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Improving student engagement by mathematics learning based on contextual teaching and learning

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Abstract. Student engagement is important in every learning because learning activities are not just a transfer of knowledge but also as a potential development that is owned by students. This study aims to determine the increase student's engagement of MTs grade VIII learn based contextual teaching and learning (CTL) learning device in the form of lesson plans and student worksheets. The research design used One Group Design. The sample of this study involved students of class VIII in the 2018/2019 school year were 25 students of class VIII.1 as an experimental class. The instrument used was a student engagement questionnaire and field notes. Data were analyzed quantitatively using means and n-gain and described descriptively. The results showed that the n-gain was 0.215, which means that there was an increase in the student's engagement learning by using CTL-based mathematics learning in the low category.

1. Introduction

Every mathematics learning activity carried out not only transfers knowledge from the teacher to the students, but the learning activity also requires students to be able to develop the potential they need and involve directly in gaining knowledge. Students engagement that they display in learning will be support in achieving learning objectives. Students will get meaningful knowledge and have a positive impact on their learning outcomes and achievements. Student engagement in the learning process is measured by 3 domains: cognitive engagement, affective engagement and behavioral engagement [1]. Skinner in [2] said the student's engagement was important because the student's engagement addressed the level of attention, effort, persistence, positive emotions and commitment of a student in the learning process. The same thing was stated by Ladd & Daniella in [3] states the behavior of student involvement is very important because this behavior supports the learning process so that it can take place well. According to Dharmayana [4] the emotional competence and involvement of students in schools play a positive role in the academic achievement of students. This shows that the students' engagement needs to be considered because it can support the learning process and academic achievement of students.

Education in Indonesia currently refers to the 2013 curriculum which has been in effect since 2013 while the implementation is more extensive in 2014, but to date, the field implementation in the field of mathematics curriculum 2013 has not been carried out properly. Based on observations by some junior high schools in one of the districts in Indonesia in July-December 2018, it was found that the mathematics learning activities carried out still tended to be one-way dominated by teachers (Teacher Centers). The same thing also stated by Ardiansyah [5] said that learning which took place was still one-way. Generally, the learning pattern at each meeting conducted by the teacher is conventional which begins with the explanation of the material, provides examples of application, provides training and at



the end of the lesson the students are given homework. So that in learning activities most students are passive, bored and they are not able to communicate the ideas they have.

Mustika and Kusdayati [6] in their study found that students engagement in learning is still relatively low as indicated by the behavior of lack of effort and perseverance in learning activities both inside and outside the classroom, negative reactions arise when given the task of learning and lack of focus on learning. The low students engagement also found researchers in observation activities, seen in the learning process students tend to be passive, they only accept what is given by the teacher because of the lack of interest of students to learn mathematics, students are less focused on learning, tend to complain when given assignments, chatting with each other, often walking in class even though the teacher often warned them even to sleep when the learning took place. The low student's engagement if left determined will hinder the learning process so that it can reduce the learning outcomes and academic achievement of students. For this reason, the student's engagement needs to be improved in learning from cognitive, affective and behavioral skills to achieve academic achievement. Student engagement is increasingly seen as one of the keys to overcoming problems such as underachievement, boredom and alienation, and high dropout rates [7]

Responding to student's engagement in learning activities, the teacher as one of the success factors in learning must strive to improve the quality of learning. By providing quality learning tools and can increase student engagement. The use of appropriate learning tools in learning can improve students' understanding, interest, and motivation in learning. The learning tool is in the form of lesson plant and student worksheets. The learning tool must have a particular approach or model that has certain characteristics so that it is expected to facilitate and increase student engagement. The approach or model used must certainly be following the 2013 curriculum where mathematics learning should be as optimal as possible with the life of the real world and the minds of students so that it is meaningful in the lives of students. One approach to learning mathematics that can be used is the approach *Contextual Teaching and Learning* (CTL). The CTL approach is an approach that focuses more on learning on students. The CTL approach encourages students to associate the concept of learning with the real world or everyday life through constructing their thoughts and discovering the concept of learning so that students gain meaningful knowledge and can apply the competencies of learning outcomes in their daily lives. According to Sanjaya [8], there are 7 components of CTL learning including: (1) Constructivism; (2) Inquiry; (3) Questioning; (4) Learning Community; (5) Modeling; (6) Reflection; (7) Authentic Assessment.

