

THE EFFECT OF THE JIGSAW LEARNING METHOD AND INITIAL ABILITY ON THE LEARNING OUTCOMES OF AUTOMOTIVE ENGINEERING STUDENTS

Frandska Eltjan, Amat Mukhadis, Paryono

Universitas Negeri Malang

E-mail: frandskaeltjan@gmail.com

ABSTRACT

The purposes of this study were testing the significant differences of learning outcomes between group of students who were treated with jigsaw learning method and those who were treated with the conventional method with considering the students' initial ability. This study was designed with a quasi-experimental non-equivalent control group design. The sampling technique used random assignment. The sample consisted of 63 students. A test was used to measure the initial ability and learning result of the students. The data were analyzed by using a two way Anova method. The results were: (1) the learning outcomes of students in the subject of electronic ignition system maintenance with jigsaw learning method was better than the students treated with conventional learning; (2) based on the learning outcomes in the subject of electronic ignition system maintenance, a group of students with high initial ability was better than a group of students with medium and low initial ability; (3) there was not interaction between learning method and initial ability towards learning outcomes students. It means, the excellence of jigsaw learning and conventional learning in improving learning outcomes for the subject of electronic ignition system maintenance do not depend on students' initial ability.

Keywords: jigsaw learning method, initial ability, learning outcomes

INTRODUCTION

Vocational High Schools are educational institutions that are expected to create high quality students and to develop the potential of its students to be able to work in certain areas. Referring to the Regulation of the Minister of National Education No. 22 of 2006, it is stated that the purpose of vocational high schools is to improve intelligence, knowledge, personality, noble character as well as skills of student to live independently and follow further education in accordance with the vocational program (Ministry of National Education, 2006).

The Regulation of the Republic of Indonesia number 20 in 2013 article 15 states that vocational education is middle education that prepares students mainly to work on certain areas. Vocational high schools prepare students to enter employment and develop professional attitudes. As vocational education, vocational education institutions are expected to be able meet the academic demands for achieving the educational goals.

One of the competency standards that every students of vocational high school have to

master is the subject of electronic ignition systems maintenance. The subject of electronic ignition system is basic competence that must be mastered by students majored in automotive engineering, because it is one of the main subject in automotive engineering. Based on the Decision of the Director General of High School Education number 1464/D3.3/KEP/KP/2014, this subject is included in C3 group which is the group of skill competency on light vehicle engineering expertise package. According to the syllabus of K-13 curriculum, the characteristics of this subject is competencies taught to the twelve grade students of light vehicle engineering classes in odd semester consist five main subjects, namely: (1) Definition of an electronic ignition system; (2) Definition and function of components in electronic ignition system; (3) Various kinds of signal delivery in electronic ignition system; (4) The principles of how electronic ignition system work; (5) Interference analysis and repair of electronic ignition system.

Electronic ignition system learning has a variety of subjects including identifying various

kinds of electronic ignition system which are: (1) Electronic ignition system with platina (TCI-K); (2) Electronic ignition system with inductive sinyal (TCI-I); (3) Electronic ignition system with hall sinyal (TCI-H); (4) Electronic ignition system with micro-prosesor (Ulrich & Mardji, 2000).

Based on observations on 7th September 2016 at SMKN 6 Malang with interviewing the teacher, the difficulty encountered during the learning process was the students were passive in working together, expressing opinions, as well as asking and answering questions. This was related to the ability to think and to communicate. In addition, the students' learning outcomes obtained in 2015 to 2016 in the odd semester was less satisfactory. The average of the students' learning outcomes in the classes of XII TKR 1, XII TKR 2, XII TKR 3, XII TKR 4, XII TKR 5 were 75, 69, 68, 62, and 70 respectively.

The overall students' learning outcomes in the class of XII TKR in 2015-2016 was not effective because the average scores was just 69, and it did not reached the desired minimal mastery criteria which was 71. In addition, researchers observed the learning process in the class XII TKR 1 still used the conventional learning in the form of lectures with the help of power point presentations. When teachers deliver learning materials some students had jokes and some students just be silent listening the explanation from the teacher. The students felt bored with the learning situation, the student's interest to receive the materials being studied was low.

