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Implementation of Contextual Teaching and Learning and Authentic Assessments to the Science (*IPA*) Learning Outcomes of 4th Grade Students of Primary Schools (*SD*) in Kota Kupang

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui penerapan CTL dan penilaian otentik terhadap hasil belajar IPA siswa kelas IV SD. Penelitian ini merupakan penelitian eksperimen semu dengan menggunakan desain faktorial 2 x 2. Populasi berjumlah 110 siswa, dimana 60 siswa dipilih sebagai sampel melalui teknik random sampling. Pengumpulan data menggunakan metode tes objektif. Analisis data menggunakan one-way ANOVA dan two-way ANOVA yang dilanjutkan dengan uji t-Scheffe. Hasil penelitian ini menunjukkan bahwa: terdapat perbedaan hasil belajar antara siswa yang mengikuti pembelajaran CTL dengan pembelajaran konvensional; terdapat perbedaan hasil belajar siswa yang mengikuti penilaian kinerja dengan penilaian proyek; ada pengaruh interaksi antara model pembelajaran dan penilaian yang digunakan terhadap hasil belajar; terdapat perbedaan hasil belajar siswa yang mengikuti CTL, yaitu antara siswa yang mengikuti performance assessment dengan siswa yang mengikuti project assessment; terdapat perbedaan hasil belajar pada siswa yang mengikuti pembelajaran konvensional, yaitu antara siswa yang mengikuti performance assessment dengan siswa yang mengikuti project assessment; terdapat perbedaan hasil belajar siswa yang mengikuti performance assessment yaitu antara siswa yang mengikuti pembelajaran CTL dengan pembelajaran konvensional; dan terdapat perbedaan hasil belajar pada siswa yang mengikuti penilaian proyek, yaitu antara siswa yang mengikuti pembelajaran CTL dengan siswa yang mengikuti pembelajaran konvensional. Oleh karena itu, penerapan CTL dan penilaian autentik terhadap hasil belajar IPA siswa kelas IV SD.

ABSTRACT

This study aims to discover the implementation of CTL and authentic assessment to the science learning outcomes on 4th-grade students of primary school. This study is quasi-experimental using a 2 x 2 factorial design. There are 110 students as the population, in which 60 students are appointed as the samples thru a random sampling technique. Data collection uses an objective test method. The data are analyzed using one-way ANOVA and two-way ANOVA that is followed by t-Scheffe test. The results of this study indicate that: there is a difference of learning outcomes between the students who attend the CTL with the conventional learning; there is a difference on the students' learning outcomes who attend the performance assessment with the project assessment; there is an influence of interaction between the learning model and assessment used to the learning outcomes; there is difference of the students' learning outcomes who attend the CTL, in which it is between the students who attend the performance assessment and the students who attend the project assessment; there is a difference of learning outcomes on the students who attend the conventional learning, in which it is between the students who attend the performance assessment and the students who attend the project assessment; there is a difference of learning outcomes on the students who attend the performance assessment, in which it is between the students who attend the CTL and conventional learning; and there is a difference of learning outcomes on the students who attend the project assessment, in which it is between the students who attend the CTL and the students who attend the conventional learning. Hence, the implementation of CTL and authentic assessments toward the science learning outcomes of 4th-grade students of primary school.

1. INTRODUCTION

The final activities of science learning at the primary school level is an evaluation process that aims to discover the learning outcomes obtained by the students. Learning outcomes are the ability possessed by the students after they receive experiences (Kennedy et al., 2018; Trisnawaty, 2017; Vereijken et al., 2018). The students who have high Science learning outcomes indicate that the students have encountered a meaningful science learning process. It means that in science learning, the students obtain knowledge,

