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THE INFLUENCE OF PHYLOGENY TREE-ASSISTED TPS OF INVERTEBRATA MATERIALS TOWARDS STUDENTS' COGNITIVE LEARNING RESULTS AND CRITICAL THINKING ABILITY

Yulia Hafsah Wulandari✉, Supriyanto, Bambang Priyono

Department of Biology, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Semarang, Indonesia

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Abstract

Efforts to improve the critical thinking skills of students of SMAN 1 Bae Kudus in meeting the rules of Graduate Competency Standards required communicative learning model in order to stimulate ideas and mental namely models TPS (Think Pair Share). This study aims to determine the effect of phylogeny tree-aided model. The research objectives include the class X second semester of the 2015/2016 academic year. Class sample is X MIPA 1 (experimental class) and X MIPA 4 (control class) with a convenience sampling technique. The study design using posttest only controls group design. The results of descriptive teacher responses indicate TPS models make the discussion more effective and more active for student. with good-excellent category on the positive statement. Activity of students in the experimental class as much as 78% of students are very active, the cognitive learning critical thinking high as 84% of students are very critical with classical completeness percentage of 90.6%. Researches by applying the model TPS-aided phylogeny tree have positive effect on the cognitive learning and critical thinking skills activity of students. Model TPS-aided phylogeny tree is effective and can be applied in learning activities invertebrate material.

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✉Corresponding author:
Yulia Hafsah Wulandari
Department of Biology, Faculty of Mathematics and Natural Sciences,
Universitas Negeri Semarang, Indonesia
D6 Building 1st Floor, Jl Raya Sekaran Gunungpati
Semarang Indonesia 50229
E-mail: yuliahafsah@gmail.com

INTRODUCTION

The Policy of Passing Competence based on Permendikbud No. 54 year 2013 states that students' passing qualifications include attitudes, knowledge, and skills should be completed to create students who are able to think critically to reach their lifetime success and able to solve problems in the future (Nawawi, 2015). The attempts done by SMAN 1 Bae Kudus to reach this is by implementing the use of scientific approach based on 2013 curriculum in the school with such criteria that can motivate and inspire the students to think critically, analytically, and correctly in identifying, understanding, solving problems, and applying learning materials (Prilianti, 2014). Based on the observation of the researcher during Internship program in SMAN 1 Bae in August-October 2015, it showed that the support of critical thinking to students has not been successfully achieved since teachers were still using factual and conceptual exercises.

One of the learning models which can be implied to improve that is using TPS (Think Pair Share). According to Ibrahim (2005), TPS learning model has three steps, including thinking, pairing, and sharing. Lie (2008) opines that TPS model provides students chance to work by themselves and optimize their participation in the learning process.

Some researchers have proven that TPS is positively influenced students in learning. Darmiyanti (2013), says that there is a significant and positive influence of think pair share model to physics concepts of wave and vibration. Other researches done by Hidayat (2013) prove that cooperative learning with think pair share method is more effective to improve students' activeness in class. The research related to critical thinking done by Herliani (2013) states that critical thinking of the students can be improved by using cooperative learning model.

This TPS model was planned to be applied in the invertebrate materials for X graders in the even semester. The materials which should be mastered include animalia's characteristics, classification, and animals' taxonomy levels with their role. The scopes of the materials were very much that attracts negative opinion from students since it has many things to memorize (Kusuma, 2011). Basically, invertebrates are related to the materials of biodiversity in the sub-material of living things classification in the odd semester. The relation of both materials can be a solutive way to ease the learning process of invertebrates through phylogeny tree (learning the characteristics of species using the relation of kinship). Based on the interview to biology teachers in SMAN 1 Bae, the implementation of phylogeny tree in invertebrate materials has never been done before. Thus, the students were not able to overcome the passing grades. It is proved from the observation to the school in 14th January 2016, showing that students' learning result in invertebrate materials is dissatisfying with 100% percentage of students who does not pass the grade in academic year of 2013/2014 and 92.75% in academic year 2014/2015.

These explanations strengthen the background of this research regarding the influence of phylogeny tree-assisted TPS model in invertebrate materials towards students' cognitive learning results and critical thinking. This research is hoped to be able to support the learning process and improving the quality of graduates from SMAN 1 Bae Kudus based on the passing qualification.

