Journal of Physics: Conference Series

The Effectiveness of Cooperative Learning Model in the Type of *Numbered Heads Together* (NHT) Assisted with *Picture Puzzle* Media on Self-Efficacy and Student Learning Outcomes in the Coordination System Material

To cite this article: A. Sri Puji Retno *et al* 2021 *J. Phys.: Conf. Ser.* **1779** 012058

The Effectiveness of Cooperative Learning Model in the Type of *Numbered Heads Together* (NHT) Assisted with *Picture Puzzle* Media on Self-Efficacy and Student Learning Outcomes in the Coordination System Material

Sri Puji Retno A.[1*], Nur Khoiri[2], Bunga Ihda Norra[3]

[1]Student of Biology Education, UIN Walisongo Semarang, Central Java, Indonesia, [2]Lecture of Biology Education, UIN Walisongo Semarang, Jawa Tengah, Indonesia, [3]Lecture of Biology Education, UIN Walisongo Semarang, Jawa Tengah, Indonesia

[1]aminingsihretno@gmail.com [2]nurkhoiri@walisongo.ac.id [3]bungaihda@walisongo.ac.id

Abstract. The purpose of this study was to determine the effectiveness of cooperative learning model in the type of *Numbered Heads Together* (NHT) assisted with picture puzzle Media on self-efficacy and student learning outcomes. The research design used was *quasi experimental design* in the form of *nonequivalent control group design*. The sample of this study was class XI in SMA Al Islam Wirosari which was taken by non-probability sampling with the number of 77 students. The data were analyzed by using independent sample t-test, based on the result shows that: (1) The student's self-efficacy score obtained t-count (3.890)> (5% = 1.665), then Ho is rejected and Ha Furthermore. The t-test results on students learning outcomes obtained t-count (3,357)> (5% = 1,665), then Ho is rejected and Ha is accepted. (2) Based on the results of the N-Gain test the self-efficacy score of the experimental class was 0.3 and included in the middle category, the control class was 0, 1 was included in the low category, while the N-Gain test result of students learning outcomes in the experimental class were 0.506 and it included in the middle category , in the control class of 0, 285, it included in the low category. This study concluded that the Numbered Heads Together (NHT) in cooperative learning model assisted with picture puzzle media is effective in self-efficacy and student learning outcomes in the coordination system material.

Keyword: NHT (Numbered Heads Together) Model, *Picture Puzzle* Media, Self-Efficacy, Learning Outcomes, Coordination System

1. Introduction

Learning outcomes is part of students which it cannot be released by them as a form of actualization of students' self potential. So, learning outcomes can be used as benchmarks of success achieved by students during the lesson . Learning outcomes is the level of students success in learning the subject at school which is expressed in scores and obtained from test results to recognize a number of specific subject matterials. (K. Brahim, 2007).

Seeing the importance of learning outcomes, of course it cannot be separated from its existence towards the learning process that is passed. Learning is a complex process, the changes of behavior that occur when the learning process is observed after an evaluation or assessment. That value is a measure of student success over the learning process in the long time and then takes the final test. The teacher determines student achievement from the test (Rusman, 2017).

According to Bloom learning outcomes includes cognitive, affective and psychomotor abilities. The cognitive domain is knowledge (knowledge, memory), comprehension (understanding, explaining, summarizing). Affective domain is receiving (responding attitude), responding (giving response). The psychomotor domain includes productive, technical, physical, social and intellectual skills (Suprijono, 2015)

One way that students can get high grades, students must be able to understand their potential. One aspect of self-efficacy is self potential. Self-efficacy or self-efficacy (efficacy expectation) is one's own perception of how well the self can function in certain situations. Self-efficacy is an important factor related to confidence in one's own potential (Alwisol, 2014).

Someone with good self-efficacy will have the belief that they can solve a problem that is faced well without having to procrastinate (Rahmi et al., 2017). While someone who has low self-efficacy tends to easily give up facing the situation (Schultz & Sydney, 2016)

Seeing the importance of self-efficacy and student learning outcomes in the learning process causes the influencing factors to be very complex. The factors that influence self-efficacy and learning outcomes are internal factors and external factors. Internal factors are factors that originate from within students, such as physical (physical) and psychological factors (Sugihartono, et al, 2007), while external factors are factors that originate from outside the student, such as environmental factors and instrumental factors (learning tools, curriculum, teachers, etc.) (Rusman, 2017). These factors must be considered more by both teachers and students.