Pribadi (2011: 85) suggests that conventional learning uses a lecture method by teacher to deliver informations and knowledge to group of students, while students listen carefully and record the key points presented by the teacher. In other words, the teacher is more active than the student, so the role of the student as the subject of learning is not achieved.

In general, the learning model can be classified into several types, there are individualistic learning, competitive learning,

and cooperative learning (Lie, 2010:12). One type of learning method that is considered accommodative to improve the learning outcomes is cooperative learning method. This method can be a good alternative in the learning process, this is in accordance with the opinion of Slavin (2009:4) that there are some reasons why cooperative learning being used : (1) to improve students' achievement; (2) to develop relationship between groups of students; (3) to provide acceptance of an academically weak friend; dan (4) to increase confidence.

Theoretically, the cooperative learning method can be used as a solution as an alternative to improve the students' learning outcomes. One type of cooperative learning method is Jigsaw. Isjoni (2009:54) stated that jigsaw cooperative learning is a learning method that emphasizes on the students' activity in searching, processing, and reporting information from various sources that are finally presented in front of the class. Jigsaw contains six stages namely :(1) form a group of origin (2) divide tasks and form expert groups; (3) expert discussion; (4) group discussion of origin; (5) giving individual test; and (6) assessment.

Jigsaw learning will increase students' academic mastery because in this method students occupy a very dominant position in the learning process and the occurrence of cooperation in the group will facilitate students in understanding the materials. Learning with jigsaw technique can improve the quality of the students' learning (Tawardjono et al., 2014, Waluyanti and Santoso, 2015).

Downey, Leinhardt, Slavin, and Stronge in Arends (2008:12) show that cooperative learning can significantly improve learning achievement. In addition, with expert group discussions each student strives to understand every material learned and responsible for conveying to each member of their original group. Although students have the full responsibility to complete their own tasks, each student must also know and solve all the questions. In line with this, Isjoni (2009: 78)

also revealed that in jigsaw learning there are groups of experts and groups of origin. The origin group is the initial group of students consisting of several members of the expert group formed by observing the students' diversity and background. The group of experts is a group of students consisting of members of other groups (home group) who were assigned to explore a particular topic and then explained to the members of the original group. Their cooperation within the group of experts and the initial group provide better opportunities for students to ask a friend of the group, because sometimes students are reluctant to ask the teacher as a mentor when they found difficulty in understanding a subject (Zuhri, 2008:28).

Apart from the applied method of learning, student learning outcomes also be influenced by other factors that is the initial ability of the students. Herawati et al. (2013: 38) said the student's initial ability is one of the internal factors that affect student's learning achievement because the initial ability can describe the readiness of students in following a lesson. Early skills are also viewed as relevant skills that students have to follow a lesson. Therefore, in this study, it will also be examined the influence of students' initial ability on learning outcomes.

The purpose of this study was to test the significance of: (1) the differences of learning outcomes in the subject of electronic ignition systems maintenance between groups of students who were treated with an alternative method of jigsaw learning and groups of students who were treated with the conventional learning; (2) the differences of learning outcomes in the subject of electronic ignition system maintenance between groups that have high medium, and low initial ability (3) interaction between the learning method and the initial ability to the students' learning outcomes.

METHOD

The study used a quasi-experimental with non-equivalent control group design. Pre-test and posttest were given to two groups (experiment and control) that was determined with a random assignment. Selection of study design was in accordance with the opinions expressed by Campbell & Stanley (1996) in Mukhadis (2016: 241-242) that selection and the purpose of a quasiexperimental design are: (1) Manipulating one or more independent variables systematically and logically (2) Observing its effect on the dependent variable (3) Minimizing the possibility of contamination of other variables (variables either the moderator or control variables); dan (4) The strategy of assignment random sampling to the existing groups (classes) in determining the control group and experimental group. The relationships between the subjects treated as experimental and control groups, designated alternative treatments, and measurements through pretest and posttest in this research design were presented in Table 1

Table 1. Research Design

Subject	Pre test	Treatment	Post test
Experimental Group	O_1	X	O_3
Control Group	O_2	-	O_4

Source : Mukhadis (2016: 246)

- X) : Jigsaw learning
- (-) : Conventional learning
- (O_1) : The pretest result of experimental group
- (O_2) : The post test result of control group
- (O_3) : The pretest result of experimental group
- (O_4) : The post test result of control group

The class of XII TKR 1 was the experimental group that received a designated

alternative treatment. The class of XII TKR 2 as control group received the conventional learning. Both classes did a pretest to find out the initial ability of students, and then they did a posttest to find out the learning outcomes. The selection of experimental group and the control group is conducted through random sampling.