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understanding, conceptions, and meanings that obtained through a constructive process and their active involvement to complete, connect, form a picture, organize, and make analogies about many important things from the experience and or science learning (Bao & Koenig, 2019; Darling-Hammond et al., 2020; Hossain, 2015; Irianto et al., 2017; Maranan, 2017). If the students have low science learning outcomes, it indicates that there is a problem in the learning. Inappropriate learning model selection can influence the learning outcomes and the students learning activities (Allchin, 2013; Arviansyah et al., 2016; Djafar et al., 2014; Lasmini, 2018; Maisaroh & Rostrieningsih, 2012; Sarah, 2020), including the assessment techniques performed (Crooks, 1988; Edwards, 2013; Howard et al., 2017; Jimaa, 2011; Kraft, 2017). Improvements and efforts to improve science learning outcomes for primary school students need to be done continuously (Best & Dunlap, 2014; Curran & Kitchin, 2019; Ningsih et al., 2019; Qistina et al., 2019). The improvements in the use of appropriate methods and assessments based on the characteristics of science and students' condition need to be carried out as an effort to provide assurance of improving student learning outcomes and understanding (Brown, 2001; Genlott & Grönlund, 2013; M. Munawaroh, 2017; Nurjanah, 2016).

Formally and ideally, the teacher as the manager of learning should be able to make an effort for interaction between the students and other components. Ideally, the learning activities should not only be centered on the teacher as a source of knowledge (teacher-center) but involve the active role of the students in the learning process so that the expected learning outcomes can be achieved. In fact, science learning at the primary school level in Indonesia, the learning process is still dominated by the teachers; thus, the conventional model in the form of lectures is an option in determining the learning strategies. Furthermore, the process of science learning in primary schools is still carried out conventionally. The impact of this pattern is becoming increasingly visible. The PISA score results for Science on 4th grade, Indonesia is ranked 45th out of 48 countries with the Science scores of 397 points. The proportion of Indonesian teachers who get difficulty in following the curriculum changes is still categorized as high, in which it is 12.18%. In 2015, Indonesia is ranked 62nd out of 70 countries with a score of 403 (OECD, 2016). The PISA survey results in 2018 indicate that Indonesia's ranking is 73rd out of 79 countries with a score of 396 in the science sector (Avvisati et al., 2018). This clearly shows that the ability of Indonesian students in the field of science is still left behind from other countries. In a more specific context, this condition also occurs in Kota Kupang, East Nusa Tenggara Province. Data from the Provincial Education Office of East Nusa Tenggara show tremendous disparities in the teaching and learning process in schools (Dhiu et al., 2009; Dolpino, 2015). The observation results of Aiman et al (2020) in the 4th-grade of a public school in Kota Kupang indicate that in the academic year of 2019/2021, the science learning outcomes are still low. There are only 12 (40%) of students who complete, while 18 students (60%) are incomplete due to their scores that do not reach the Minimum Completeness Criteria, of which criteria is 65. The teachers also have not maximized the use of appropriate learning models and assessment techniques in accordance with the characteristics of science learning.

Various previous studies have been carried out in an effort to overcome the problems of science learning, especially those related to the learning outcomes in primary schools. STEM-Based Volcano Eruption Simulation has been implemented in the science learning of 1st grade (Twiningsih, 2020). The development of teaching material in the science material has been carried out (Kurniawati et al., 2017), i. e. Realia Media (Lalian et al., 2019), yet this study does not explain the level of class which is the focus of the study. Demonstration method; Student Worksheet Based on Scientific Approach; science, technology, and society (STS); the use of animation based on brain-based learning has been implemented in the 5th grade (Nurkholis, 2019; Permana et al., 2018; Utami et al., 2019; Wulansari & Suarni, 2020) to improve learning outcomes. CTL has been implemented in the science learning of 5th grade and it is able to improve the learning outcomes and the learning quality (Aliyyah et al., 2020). Particularly in 4th grade, other researchers have tried to implement quantum teaching (Mufarrid et al., 2020), develop a Supplementary Science Teaching Materials with Ethnoscience (Kumalasari et al., 2021), develop a Moodle-Based E-Learning (Ariesta et al., 2019), and Cooperative Learning Model (Pardiyana, 2020) to the class that experience boredom in the learning.

According to the above review, a study on the implementation of CTL and improving the learning assessment process that is accurate and comprehensive of the 4th-grade science learning outcomes is very necessary. CTL is a holistic learning process to assist the students in understanding the meaning of certain material by connecting to daily life context (personal, social, and cultural context) (Haryanto & Arty, 2019; Lotulung et al., 2018; Setiawan et al., 2020). Thru a CTL, the students will have knowledge or abilities that are dynamic and flexible to construct their understanding actively (Halik, 2016; Sihono, 2004). The CTL encourages the students to be able in implementing on their life, it means that the CTL learning not only hopes that the students can understand the material to be studied but also how the subject matter can color their behavior in everyday life.