The CTL approach emphasizes student's engagement in the learning process. Taylor [9] states the strategies used in increasing student engagement are, namely, exploration, relevance, multimedia, instruction, and authentic assessment. Where some of these strategies can be applied in the CTL approach. Based on the 7 components of CTL applied in the learning device developed in the form of lesson plans and student worksheets, it is expected to facilitate and increase the student's engagement in the learning process. Previous research has been conducted by Arum [10] who examined the student's engagement in cosmetology students. The study was conducted to determine whether there are differences in student engagement learn by using a device based CTL.

2. Materials and Method

This research is pre-experimental research with one group pretest-posttest research design. Thus to find out the differences in students engagement is done with the following research design can be seen in the following Table.1 [11]:

Table 1. Design Research One Group Pretest Posttest

Group	Observation	Treatment	Observation
Experiment	O ₁	X	O ₂

In this design, the grouping of research subjects is class VIII students. The experimental group was given a participant questionnaire (O₁) before learning with CTL-based learning. (X) is given, then at the end of the treatment, a student engagement questionnaire (O₂) is given.

This research was conducted at Junior high school in one of the districts in Indonesia, conducted in the even semester of the 2018/2019 school year. The population in this study were students of class VIII, samples were taken in class VIII.1 of 25 people, as a class that uses CTL-based learning tools that use lesson plans and student worksheets on the material to plane 3-dimensional space. The sampling technique was carried out using random sampling, using class VIII daily test data conducted a normality test with the Kolmogorov-Smirnov test and the homogeneity variance test of each population data group used the Levene test.

After being normal and homogeneous, the class selection is chosen by drawing, so class VIII.1 is chosen as the experimental class. In the implementation of teacher learning and student learning using CTL-based tools that have been validated by experts. Data collection instruments used were students' engagement questionnaire and field notes. The student engagement questionnaire used was a questionnaire developed by Kong translated by Syarfuddin [12] whose validity and reliability was known. The student engagement questionnaire uses a Likert scale with weights of 1 to 5 namely often for weights 5, almost often for weights 4, sometimes for weights 3, rarely for weights 2, and almost never for weights 1. The results of student engagement questionnaire were analyzed using N-Gain to see an increase in student engagement [8]. All statistical tests of the research data used the SPSS program. Knowing there is an increase between pre-test and post-test or gain. Classification of increasing N-Gain in Table.2 The amount of increase is calculated by the normalized gain formula using the formula [13]:

$$N\text{-gain} = \frac{\text{skor postes} - \text{skor pretes}}{\text{skor maksimum} - \text{skor pretes}}$$

Table 2. Classification for increasing N-gain

Normalized Gain Average	Classification
N-gain $\geq 0,70$	High
$0,30 \leq \text{N-gain} < 0,70$	Medium
N-gain $< 0,30$	Low

3. Results and Discussion

This research was conducted in class VIII using a CTL-based mathematics learning device. On the material plane 3-dimensional space in the form of lesson plant applied by teachers and student worksheets that are done by students. In the activity process student engagement was observed which consisted of three domains namely Cognitive Engagements including the Surface Strategy, Deep Strategy, and Reliance; Affective engagements include Interest, Achievement Orientation, Anxiety and Frustration; Behavioral engagements include *Attentiveness* and *Diligence* [1].

3.1. Cognitive Engagement

According to Rotgans and Schmidt [14], Cognitive engagement is a psychological condition where students make a lot of effort to really understand the topic of learning and a number of ways that last for a long period of learning. The following results of the average questionnaire of student involvement in the domain of cognitive involvement are presented in Table 3.

Table 3. Average Results Questionnaire Students Engagemnet in Domain Cognitive Engagement

Items	Domain of student engagement	Before		After	
		Mean	Standard deviation	Mean	Standard deviation
7	Surface Strategy	3.43	0,23	3.12	0,21
7	Deep Strategy	2.71	0,28	3.03	0,372
7	Reliance	3.73	0.22	3.75	0,245

The questionnaire on the aspect of surface strategy consists of 7 items that reveal the statements of students using the surface strategy, for example memorizing formulas formula surface area of cube, beam, pyramid volume or memorizing completion methods. In-depth strategies related to the extent to which students are able to know their abilities / self-understanding, apply knowledge and how deep they learn material, for example application in the contextual problem Reliance is related to the extent of the closeness/trust of students towards the teacher. Based on the table above, it can be seen that the surface strategy of students after learning with CTL-based learning decreases and students' in-depth strategies increase. This indicates that there has been involvement of students in surface strategies, in-depth strategies, and reliance.