The factorial design was used to determine the results of data analysis in this study consisting of two factors namely: (1) Implementation of jigsaw and conventional learning in the class of XII TKR SMK Negeri 6 Malang; (2) the initial ability of students are divided to three categories high, medium, and low. This factorial design was expressed in the form of pattern A.2 x 3 as presented in Table 2.

Table 2. Factorial Design 2 x 3

Initial ability	Learning Method	
	Jigsaw (X_A)	Conventional (X_B)
(X_1)	X_{A1}	X_{B1}
(X_2)	X_{A2}	X_{B2}
(X_3)	X_{A3}	X_{B3}

- (X_1) : High initial ability
 (X_2) : Medium initial ability
 (X_3) : Low initial ability
 (X_A) : Jigsaw learning method
 (X_B) : Conventional learning method

The students were divided into 2 groups. The experimental group was treated with alternative treatment in the form of jigsaw learning (X_A) and the control group was treated with the treatment that has been going on in the form of conventional teaching learning (X_B). Each of the experimental and control groups was categorized into three categories: high initial ability students (X_1), medium initial ability students (X_2), and low initial ability students (X_3).

The population of this study was the class of XII Light Vehicle Engineering at SMK Negeri 6 Malang in the academic year of 2016/2017. The sample was selected by using a random sampling technique that was taking two classes from the five classes that were the class of XII TKR 1 (31 students) as experimental

group and the class of XII TKR 2 (32 students) as the control group. The selection of the group was rearranged through the draw but it was not individually randomized thus it did not disturb the learning process that was going on (Mukhadis, 2016: 243).

The research variables consisted of: (1) independent variable that was learning method; (2) moderator variable that was initial capability; (3) control variable that was learning material in accordance with the core competencies and the basic competencies that were determined, and allocation of time; (4) dependent variable that was the students' learning outcomes in the subject of electronic ignition system maintenance.

The research instrument used in this study was a test because it was characterized by the nature of the response given by the respondent (testee) contains the element of right or wrong meaning (Mukhadis, 2013: 202). The instrument to calculate the initial ability and learning outcomes of students consisted of 50 multiple choices questions that suit with the basic competence of the subject of electronic ignition system maintenance. Each item had score of 2 if it was true and 0 if it was wrong.

The data collection used the method of tests and observation. The test method in study were divided into two, pretest and posttest. The result of the pretest was used to measure the initial ability of students before the treatment, while the results of the posttest was used to examine the results of the study after the treatment. Meanwhile, the observation method was used to observe the effect of treatment of different lesson plan which were the conventional learning, in the control group and jigsaw learning method in the experimental class.

After all the data were collected, then the testing done in the data into two phases are: (1) pre-requirement test used to analyze the initial ability data including normality test by using One Sample Kolmogorov-smirnov and homo-geneity test by using Levene tes, if the varieties among the

groups distribute normally and homogen, the variety analysis among the group for hyphotesis testing can be continued; and (2) hyphotesis test used to test the hyphotesis of the study was submitted by using the two ways variety analysis test (Two Way ANOVA) with the helping of SPSS program 17.0 version, with the dependent variable of the lesson and the fixed factors value of learning method and initial ability.

RESULTS AND DISCUSSION

Before the hyphotesis testing was conducted, firstly the pre-requirement test should be performed (normality and homogeneity test) on the initial ability data. With the significance level of $\alpha = 0.05$, the data can be categorized as a normal (normal test) and homogen (homogenety test) distribution if $p > 0.05$ and the data is not a normal and non homogen distribution if $p < 0.05$.

The normality test of the initial ability data acquired the significance value of 0.970 in the experimental class, meanwhile the significance value of the control class is 0.486. The significance value is above the significance standard ($p > 0.05$) then it could be concluded both data have normal distribution. The resume of the normality test results is presented in Table 3.