Additionally, the authentic assessment is used to measure the students' abilities in every task which represent the problems in the real world; therefore, it can be stated that the authentic assessment assisted learning makes student-centered learning and the teacher acts as a learning facilitator (Fatonah & Prasetyo, 2013; Gleason et al., 2011; Hallas, 2008; Keiler, 2018; Villarroel et al., 2018). The authentic assessment is feasible to be combined with CTL (Halik, 2016; Muchtar, 2017; Wahyuni, 2013), and the type that will be combined is the performance assessment and the project assessment. The performance assessment is a tracing process of the product, meaning that the performance assessment is carried out when the students go through a learning process, and the performance of the process can be seen from the performance shown (Guntur, 2014; Sihombing et al., 2017; Yuniati, 2011). The project assessment is an in-depth investigation of a real topic (Agustini & Sastrawijaya, 2013; S. B. Munawaroh et al., 2017). Other research indicates that there are significant differences in student learning outcomes before and after using project assessments.

By looking at the existing condition, it is possible if the CTL approach and authentic assessment are implemented in 4th grade of Primary Schools in Kupang City. This study aims to determine the implementation of CTL and authentic assessment of science learning outcomes in 4th grade students of Primary Schools in Kota Kupang for the academic year of 2017/2018. The CTL approach involves seven main components of effective learning, namely constructivism, inquiry, questioning, community learning, modeling, reflection, and actual assessment. Through the CTL approach and authentic assessment - as an important contribution - it is hoped that the students will have a high learning interest in Science in order to obtain optimal learning outcomes, and become an inspiration for further researchers to research and develop further.

2. METHODS

This study is quasi-experimental study. The design of this study uses a 2 x x2 factorial design. A treatment using the CTL learning model is given to the experimental group of this study, while a treatment using conventional learning is given to the control class. The experimental and control classes are divided again to be two groups, namely the students who use performance assessment and the students who use project assessment. The learning material used in this study is force material. The hypotheses of this study are: (1) There is a significant difference to the Science learning outcomes between the students who attend the CTL learning model and the students who attend the conventional learning; (2) There is a significant difference to the learning outcomes between the students who attend the performance assessment and the students who attend the project assessment; (3) There is a significant influence to the interaction between the learning mode and the assessment models towards the Science learning outcomes; (4) There is a significant difference to the Science learning outcomes of the students who attend the CTL learning model, in which it is between the groups of students who attend the performance assessment and the groups of students who attend the project assessment; (5) There is a significant difference to the Science learning outcomes of the students who attend the conventional learning, in which it is between the groups of students who attend the performance assessment and the groups of students who attend the project assessment; (6) There is a significant difference to the Science learning outcomes of the students who attend the performance assessment, in which it is between the groups of students who attend the CTL learning model and the groups of students who attend the conventional learning model; and (7) There is a significant difference to the Science learning outcome of the students who attend the project assessment, in which it is between the groups of students who attend the CTL learning model and the groups of students who attend the conventional learning model.

This study is carried out at SDN Oeba 3 and SD Muhammadiyah 2 Kota Kupang, East Nusa Tenggara Province. The schools' selection is based on the recommendation of Education Authorities of Kota Kupang and cooperation between institutions that have been carried out so far. The sampling technique uses random sampling which includes 4 classes, namely IVA class, IVB class of SDN Oeba 3 Kupang and IVA class, IVB class of SD Muhammadiyah 2 Kupang. The IVA and IVB classes of SD Muhammadiyah 2 Kupang are used as the experimental classes consisting of 60 students and the IVA and IVB classes of SDN Oeba 3 Kupang are used as the control classes, in which there are 50 students on the classes, so that overall, the objects in this study amounted to 110 students. The four classes have almost the same characteristics i.e. the average age of 9-10 years and they come from the Timorese ethnic group. There are two variables used in this study, namely the CTL approach and authentic assessment as the independent variables, whereas the dependent variable is the learning outcomes. The learning is carried out in the force material. The implementation of CTL learning is adopted from the generally accepted syntax (al Tabany, 2014), while the control class uses conventional learning and authentic assessment. The learning is carried out for 4 meetings. In the experimental class, the researcher implements the CTL and authentic assessment by using several learning

stages, namely constructivism, questioning, inquiry, community learning, modeling, and reflection. After the six stages, then proceed with the actual assessment.