METHOD

The type of this research is Quasi Experimental Design with Post test Only Control Group Design. The sampling technique of this research used Convenience, the determination of sampling decision with statistical easiness. The samples of this research came from two classes, X MIPA 1 (experimental class with phylogeny tree-assisted TPS model) and X MIPA 4 (control class with discussions in big groups).

RESULT AND DISCUSSION

This research is used in SMAN 1 Bae Kudus, located in Jalan Jenderal Sudirman Km.4 Kudus. The data obtained in this research include the students' cognitive ability through students' cognitive learning results, critical thinking, and the execution of TPS model, students' opinion, and teachers' opinion.

This research is aimed to unveil the influence of phylogeny tree-assisted TPS model for invertebrate materials towards students' cognitive learning result and critical thinking.

According to Ibrahim (2005), TPS learning model has three steps, including thinking, pairing, and sharing. The result of the research proves that three TPS steps can be done based on the syntax. This statements is proved in Table 6 where the observation result on the execution of think, pair, and share in TPS learning model has fulfilled very good execution category with the percentage of 97-100%. Lie (2008) opines that TPS model provide students chance to work by themselves and optimize their participation in the learning process. This statement is proven in Table 7 regarding students' questionnaire result in the positive statement number 2 and 3 emphasizing on the behavior of the students while participating in the learning process. It obtains high data percentage of 100%, this number fulfills the very good category. The implementation of phylogeny tree-assisted TPS model is proven tohave positive value towards students' learning activity supported with cognitive learning results based on the research purpose.

Table 1. *Posttest*

Class	α	X^2 count	X^2 table	Conclusion
Experimental	0.05	2.29	5.99	Ho accepted
Control		5.58	7.81	Ho accepted

Normality Test

Students' cognitive learning results were obtained from the posttests based on table 3, ≥75% of experimental class' students' classical cognitive learning results who get phylogeny tree-assisted TPS model can pass the score of ≥76 from overall students. Meanwhile, control class had very low classical passing grade ability with 5.3%. This result is in line with the research done by Zuhara (2014). That is to say, the implementation of TPS in class can make the teachers get classical passing grade for more than 75% of the students. This classical passing grade ability proves that cooperative learning can improve students' academic achievement.

Table 2. T-test data from *Posttests* in Experimental and Control

Class	N	$\bar{x}$	t count	t table	Conclusion
Experimental	32	86.6	11.496	1.995	Ho rejected
Control	38	65.5			

Table 3. Students' Classical Passing Grade

Passing Grade	Classical Provision	Class	
		Experimental	Control
≥76	≥ 75%	90.6%	5.3%

The high result of classical passing grade in experimental class who get the application of phylogeny tree-assisted TPS model answers the problems stating that invertebrate material is difficult for the students since it has many things to memorze (Kusuma, 2011). Initial data of the observation shows that students' classical passing grade for invertebrate material in two academic years (2013/2014 and 2014/2015) improve significantly from 0-7.25% to 90.6%. The implementation of TPS model in invertebrate material assisted with phylogeny tree can be displayed using power point presentation. It gives students positive value in learning. This statement is correlated to the observation sheets of TPS steps execution levels stating that students are ready in following the learning activities or based on the syntax of motivation in the lesson plan of experimental class. In detail, 100% of students are ready to be involved in the learning process with very good category.

The classical passing grade ability for experimental class who get the TPS treatment has passed one of the aspects of research purposes proven in Table 4 (students' cognitive result in critical thinking). Students' level of critical thinking in experimental class shows the domination of very critical students with total of 84% very critical students and 16% critical ones. In the other hand, critical students in control

class dominate with total of 66% critical students and 34% relatively critical students.