Table 3. The Normality Test Result

Research Subject	Sig.	P	Information
Experimental Class	0.970	> 0.05	Spread Normally
Control Class	0.486	> 0.05	Spread Normally

The homogeneity test is used to show if two or more sampling data group come from the population which has the homogen variety. The result of the initial ability data acquired the significance value of 0.429. This significance value was above the standard of significance ($P > 0.05$), then it could be concluded if the data were homogeny.

Table 4. Homogeneity Test Results

Statistic test	Sig.	Information
Levene Statistic	0.429	Homogen

The analysis of prerequisite test results showed the data was qualified to further be tested with hypothesis testing. It was conducted to find out whether there were significant differences between each of the learning method categories and the initial ability as well as their interaction. Table 5 shows that Ho was rejected with $P < 0.05$, thus it could be interpreted that there was a significant differences of learning outcome between groups of students treated with jigsaw learning and conventional learning.

Table 5. Results of Variety Analysis

Source	F	Sig.	P
Learning Method	7.779	0.000	< 0.05
Initial Ability	96.866	0.000	< 0.05
Learning Method*Initial Ability	1.842	0.168	> 0.05

Table 6 explains that the results of the students treated with jigsaw learning performed better learning outcomes with the average score, the highset score and the lowest score of 82.3226, 96, and 70 respectively rather than the students treated with the conventional learning with the average score, the highset score and the lowest score of 74.6875, 90, and 60 respectively.

Table 6. Summary of Descriptive Analysis of Student Learning Outcomes

Group	Mean	Max	Min
Experiment	82.3226	96	70
Control	74.6875	90	60

The students were grouped based on the initial ability by referring to the pre-test analysis results. The groups were divided into three categories, namely: (1) the group of student with the high initial ability; (2) the

group of student with the medium initial ability; (3) the group of student with the low initial ability. This categorization was resulted from initial calculation interval based on the difference between the highest score with the lowest score. The difference was then divided by the sum of three appropriate categories. After the interval specified, then students were classified according the category intervals. The students in the experiment group, with high, medium and low initial ability were 32.25%, 29.03%, and 38.72% respectively. While in the control group, they were 25%, 31.25%, and 43.75% respectively.

Based on the data analysis, H_0 was rejected by $P < 0.05$. This could be interpreted that there was a significant learning outcome differences between the group of students with high, medium and low initial ability. The students with high initial ability performed higher learning outcomes with the average, the highest and the lowest scores of 88.44, 96, 82 respectively. The students with medium initial ability performed the average, the highest and the lowest scores of 79.36, 86 and 70 respectively. Furthermore, the students with low initial ability performed the average, the highest and the lowest scores of 70.84, 80 and 60 respectively.

The results showed the percentages of the students with high, medium and low in the experiment group were 32.25%, 29.03%, and 38.72% respectively. While the percentages of the students with high, medium and low in the control group were 25%, 31.25%, and 43.75%. Hypothesis testing was conducted to examine the students' learning outcomes in the subject of electronic ignition system maintenance treated with jigsaw learning was better than the students treated with conventional learning.

The differences of the students' learning outcomes were mainly resulted from the role of students in the learning process. In teaching-learning process conducted in experimental classes, teachers divided students into several groups in accordance with the subject matter to be provided. Each Member of the group had

responsibility to focus on learning materials to be presented to the initial group thus, the students can develop the knowledge, the ability to communicate, and skills in an open and democratic learning atmosphere. Sharan in Joyce (2009: 309) stated that learning in groups may cause migration of motivation from the external to the internal landscape. In other words, when the students work together in resolving a task, they will be interested in learning materials because they realize its' importance. They do not merely act as the objects of learning but as tutors to their peers (Isjoni & Ismail, 2008). Slavin in his research shows that cooperative learning is superior in improving learning outcomes (Ibrahim, 2000:16). In contrast with the jigsaw cooperative learning method, in the conventional method, students become more passive and teachers cannot get accurate data about the students' understanding.