Data collection tools used in this study are the validity of learning devices in the form of Lesson Plan, Student Worksheet, and test item that is validated by the experts or validators. Overall, the results of the validation of learning devices carried out by the validator show that the learning devices prepared by the researcher obtain a general assessment are said to be valid. Based on the results of the validation, the researcher implements those learning devices in this study. The learning outcomes test uses an objective test (multiple choice), then validated using 4 criteria, namely the test validation using the two expert test tabulation matrix, the test item validation is analyzed by correlating the item scores with the total score obtained by the response, the instrument reliability using KR-20, the level difficulty, and difference power test. At the end of the meeting, the experimental class (CTL learning and authentic assessment) is compared with the control class (conventional learning and authentic assessment) to observe a significant difference to the CTL learning which is combined with the authentic assessment and the conventional learning is combined with the authentic assessment. The instrument used to measure the students' learning outcomes in this study is in the form of a test instrument for the Science learning outcomes. This test is in the form of an objective test of multiple choice. The students will obtain a score of 1 if they answer correctly and a score of 0 if they answer incorrectly. The dimensions used follow the revised bloom taxonomy, namely remembering (C1), understanding (C2), implementing (C3), analyzing (C4), evaluating (C5), and creating (C6). Before using the instrument, content validity test, item validity, test reliability, different power, and test difficulty level are conducted. To determine the content validity, it is carried out by the judges. The instrument that has been assessed by the judges; then, it will be tested in the field. The test of instrument aims to determine the validity and reliability of the instrument, difficulty level, and difference power of the test instrument of the learning outcomes. The data analysis technique used to test hypothesis 1 and hypothesis 2 is the one-way ANOVA technique, the hypothesis test 3 uses the two-way ANOVA technique, for the hypothesis test 4, hypothesis 5, hypothesis 6, and hypothesis 7 use the technique of t-Scheffe test.

The value of Hypothesis 1 is 7.40, there is a significant difference between the students who attend the CTL learning model and the students who attend the conventional learning model. The value of hypothesis 2 is 9.23; there is a difference in science learning outcomes between the students who take the performance assessment and the students who take the project assessment. Hypothesis 3 value is 2.941; there is an influence of the interaction between the learning model and the assessment model used on the science learning outcomes. Hypothesis 4 value is 7.5; there is a difference in science learning outcomes among the students who attend the CTL learning model between the students who attend the performance assessments and the students who attend the project assessments. The value of hypothesis 5 is 4.11; there is a difference in science learning outcomes in the students who take conventional learning model, in which it is between the students who take performance assessments and the students who take the project assessments. The value of hypothesis 6 is 8.91; there is a difference in the science learning outcomes among the students who take the performance assessments, in which it is between the students who take the CTL learning model and the students who take the conventional learning model. The value of hypothesis 7 is 5.52; there is a difference in the science learning outcomes among the students who take the project assessment, in which it is between groups of students who take the CTL learning model and groups of students who take the conventional learning model.

3. RESULT AND DISCUSSION

Results

In this study, seven hypotheses are submitted. The hypotheses test in this study is carried out by means of a statistical method using One-way ANOVA formula and Two-way ANOVA, where there is a difference of science learning outcomes among the students who attend the CTL learning model and the students who attend the conventional learning model. The null hypothesis is successfully rejected, meaning that there is a significant difference between the students who take the CTL learning model and the students who take the conventional learning model. This review is based on the analysis results that indicate the F score of 7.40 with the significant value of = 0.01 (sig. < 0.05) and the average of students' science learning outcomes who follow the CTL learning model is higher than the science learning outcomes of the students who followed the conventional learning model. The difference in the achievement of science learning outcomes can be explained from a theoretical point of view between the CTL learning model and the conventional learning model where both have different characteristics. Another study that is in line with the results of this study is a study which it is elucidated that the implementation of the Contextual Teaching And Learning (CTL) approach in science learning can improve science learning outcomes (Tirtasari et al.,

2015). In this study, there are several differences in the learning outcomes of the students who attend the performance assessment and the students who attend the project assessment.

