kinematics are as follows: 1 Dimension with indicators consisting of answering questions given by lecturers, collaborating with the group, presenting results of the discussions, proposing questions, expressing opinions and completing questions are presented in the following Table 2:

Table 2: Student Activity on the Subject of 1 Dimensional Kinematics in the First Meeting of the Cycle I

No	Activity Indicators	Number of Students	Number of Student Who Get Scores of			
			1	2	3	4
1	Answering lecturer's questions	37	0	29	0	8
2	Collaborating with the group	37	0	0	17	20
3	Presenting discussion results	37	0	0	30	7
4	Asking question	37	0	34	0	3
5	Expressing opinions / ideas	37	0	34	0	3
6	Working on tasks	37	12	19	6	0
Percentage (%)			5,405	52,25	23,87	18,47

Every indicator of students' activeness assessment with score 1 means a low level of activeness indicator. Score 2 means quite enough activeness. Score 3 indicates a high level of activeness. Score 4 means a very high level of students' activeness.

From Table 2 it can be seen that the total number of students with very high level of learning activeness, when using the CTL method, is 18.4%. The list of students in learning activities with a high activeness score indicated 21 students working with groups, 30 students presenting results of the discussion, and six students working on questions. The total of students with a high level of learning activeness using CTL is 23.87%.

Indicators also represent students who obtain quite an active score in the learning process, in relation to often seeing other friends doing learning activity, making jokes with other friends though still paying attention to the learning by answering questions, providing questions to lecturers, and expressing opinions and working on tasks. Their percentage is 52.25%.

Twelve students have a low level of activeness, as indicated in relation to their working on tasks which students are cheating on, when working on given questions by lecturers. This is due to a lack of motivation given by lecturers to students who might otherwise be more active and honest in completing any given tasks.

Results of students' learning activeness on each indicator, from Cycle I at the second meeting, with the subject of the Kinematics 2 Dimensional, are presented in Table 3:

Table 3: Student Activity on the Subject of Kinematics 2 Dimensional at the Second Meeting of Cycle I

No	Activity Indicators	Number of Students	Number of Student Who Get Scores			
			1	2	3	4
1	Answering lectures' questions	39	0	9	0	30
2	Collaborating with groups	39	0	1	17	21
3	Presenting discussion result	39	0	0	31	8
4	Asking question	39	0	28	0	11
5	Expressing opinion / idea	39	0	29	0	10
6	Working on task	39	0	10	0	29
Percentage (%)			0	32,91	20,51	46,58

Thus, students' learning activeness is reflected in extremely high scores as to the following indicators: The number of students answering lecturers' questions is 30 students; working with groups, 21 students; presenting results of the discussions, eight students; asking questions, 11 students; expressing opinions, 10 students; and working on tasks, 29 students. The total of students at a very high level of learning activeness, when using CTL in Cycle I at the second meeting, is 46.58%. The number of students' with a high score for activeness in working with a group is 17 students, and the number presenting results of discussions is 31 students. The total of students at a high level of activeness by using the CTL method is 20.51%. The percentage of students with a quiet level of activeness, which can be seen from their silence during the learning process, seeing other friends doing learning activity, talking to other friends is 32.91%. At the second meeting of Cycle I, there is no student who does not engage in learning before lecturing started; the lecturers provide motivation to be more active and be honest in working on any given task.

Results of students' learning activeness for each indicator from Cycle II, with the discussion theme of Wave Interference, are presented in the following Table 4:

