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The Effect of STAD and TPS Integration in Biology Learning Toward the Students Cognitive Achievement

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This research was undertaken to examine the effect of the Student Team Achievement Divisions (STAD) and Think Pair Share (TPS) integration strategies in biology learning of ecology toward the cognitive achievement of biology; the difference between higher and lower student ability in biology learning. The method design of the research was a pretest-posttest non-equivalent control group with 2x2 factorial. The study was conducted in senior high schools in Metro City. The research result showed that there is an effect of STAD and TPS integration models in biology learning of ecology toward cognitive biology achievement. There is no difference between higher and lower student ability in cognitive performance because lower ability students could reach the result scaffolded by upper ability students. This suggests that teachers need to implement STAD and TPS integration in biology learning. Teachers are also expected to empower the difference of academic ability in the learning group.

Keywords: *Academic Ability, Cognitive Achievement, Cooperative Learning, STAD, and TPS.*

Introduction

Since the 2013 Curriculum was implemented in Indonesia schools, all of the teachers need to enrich teaching capability and skills, teaching paradigm moves to a learning paradigm, from teacher-centered teaching to student-centered learning. All of those demand and challenge teachers to activate and empower students to learn actively, creatively, and innovatively. Competency-based education is expected to accommodate all essential education components and teaching paradigm-change. The attempt to develop knowledge with education quality improvement is interconnected with the effort to empower students' potential. The teaching done in the classroom should be able to improve, allowing the students' activities and creativity to flourish. Students, as unique and different personalities, have different academic competencies from each other. These differences should be acknowledged through teaching and empowered to obtain processing improvement and learning achievement.

The reality of education, especially learning programs, improvement in Indonesia, for the time being, has not reached the desired expectation in which the education quality is still low as viewed from the national exam scores. The contemplation towards the reality and empirical fact in the Metro City conducted by Muhfahroyin (2007; 2008) indicates that education has not obtained the adequate success seen from the learning process and learning results. The students' learning result of all senior high school students in Metro City is seen to be low. It has not reached yet the 75% fulfilling minimally **c**ompleted **c**riteria (KKM); the classic completeness only gains 54% (Muhfahroyin, 2008). The students' academic competencies in the class are different from each other in which the teacher does not pay much attention to them in the learning process. The learning strategies applied by the teacher have not accommodated all students' academic competence characteristics. Therefore, the gap between high capability and low capability students is still vast.

Based on the national education reality, especially the education in Metro mentioned above, an attempt is required to investigate the learning strategies as one of the education components which contribute to a constructivist and learning community such as *cooperative learning* (Kusuma & Darmawan, 2019; Muhfahroyin, 2009a; 2009b). The collaborative learning strategies have various types that can be adapted and develop, for instance, Student Team Achievement Divisions (STAD) and Think Pair Share (TPS). STAD is a simple cooperative learning type that can help teachers who have not been familiar with applying collaborative learning (Arends, 2004; Damopolii & Rahman, 2019). All of the strategies need to use students centered learning. According to Ridlo and Alimah (2013), the student-centered learning of environmental exploration may be conducted using active- and cooperative-based strategies. Examples of these strategies are contextual learning, participatory learning, and inquiry learning.

The previous researcher indicates that Student Team Achievement Divisions (STAD) strategies help students improve learning prestige, desire, learning activity, motivation, and cooperation

in the group. This leads students to solve the problem more quickly in idea science learning and social learning (Lamba, 2006; Parno, 2012); compared with lecturing learning and several other strategies, STAD provided beneficial effects (Hasan, 2011; Purnawan, 2018).

In line with the STAD strategy, cooperative learning TPS type in its syntax yields opportunity to students to think deeply about questions given by the teacher, further students discuss it in a group or pairs and share their ideas (Arends, 2004; Kusuma & Darmawan, 2019). TPS strategy provides students use of waiting time well to sharpen logical thinking thtough of the problems or questions given by the teachers (Allen and Tanner, 2002). Previous research shows that the TPS strategy helps students improve learning prestige, critical thinking, desire, and cooperation in the group (Amnah, 2011; Hasanah, 2011). Concerning lecturing learning and Numbered Head Together, the TPS strategy gives better effect (Suripah, 2012; Kamagi, 2013; Pantiwati, 2012).

STAD and TPS syntaxes, as cooperative learning strategies, have different emphases. STAD strategy reveals opportunities for the teachers to provide information to give students a task for working in a group (Andariana, Zubaidah, Mahanal, & Suarsini, 2019). Whereas, TPS strategy emphasizes individual thinking, discussion, pairs, and sharing between the class members. Based on the rationality of STAD and TPS strategies viewed from advantages and syntaxes of each approach, the researcher conducting research applying STAD and TPS integration in Metro City. Furthermore, the researcher could analyse the effect of the STAD and TPS integration toward the cognitive achievement of biology to better understand the difference between higher and lower students' ability toward the cognitive performance of biology (Firetto & Meter, 2018; Müller & Wehner, 2010).

