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The impact of using LINE@ on the cooperative learning to improve the critical thinking skills of high school students

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Abstract. The widespread use of social media enables new opportunities in various fields including in education. This study aimed to determine the influence of social media usage, in this case, LINE@, on cooperative learning environment to improve critical thinking skill. This research was conducted on Year 11 students on physics, especially for Elasticity subject. The method used in this research was the quasi-experiment with pretest-posttest controlled group design. The independent variable of this research was learning strategy. The dependent variable was critical thinking skill measured by essay. The covariates used were prior knowledge measured by multiple-choice questions. Statistical analysis technique used ANCOVA with the error margin of 5%. The results showed that students who received cooperative learning using LINE@ tend to have better critical thinking skills after learning compared to conventionally taught students. Prior knowledge can be used as a predictor to examine the level of critical thinking skills. The contribution of previous knowledge was relatively small indicating that the role of learning strategy was relatively high in influencing the improvement of critical thinking skills.

1. Introduction

Social media is now days being utilized in various fields with higher and higher intensity from time to time. The users of social media in Indonesia are increasing each year [1]. There is a tendency that societies get more comfortable with using social media in their activities. School-age children, who are digital natives, even get more comfortable in using telecommunication media rather than adults who are digital immigrants [2]. This situation also occurs in the school environment where most students use the smartphone in their daily activities. Most activities that use the smartphone are through social media [1]. It becomes opportunities for educators to develop more comfortable and flexible learning for students by utilizing social media.

The use of social media surely gives both positive and negative impacts on students. On the negative side, social media activities open the potential for a cyber-bullying, online harassment [3], negative word of mouth [4] and others. Accompaniment and teaching for normal internet usage need to be carried out by educators to mitigate those impacts. On the positive side, numbers of researchers find out the result of learning by utilizing social media on various subjects at school [5,6,7]. Review of



the result show there is many positive aspects. However, among the researchers, there are only a few numbers of research that utilize social media for cooperative learning that encourage higher order thinking skills improvement. Therefore, this study is famous as the learning demand-oriented in 4C (critical thinking, creativity, communication, and collaboration) as addressed by UNESCO.

Various studies on cooperative learning (CL) showed that STAD type (Student Teams Achievement Division) is relatively more prominent compared to other models for various reasons. The implementation of this strategy in multiple fields showed the excellent result [8,9,10]. It is possibly because this strategy is relatively practical and consistent with the teaching philosophy. Therefore, this strategy has broad generalization level on the outcome. In today learning active development, learning strategy with STAD has the potential for being able to improve learning performance related to 4C.

Considering new opportunities in a better learning practice by utilizing social media and cooperative learning strategy, this research aims to determine the influence of learning strategy towards critical thinking skills if observed from prior knowledge. The researchers expect that this research will contribute to learning practice which meets current student's needs that relatively have the different focus on demand for learning outcome performance.

2. Method

2.1. Participants

Participants of this research were Year 11 Science students. The study was conducted on physics subjects on the topic of Elasticity in the academic year of 2017/2018 in Yogyakarta Special Province, Indonesia. The location of the school is in the suburban area. Generally, the parent's income level is from middle to low-class society. The school quality in this area is in average level indicated from the scoring average of students' national examination from year to year. Even though in the suburban area, teachers and students at the school have smartphone used in their daily life including for social media activities. Thus, students have understood how to use Line@. Teacher and students' understanding to use this application becomes an important part to ensure the internal validity of the research process.

2.2. Research design

This research is quasi-experiment with post test only controlled group design. Since student's randomization was technically impossible to be done, randomization was only conducted when choosing classes as a control and treatment group from 5 classes (156 students). Sampling for control and treatment group was taken by using simple random sampling technique. Control group consisted of 31 students and treatment group consisted of 32 students. To ensure internal validity, students considered in the research were only ones entirely attended all learning activities. Ones who did not fully participate in all actions were taken out from the research sample.

In control group, students were taught with the conventional method by using the textbooks at school while in the treatment group, students were taught with cooperative learning strategy, which in this research was STAD (student team achievement division) by using, by Line@. Thus, in treatment group blended learning was carried out by combining face-to-face learning at the classroom with independent activities and enrichment via Line@. The research variables were learning strategies as the independent variable, critical thinking skill as the dependent variable, and prior knowledge as covariates.

2.3. Material and learning activities

Line@ is a social media application that can be used on both computer and smartphone. This application can be downloaded via Play Store on an Android smartphone or link <https://line.me/en/download>. Students and teacher can independently install this application on their device to be used for learning. To run this application, teacher and students should register to have an account to use in social media activities.