Studies from previous research also showed the similar results. Annas (2014) and Suratno (2010) found that students taught with cooperative jigsaw learning method perform better in their learning than students who were taught with the conventional one. Suratno (2010) suggested that jigsaw could create more dynamic learning climate, thus the students could actively follow the learning process. Nur (2014) concluded that one of the advantages of jigsaw learning was more meaningful and students centered learning, so that the ability of the creative thinking and soft skills of the students could be increased. Zuhri (2008) in the other fields of study found that the excellent benefits of jigsaw learning method were (1) effective, because it involves the activeness of students while working in a small group. Students are placed in heterogeneous groups in terms of academic ability, motivation, and gender. (2) the existence of the specialization of duties, because the setting requires each student will get a special role in achieving the objectives of the learning activities.

In addition, Suratno (2010) claimed that the jigsaw learning method involved communication between students in groups of experts as well as groups of origin. Interchangeably, the students in the group of experts acted as tutor in the group of origin. Being a peer tutor, the students were highly motivated to improve their ability to communicate and argue the learning materials so that the knowledge owned at the time of working together in the group of experts could be received clearly by a friend in the group of origin. In conclusion, jigsaw learning is more excellent rather than conventional learning. It encourage the students to be active and to think critically in understanding the concepts of a lesson. Jigsaw learning focuses on the independence of the students in learning activities. They are no longer received the materials in one direction.

Based on the results of hypothesis testing, the students with high initial ability performed better learning outcomes than the students with medium and low initial ability. The high initial ability students were able to master the material more quickly, because they had adequate knowledge to start their learning. Irawan (2016) and Anggraini (2013) also supported this result and suggested that the students who had high initial ability would retain the higher learning results. Thus it clearly proves that the initial ability affects the students' learning outcomes. The initial ability is the internal factor that influence the results of the student's learning. It describes students' preparation in following a lesson (Herawati, et al., 2013). Rahmat (2016) explains that the initial ability has a positive influence on learning outcomes in terms of the ability and knowledge domain, but it does not have positive influence on learning outcomes in terms of the attitude domain. The students with high or low initial ability have the same opportunities to form attitude on practical subjects. The attitude of the students can be formed during the learning process. This means that the attitude of the students is more

influenced by the teaching method than the initial ability. Students who have higher initial ability may resolve the problem more quickly than their friends who have a lower initial ability. In addition, the initial ability for teachers also serve as information for determining steps in starting the learning process. By knowing the capabilities of the students, the teacher will know which students have understood the concept of the previous lesson or not. If students have not yet understood the concept of previous lessons, then students will have difficulty in accepting the concept of next lesson, so that it will be easier for the teacher to deliver the subject matter.

The results of hypothesis testing pointed that there was not interaction between the learning method and initial ability against the learning outcomes. This means that the excellence of the jigsaw learning to improve the learning outcomes does not depend on the students' initial ability, vice versa.

Irawan (2016) stated that the learning method could improve the learning outcomes on all categories of initial ability. Widhiarso (2011) found out the success of a learning method in improving students' learning outcomes do not depend on the initial ability of the students. In contrast, Anggraini (2013) suggested that there was interaction between the learning method, motivation to learn, and the student learning results. This was caused by the influence of a learning method towards students' learning outcomes depends on the motivation to learn and the initial ability of the student. In other words, the learning method need to be tailored to the characteristics of learning motivation and the initial ability of the students.

Based on these findings, the difference in the students' learning outcomes in the experimental group and the control group applies on all categories of initial ability. Vice versa, the difference of learning outcomes on every categories of initial ability apply on every learning method.

CONCLUSION

The students' learning outcomes in the subject of electronic ignition systems maintenance using jigsaw learning method is better than the students' learning outcomes treated with conventional learning method. The learning outcomes of the students with high initial ability in the subject of electronic ignition systems maintenance was better than the students with medium and low initial ability. There is not interaction between learning methods and initial ability towards learning outcomes. It means: (1) the improvement of the students' learning outcomes using jigsaw learning method is valid on any initial ability levels. (2) the students with high initial ability are superior than group of students with medium and low initial ability and this superiority does not depend on the learning method. The stakeholders of vocational high schools should design the programs of mentoring, supervisions, and teachers training to invite the teachers to update their knowledge of new learning methods because using conventional learning method is less effective. The teachers of vocational high school can apply the jigsaw learning method as an alternative besides conventional learning to help the students improve the independence and activeness in learning and solving every problems. Moreover, the teachers should pay attention to the variety of students' initial ability, because initial ability affect the process and the students' learning outcomes.

