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The Effectiveness of NHT Cooperative Learning Assisted with Picture Puzzle Towards Students' Learning Activity and Outcomes in Plant Tissue's Structure and Function Material

Idaliani Prikadiastuti[1]✉, Amin Retnoningsih[1], Sumadi[2]

Biology Department, Mathematics and Natural Science Faculty, Universitas Negeri Semarang, Indonesia

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Abstract

Limited number of microscope in a school become an obstacle to learning process, including to do an observation to structure and function of tissue, especially from plants. This research discussed about plant tissue. Most students considered that this material was difficult due to limited number of microscope and limited textbook information. Students became bored since the learning material was done only by listening and noting teachers' explanation. The learning process suppose to make them active, one of the alternative was by Numbered Head Together (NHT). The limited number of microscope can be handled by the picture in picture puzzle. The purpose of this research was to analyze the effectiveness of NHT with picture puzzle to the activity and learning outcome of studenst in plant tissue structure and function material. This research used pre-experimental with One Shot Case Study. The analysis of data included quantitative data to students' activity, learning outcome, students' opinion, and descriptive analysis to teacher's opinion. The result of this research showed that 91% of the students became active and very active. 82% of the students were also passed the score. Teacher and students gave positive reviews to the learning process. Based on the learning outcome, it was concluded that the cooperative learning of NHT with picture puzzle was effective in increasing students' learning activity and outcome in plant tissue function and structure material.

✉ Correspondence:
Gedung D6 Lt.1 Jl Raya Sekaran Gunungpati Semarang
E-mail: naira_faiza@yahoo.com

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INTRODUCTION

The achievement of education's goal depends on the learning process between students and teachers (Permatasari *et al.,* 2014). The roles of teachers are very important to the successs of education in school. Teachers have role in (1) arranging and formulating the learning goals, (2) choosing and arranging learning material which is based on the needs, interests, and students' growth development, (3) choosing variative learning methods and media, and (4) arranging the appropriate programs and evaluation tools (Hamriah, 2013).

Teachers are demanded to execute interesting and student-centered learning activity. Somehow, in fact, the conventional learning system is still used in many schools, including Mataram Junior High School Semarang. The learning activity which is centered to the teachers made them active while the students become passive in class that they only listen and note teachers' explanation (Wulan & Kartijono, 2015). This thing is a boredom to students that makes them unable to concentrate, thereby, not all of the materials will be kept in students' memory (Daud & Fauzan, 2011).

The learning process which is not empowering students' a lot and have less microscope observation cannot make the students understand the materials maximally (Octavia & Purwantoyo, 2016). Rohayati *et al.*, (2016) adds that the use of exercise book and students' worksheet which does not have many pictures as learning media in the teaching of plant tissue structure and function makes the students difficult to understand the material. Based on the analysis of final term ecam os 2015/2016 academic year students, more than 75% students in Mataram Junior High School Semarang has not passed the passing grade.

Teachers can improve the learning activity and increase their outcome using cooperative learning. Cooperative learning is learning strategy with many students gather in a small group consists of students with different intelligent level. The completion of exercise in the group demands every student to cooperate and help each other to understand learning materials (Suparmi, 2012)..

One of cooperative learning method which can stimulate students' activeness is Numbered Heads Together (NHT). NHT refers to learning group in which every member is given different numbers to do different tasks. This learning method involve the students to learn the material in certain subject more. According to Mustafa *et al.* (2011), NHT includes four learning steps, including: (1) numbering, (2) asking question, (3) thinking together, and (4) answering. The strength of NHT is demanding the students to be ready since the teacher will call the students' based on their number randomly to report their discussion result in front of the class and the same number from every group is also given the same tasks. Meanwhile, the other students give opinion to the students who reports their discussion (Mulyatiningsih, 2012).

Plant tissue structure and function is a material which is difficult to master by the students. It is proven from many students who did not pass the passing grade. The use of textbook without any observation due to limited number of miscroscope in learning activity can make the material difficult to understand (Kurniawati & Rahayu, 2014).