One of external factor that influences learning is the instrumental factor. Inside there is a learning instrument that is the learning model. If the learning model used is interesting then student learning outcomes or student achievement will also be high. In line with Wibowo's research (2010) learning using one cooperative model shows better learning outcomes than using the lecture model. Strengthened by Wahidah's research (2013) there was indeed a proven positive influence between the cooperative learning model and student learning outcomes.

One form of effective learning models is the cooperative learning model. Cooperative learning is student learning activities carried out in groups (Rusman, 2017). Students who study in groups will find it easier to understand the material. One form of cooperative learning models is the NHT (Numbered Heads Together) model. Numbered Heads Together is a learning method in which each student is numbered and made into a group, then the teacher randomly calls out a number from the student. The purpose of this learning model is to provide opportunities for students to share ideas, discuss answers, and enhance cooperation (Hamdani, 2011).

Based on the background of the above problems, this study aims to examine the effectiveness of the NHT learning model on self-efficacy and learning outcomes of high school students.

2. METHOD

This type of research is a quasi-experimental design research with pretest - posttest control group design. The study was conducted during the even semester at Al Islam Wirosari Grobogan High School. The population of this study were 77 students of Natural Sciences 1 and Natural Sciences 2 classes. Sampling uses saturated sampling that is to make all members of the population as a sample. Class XI IPA 1 as a control class and class XI IPA 2 as an experimental class

The experimental class was given treatment in the form of learning using the NHT learning model while the control class used an interactive lecture learning model. Before the learning activities both experimental and control class students were given a pretest as well as after the learning activities were given a post test to find out the learning outcomes. In addition to knowing self-efficacy students were given a self-efficacy questionnaire before the pretest and after the post test.

The pre-requirement analysis of the pre-test and post-test scores and self-efficacy questionnaire scores was performed using the normality test and homogeneity test. Normality test uses the *Chi Square* formula (X2). with a significance level (α) of 5%. if $\chi 2$ *count* ≤ $\chi 2$ *tables* then the data can be declared normally distributed (Sugiyono, 2016: 204). Homogeneity test is done by comparing F_{count} with F_{table} significance level of 5%, If $F_{count} < F_{table}$ then the data is homogeneous.

Hypothesis testing techniques using t-test (independent sample t-test) one party with a significance level (α) of 5%. If t-count ≤ t-table, H_o is accepted and H_a is rejected, which means the average self-efficacy score and the post-test scores of the experimental class students are not higher than the control class. If $t_{count} > t_{table}$ then H_o is rejected and H_a is accepted, which means the average self-efficacy score and the post test score of the experimental class students is higher than the control class so that learning using the NHT (Numbered Head Together) cooperative learning model is assisted by effective picture puzzle media self and student learning outcomes.

3. RESULTS AND DISCUSSION

3.1 Description of Data on Self-Efficacy and Learning Outcomes

Student self-efficacy data were taken from self-efficacy questionnaires that were distributed before the pretest and after the post test. The summary of the results of each student's self-efficacy indicator in the control and experimental class can be seen in Figure 1. Following:

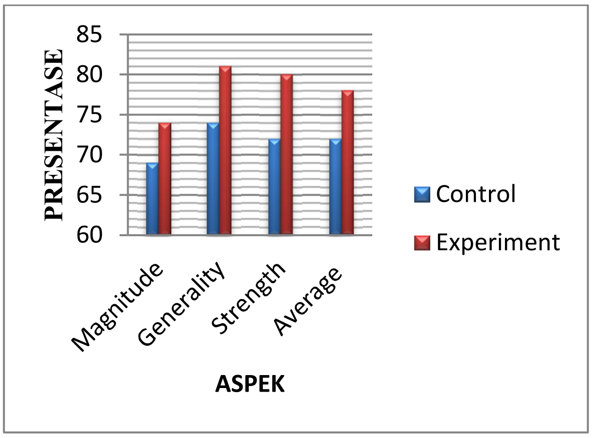

Figure 1. Student’s Self Efficacy

Figure 1. Showing the results of student self-efficacy in terms of 3 indicators / aspects / dimensions of self-efficacy in the experimental class the dimensions of magnitude were 74%, generality was 81%, strength was 80% and an average of 78% was obtained. Whereas in the control class the dimensions of magnitude are 69%, generality is 74%, strength is 72% and an average of 72% is obtained. the percentage of self-efficacy questionnaires in the experimental class was higher than the percentage of self-efficacy questionnaires in the control class.