Methods

Time and Location

The research was conducted at state and private Senior High Schools in Metro City in odd semester academic years in 2017.

Population and Sample

The research population deals with students of class X of state and private senior high schools in Metro City. Sampling was conducted by using simple randomized sampling to determine the school which were used as research locations. From these locations, the researcher obtained two schools. Each school took two classes, and each category at each SMA is used to display the STAD and TPS integration and lecturing strategy. Learning with STAD and TPS was integrated with STAD and TPS learning steps. It can explain that when the students conducting learning in the small groups, they are performing TPS steps, namely Thing, Pair, and Share.

The average for each class is 33-36 students. Students at each strategy taken 33.3% (23 students) of higher ability students and 33.3% (23 students) of lower ability students, so the total samples are obtained, 92 students. Grouping of the students' academic ability is based on the final national exam scores.

Data Collecting

The instruments exerted to measure dependent variables in this research is a test, applied to show cognitive learning result data. The data collection steps in this research consist of pretest and posttest.

Data Analysis

To analyze the student's cognitive achievement in the research, ANCOVA was used. After that, to advance the test conducted by Least Significant Differences (LSD) analysis (Sujana, 1994;). Statistical analysis is supported by software *SPSS 14 for Windows*, performed with the level of significance 0.05 ($p<0.05$). Before the hypothesis test was conducted, a normality and homogeneity test was done. The normality test used the One-Sample Kolmogorov-Smirnov test, while the homogeneity test used Leven's Test of Equality of Error Variances (Sujana, 1994; Winarsunu, 2007). The average scores of descriptive analysis were used to describe the profile of cognitive achievement in biology learning.

Research Design

The design of the research was a quasi-experiment, design of the study conducted by pretest-posttest nonequivalent control group design 2 x 2 factorial.

Results and Discussion

The average scores of pretest and posttest learning results, together with their categories, can be explained as follow. The average of pretest learning results for all groups of research subjects was categorized unsatisfied for the integrations of STAD and TPS, lecturing strategies, high ability, low ability, interaction of STAD and TPS integration with high academic ability, communication of STAD and TPS integration with little capacity, lecturing strategy with high strength, and lecturing strategy with low knowledge. The average of posttest learning results for STAD and TPS integration of the research subjects was categorized ‘very well’. In contrast, the interaction of STAD and TPS integration with low ability was categorized is ‘good’. Referring to Slavin (1995), in the cooperative learning model, especially STAD and TPS type, students are assigned to 4 to 5 members in a group that are mixed in academic ability, gender, and ethnicity.

The average of posttest learning results for the interaction of lecturing strategy with high ability was categorized ‘well’, so was the interaction of lecturing strategy with low ability—the average of posttest learning results are presented in Table 1.

For the learning strategy source obtained p-level < 0,05 (p<0,005) with Sig. 0,000. Ho states, "There was no effect of learning strategy towards cognitive achievement,". As such Ho is not accepted. Therefore, the research hypothesis stating, "There was an effect of learning strategy towards cognitive achievement” is accepted. The average scores of cognitive achievement of the students through the STAD and TPS integration were higher than the average scores of student cognitive achievement through lecturing strategy. When stated in percentages, biology learning with STAD and TPS integration has the average scores of students' cognitive achievement corrected 16.35%, which is higher than biology learning using the lecturing strategy.

In relation to the students’ academic ability, source obtained p-level <0.05 (p<0.005) with Sig. 0.314. It means Ho states, "There was no difference in cognitive achievement between students' having the high ability and low ability", and this is accepted. As a result, the research hypothesis stating that, "There was a difference of cognitive achievement between students ‘of cognitive learning achievement having the high ability and low ability" is not accepted.

For the interaction of learning strategy and academic ability, the source obtained p-level < 0.05 (p<0.005) with Sig. 0.937. This means Ho, "There was no effect of interaction between STAD and TPS integration with the academic ability of biology cognitive learning achievement", is accepted. Therefore, the research hypothesis stating, "There was an effect of the interaction of between STAD and TPS integration with the academic ability of biologically cognitive learning achievement” is not accepted. The average scores of students’ cognitive learning achievement from higher to lower respectively on the interaction: 1) STAD and TPS integrations with higher ability, 2) STAD and TPS integrations with low capacity, 3) lecturing strategy with higher strength, 4) lecturing strategy with little knowledge. The average scores of cognitive achievement of the students through the interaction STAD and TPS integrations with higher ability was 1.34% higher than the average scores of student cognitive achievement through the interaction STAD and TPS integrations with in-depth knowledge.