Table 4. Cognitive Results of Critical Thinking

Score	Criteria	Experimental Class		Control Class	
		Students	Percentage (%)	Students	Percentage (%)
81,25 < P ≤ 100	Very Critical	24	75	0	0
62,50 < P ≤ 81,25	Critical	8	25	25	66
43,75 < P ≤ 62,50	Relatively Critical	0	0	13	34

Table 5. Students' Critical Thinking Activities

Score	Criteria	Experimental Class		Control Class	
		Student	Percentage (%)	Students	Percentage (%)
81-100%	Very Active	25	78	7	18
61-80%	Active	6	19	25	66
41-60%	Relatively Active	1	3	6	16

Table 6. The Execution of TPS Model

Steps	Percentage	Execution Level
1. Introduction	100%	very good
2. Main Activity	100%	very good
3. Think	97%	very good
4. Pair	97%	very good
5. Share	100%	very good
6. Closing	98%	very good

Table 7. Table of Students Answer to the Questionnaire

Questions	Numbering	Percentage	Category
Positive	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 30	75.0 - 93.1 %	Good – Very Good
Negative	15, 25, 27, 28, 29	33.1 – 59.4 %	Low - Medium

The data show that students' level of cognitive critical thinking in experimental class is higher than the control class. This research shows that through TPS model assisted with phylogeny tree can stimulate students in experimental class to be more active and critical to achieve very critical category. This result is in line with the research of Choy (2009), showing that respondents have two ways of becoming a critical thinker.The majority think that critical thinking methods can help the students enjoy the learning process. It means critical thinking can be a tool to stimulate students' critical mindset and help them in getting better learning result. However, Riddell (2007) noted that critical thinking should not be defined but explained by its components and features, stages, and characteristics as how critical thinking experts have done. The other respondents opine that critical thinking involves reasoning that makes students analyze the learning process by themselves. This learning result of students' cognitive critical thinking is supported with students' opinion to the third point and fourth point of questionnaire regarding the steps of think which allows them to think independently. Think is focused on students' ability in critical thinking, especially in answering the posttest. According to Gokhale (2003), high levels of knowledge are located in the category of C4-C6 (analyzing, evaluating, and creating).The result of students' questionnaire in think obtaining was very good category in 90% and 85%. Students' cognitive ability to think critically, has the criteria of very critical, is strengthened with teachers interview answers to students' critical mindset, answering that:

Students' critical mindset is build through couple discussion by asking in group continued with

discussion of question and answer to the whole class community. Then, it is continued with the posttest answer.

The answer of teachers' opinion was also related to students' improvement of critical mindset after the posttest.

The data related to the critical ability of students in experimental and control class was supported by the t-test of the posttest as what has been seen in Table 2. The t-test counting proves that $t_{count} \geq t_{table}$ where the initial hypotheses (Ho) were rejected. In summary, students' average posttest results from the experimental class were higher than the control class. This result is in line with Darmiyanti's (2013) research in which there is a significant and positive influence of think pair share model towards physics materials of wave and vibration. Another supports came from Herliani (2013) stating that students' critical thinking can be improved with cooperative learning generally, specifically TPS method.

Another result is supporting the cognitive scoring of students' critical thinking skills. This data is used to support the validity and accuracy of students' cognitive learning results of critical thinking through posttest. The observation result is used to know the score of critical thinking activities of the students. Based on Table 5, the observed data to the activity of critical thinking between experimental class (X MIPA 1) and control class (X MIPA 4) shows significant difference. Students' activeness in critical thinking in experimental class showed that the level of critical thinking was dominant with 78% very active students, 19% active students, and 3% which was relatively active. Meanwhile, the control class showed that the critical mindset was more dominant with 66% active students, 18% very active students, and 16% relatively active students. This thing shows that based on the critical ability of students, the experimental class was dominated by very active students while the control ones was dominated by active students. This result is in line with the result of Alpusari (2015), saying that the implementation of TPS model is generally able to improve students' scientific skills. The most dominant improvement are the aspects of application, inferential, communication, planning, observation, and hypotheses. Only for asking questions, the students have decreasing level. These aspects are the aspects used to value students' critical thinking. The result of research's observation on students' critical thinking ability was also supported with questionnaire to students' opinion with positive question on their activeness. The data of students' opinion in several positive questions were valued in the range of 75.0 - 93.1%. It shows that the students' opinion were in good until very good category to the learning model. Good category as prove of students' activeness during the observation of critical thinking activity. The other stimulation was earned from the teachers' interview answers in the second and fifth points of new changes of students after the new treatment. The teachers say:

The visible change of students is their discussion was done effectively and intensive, so, every group can have an active role in the discussion.