Natural science laboraty in Mataram Junior High School is not possible to make them execute the practicum since it is used as a store room. In addition, the number of microscope existed is only 5 and only 2 of them which is still able to be used. It is not comparable to the total of the students in the class which is 25.

It can be handled by using pictures as the media. Pictures can handle the problem of limited microscope by giving them visual experience that ease them in memorizing the learning concept (Afidah *et al.*, 2012). The pictures can be packed as picture puzzle.

Puzzle is a simple medium on a frame to arrange. The use of puzzle can help the learning process since the students are involved actively. Students can play and learn in the class making them able to memorize the materials easily (Chamidah & Mitohari, 2014). Picture puzzle is a puzzle which is made as a game to solve. This medium can help students improving their creativity (Wahyuni & Maureen, 2010). The use of picture puzzle is hoped to ease the sudent in understanding the material, especially regarding

plant tissue structure and function. It can solve the problem of limited observation and motivate the students in following the learning activity.

The aim of this research is to analyze the effectiveness of NHT cooperative learning with picture puzzle to students' learning activity and outcome in plant tissue structure and function material.

RESEARCH METHOD

This research was done in the even semester of 2016/2017 academic year. This research used pre-experimental design with One Shot Case Study type. The population in this research is all 74 8th grade students. The sample is determined by taking all 8th grade class from 8A, 8B, and 8C. The sampling method was using purposive sampling.. The procedure which is arranged in this research included (1) The initial by interview with biology teacher for the 8th grade in Mataram Junior High School Semarang; (2) Planning the learning activity of the research including the learning tools; (3) Making the research instrument to obtain the data; (4) Doing the tryout to the research samples; (5) Analyzing the tryout including the validity, reliability, difference, and difficulty levels; (6) Executing the learning activity with NHT cooperative assisted with picture puzzle in learning material of plant tissue function and structure; (7) Analyzing the data including students' activity, learning outcome, and students and teacher opinion; (8) Arranging the outcome and evaluation.

The indicator of effectiveness in this research includes: (1) students' classical activity is ≥75% in active and very active criteria; (2) ≥75% students passes the passing grade, ≥70.

RESULTS AND DISCUSSION

The result of this research includes the students' activity, students' opinion, and students and teachers' opinion. The data of students' activity was obtained from observation to students' during the learning process of plant tissue material with NHT cooperative assisted with picture puzzle.

The implementation of NHT cooperative assisted with picture puzzle in plant tissue structure and function material can increase students' activity. Nevertheless, the learning process cannot make all of the students become active since there are some students which is still in less active.
The percentage of students' criteria is portrayed in Table 1.

Table 1 Recapitulation of Students' Activity in Every Meeting

Criteria	Meetings								
	I			II			III		
	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)
Very Active	4	20	4	16	28	17	20	52	21
Active	76	72	79	76	68	75	76	44	71
Less active	20	8	17	8	4	8	4	4	8
Very active and active students	80	92	83	92	96	92	96	96	92
Classical Students' Activity (%)	85			93			95		

The students which is less active in the first meeting in 8A and 8C class tend to be higher than 8B. It is because the process of delivering information was done orally with contextual approach where teacher present real plants in the class and explain the parts of it.

Based on the experience in both class, teacher changes the initial information delivery in 8B by giving power point presentation with clear picture. This kind of material can increase the students' spirit and make the materials becomes brief until easily understanding (Riyono & Retnoningsih, 2015).

The increase of average activity percentase of the students classically in the second meeting was 8%. The increase of average activity percentase of the students classically in the second meeting was 8%. It is because the change initial of information delivery to be more interesting and students have been able to

know the steps of learning activity. Students become enthusiastic and interested to learn. The interest in students' mind becomes the basis of students' activeness. Students who have high interest in learning activity give active intention and active role (Aritonang, 2008).