In addition to being reviewed from each dimension, students 'self-efficacy was also viewed from the results of students' self-efficacy scores during the pretest and post test of the experimental class and the control class. The average score of the self-efficacy score of the experimental class students was 78.19 and the average score of the self-efficacy score of the control class students was 71.55 so that the average self-efficacy score of the experimental class students was higher than the average score of the self-efficacy of the control class students (78.19> 71.55). The average score of students' self-efficacy scores of the experimental class and the control class can be seen in Figure 2. The following.

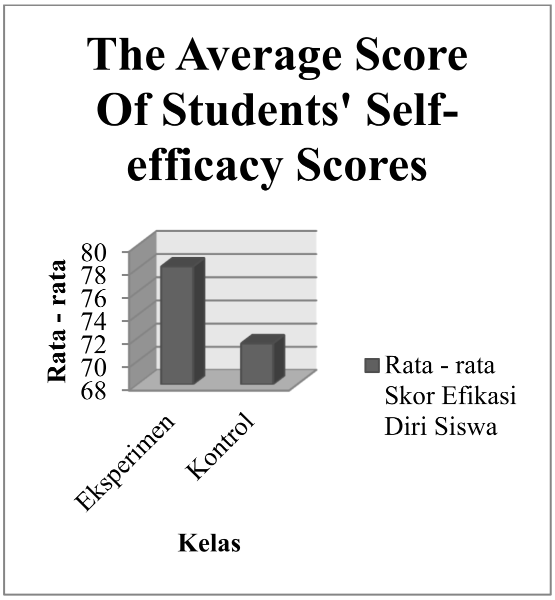

Figure 2. Comparison of The Average Score of Student Self Efficacy Scores

The average post test score of the experimental class students was 84.11 and the average post test score of the control class was 79.97 so that the average post test score of the experimental class was higher than the average post test score of the control class (84, 11> 79.97). This can be seen in Figure 3. below.

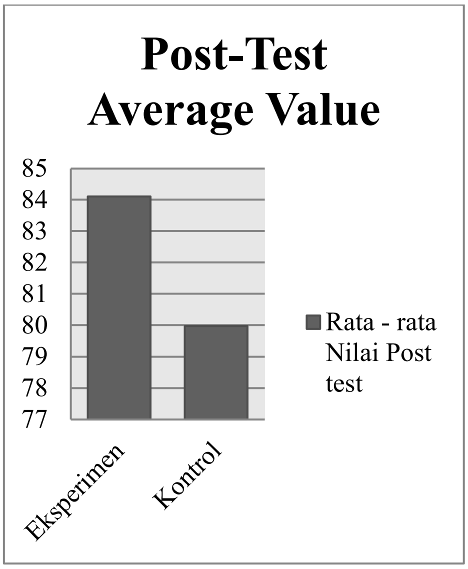

Figure 3. Comparison of Post-Test Average Value of Experiment Class and Control Class.

The average N-gain of the experimental class is higher than the control class, where the average N-gain of the experimental class = 0.586 and belongs to the medium category while the average N-gain of the control class = 0.285 and belongs to the low category. This can be seen in Figure 4. Following:

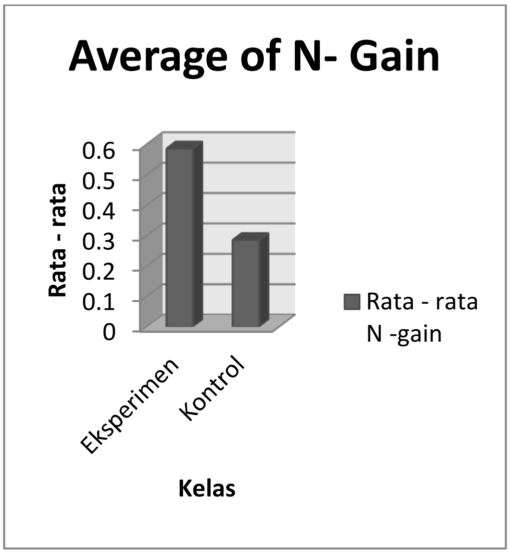

Figure 4. Comparison of questionnaire self-efficacy Experiment Class and Control Class.