Table 4: Student Activity in Cycle II with Discussion Theme of Wave Interference

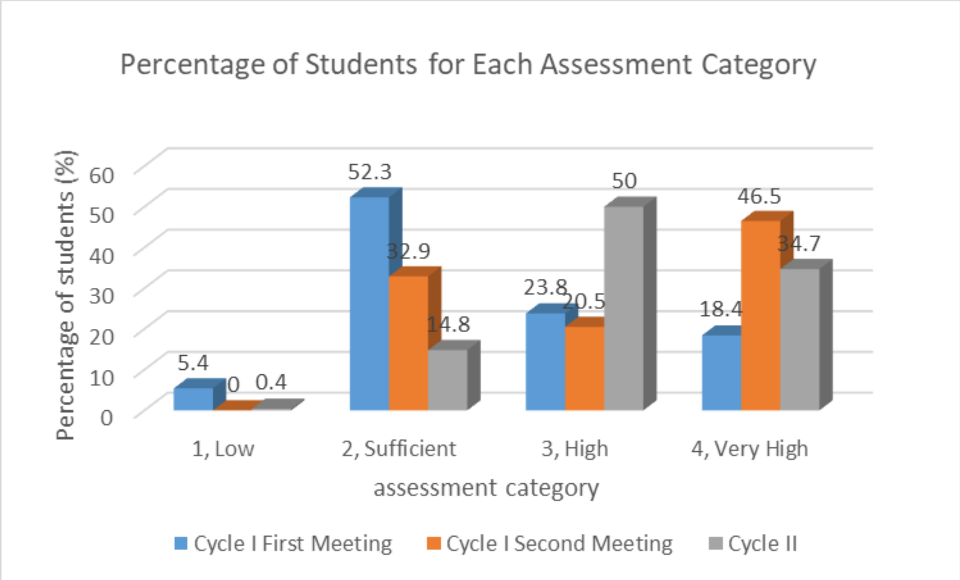
No	Activity Indicators	Number of Student	Number of Student Who Get Scores			
			1	2	3	4
1	Answering lecture's question	36	0	6	0	30
2	Collaborating with the group	36	0	0	8	28
3	Presenting the discussion result	36	0	0	30	6
4	Asking question	36	0	25	0	11
5	Expressing opinion / idea	36	0	1	35	0
6	Working on task	36	1	0	35	0
Percentage (%)			0,463	14,81	50	34,72

Based on Table 4, the division of students with a very high level of activeness in learning Physics provides the number of 30 students, who are answering questions given by lecturers. Also, there are 28 students collaborating with groups, six presenting results of the discussion, 11 asking questions, and there is no student with a very high activeness in the indicator of expressing opinions or ideas. The total of students with very high level of activeness in learning using CTL learning method on the subject of Interference is 34.72%.

High levels of students' activeness can be seen in indicators which show eight students working with a group, 30 presenting discussion results, and 35 working on tasks. The number of students in high level of activeness using CTL learning method on the subject of Interference Waves is 50%. Quite active levels in the learning process can be seen in indicators of students being silent during the learning process, seeing other students doing the learning activity and making jokes with other students being at 14.81 percent. There is one student who is not involved in learning, among others working on tasks in which the student is unfocused with any given questions by lecturers.

Results of the research can be analyzed from an acquisition value of student activeness, based on assessment seen in Figure 1.

Figure 1. Graph of Students' Activeness Value in the Physics Courses



Implementation of the learning process at the first meeting in the Cycle I stills find unfocused students, students disturbing others, students without the courage to express their ideas /opinions both in group discussions and in class discussion, inactive students in groups resolving questions, and cheating students working on tasks. This is a result of lecturers giving less motivation to students to be active during learning, to have the willingness to express their opinions, and to be honest in working on tasks. Percentages of high and very high scores in Cycle I at the first meeting are 23.8% and 18.4%.

Lecturers gave improvements in terms of motivation in Cycle I, at the second meeting. Therefore students' activeness increased compared to the first meeting in Cycle I. This can be seen in students paying more attention to lecturers' explanations, students starting to be courageous, and becoming accustomed to ask lecturers questions. The number of high and very high scores in Cycle I, at the second meeting, are 20.5% and 46.5%.

Improvements were conducted in Cycle II. Motivation was given to students. They were also divided into several groups, so that students with ability can blend in with less able students, leading to more effective and improved discussion compared to Cycle I at the first and second meetings. The total of students with a high score of activeness is 50%, and a very high score of 34%. In Cycle II students have started to decrease their jokes with friends and to focus on learning. This can be seen by the score of 1 (low) and 2 (enough) on each activeness assessment indicator, as 0.4% and 14.8%.