The students' activity can experience increase or decrease from active to very active or less active. It is delivered in Table 2 as follows.

Table 2 The Recapitulation of Increase and Decrease to Students' Activity

Criteria of Students' Activeness	The number of students who experience criteria changing					
	A		B		C	
	I-II	II-III	I-II	II-III	I-II	II-III
Active to Very Active	4	3	6	7	3	3
Active to Less active	2	1	1	0	1	1
Stay Active	12	15	11	10	15	14
Very Active to Active	2	3	4	1	0	2
Very Active to Less Active	0	0	0	0	0	0
Stay Very Active	0	1	1	6	1	2
Less Active to Active	5	1	2	0	3	1
Less Active to Very Active	0	1	0	0	0	0
Stay Less Active	0	0	0	1	1	1

The changes of criteria to students' activity happened in the second and third meetings. The total of students with stay active criterion was higher than the others. The increase of students to be very active is influenced by students with active criteria in every class, but in 8A, it is also influenced by less active students. The decrease of less active students because they changed to be active and very active students.

Based on the interview with the stduents, their changes of activeness from less active to active of very active was because they were interested with picture puzzle. Beside making them enjoy, picture puzzle gave students the different pictures in their textbook. The picture given was clearer and more colorful. The purpose of pictures is visualizing concepts which supposed to e given to students (Musfiqon, 2012).

The changes of criteria to students' activity in every meeting can be seen in Table 3.

Table 3 Recapitulation of Criteria Changes to Students' Activity in Every Meeting

The Changes of Students' Activitty in Meeting I – II – III	Total of Students		
	VIIIA	VIIIB	VIIIC
Active – Active – Active	9	6	12
Active – Active – Very active	2	5	3
Active – Active – Less active	1	0	0
Active – Very active – Active	3	1	2
Active – Very active – Very active	1	5	1
Active – Less active – Active	1	0	1
Active – Less active – Very active	1	0	0
Active – Less active – Less active	0	1	0
Very active – Active – Active	2	2	0
Very active – Active – Very active	0	2	0
Very active – Very active – Very active	0	1	1
Less active – Active – Active	4	2	2
Less active – Active – Very active	1	0	0
Less active – Active – Less active	0	0	1
Less active – Less active – Less active	0	0	1

The average changes to students' activeness criteria were stayed in active and very active, even in 8B and 8C, there was one student which is stayed in the criterion of very active. Based on the interview to these students, they were known of having high motivation to education. They tried to have high learning achievement at home or at school. Based on Hamdu & Agustina (2011), there was an influence between motivation to learning achievement.

The result of the observation to all three classes showed that the less active students can change to be active and even in 8A, become very active. After the interview to those students, it was known that their activeness was because of the implementation of NHT cooperative with picture puzzle. The students usually learn individually, then, with NHT cooperative, they can have group discussion. This group discussion can be a forum for the students to ask, discuss they opinion, learn from others opinion, give critics, and conclude students' invention in writing (Trianto, 2014).

In 8B, there were students changed from active to less active in 3rd meeting. After the interview, the students was known that he/she was less motivated to the learning process. One of the factors here is family environment. The environment and family support the increase of students' learning outcome, including the facility to learn (Purwanto, 2010).

In 8C, there was a student which activeness stay in less active from the first to third meeting. Based on the observation from the observer and interview to the teacher, the student was naturally uncommunicative and alienated himself in the class. Thus, she had less interaction to other people in class.

According to Huda (2013), every student was not born to be able to interact with others. Students should be able to have social skills to cooperate and be motivated to use the cooperative skills in cooperative group. In the discussion, students can interact with their friends, students can discuss something based on their mind and give more comprehensive understanding to the materials (Simsek *et al.,* 2013).

Students' activeness can be seen from each activity in the learning process. The student activities on each aspect with cooperative NHT assisted with picture puzzle in plant tissue's structure and function material can be seen in Table 4.