In conducting learning, the teacher prepared a lesson plan which had been validated, so it met the learning objective. Learning strategy in treatment class was cooperative learning with STAD type. This strategy is relatively a simple strategy but good for encouraging teamwork. On Elasticity material, student's groups were given various information and problems which could be accessed on their Line@ account. Class activities were used to discuss among groups and confirm students' understanding by the teacher. The stages of learning implementation with STAD type by using Line@ were the modification of what had been developed by [11], as follows:

- At the first meeting, the teacher explained the learning objective and delivered a preface related to the learning process.
- Next, the teacher divided students into small groups consisting of five or six students (6 groups) which were heterogenetic concerning previous learning achievement and sex. These groups remained until the end of learning.
- During the learning process, the teacher and students interacted by using Line@. The teacher posted subject material, assignment, and quiz on Line@. During the lesson, students could have the discussion, and the result was also posted on Line@.
- At every end of lesson season, the teacher gave a quiz or question to be finished individually according to the material that had been learned in group. The result was submitted to be compared to the previous score.
- This individual score would contribute towards their group's score. At the end of the meeting, the teacher announced each group's score and gave appreciation to improve students' learning motivation.

2.4. Data collection and analysis

The data of critical thinking skill was taken by using five essay questions. The questions were scored based on the stages of solving a complex problem related to Elasticity. The questions were developed with the reference of taxonomy bloom on the level of C3 and C4. Before used, the questions had been tested on item discrimination, the degree of difficulty, validity, and reliability.

The data analysis used parametric statistic by considering data normality and homogeneity. Next, the data was analyzed using Covariance or ANCOVA to find out the significance of the learning strategy influence towards critical thinking skills and the covariate as the predictor.

3. Result and discussion

3.1. Result

Learning activities with Line@ enable higher interaction between students and the teacher without being known by other students. With this application, the teacher can give different focus portion for each student. Some screenshots of activities between student and teacher, student and another student are shown on Figure 1.