The research result indicated that STAD and TPS integrations significantly affect students’ cognitive learning achievement. Students learning through STAD and TPS integrations underwent higher average score improvement of cognitive learning achievement than students learning through the lecturing strategy. The development of cognitive performance can be seen from the average scores improvement of cognitive learning achievement before treatment (pretest) compared with the average scores of cognitive learning achievement after surgery (posttest). When the corrected average scores were discussed, students learning through STAD and TPS integrations was higher than those who learned through the lecturing strategy.

The research result indicated that learning conducted by STAD and TPS integrations significantly affects the students' cognitive learning achievement. The development of conducted learning achievement can be known from the average scores of cognitive learning achievement before treatment (pretest) compared with the average scores of cognitive learning achievement after implementation (posttest) (Purba, 2015; Syafiq & Rahmawati, 2017). In other words, students learning through STAD and TPS integration strategies had higher average scores of cognitive learning achievement than those who learnt through the lecturing strategy.

The research result above correlate with previous research about the implementation of STAD (Lamba, 2006; Parno, 2012). Previous research indicated that learning through the STAD strategy could increase students' cognitive learning achievement. The research results of this study also correlate with the previous analyses about the implementation of TPS (Amnah, 2011; Hasanah, 2011; Suripah, 2012; Kamagi et al., 2013), stating that learning through TPS strategy could increase students' cognitive learning achievement. After being integrated, STAD strategy syntax, and TPS strategy syntax, were both able to improve the average scores of students' cognitive learning achievement significantly.

The average score improvements of this cognitive learning achievement were interconnected with the characteristics of STAD, and TPS integrations syntaxes develop by the researcher of this study, because all of TPS, namely thinking, pairing, and sharing, could give reinforcement to the STAD syntaxes. Through the STAD strategy, the teachers referring to the student's workgroup provide new information every week to the student verbally or through text. Students in a class were divided into group work with 4-5 students, and each group had heterogeneous members consisting of males and females who were from various tribes, having high, mid, and low abilities (Ibrahim et al., 2000; Lord, 2001). All group members work cooperatively with active learning. Working by group conducted through STAD was integrated with TPS steps: thinking, pairing, and sharing, so that group working empowerment ability appears through TPS strategy empowerment. Students' active participation in this integrated learning strategy could improve achievement. Therefore students involved in the learning process through STAD and TPS integration strategy had higher average scores of students' cognitive learning achievement than those who learned through the lecturing strategy. Both STAD and TPS are cooperative learning strategies which can be ussed to learn ecology material by using contextual learning. According to Ridlo and Alimah (2013), the student-centered learning of environmental exploration may be conducted using active-based and cooperative-based strategies.

Learning through STAD and TPS integration emphasized the material presented by the teachers, and this material is reinforced by group work. Group members work together using the activity sheets or other sets of learning in completing the learning materials. Then they help each other understand the learning materials through the tutorial, quiz, and discussion. Group

work is performed by focusing on individual *thinking*, twice *pairing, and sharing* by the presenter to other students. They are cooperating well in the group indicated by guidance to the students having higher and low academic abilities via either *pairing* or *sharing*, which raises the process of *scaffolding*. Through the scaffolding in the group work, the students will help each other to complete work and solve the problems in their learning.

This learning has several perspectives that can be developed, such as motivation perspectives, social, cognitive, cognitive elaboration, and psychology (Arends, 2004; Hijriyah, Darmawan, & Zamzami, 2018). The learning process with STAD and TPS integrations fit the constructivist learning paradigm focusing on the development of students' ability to discover the problems of the answers being investigated (Armstrong, 1998; Parno, 2012). STAD and TPS are kinds of cooperative learning. Furthermore, Ridlo and Alimah (2013) state that student-centered knowledge can implement ongoing education and cooperative learning. Cooperative learning is a kind of active learning—students learning in a collaborative group to perform their tasks, research projects, and sharing their achievement.

The academic ability did not affect the students' cognitive learning achievement factually. The result of this research showed that the students having higher theoretical knowledge on the average scores of cognitive learning achievement was almost similar to those having low academic ability because lower ability students could reach the success through *scaffolding* by higher ability students in the group. The result of this study did not correlate the previous research perform by Tindangan (2006), which stated that students having higher and low academic abilities were given similar learning treatments; that's students would have different cognitive learning achievements that were based on their academic learning level. The studies conducted by these researchers concluded that the students having high academic abilities obtained more top cognitive learning achievements than those who had low academic skills. In other words, the implementation of STAD and TPS integration in the learning can scaffold the lower students' academic ability to equal the higher students' academic ability.