The analysis of the students' activity in each aspect in Table 4 showed that 8A, 8B, and 8C had different highest aspects; somehow, they have the same lowest aspect in giving opinion. It is because of the limit of time to the learning process. This aspect only needs some students instead of all students. The students who are brave in speaking their opinion have high confidence. The solution to solve this problem is teacher can ask other students to write their opinions in a piece of paper and submit it to the teacher.

Table 4 The Recapitulation of Students' Activity in Every Aspect

No	Aspek	Kelas VIII			Rata-rata	Kriteria
		A (%)	B (%)	C (%)		
1.	Memperhatikan dan mendengarkan penjelasan guru	77	82	73	77	Aktif
2.	Menyelesaikan tugas dengan berdiskusi bersama teman sekelompok	79	80	73	77	Aktif
3.	Ketepatan waktu menyusun *puzzle*, berdiskusi dan menjawab soal LDS	82	87	85	85	Sangat Aktif
4.	Mencocokkan gambar di *puzzle* dengan hasil pengamatan mikroskop	84	86	85	85	Sangat Aktif
5.	Aktif bertanya ketika mengalami kesulitan	76	77	78	77	Aktif
6.	Kemampuan siswa menjawab pertanyaan yang diajukan guru	78	76	75	76	Aktif

Lanjutan tabel 4

7.	Menyampaikan pendapat	67	75	70	71	Aktif
8.	Menjawab soal kuis	76	88	80	81	Sangat Aktif

Class 8A had highest aspect in matching puzzle pictures with microscope observation. Based on the interview result to some of the students, the existence of picture puzzle can make the learning activity become more interesting. Students can learn not only by playing but also by discovering. Educational games have inherent potential to (1) arouse and sustain interest in learning, (2) generate new ideas in learners, (3) foster social interaction, (4) excite learners, (5) recall information easily, (6) remove fatigue and, (7) generally help learners with low achievement potential (Babayemi & Olagunju, 2014).

8B had highest aspect in answering the quiz. The understanding level and competition in the 8B was higher than 8A and 8C. It made the students very enthusiastic to answer every quiz item. Every student is able to increase their learning achievement because they can get reward from their teacher by answering the question correctly. Cooperative learning made students compete to get the best result. Competition has been defined as a social process that occurs when rewards are given to people on the basis of how their performances (Attle & Baker, 2007).

8C had the highest aspect in arranging the puzzle in certain time with discussion and matching the picture puzzle with the result of microscope observation. Based on the interview to the students, the students said that picture puzzle can solve the problem of limited observation with monocular microscope. The picture in picture puzzle can make the anatomy of plants seemed clearer. The potential benefits of educational game to foster learning during classroom instructional process, teachers should incorporate the use of game especially puzzle game for effective basic science delivery (Babayemi & Ankisola, 2014).

The result of the research showed that all sample classes had average classical activity percentage ≥ 75% students with active and very active criteria. The increase of activity to students' learning activity with NHT cooperative assisted with picture puzzle can increase students' learning outcome.

The second variable in this research is students' learning outcome was influenced by the implementation of NHT cooperative with picture puzzle.

The data from students learning outcome are shown in Table 5.

Table 5 Recapitulation of Students' Learning Outcome

Components	Class VIII A	VIII B	VIII C
∑ students	25	25	24
Lowest Score	62	68	62
Highest Score	89	92	87
Average Score	75	80	75
∑ Students with Passing Score (≥70)	20	22	19
∑ Students who hasn't passed	5	3	5
% classical passing students	80	88	79
% classical students who hasn't passed	20	12	21
% overall passing students	82		

Table 5 showed that the average learning outcome from the classical passing students in three class has exceeded the minimum criterion. The percentage of classical students who passed in 8B was higher than in 8A and 8C. This high percentage showed that the implementation of NHT cooperative with picture puzzle eased the students in understanding plant tissue structure and function material. The implementation of cooperative learning had significance to students' social and academic development. Students who got cooperative learning can have better ability and achievement (Pietersz & Saragih, 2010).