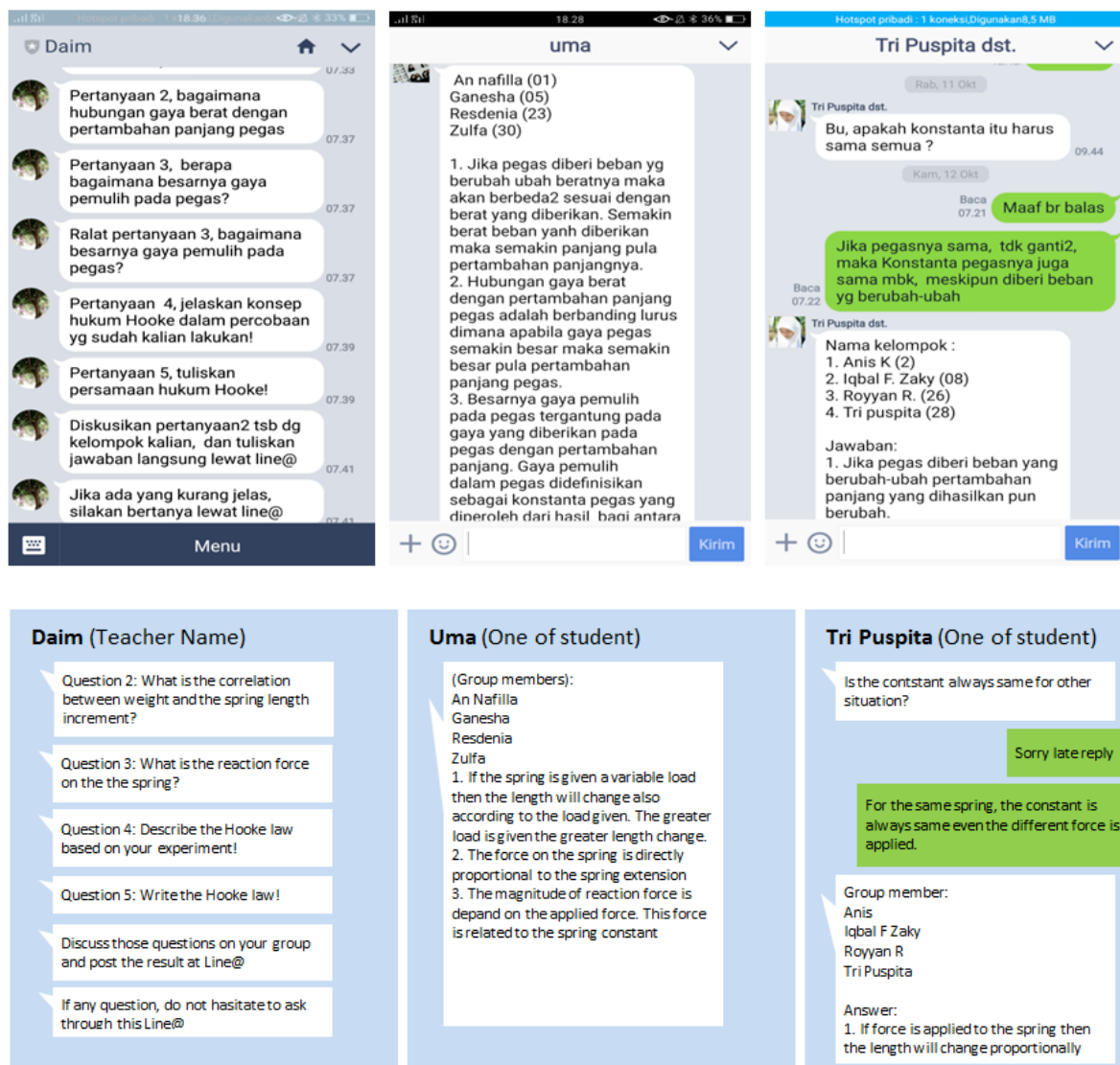


Figure 1. The screenshot of some activities on Line@ (above) and its translation in English

The measurement data of critical thinking skills in control and treatment group was then analyzed with descriptive statistic and ANCOVA. Table 1 shows the result of the descriptive statistics. It is seen that CTS average score for treatment group (66.91) is higher than the score for the control group (59.87), while the standard deviation of treatment group is narrower (6.87) than the control group (14.1). These two findings become essential to the effect of cooperative learning by using Line@ at class. There is a tendency that treatment group consisting of students who study Elasticity with cooperative learning by using Line@ tend to have better critical thinking skills after learning. Also, in the whole group, the distribution of critical thinking skills seems to be similar among students at the end of learning. This similarity can be identified from the standard deviation of treatment group which is smaller than the control group (students who studied conventionally). The difference of standard deviation also shows that at the end of learning both groups become heterogeneous groups. This heterogeneity can be identified from the result of the test of homogeneity of variance with Levene's statistic ($F = 28.91$; $p = 0.002 < 0.05$).

Table 1. Descriptive statistics dependent variable: CTS after learning

Learning Strategy	Mean	Std. Deviation	N
Conventional	59.8710	14.10140	31
Using LINE@	66.9091	6.87097	33
Total	63.5000	11.45592	64

The ANCOVA test on the error margin of 5% was conducted to find out a difference of CTS score between the control and treatment group, and whether prior knowledge could be used as a predictor. The dependent variable was the CTS score, and the independent variable was the learning strategy. The test result is shown in Table 2.

Table 2. Tests of effects between-subjects, dependent variable: critical thinking score after learning

Source	Type III sum of squares	Df	Mean square	F	Sig.
Corrected Model	1435.177 ^a	2	717.588	6.406	.003
Intercept	1.702	1	1.702	.015	.902
PreK	643.388	1	643.388	5.744	.020
LS	1146.381	1	1146.381	10.234	.002
Error	6832.823	61	112.013		
Total	266332.000	64			
Corrected Total	8268.000	63			

a. R Squared = .174 (Adjusted R squared = .146)

The results indicate that there is a significant difference in the average score of critical thinking skills between the control and treatment group. This difference can be identified from the significant influence of learning strategy (LS) ($p = 0.002 < 0.05$). The learning outcome (CTS) of students taught with STAD strategy by using Line@ is significantly higher than the conventional one.

3.2. Discussion

The result of statistical data processing shows that traditional learning is relatively less effective in improving critical thinking skills in physics compared to learning with STAD strategy by using Line@. This finding is parallel to the other research on physics learning using cooperative learning [12,13] and learning using social media [7,14,15]. Some factors are influencing this difference in learning outcomes. Cooperative learning, which was designed to encourage social interaction among students, tends to support information sharing among students during the learning process [16]. This information sharing occurs when students among groups discuss solving problems.

During the discussion, students will get feedback on their understanding from other students. This feedback will influence the change of perception of students on the idea they have. Higher interaction in STAD learning also motivates students in learning, and it does not happen to students in traditional learning. High motivation tends to improve student's learning outcome at the end of the learning process [17,18].

The level of student's comfort in interaction by using Line@ also becomes a factor that makes students get more natural and more comfortable in delivering the idea. In traditional learning, there is a tendency that students feel reluctant to provide their opinion because of various communication obstacles in their learning environment. It is different from when they write their idea on Line@. They tend to be more self-confident. From this process, it seems that students on learning with this strategy can show better learning outcomes in critical thinking skills. Nowadays, the technology has given high impact to the learning philosophy and practices [19,20] for better student performance.

4. Conclusion

This study shows that learning strategies influence the learning outcomes. Students who are taught with STAD learning strategy by using Line@ have higher critical thinking skills after learning compared to students taught conventionally. This research also reveals that interaction in STAD learning by using Line@ improve the level of students' critical thinking skills, although it is undeniable that their learning outcome is also influenced by their prior knowledge. These research findings support the notion that social media has great opportunities to be used on cooperative learning to improve student's learning performance in various aspects.

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