Discussion

A low level of students' activeness influences whether there is a quiet class atmosphere. Even less motivated students will have a better understanding of learning materials, influencing student learning. Increasing students' intensity when associating materials with everyday life in the environment, can be a solution for student inactivity. Learning conducted in a scientific environment, in accordance with the characteristics of CTL, is as follows: (1) Learning is conducted in the context of *authentic* learning, directed at the achievement of skills in a real-life context or a study conducted in a natural environment (*learning in a real life setting*). (2) Learning provides an opportunity to students to work on meaningful tasks (*meaningful learning*). (3) Learning is implemented by providing meaningful experiences to students (*learning by doing*). (4) Learning is conducted through group work, discussions, mutual friend correction (*learning in a group*). (5) Learning provides an opportunity to create a sense of community, working together, and mutual understanding between each other deeply (*learning to know each other deeply*). (6) Learning is implemented actively, creatively, productively, and by unselfish cooperation (*learning to ask, to inquiry, to work together*). (7) Learning is conducted in a fun situation (*learning as an enjoyable activity*) (Muslich, 2009).

Increased student activeness on Cycle I at the second meeting leads to a more fun class atmosphere. Further, students are more interested in paying attention to explanations by lecturers than other activities. It also influences learning achievement in the subject of kinematics 2 Dimensions. To further improve student activeness in learning Physics, in Cycle II lecturers then prepare more samples of material connectedness with surrounding environments. The uniqueness of CTL is that a learning model emphasizes students' activity comprehensively, either physical or mental. Learning is considered not only as memorisation, but as a process for experiencing real life. Class in CTL is not only a place to get information, but also as a place to test their ability to find data in the field; the subject material is determined by the students themselves, not the results of others (Jonathan, 2017). CTL has the character of: (1) *Relating*. Learning has connectedness with student knowledge and the context of real life experience. Connectedness here include the connectedness of subject materials with knowledge and skills, other subject materials, media exposure, family context, school, community, real world experience, child needs, and the breadth of the material. (2) *Experiencing*. Learning gives an opportunity for students to interpret their knowledge by discovering and experiencing themselves directly. (3) *Applying*. Learning emphasizes the application of concepts, principles, and procedures that are learnt in different contexts, so it is beneficial to students' life. (4) *Cooperating*. Learning encourages students to work together, with fellow lecturers, friends, and learning resources. There are relevant activities such as group work, discussions, interactive communication, tolerance of differences on gender, tribe, religion, social status, and cultural perspective. (5) *Self-regulating*. Learning encourages students to regulate themselves and be independent. Its indicators include motivation for life-long learning; motivation to find and use information on the basis solely of awareness of that information; applying the principle of *trial and error*; and reflection. (6) *Authentic assessment*. Learning is to measure, monitor, and assess all aspects of learning outcomes (*cognitive*, *affective*, *psychomotor*), whether any perceived results or any changes or developments, assessment of learning result in the classroom or outside (Sears, 2003).

Physics is the most fundamental science and includes all natural sciences. In a broad sense, Physics means a wide branch of science which outlines and describes the elements in the Earth and its phenomena. Physics is the science that requires more understanding than only memorizing. From a variety of symptoms that can be seen in nature, it looks for natures and characteristics so that general principles can be understood certainly. An example is looking at objects with different weights being dropped. It transpires that objects dropped from the same height will fall on the ground at the same time, when gas friction is ignored. The core of this experiment is an example of the general principle of generalization, namely: “the rate of free fall of an object does not depend on its weight”. However, Physics is divided into the study of motion, liquids and gases, heat, sound, light, electricity, magnet and modern topics (Harrys Siregar, 2003).

Conclusion

Class action research on learning Physics using CTL methods can increase student activity, as represented by indicators in this research. Those indicators were the percentage of students asking lecturers questions, students actively discussing in groups, students presenting results of discussions, students asking questions generally, students expressing opinions as explanations by lecturers, and students working on tasks. Actions performed as CTL are: relating subject materials to everyday life through discussion and questions relating subject materials to the surrounding environment, giving percentages of group discussion results, rewards in the form of group scores, and making conclusions on the given subjects.

To improve students’ activeness by using the CTL method, it is recommended that there be: 1) provision of motivation by lecturers to students, to be honest in completing tasks; 2) division of groups based on students’ scores, to obtain balanced groups; 3) clear instructions for tasks; and 4) division into small groups ranging from 4-5 students.

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