The average N-gain questionnaire self-efficacy experimental class is higher than the control class, where the average N-gain experimental class = 0.3 and included in the medium category while the average N-gain control class = 0.1 and included low category. This can be seen in Figure 5. follows:

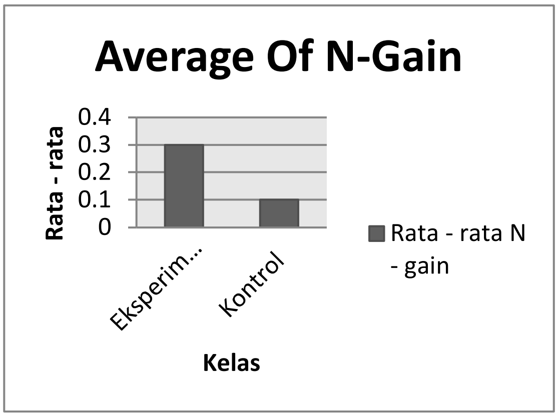

Figure 5. Comparison of Average N-gain Self-Efficacy Score of Experiment Class and Control Class

3.2 Analysis of Test Prerequisites

Normality test results of learning outcomes data with a significance level (α = 5%) for the experimental class with $X^2{}_{count}$ pretest 7,714 and $X^2{}_{count}$ post test 6,765 less than $X^2{}_{\text{table}}$ 11,070 because $X^2{}_{count}$ < $X^2{}_{\text{table}}$, then the data is normally distributed, then in the control class with $X^2{}_{count}$ pretest 10.193 and $X^2{}_{count}$ post test 6.691 less than $X^2{}_{\text{table}}$ 11.070 because $X^2{}_{count}$ < $X^2{}_{\text{table}}$, then the data is normally distributed. As for the results of the normality test of students' self-efficacy data after treatment with a significance level (α = 5%) for the experimental class with $X^2{}_{count}$ 10.720 less than $X^2{}_{\text{table}}$11.070 because$X^2{}_{count}$ < $X^2{}_{\text{table}}$, then the data is normally distributed, then in the control class with $X^2{}_{count}$7.037 less than $X^2{}_{\text{table}}$ 11.070 because $X^2{}_{count}$< $X^2{}_{\text{table}}$,, then the data have a normal distribution.

Homogeneity test results of learning outcomes data, the F_{count} pre test results were 1.027 and the post test results obtained F_{count} of 0.543, while the was F_{table} 1.725. From these data it can be seen that F_{count} < F_{table}, thus the learning outcomes of the experimental class and the control class have the same variance or the data of both samples are homogeneous.

For post-test self-efficacy scores obtained F_{count} of 1, 496, while $F_{table}$for 1.725. From these data it can be seen that $F_{count} < F_{table}$, thus the data of self-efficacy scores in the post test of the experimental class and the control class have the same variance or the data of both samples are homogeneous.

3.3 Hypothesis testing

After the prerequisites are tested, the posttest value data is tested by the hypothesis using a one-party independent sample t-test. The test criteria: if t_calculate ≥ t_ (table) with dk = n_1 + n_2 - 2 and a significance level of 5%, then H_o is rejected and H_a is accepted so that the average post test value of the experimental class students higher than the average post test score of control class students.

In addition to the cognitive learning outcomes data (Post-test) analyzed, the results of students' self-efficacy scores will also be tested in hypotheses using a one-party independent sample t-test. The test criteria: if $t_{count} \geq t_{table}$with dk = $n_1 + n_2 - 2$ and a significance level of 5%, then H_o is rejected and H_a is accepted so that the average self-efficacy score of the experimental class students is higher than the average score of students' self-efficacy scores control. Based on the t-test calculation of the experimental class and the control class the following results are obtained:

Class	Experiment	Control
Calculate of Value	2971	2791
N	38	39
Average	78,19	71,55
Varians	44,71	66,90
Standart Of Deviacy	6,69	8,18
t_{count}	3,890	
t_{table}	1,665	
Dk	75	

Table 1. shows that $t_{count} > t_{table}$is 3,890> 1,665, then t_{count} is in the rejection area H_o. Therefore it can be concluded that the average score of students 'self-efficacy scores in the experimental class is higher than the control class which means the use of the NHT (Numbered Heads Together) cooperative learning model is assisted by a puzzle picture media effective on students' self-efficacy.

