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Students' multiple intelligences empowering to learning achievement of cognitive through plasma cluster strategy

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Abstract
The aim of this study was to clarify the effect of learning strategies namely plasma cluster multiple intelligences based on learning achievement of cognitive. The study design used was quasi experiment performed using nonequivalent draft pretest-posttest control group design. Two groups of samples formed in this research were student grade XI Biology class 1 as the experimental class, and student of Biology class 2 as the control class. The instrument used in this study was the observation sheet implementation of learning, which is useful to know the feasibility of learning experimental class and control classand multiple intelligences questionnaire used to identify the dominant intelligence on each student. Data was collected through a pretest and posttest. Data analysis was performed with descriptive analysis, while anacova test was performed in order to test the hypothesis; further the test of Least Significant Difference (LSD) is performed. The calculation was assisted with SPSS 18 for Windows. Findings of the research showed that: the learning of plasma cluster multiple intelligences based is influences on the learning achievement of cognitive. Meanwhile, there is an increased learning achievement of cognitive of students being treated with learning strategy of plasma cluster based multiple intelligences by 50.00% higher than the conventional learning strategy by 23.01%. Related to this conclusion, the researcher suggests that teachers would use plasma cluster with multiple intelligences based consistently because it has proven successful to improve learning achievement of cognitive.

Keywords: Multiple intelligences, plasma cluster strategy, learning achievement of cognitive

1. Introduction
Education is a process to develop students' potential in accordance with the cultural values and norms in society. The implementation of education will provide assurance to the nation's development because education can produce qualified human resources having the ability to face the challenges of life. Among the various subjects studied in the educational process, biology is one of the important subjects to be mastered by students (Asele *et al*, 2016). Wood (2002) [6, 32] and Erdogan *et al* (2012) [10] explained that biology learning aimed to equip the students with the concepts of biology that could be understood and applied in their lives in order to improve the ability to manage nature with a sense of responsibility and to improve the ability to cope with change in society.

Biology is the science that examines the objects and natural phenomena issues. All objects and natural phenomena are objects of study in biology. According to modern theories, the learning process does not depend at all on the presence of the teacher as a manager of the learning process. This is based on the learning process essentially an interaction between learners with the object being studied. Based on this, the role of media sources and learning can not be ruled out in the process of learning biology.

The learning process is a manifestation of the interaction of biological subjects (students) with an object consisting of objects, events, processes, and products (Djohar, 1987) [9]. Biology education should be placed as an educational tool and not as a goal of education, and consequently in the learning of the subject should give lessons to learn to interact with the object of learning independently, so as to explore and discover concepts. Thus, learning biology emphasizes the interaction between the subject and the object being studied. These interactions provide opportunities for students to practice to learn and understand how to learn, developing the potential of rational thought, skill, and personality as well as get to know the problems of biology and the assessment.

The facts that occurred in Santa Maria Catholic High School Malang show that conventional learning is still largely dominating the learning process. Learning is done in the classroom is still centered on the teacher (teacher centered), still using traditional learning methods such as lectures, tend to emphasize the cognitive abilities such as the ability of logic (mathematics) and linguistic (language), has not sought the empowerment of multiple intelligences in the learning process. With this sort of earning performed by teachers, it would result in the learning process, which is boredom, and uninteresting, and less prepared to follow the learning that can lead to lazy students looking for information themselves, they tend to ask the teachers who are considered as the source of reliable information. So far, teachers only ask the students to learn, but rarely taught students how to learn, as a result they have difficult times in solving problems, make decisions, critical thinking, and creative thinking.

Plasma Cluster learning strategy is one of the many alternatives in fulfilling the expectations. Plasma Cluster learning strategy is a contextual learning strategy. The word plasma is anacronym of selection, the mastery of competencies while cluster means a small group that deliberately formed. The learning strategy has been adopted

and developed from a blend of Problem Based Learning (PBL), Think Pair Share (TPS), and added by the use of learning resources to help students in the selection and control of the material competence in groups. Plasma cluster learning strategy involves students to select and search for learning resources that can facilitate learning to achieve competence (Johan, 2012) [14]. Learning resources will refer to any person (s) or any material (whether acquired or locally produced) with instructional content or function that is used for formal or informal teaching/learning purposes. Learning resources may include, but are not limited to, print and non-print materials; audio, visual, electronic, and digital hardware/software resources; and human resources (PEI, 2008) [19].