They also add:

Students were also more active in discussion in pairs, so, it can improve their critical mindset individually.

The stimulation as the conclusion of students' activeness after TPS model was also researched by Hidayat (2013) who was similarly stating that the cooperation in TPS makes the learning process more effective and highly participative.

The opposing data was also found in this research. The cognitive learning result of critical thinking in Table 4,showing that there are 5 students who are included in the critical criteria with the score ranged from $62.50 < P \leq 81.25$, but, they haven't passed the passing grades since the lowest score of this class were not qualified with the score of $62.5 < N \leq 67$ (passing grade). So, there should be a remedial based on the procedures in the lesson plan. The result of research activities in critical thinking based on Table 5 showed that there is only one student who was relatively active. The data was proven from several questionnaires for students' negative opinion in points15, 25, 27, 28, and 29 which was chosen by the students ranged in the total of 33.1-59.4% with low to medium category. The low and medium of negative opinion show that there are still some students who haven't fulfilled the positive statement in students' opinion. The existing negative opinions are related to students who are still felt forced to deliver presentation in front of the

class, unable to study with the implementation of TPS, cannot get the advantage of TPS model, and still being less confident. Those things showed that there were still some students who has less critical thinking. It was also the prove that the TPS still has lackness.

The supporting result of this research is delivered in students; opinion in Table 7 showing the students in experimental class' opinion towards the use of TPS model assisted with phylogeny tree where the positive value has the range of percentage in 75.0 - 93.1%. This thing proves that the students' opinion in positive statement explaining activeness indicators has excelled good until very good in TPS learning inside of classroom. This result is in line with Munawwaroh (2015) saying that think pair share model is easy to apply in the learning activity, besides, the execution of this learning model helps students to be more focus on the materials. This thing is also able to help students in deciding collective idea and correcting their understanding, thus, they can be more focus on the given exercise and earn a good result. The result is supported from the answers of interview from teachers' opinion in the first and fourth point of applying TPS where:

The application of cooperative learning model of think pair share in learning invertebrate works well, and, learning activity inside of class can be more conducive and calm.

The application of cooperative learning model of think pair share in learning invertebrate works well since it makes the discussion works effectively inside of the classroom.

Those answers can conclude that TPS model application assisted with phylogeny tree can make learning activity be more conducive and calm and improve the effectiveness in group discussion activity. This good statement proves that the execution level of the model is more than good. The scoring of the execution is delivered in Table 6 stating that 32 students following invertebrate material learning using TPS model assisted with phylogeny tree. The scoring starts from students' preparation, the focus of students in understanding teachers' direction of TPS model steps in the main part, students explore their ability independently in think, finishing the pair exercise in pair, delivering their discussion's result in share, and finishing the learning process in closing. All of those aspects have been categorized as very good. This thing supports Wibowo (2011) saying that TPS have strength comparing to the other method, where there is "an optimization of students' participation since the group will be more easily controlled and optimized in solving learning problems in pairs". This theory is proven through students' opinion in point 5, 6, 9, and 12 with the statements of TPS model in pair has very good percentage in the level of 88.8 - 93.1%. Wibowo (2011) adds that this model can help students to find ideas collectively and correcting their understanding that they can be more focused on the exercise and get good grades in the end. The other strength is explained in problem solving, pair understanding and helping each other, making conclusion, and delivering presentation. This theory is proven from students' opinion number 13 and 14 in relation to share part or sharing information where the level of sharing was in the range of 91.9 - 92.5% in a very good criterion. According to students' opinion, this assisted TPS model has reached the good to very good criterion in the range of 75.0 - 93.1%, meaning that the model is positively influential and easily applied.

CONCLUSION

The result of analysis and the discussion from the research can conclude that TPS model assisted with phylogeny tree is positively influential to students' cognitive learning result and their ability of critical thinking. It is proved from the classical passing grade of the experimental class which was 90,6% with the average score of 86,59. Moreover, the students with critical thinking were dominantly active during the learning process of the class.

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