Table 2. Recapitulation of Calculation Results for Hypothesis II Test (Learning Outcomes)

Class	Experiment	Control
Calculate of value	3196	3119
N	38	39
Average	84,11	79,97
Varians	37,61	20,45
Standart of Deviacy	6,13	4,52
t_{count}	3,357	
t_{table}	1,665	
Dk	75	

Table 2. Shows that that t_{count}> t_{table} is 3,928> 1,665, then $t_{count}$is in the rejection area Ho. Therefore it can be concluded that the average post test score of the experimental class students is higher than the control class which means that the use of the NHT (Numbered Heads Together) cooperative learning model is assisted by the puzzle picture media effectively on student learning outcomes.

The experimental class and the control class actually get the same learning time as much as two meetings and each meeting for 2 X hours (2 X 45 minutes), the same teacher, the same learning material, namely the coordination system material. However, in this study the difference between the experimental class and the control class is the learning model. In the experimental class using the NHT learning model while in the control class using regular learning with the lecture method.

3.4 Self-efficacy

The average score of the self-efficacy score of the experimental class students was 78.19 and the average score of the self-efficacy score of the control class students was 71.55 so that the average self-efficacy score of the experimental class students was higher than the average score of the self-efficacy of the control class students (78.19> 71.55). Self Efficacy (Self efficacy) students have increased after being given. treatment of different learning models between the experimental class and the control class. because self-efficacy arises when students understand a certain material concept. Students who have high self-efficacy can increase their academic abilities so self-efficacy is very influential on student learning outcomes. This is in accordance with the theory of Bandura (1997: 30) In carrying out various tasks, people who have high self-efficacy are as people who perform very well. Those who have high self-efficacy are happy to meet challenges. Self-efficacy does not appear by itself but is obtained from many sources including self-experience, others, when the interaction between the teacher and students who share knowledge can increase student self-efficacy. In line with the thinking of Schultz & Sydney (2016: 407-409) assessment of self-efficacy is based on four sources of information, namely: Achievement, indirect experience, verbal persuasion, physiological and emotional stimuli. During the group discussion each student will feel that if there is an active student who can answer questions from the teacher there will be a sense of confidence that he can also do the same with the student. This is the benefit of the Numbered Heads Together (NHT) learning model where experience indirectly influences the high and low self-efficacy of students.

Viewed from Figure 1 it can be seen that the percentage of self-efficacy questionnaire in the experimental class is higher than the percentage of self-efficacy questionnaire in the control class. In the magnitude dimension where this dimension refers to the level of difficulty of the task that is believed the individual will be able to overcome it (Bandura, 1997: 37) students who find it difficult to do the task in the control class more than in the experimental class. In the generality dimension where this dimension refers to variations in situations where an assessment of self-efficacy can be applied (Bandura, 1997: 37) students who judge themselves feel capable in the experimental class more than in the control class for which most of them give an assessment that they are pessimistic about something they do. On the strength dimension where this dimension is related to the strength of one's self-efficacy when dealing with the demands of a task or a problem (Bandura, 1997: 37) students who work diligently and are tenacious in their work in the experimental class are more numerous than students in the control class whose majority are easy despair of a challenge if the challenge is difficult. This means that the level of student confidence in their abilities in the experimental class is higher than in the control class. The students' self-efficacy score data were also further analyzed using the effectiveness level test (N-gain) whose results showed that the average N-gain of the experimental class self-efficacy questionnaire was higher than the control class, where the average N-gain of the experimental class = 0.3 and included in the medium category while the average N-gain control class = 0.1 and included in the low category. In this study the category of improvement only gets moderate results for the experimental class. This is because at the time of the learning process in the experimental class is more conducive than the control class but the ability of students between the experimental class and the control class that is not much different can also be the cause.

3.5 Learning outcomes

The average post test score of the experimental class students was 84.11 and the average post test score of the control class was 79.97 so that the average post test score of the experimental class was higher than the average post test score of the control class (84, 11> 79.97). This can be seen in the following graph 4.1. The difference in the results of the post test scores is influenced by the learning model applied. In the experimental class when learning takes place students are more active and enthusiastic in learning so learning tends to be interesting and fun this is confirmed by Munadi in Rusman (2017: 130-131) that the use of learning models is one of the factors that influence learning outcomes, namely instrumental factors or factors from outside the student. In addition, students are also interested in the rewards given to the most active groups so that this increases the enthusiasm of students to understand material that has an impact on learning outcomes that are higher than the control class. According to Suryani, et al (2012: 83) learning models in the form of cooperative learning can enhance academic achievement so as to help students understand difficult concepts. This is consistent with research in which NHT learning strategies affect student cognitive learning outcomes (Nursyamsi, 2016: 197).