The process of understanding a matter of competence conducted in groups is a cooperative learning that can help students in preparing a concept that built from each member of the study group. Group learning can help students in the mastery of competencies, with the interaction between the students, thus all acquired in the learning process will be faithful memory for the students. Learning process with group discussions strategy can generate optimism and spirit of student learning compared to individualistic learning (Garbett, 2011) [12].

The application of learning strategy Plasma Cluster is expected to increase the creative power of teachers in preparing varied learning resources, quality, fun, and innovative in teaching and learning so that students do not feel bored. Students also will stay motivated in learning, because students participate actively in the learning process in the classroom. During the learning process, students will be trained to be able to dig up information by using a variety of learning resources, and teachers can be a friend for the learning. In addition to using plasma cluster learning strategy, it is necessary also to know the multiple intelligences owned by students. To know the multiple intelligences owned by the students is the key to the success of students' future.

Multiple Intelligences theory asserts that every individual has different types of intelligence and that they need different methods to develop each intelligence (Al-Zyoud and Nemrawi, 2015) [2]. The theory is based on the idea that intelligence is traditionally defined in terms of IQ, which measures the ability to narrow the range of linguistics and logic/math (Christison, 1996) [7], but everyone has a unique way to solve problems faced. In line with that conveyed by Kagan (2000) [15] that every person has one or more intelligence with different percentages. Meanwhile, according to (Abdi, *et al*., 2013) [1] suggests that intelligence is the ability to apply one or more of the intelligences in a way that is valued by society or culture. Intelligence is not only seen from the value obtained by someone. Intelligence is the ability of a person to see a problem, then solve these problems, or create products that can be useful to others. Multiple Intelligences is not to label students to have only one kind of intelligence, but Multiple Intelligences gives a picture that every individual has eight kinds of intelligence with a different composition and dominance.

Teachers expressed with the application of Multiple Intelligences it will give students a meaningful choice to learn and to communicate their knowledge even if the student's choice needs to be controlled (Kornhaber, *et al*., 2004). Assignment of teachers is to create a pleasant environment and help students to use the five senses to cultivate all that intelligence. If teachers have to undertake optimally then the results obtained throughout the kinds of students' intelligence then these students will grow to high levels. Teachers can encourage the raising of the whole modality of learning, help students connect the skills and the development of various intelligence in learning at school through teachers to explore the ability of students so that intelligence would develop (Samples, 2002) [24]. Meanwhile (Saher, 2013) [13] states that teachers should assess students to learn in a way that it can give a true picture of the strengths and weaknesses found in students.

This study aimed to describe the influence of plasma cluster learning strategy based on multiple intelligences on the learning achievement of cognitive in class XI student of biology Catholic High School Santa Maria Malang.

2. The Literature Review

2.1 Multiple Intelligences

Multiple intelligences theory and its implementations have been employed to various fields of education. Intelligence, briefly, is the capacity to modify and adjust one's behaviors in order to accomplish new tasks successfully (Ormrod, 2006) [18]. Gardner defined intelligence as "the ability to solve problems or to create products that are valued within one or more cultural settings (Furnham, 2009) [11]." As Armstrong points out, Gardner provided a means of mapping the broad range of abilities that human possess by grouping their capabilities into eight comprehensive categories of intelligences are as follows: linguistic intelligence, logical mathematical intelligence, spatial intelligence, bodily kinesthetic intelligence, musical intelligence, interpersonal intelligence, intrapersonal intelligence and naturalist intelligence (Armstrong, 2009) [4]. Furthermore, Gardner has also mentioned a possible ninth intelligence of spiritual intelligence (or existential intelligence), but has not included it officially in this theory (Peariso, 2008) [20].

2.2 Learning Achievement of Cognitive

Cognitive achievement is the result of an interaction act of learning and teaching acts. Cognitive learning outcomes based on Bloom's Taxonomy revised by Anderson and Kratwohl (2001) [3] covers: (1) remembering (C1); understanding (C2); applying (C3); analyzing (C4); evaluating (C5); creating (C6).Cognitive learning outcomes in this study was measured using test item descriptions are given at the beginning (pretest) and final (posttest).

2.3 Plasma ClusterStrategy

Plasma cluster strategy is the developed from cooperative learning strategies. According to Johan (2012) [14], learning strategies Plasma Cluster engage students to select and search for learning resources that can facilitate learning to achieve competency. Plasma cluster strategy has eight steps, namely: (1) preparing students to learn; (2) building schemata; (3) introducing the topic and its intended competens; (4) grouping the student and identifying learning sources; (5) setting the report and preparation presentation; (6) presentation and discussion; (7) knowledge development; (8) reflection and evaluation.