The result of the ANCOVA test indicated that the interactions between the learning strategy and the academic ability were not affected factually towards the cognitive learning result because lower ability students could reach the achievement scaffolded by higher ability students. This happened because there was no significant difference in the students' cognitive learning result through the effects of learning strategy and academic ability. Even though the result of the ANCOVA test was not substantial towards the learning strategy and the theoretical knowledge, the corrected average scores of the cognitive learning result had significant differences.

The STAD and TPS integration interactions of the high academic ability had the corrected average scores of cognitive learning results, which were more senior and more significant differences than those of the STAD and TPS integration learning interactions of the low academic

ability. The STAD and TPS integration interactions of the high and low academic skills had significantly corrected average scores of the cognitive learning result than those of the academic ability. The interactions of lecturing strategy, having the corrected average scores of cognitive learning results, were lower than those of the STAD and TPS integration interactions for either ability levels. The ANCOVA test indicated that the STAD and TPS integration improved the corrected average scores of high capacity towards the posttest compared with the pretest, and so were the corrected average scores of the lecturing strategy.

The further investigation of the corrected average scores of cognitive learning ability indicated that the STAD and TPS integration interaction of the higher academic knowledge had more significantly corrected average scores of cognitive learning result than that of the lecturing strategy of lower academic ability, but their discrepancies were different. This case indicated that the STAD and TPS integration could better improve the cognitive achievement that could help minimize the distance between high and low students' abilities. The different skills of high and low students' capabilities of the cognitive learning results that were not significant did not support the theory and the results of the studies conducted by previous researchers (Karmana, 2011). Previous research concluded that students with high ability tended to obtain more significant learning achievement than those who were low ability.

However, the results of this study supported the research findings done by Lord (2001) and Karmana (2011) by saying that cooperative learning potentially improves students' thinking ability and cognitive learning achievement of the high students' ability compared with the low students' knowledge. The critical finding of this study that could be taken was that the cognitive learning achievement improvement of the 'low ability' students' had increased significantly. Therefore, the mastery learning criteria (KKM) that had been determined before by the teachers could be completed by all high and low students' abilities. This case was significantly affected by the remedial program that was carried out. Therefore, all students who have already obtained the completed learning did not need to attend the therapeutic teaching program. Constructivist learning of STAD and TPS integrations had previously been able to overcome the problems in deleting the remedial teaching program for the low ability students.

The high students' ability of STAD and TPS integration interactions had more significantly corrected average scores of cognitive learning achievements than those of the 'low' students' knowledge. The interactions of STAD and TPS integrations with high and low students' abilities had more significantly corrected average scores of cognitive learning achievement than those of the lecturing strategy with high and low students' skills. The top students' knowledge of lecturing learning had more significantly corrected average scores of cognitive learning achievements than those of the 'low' students' ability.

The average scores of the students' cognitive learning ability of the STAD and TPS integration interactions to the high students' ability were more significant (1.34 %) than those of low students' knowledge. The further inquiry of mastery learning criteria (KKM) that had been determined before by the teachers indicated that the mastery learning criteria (KKM) could be obtained by all high and low students' abilities. This finding could be used as the primary recommendation to achieve the learning completeness, and the teachers should not carry out the remedial teaching program. Still, it could be anticipated with the learning implementation that empowered the students effectively and efficiently.

Conclusion

Based on the results of the research, it can be concluded that: 1) there was an effect of the learning strategy towards cognitive learning achievement. 2) There was no difference in cognitive learning achievement of the high and low students' abilities. 3) There was no effect between the learning strategy interaction and academic ability towards cognitive learning achievement. Based on the research result, it can be suggested that the teachers need to implement STAD and TPS integration. This implementation is expected to improve the academic ability in biology learning. Implementation of the STAD and TPS integration can improve all of the teacher's capability of implementing biology learning; students' cognitive achievement can be better qualified through use of STAD and TPS.

Table 1. Pretest and Posttest Scores Average of the Cognitive Achievement of Biology Learning.

No.	Variable	Pretest	Category	Posttest	Category
1	STAD and TPS Integration (I)	36.73	Low	81.62	Very Good
2	Lecturing (K)	38.67	Low	77.18	Good
3	Higher Ability (KA)	41.38	Low	78.36	Good
4	Lower Ability (KB)	43.21	Low	72.68	Good
5	The interaction I - KA	40.75	Low	82.92	Very Good
6	The communication I - KB	29.47	Low	77.62	Good
7	Interaction K - KA	31.69	Low	63.79	Good
8	Interaction K - KB	37.83	Low	61.37	Good

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