The average post test value in the control class is lower than the experimental class. This is because when learning in the control class students tend to be inactive and sometimes there are even students who play alone, sleepy, chatting with their peers, often permission to use the restroom, and so on. In fact, in this interactive lecture model the teacher has provided material for the coordination system by lecturing as well as provoking questions related to the material so that students remain attentive and give a good response. The teacher places himself as the main source of knowledge. The teacher conveys knowledge to students, organizes all teaching and learning activities, while controlling the knowledge and skills that students must master. Conventional teaching is based on the theory of behaviorism. The stimulus process response and the law of practice become very dominant in learning. The teacher provides a stimulus in the form of delivery of material, while students respond by taking notes, processing information in their memory, and asking if there is material that is not understood (Ratumanan. 2015: 15). The pretest - post test value data was also further analyzed using the effectiveness level test (N-gain) which results showed that the average N-gain of the experimental class was higher than the control class, where the average N-gain of the experimental class = 0.586 and including the medium category while the average N-gain control class = 0.285 and included in the low category. In this study the category of improvement only gets moderate results for the experimental class. This is due to the fact that during the learning process both the experimental class and the students' control when they were going to do the post test were equally highly motivated so that the learning outcomes obtained did not disagree too much.

4. Conclusion

Based on the results of the analysis and discussion that has been done, it can be concluded that the Numbered Heads Together (NHT) in cooperative learning model assisted with picture puzzle media is effective in self-efficacy and student learning outcomes in the coordination system material.

References

[1] Alwisol, *Psikologi Kepribadian*, Malang: UMM Press, 2014.
[2] Bandura, A., *Self-efficacy: The exercise of control* (pp. 3-604), New York: wH Freeman, 1997.
[3] Hamdani, , *Strategi Belajar Mengajar*, Bandung: CV Pustaka Setia, 2011.
[4] K. Brahim, Theresia., "*Peningkatan Hasil Belajar Sains Siswa Kelas IV Sekolah Dasar, melalui Pendekatan Pemanfaatan Sumber Daya Alam Hayati di Lingkungan Sekitar*", Jurnal pendidikan penabur no 09 tahun ke 6 hlm. 4, 2007.
[5] Nursyamsi, Aloysius Duran Corebima, Herawati Susilo, *Pengaruh Strategi Pembelajaran Numbered Heads Together (NHT) Terhadap Hasil Belajar Siswa SMA Negeri 1 Muara Badak*, Jurnal Pendidikan:Teori, Penelitian, dan Pengembangan Volume: 1 Nomor: 10, 1993—1998, 2016.
[6] Rahmi, N., Khaldun, I., & Fitri, Z., Hubungan Efikasi Diri dan Kemandirian Belajar dengan Indeks Prestasi Kumulatif (IPK) Mahasiswa Pendidikan Kimia Angkatan 2012, 2013, dan 2014 Universitas Syiah Kuala, *Jurnal Ilmiah Mahasiswa Pendidikan Kimia*, *2*(1), 2017.
[7] Ratumanan, *Inovasi Pembelajaran*, Yogyakarta: Ombak, 2015.
[8] Rusman, *Belajar dan Pembelajaran Berorientasi Standar Proses Pendidikan*, Jakarta: Kencana, 2017.
[9] Schultz, Duane P., & Sydney Ellen Schultz, *Teori Kepribadian*, Jakarta: EGC, 2016.
[10] Sugihartono, dkk., *Psikologi Pendidikan*, Yogyakarta: UNY Press, 2007.
[11] Suprijono, Agus, *Cooperative Learning Teori Dan Aplikasi PAIKEM*, Yogyakarta: Pustaka Pelajar, 2009.
[12] Suryani, Nunik dan Agung, Leo, *Strategi Belajar Mengajar*, Yogyakarta: Ombak, 2012,.
[13] Wahidah, Nur, Skripsi: Pengaruh Penerapan Metode *Numbered Head Together* (NHT) Terhadap Minat Dan Hasil Belajar IPA Biologi Siswa Di MTsN Maguwoharjo, Yogyakarta: UIN Sunan Kalijaga, 2013.
[14] Wahyu, W., Peningkatan Efikasi Diri Peserta Didik dalam Pembelajaran Kimia melalui Teknik Jigsaw II, *Prosiding Simposium Nasional Inovasi dan Pembelajaran Sains 2015*, 2015.