2.4 Conventional Learning (CL)

Conventional learning is a learning method teacher center where the teacher will explain the material and students will only listen to it. Correspondingly, according Ruseffendi (1991) [22], the conventional learning generally dominate classroom teachers, pupils are generally passive and just accept. In conventional teaching teachers to teach a number of students in a room with almost the same capabilities, and interests and abilities of students are also assumed to be equal. Thus, conventional learning is learning which is often used by teachers in the classroom the teacher usually only to transfer knowledge to the learners.

3. Methods

3.1 Research's Design

The design of this study used was a quasi-experimental. In this experiment, the control group and the experimental group were both formed naturally from the beginning. The study design used namely nonequivalent pretest-posttest control group design. There were two variables of this study, i.e independent variable was the plasma clusterstrategy based on multiple intelligences and the dependent variable is the learning achievement of cognitive.

3.2 Population and Sample

The population in this study was using total sample because this study was taking the whole class XI Santa Maria Catholic High School Biology Malang in the academic year of 2014/2015 of even semester, amounting to 2 classes. The sample in this study was students of class XI Biology 1 and XI Biology 2 in Santa Maria Catholic High School in Malang. Class XI Biology 1 is a class that was used as an experimental class while the class XI Biology 2 was used as the control class. The experimental class there has been already a form of cluster formed in accordance with the dominant intelligence (intrapersonal, interpersonal, linguistic, musical, visual, existential) obtained through a questionnaire of identification of multiple intelligences. The sampling technique was using simple random sampling technique, which was performed randomly to the assigned classes containing students with heterogeneous academic ability. Related to the number, grade XI Biology 1 was in total of 33 students and Class XI Biology 2 was in total of 38 students. Equivalence testing samples was done by using a different test criteria that there is no difference between the classes used ($p > 0.05$).

3.3 Instrument

Data collection instrument used in this study consisted of instruments for the measurement of independent variables which include: (1) syllabus;(2) lesson plan;(3) student worksheet based on multiple intelligences;(4) learning feasibility observation sheets, and (5) multiple intelligences questionnaire which refers to (McKenzie, 1999) [17] and instrument for the measurement of the dependent variable was an essay test. Essay test was in the form of open-ended questions used to obtain data on learning achievement of cognitive. Essay test was then assessed using a rubric learning achievement of cognitive that refers to (Hart, 1994) [13]. Data were obtained by pretest and posttest. The data obtained were then tested for normality and homogeneity of the data, and further analyzed using Anacova test, followed by LSD test if needed.

4. Results

The level of mastery of the domain learning achievement of cognitive include aspectsremembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), creating (C6). The average score of mastery of domain learning achievement of cognitive pretest and posttest can be seen in Table 1.

Table 1: The average score pretest and posttest learning achievement of cognitive

No	Domain	Experiment class		Coventional class	
		Pretest	Posttest	Pretest	Posttest
1	Remembering (C1)	1,74	3,50	2,13	3,24
2	Understanding (C2)	1,55	2,78	1,83	2,31
3	Applying (C3)	2,42	2,89	2,06	2,39
4	Analyzing (C4)	2,37	3,02	2,25	2,45
5	Evaluating (C5)	1,86	2,73	1,60	1,92
6	Creating (C6)	1,70	2,39	1,39	1,68

In table 1 shows that the achievement of mastery of the domain of cognitive learning outcomes were studied using learning strategies plasmacluster based on multiple intelligences and students who are learning with conventional learning in general has increased. The average mastery of highest indicators of cognitive learning outcomes for the experimental class in the domain of applying in the amount of 2.42 during the pretest and in the domain of remembering, that is equal to 3.50 when the posttest. In contrast to the conventional class data showed cognitive mastery level was highest in the domain of analyzing which of 2.25 during the pretest and in the domain of remembering that is equal to 3.24 at the time of the posttest.

Lowest level of mastery of the cognitive pretest for the experimental class in the domain of understanding, which amounted to 1.55, while when posttest on creating domain of 2.39. In a conventional classroom, creating cognitive mastery of low of 1.39 at the time when the pretest and posttest of 1.68.

The increase of each domain of the learning achievement of cognitive in the experimental class and conventional class after given treatment that includes aspects of remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), creating (C6). The percentage increase in domain of learning achievement of cognitive during pretest and posttest can be seen in Figure 1.