This is because in CTL-based learning students are facilitated to construct their thoughts and find learning concepts that begin with things that are around them or contextual. From the field notes, it is also processed that in learning students are not just memorizing existing formulas, but students try to think, understand learning, want to know how the knowledge obtained can be applied in daily life and other fields of science. Learners' confidence in the teacher 3.75, this indicates that students have a good closeness to the teacher, but does not state the students are not independent. Because in CTL-based learning the teacher is a facilitator where if students experience difficulties will be assisted by the teacher.

3.2. Affective Engagement

Affective engagement is related to the reaction of students to the learning environment that affects the willingness of students to engage in school activities, especially learning activities [15]. The aspects of affective engagement are seen from the aspects of interest, achievement orientation, anxiety, and frustration. The following results of the average questionnaire student engagement in the affective engagement domain are presented in Table 4.

Table 4. Average Results Questionnaire Student Engagement Domain Affective Engagement

Items	Domain of student engagement	Before		After	
		Mean	Standard deviation	Mean	Standard deviation
6	Interest	3.15	0.27	3.51	0.34
6	Achievement Orientation	3.57	0.14	4.02	0.195
5	Anxiety	3.33	0.272	3.58	0.125
5	Frustration	2.60	0.169	2.19	0.275

Based on the table.4 aspects of interest there is an increase in the leveling of the learners after learning with based CTL. Where is the concern in the interest of students when learning mathematics, satisfied when solving problems, curiosity is quite high and like when starting a new topic? This can be seen when the CTL-based learning process students are very enthusiastic in learning activities, enjoy learning with the activities presented because it starts with contextual things around them, and are interested in how to solve problems in various ways and they are very satisfied when can get a solution to the problems encountered. Achievement orientation aspects relate to the objectives or expected outcomes of students in learning. From the results of the questionnaire the average achievement of students

increased by 0.45, this shows that CTL-based learning was able to motivate students in achievement orientation, although so far they always think mathematics is difficult. Aspects of anxiety include students' anxiety in facing exams and grades obtained. If seen in the learning process students are not the least bit anxious, even they are very happy and enthusiastic. But when the test or test takes place their anxiety in the test is still high, increasing from the previous process. The frustrating aspects include discomfort, fatigue, and dislike in learning mathematics. Based on the results of the questionnaire obtained an average after using CTL-based learning is 2.19, the frustration of students decreased in learning mathematics based on CTL can be categorized low. From the field notes there were no students who seemed frustrated during the learning because the CTL-based learning that was carried out made the students interested, excited and followed the learning activities well. This can be seen from the response of students when learning activities take place.

3.3. Behavioral Engagement

According to Archambault et al [16], Behavioral engagement is a psychological experience that involves the active involvement of students in-class activities. Behavioral engagement is closely related to student participation in the classroom. Behavioral engagement students' in learning can be seen through aspects of *Attentiveness* and *Diligence*. The following results of the average questionnaire of student engagement in the domain of behavioral engagement are presented in Table 5.

Table 5. Average Results Questionnaire Student Engagement Domain Behavior Engagement

Items	Domain of student engagement	Before		After	
		Mean	Standard deviation	Mean	Standard deviation
6	<i>Attentiveness</i>	3.19	0.383	3.32	0.29
6	<i>Diligence</i>	2.75	0.226	3.53	0.20

Attention aspects include listening to the teacher's explanation, playing an active role in expressing pendant, taking part in discussions, concentrating and being serious in learning mathematics. From the results of the questionnaire obtained an average aspect of student attention after learning with a CTL-based device is 3.32, this is an increase from previous learning. In the CTL-based learning activities that have been carried out, students have shown their sincerity in the activities of the discovery of the concept of learning with groups, play a role in discussion, raising opinions and sharing in the learning community as well as receiving attention able to solve problems related to the concept of learning.

The aspect of perseverance experiences improvement after learning with CTL-based learning namely 3.53, wherein this aspect of perseverance seen is the perseverance of students in solving a problem. Study hard to understand it, not give up easily, if something goes wrong can improve the results, try to solve it with other methods. Based on observations made in CTL-based learning activities, it seems that students try hard to understand problems with the group, ask friends who are considered smart until they ask the teacher. The curiosity that exists in students also lead to perseverance in themselves, want to solve the problem, if wrong they also immediately fix it.