Table 1. Summary of one-way ANOVA

SV	JK	Db	RJK	F	p
Between A	1394.008	1	1394.008	9.23	< 0.05
In	17810.583	118	150.937		
Total	19204.592	119			

Table 1 shows the dependent variable learning outcomes has an F value of 9,23 with a significance value of 0,01 or less than 0,05. This shows that there is a difference in science learning outcomes between the students who take the performance assessment and the students who take the project assessment. In other words, the performance assessment is superior to project assessment in achieving the science learning outcomes. The performance assessment is a procedure that uses assignments or exercises to gain information about how a student is studying well (Oktaviani et al., 2014). The performance assessment is carried out by delivering tasks to the students, this assessment is carried out when the students conduct a discussion and deliver opinions so that thru this assessment the students feel appreciated for their opinions; thus, the students become motivated. Through the performance assessment, the students are accustomed to show performance in all matters both in solving problems, expressing opinions, discussing, and providing reasons for the answers given so that it will lead in improving the students' learning outcomes (Baker et al., 2010; Darling-hammond & Adamson, 2010; Hilliard, 2015). In this case, it does not mean that the project assessment is not suitable for assessing the students. The project assessment is an in-depth investigation of a real topic, where the students have the opportunity to apply their skills (Widiana, 2016). Based on the results of testing the third hypothesis from this study, it shows that there is an influence of the interaction between the learning model and the assessment model used on science learning outcomes. This review is based on the results of the analysis which shows that the significance value is < 0,05 and the average of students' science learning outcomes indicates that it interacts between the learning model and the assessment model.

Table 2. Summary of two-way ANOVA of Science Learning Outcomes

SV	JK	Db	RJK	F	p
Between A	23,588	1	23,588	4,900	< 0,05
Between B	193,455	1	193,455	6,583	< 0,05
Interaction A*B	220,488	1	220,488	2,941	< 0,05
In	8208,433	106	77,44	-	-
Total	805156,000	110	-	-	-

From the calculation results of two-way ANOVA (Table 2), it can be concluded that: the testing of the third hypotheses, the null hypothesis is rejected and the alternative hypothesis is received (the analysis results: the significance value of "learning model*assessment model" (A*B) = significance < 0.05). It means that there is an influence of significant interaction between the learning model and the assessment model, in which it can be illustrated thru Figure 1.

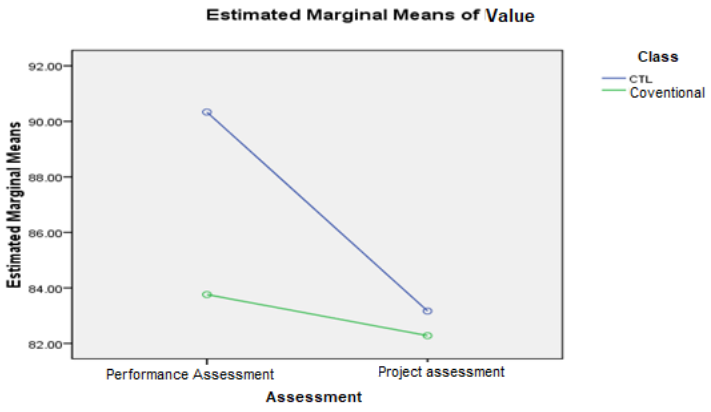

Figure 1. Interaction between the learning model and assessment model that is used to the Science learning outcomes

This study shows the influence of the interdependence relationship between the learning model and the assessment model on science learning outcomes. These findings provide information that the data from this study support the truth of the hypotheses proposed. The conclusion is strengthened by the acquisition of an average value, which indicates a reciprocal effect. The findings of this study are also in line with research that the interaction between the learning model and the assessment model has an influence on science learning outcomes (Anggreni et al., 2014). The results of the t-Scheffe test calculation get a score of Q-table (0,05) = 1,98, Q-value = 7,5; thus, the Q-value > Q-table. This means that Ho is rejected and H1 is received; hence, it can be understood that there are differences in science learning outcomes among the students who take the CTL learning model, in which it is between groups of students who take performance assessments and groups of students who take the project assessments. The results of the calculation of the sixth hypothesis using the Scheffe t-test get a score of Qtable (0.05) = 1.98, Qcount = 8.91, so that Qcount> Qtable. This means that Ho is rejected and H1 is accepted. Thus it can be understood that there are differences in science learning outcomes among students who take the performance assessment between groups of students who take the CTL learning model and groups of students who take conventional learning models. The results of the calculation of the seventh hypothesis using the Scheffe t-test get a score of Qtable (0.05) = 1.98, Qcount = 5.52, so Qcount> Qtable. This means that Ho is rejected and H1 is accepted, so it can be understood that there are differences in science learning outcomes among students who take project assessments between groups of students who take CTL learning models and groups of students who take conventional learning models.