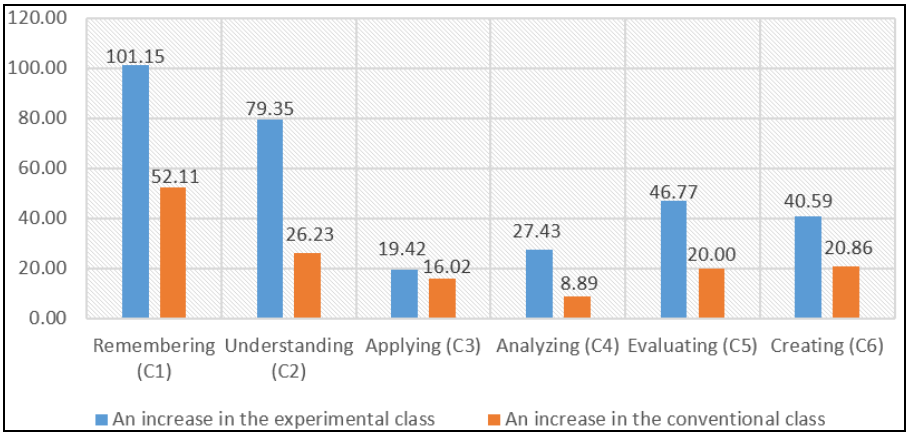

Fig 1: The Increase of Learning Achievement of Cognitive of Experiment Class and Conventional Class

The data relating to the cognitive achievement was then tested by using a statistical test of Anacova test. In Table 2 it presents a summary of Anova; the result of calculations of data of the learning achievement of cognitive based on the pretest and posttest.

Table 2: Summary of the Calculation of Learning Achievement of CognitiveAnacova

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Strategy	4274,655(a)	2	2137,327	56,769	,000
Intercept	9555,595	1	9555,595	253,806	,000
XHBKOG	951,794	1	951,794	25,281	,000
CLASS	3238,734	1	3238,734	86,024	,000
Error	2560,148	68	37,649		
Total	308979,512	71			
Corrected Total	6834,802	70			

The calculations show that the significance value was less than 0.05 which was equal to 0,000.This means that the null hypothesis is rejected and the research hypothesis is accepted. Thus, there is influence learning strategies to learning achievement of cognitive. Further testing is then performed by using Least Significant Difference (LSD), which was conducted to determine the learning strategies that provide the highest influence in improving the learning achievement of cognitive. Table 3 shows the results of a further test in the effect of learning strategies for the learning achievement of cognitive.

Table 3: Effect of Advanced Test in the Learning Strategy Against Learning Achievement of Cognitive

Class	Xhbkog	Yhbkog	Df	Hbkogcor	Notation Lsd
1=conventional	47,85	58,86	11,01	58,94	a
2=experiment	48,38	72,58	24,19	72,48	b

In Table 3 shown the average of learning achievement of cognitive from each learning strategies. The average rate of the corrected of the two learning strategies, showed that the result of the learning achievement of cognitive with conventional strategies have declined by an average of 58.94 and the results of the learning achievement of cognitive by plasma cluster strategy based on multiple intelligences has an average rate of corrected amounting to 72.48. Statistically it shows the differences in the rate of the learning achievement of cognitive that occur in both learning strategies showing significant differences.

5. Discussion

Based on the value pretest and posttest shows that learning strategies influence on the cognitive learning. This is indicated by a probability value learning strategies 0,000 or less than 0.05.It means learning strategies influence on thelearning achievement of cognitive. Students who receive instruction using plasma cluster learning strategiesbased on multiple intelligences have the cognitive achievement of higher and significantly different from the students who received conventional teaching. Based on the consistency of test results showed that the implementation of learning strategies consistently. This is evident from the significant value of 0.987 is more than 0.05.

Plasmacluster learning strategy based on multiple intelligences proved better able to increase the learning achievement of cognitive of the conventional learning strategies. The analysis showed that the increase in learning achievement of cognitive in the experimental class taught by a plasma cluster learning strategy based on multiple intelligences by 50.00%, whereas the increase in learning achievement of cognitive in a conventional classroom only by 23.01%.Learning with plasma cluster learning strategies based on multiple intelligencescan improve learning achievement of cognitive because plasmacluster learning strategies based on multiple intelligences is a strategy of cooperative learning and the learning strategy also has several advantages.

Plasma cluster learning strategiesbased on multiple intelligences has the advantage of prioritizing cooperation among students in selecting, specifying learning resources to achieve some competence required. Plasma cluster learning strategiesbased on multiple intelligences self-directed learning by considering and providing the opportunity for students to determine their preferred learning resources in the learning activities.