The average learning outcome in 8B was higher than 8A and 8C. Highest range of students' score was relatively high in 8B where 2 students got 92. Students who earned higher score, because (1) had increased of activity to very active and, (2) maintain the activity to very active in each meeting.

The activeness of the students in the learning process is one of the supporting factor of learning effectiveness (Octavia & Purwantoyo, 2016). Students' activeness can be influenced by the students manner to learn. Students who regularly learn with arranged schedule, choose correct learning method and enough learning time to increase their learning outcome.

Students who had bad learning habit tend not to pass the learning process. Based on the interview to students who did not pass, the studenst were having less preparation learning and did not do the exercise correctly. The preparation to learn can influence students' ability in understanding to the material (Riyono & Retnoningsih, 2015).

The students' activity influenced their learning result, but, the execution can be known that if student have active criterion not to have good learning result. Students with active nature do not really reflect that they can understand the material well. Students became ask, write, and interact more to other students because they did not understand the materials. It made the students did not pass the learning, although have active criterion (Octavia & Purwantoyo, 2016).

The percentage of classical learning passing score in 8C was lower than the other classes. Low individual passing grade influenced classical passing grade in the class. Nonetheless, the difference of classical passings or average score in three class were not really different. It indicated that all classes have relatively similar ability. The existence of discussion can optimize the ability of the students, dig their knowledge, and solve their problems. Students can find the answer through books or other learning source to master the material or concepts (Khasanah *et al*., 2013).

The attendance of picture puzzle as learning media can give the influence to students learning outcome. The existence of picture puzzle can make an interesting atmosphere to cheer up the learning process. The interest in learning media push the students to be attentive in the class and more active in understanding the material deeply (Nuriah *et al*., 2013).

The data of students' activity and learning outcome was supported by the opinion from the teacher and students regarding NHT cooperative with picture puzzle in the material of plant structure and function. Students gave positive responses to the learning process. This opinion was obtained from the questionnaire given to them in the end of the learning process.

The questionnaire of students to the implementation of NHT cooperative with picture puzzle consist of question which can be answered with "Yes" or "No". Students' questionnaire was filled with teacher's supervision. Most of the students stated that this learning process is appropriate to be used in plant tissue structure and function material, it eased the students in understanding the concept and make the learning process became more interesting. Some of the students said that the learning material was not only able to be applied for that material but also for the others.

The used of picture puzzle in learning activity can make the students become more interested in following the learning process. The existence of puzzle game in discussion make them eager to finish and do the LDS well. The process of arranging the puzzle contained with game educative element, cooperative, sportive, competitive and challenging were packaged in cheer up and fun learning. This cheerful condition is one of the factors making the students interested to follow the learning material (Nuriah *et al.,* 2013).

Students who are interested in learing had high learning interest and motivation. Students who are motivated can do the learning activity well making them active or even very active. This NHT gave the students chance to (1) share their ability, (2) have critical thinking, (3) share their opinion, (4) give chance to share their ability, and (5) help other students in learning based on the theory (Setianingrum & Sunarti, 2013).

Based on the interview with biology teacher in Mataram Junior High School Semarang, it was known that generally teacher gave positive review to the learning method. The data showed that this learning method can make the students more active and make the learning atmosphere more cheerful;

lately, it can also increase students' curiosity. The existence of picture puzzle as the media can make the class changes from noisy to be managed well. The implementation of NHT cooperative with picture puzzle have several obstacles, including the management of time. This learning method need good ability of teacher in handling the class and motivating the students in learning.

CONCLUSION

Based on the result of the research and discussion, it can be concluded that NHT cooperative learning assisted with picture puzzle was effective to improve students learning activeness and outcome in plant tissue function and structure material in Mataram Junior High School Semarang. It is proven by 91% of students was very active and active, and 82% students passed the score of ≥70 (the passing grade from the school).

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