Based on the presentation displayed a graph of the results of the questionnaire student engagement before and after doing CTL-based learning, it can be seen in Figure 1.

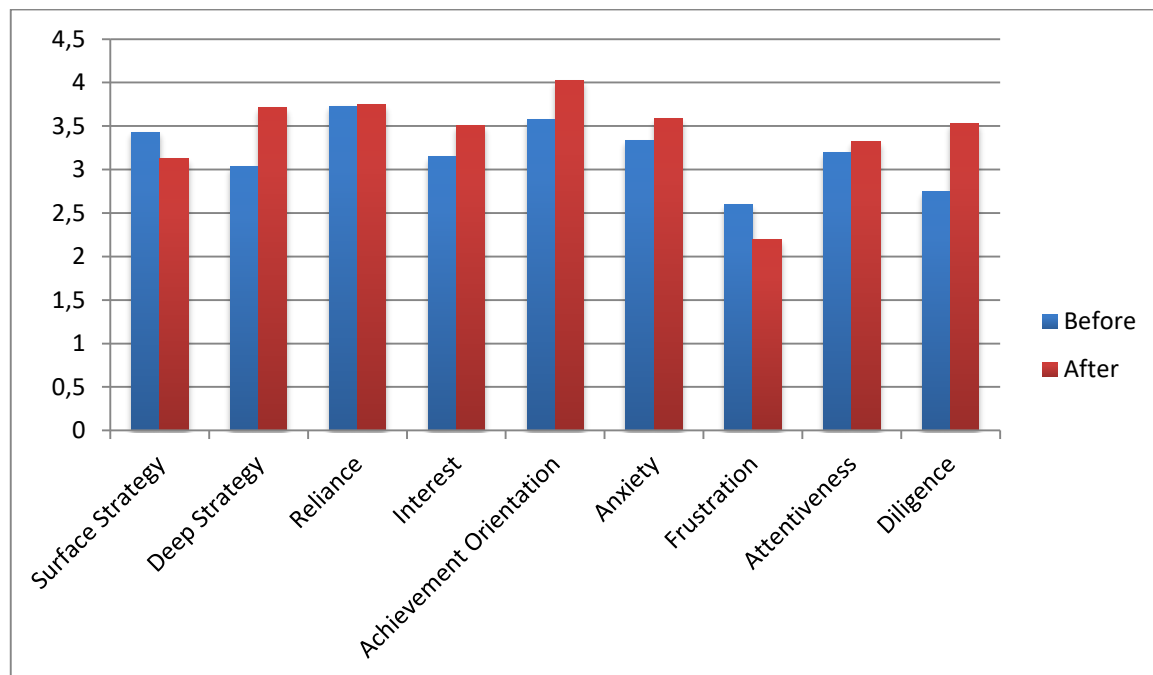


Figure 1. Graph of Results of Questionnaire on Student Engagement Before and After CTL Based Learning

Data on student engagement obtained from before and after CTL-based learning, N-gain calculations were performed. N-gain is used to determine the increase in student involvement. Table 6. Recapitulation of N-Gain.

Table 6. N-Gain Recapitulation			
Statistics	Before	After	Gain Normalization
	Score	Score	
Mean	2.20	3.34	0.215
SD	0.258	0.535	

Based on the calculation results obtained an average gain index of 0.215, meaning that there is an increase in student engagement after learning based on CTL with a low category.

4. Conclusion

Based on the findings stated in the previous section, it can be concluded that there is an increase in student engagement before and after CTL-based mathematics learning. There is an increase in student engagement after learning mathematics based on CTL in the material of flat side space with an average normalized gain index of 0.215 which means that the increase is classified in the low category.

Based on the conclusions, several recommendations that need attention from all parties interested in CTL-based learning are suggested, the teacher acts as a facilitator and moderator. Therefore, mathematics teachers who will implement CTL-based learning need to pay attention to the following points: (a) the availability of learning tools in the form of contextual problems (b) consideration is needed for teachers to intervene so that students' efforts independently and creative freedom to be actively involved achieve optimal mathematical ability development. For other researchers who want to do research it is advisable to do other material or innovation in learning new mathematics in order to be able to increase the of student's engagement.

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