Meanwhile, plasma cluster learning strategy based on multiple intelligences effect on learning achievement of cognitive which are caused: (1) involve students actively in learning both in individual and group activities; (2) provide opportunities for students to help each other in doing the task

assigned by the teacher; (3) requires students to take responsibility for the answers that will be reported to the teacher and his group; (4) teach students to be more independent in the work on the problems that are given so as to increase their confidence; (5) provide opportunities for students to provide answers to the problems that the teacher so that when a group discussion given task can be completed properly.

The increased of learning achievement of cognitive cannot be separated from the characteristics of plasma cluster learning strategy based on multiple intelligences which is a blend of Problem Based Learning (PBL) and Think Pair Share (TPS). Arends (2008) [5] stated that Problem Based Learning (PBL) helps students to develop thinking skills and problem solving skills, and become independent learners. Tan (2003) [29] states that Problem Based Learning (PBL) trains students to develop and explore further the problem by raising their awareness about different ways of thinking for the settlement on a problem. In line with the research performed by Sockalingam, *et al* (2011) [26] explains that Problem Based Learning (PBL) is based on the principle that students not only acquire knowledge but also that they know how to apply this knowledge in real situations. On the learning of Problem Based Learning (PBL), students discuss and analyze the problems in a group. This causes some issues or topics require exploration. Students then use the issue or topic that has not been resolved as a guide to direct their learning activities. Problem Based Learning (PBL) identifies two most important criteria: (1) the extent of the problem stimulates thinking or reasoning; (2) the extent of the problem leads to self-learning students.

Meanwhile, Think Pair Share (TPS) is one of cooperative learning strategies that can empower students' thinking skills. Think Pair Share (TPS) gives structure to the discussion so that the ideas and behavior of students is focused because they have to report the results to the group members. According to Arends (2008) [5] Think Pair Share (TPS) approach assumes that all recitation or discussion needs to be done in setting the whole group, and has a built-in procedure to give more time to the students to think more, respond to, and help each other. Think Pair Share (TPS) has become an alternative because the cooperative learning strategies have processes in structure to share information efficiently. It can be used as a tool to improve the learning process. According to Radhakrishna and Ewing (2012) [21], this process can be used as a guide in other learning situations that can build a foundation of knowledge and understanding. In addition, Think Pair Share (TPS) is an effective way to create an atmosphere variation pattern of class discussion.

Learning achievement of cognitive are influenced by cooperative learning. In cooperative learning study carried out by setting small groups by taking into account the diversity of the group members as a forum for student collaboration and social interaction with their peers, giving students the opportunity to learn something well at the same time and be a resource for other friends. Cooperative learning encourages social interaction. Social interactions that occur when learning is done with this cooperative learning strategies that can improve the learning achievement of cognitive.This is supported by research conducted by Slavin (2010) [25] states that the cooperative learning can meet the needs of students in critical thinking, problem solving, and integrate knowledge with experience. Furthermore Tu'u (2004) [30] states that the strategy is giving good results for students are learning strategies that involve a lot of students think, argue, talk, and express their ideas. Instead the results obtained will be low if passive students and listeners lectures teachers with strategies monologue of the teacher.

The results of this study support previous research, the research done by Johan (2012) [14] reported that there are effects of the application of learning strategies plasma cluster on the learning achievement of cognitive. Widayanti (2010) [31] conducted a study related to multiple intelligences and its relationship with student learning outcomes that no influence of multiple intelligences on learning outcomes of students. Several other studies have shown that providing learning that takes into account multiple intelligences dominant shown to improve competence in learning (Dickinson, 2004; Sugiarti, 2005; Susanto, 2005) [8, 27, 28].

6. Conclusion

There is the influence of the application of plasma cluster strategy based on multiple intelligences against learning achievement of cognitive in students XI Biology in Santa Maria Catholic High School Malang. The result of Least Significant Difference (LSD) test showed that average of learning achievement of cognitive treated by using plasma clusterstrategy based on multiple intelligences is amounting to 72.48 higher than conventional strategy that is equal to 58.94. Meanwhile, an increase in learning achievement of cognitive treated with plasma cluster strategy based on multiple intelligences by 50.00% higher than the conventional strategy that is equal to 23.01%.

7. Suggestion

Based on the above conclusion, the result of this study are very suitable for use as an alternative to improve the quality of biology education in senior high school, then presented some suggestion as follows.

1. Plasma cluster strategy based on multiple intelligences can be used as alternative to improve learning achievement of cognitive, so it can be used as input for the school to be developed as a strategy of effective learning, especially in biology and in other subjects.
2. At the time of the learning process teachers are expected to use plasma cluster learning strategies based on multiple intelligences consistently because it has proven successful to improve the learning achievement of cognitive.

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