Discussion

In fact, the performance assessment and the project assessment are the authentic assessment, yet both of them provide different results. This is due to each assessment that has advantages and disadvantages of each (Dikli, 2003; Quansah, 2018; Rukmini & Saputri, 2017). The performance assessment is a tracing process in a product and the project assessment is an in-depth investigation about a real topic. That is where the advantage of performance assessment is when it is implemented (Davey et al., 2015; Edmunds, 2006; Habók & Nagy, 2016; Memari et al., 2013; Searls et al., 2002). Especially if it is combined with the CTL learning model, it can make the students think critically in dealing with the problems (Firdaus et al., 2015; Hakim et al., 2018; Haryati, 2017; Lestari et al., 2019; Shavelson et al., 2019; Wahyuningtyas & Wuryadi, 2018). There is a difference in science learning outcomes among the students who take conventional learning model, in which it is between groups of students who take the performance assessments and groups of students who take the project assessments. The results of t-Scheffe test obtain a score of Q-table (0,05) = 1,98, Q-value = 4,11; thus, the Q-value > Q-table. It means that the Ho is rejected and the H1 is received so that it can be understood that there is a difference of science learning outcomes of the students who take the conventional learning model, in which it is between the groups of students who take the performance assessment and the groups of students who take the project assessment. The conventional learning model is a learning model that often uses lecture method. The teachers deliver their knowledge to the students by using a lecture. While the performance assessment is used to assess the achievement of competencies that require the students to perform certain tasks, such as laboratory practice, presentations, and discussions. This method of assessment is considered more authentic than a written test because what is assessed reflects the actual ability of the students.

The students who are given the project assessment get an opportunity to implement their knowledge and abilities. The implementation of project can be analogized by a story, in which it has initial phase, middle, and the end of project. The project assessment has advantages in case of the students that can plan for themselves about what to learn and how to do it. The project assessment drills the students to make a work plan; in this case, the meaning is clear (Armstrong & LeHew, 2011; Sánchez et al., 2006; Watt, 2010). The project assessment is an in-depth investigation about a real topic, where the students can get an opportunity to implement their skills. This means that the project assessment can be used to discover the understanding, ability to implement, ability to investigate, and the ability to inform from the students in certain lesson clearly (Widiana, 2016). It is different from the conventional method; the student activities receive more explanation of the correct answers on the tests that have been carried out. The students in this group will be happier to be given an explanation of the material by the teacher, in which it is by recording the lesson material without any active interaction from the teacher or between the students themselves. The students who have passive habits, rarely interact in the class, in accordance with the characteristics of the conventional learning model, where the students are more individual, and less interested in a discussion.

4. CONCLUSION

Departing from the hypotheses test, the conclusion obtained is the implementation of CTL and authentic assessment to the Science learning outcomes of 4th grade students of primary schools. This is due to the following results: there is a difference of learning outcomes between the students who attend the CTL and the students who attend the conventional learning; there is a difference on the students' Science learning outcomes who attend the performance assessment and the students who attend the project assessment; there is an interaction between the learning model and assessment model used to the Science learning outcomes; there is difference of the students' Science learning outcomes who attend the CTL learning model, in which it is between the groups of students who attend the performance assessment and the groups of students who attend the project assessment; there is a difference of Science learning outcomes on the students who attend the conventional learning, in which it is between the groups of students who attend the performance assessment and the groups students who attend the project assessment; there is a difference of Science learning outcomes on the students who attend the performance assessment, in which it is between the groups of students who attend the CTL and the conventional learning; and there is a difference of Science learning outcomes on the students who attend the project assessment, in which it is between the groups of students who attend the CTL learning model and the students who attend the conventional learning. For the education practitioners, learning models and assessments should be implemented according to the characteristics of the material, and the abilities of students and it can build good communication and interaction with students as well; thus, the entire learning process can be well received by the students.

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