REFERENCES

- Annas, M.A. 2014. *Pengaruh Model Pembelajaran Kooperatif tipe Jigsaw terhadap Hasil Belajar Dasar-dasar Kelistrikan Siswa Kelas X di SMK Negeri 1 Pundong*. Thesis. Unpublished. Yogyakarta: FT UNY
- Anggraini, V.D. 2013. *Problem Based Learning, Motivasi Belajar, Kemampuan Awal, dan Hasil Belajar*. *Jurnal Ilmu Pendidikan*. 19. 2, 187-195
- Arends & Richard, I. 2008. *Learning to Teach: Belajar untuk Mengajar*. Translator: Helly Prajitno S & Sri Mulyantini S. Yogyakarta: Pustaka Belajar
- Herawati, R.F., Mulyani, S., & Redjeki, T. 2013. *Pembelajaran Kimia Berbasis Multiple Representasi Ditinjau dari Kemampuan Awal terhadap Prestasi Belajar Laju Reaksi Siswa SMA Negeri 1 Karanganyar Tahun Pelajaran 2011/2012*. *Jurnal Pendidikan Kimia*. 2. 2, 38-43
- Ibrahim, M. 2000. *Pembelajaran Kooperatif*. Surabaya: University Press
- Irawan, V.T. 2016. *Pengaruh Blended Learning dan Kemampuan Awal Siswa terhadap Hasil Belajar Mata Pelajaran Pemeliharaan Kelistrikan Kendaraan Ringan di Kelas XI TKR SMK Negeri 3 Singaraja*. Thesis. Unpublished. Malang: PPs TM UM
- Isjoni. 2009. *Cooperative Learning: Mengembangkan Kemampuan Belajar Berkelompok*. Bandung: Alfabeta
- Isjoni & Ismail. 2008. *Model-Model Pembelajaran Mutakhir: Perpaduan Indonesia - Malaysia*. Yogyakarta: Pustaka Belajar
- Joyce & Marsha, W. 2009. *Model of Teaching*, Alih bahasa: Achmad Fu-waid dan Ateila Mirza. Yogyakarta: Pustaka Belajar
- Lie, A. 2010. *Cooperative Learning*. Jakarta: Grasindo
- Mukhadis, A. 2003. *Pembelajaran Isi Tipe Prosedural*. Malang: UM Press

- Mukhadis, A. 2016. *Metodologi Penelitian Kuantitatif: Bidang Pendidikan dan Contoh Aplikasinya*. Malang: Aditya Media Publishing
- Mukhadis, A. 2013. *Evaluasi Program Pembelajaran Bidang Teknologi: Terminologi, Prosedur Pengembangan Program dan Instrumen*. Malang: Bayumedia Publishing
- Nur, I.M. & Abdullah, I.A. 2014. Penggunaan Model Pembelajaran Kooperatif Tipe Jigsaw untuk Meningkatkan Kemampuan Berpikir Kreatif dan Soft Skill Matematika Siswa SMA. *Jurnal Matematika dan Pendidikan Matematika*, (online). 3.2, 39-53. (<http://www.ejournal.unkhair.ac.id/index.php/deltapi/article>), accessed on 15 March 2017
- Permendiknas No.22 Tahun 2006 tentang Standar Isi untuk Satuan Pendidikan Dasar dan Menengah*. Jakarta: Ministry of Education
- Pribadi, B.A. 2011. *Model Assure untuk Mendesain Pembelajaran Sukses*. Jakarta: Dian Rakyat
- Slavin & Robert, E. 2009. *Cooperative Learning: Teori, Riset, dan Praktik*. Bandung: Nusa Indah
- Suratno. 2010. Memberdayakan Keterampilan Metakognisi Siswa dengan Strategi Pembelajaran Jigsaw - Reciprocal Teaching (JIRAT). *Jurnal Ilmu Pendidikan*. 17. 2: 150-156
- Sri Waluyanti & Djoko Santoso. Peningkatan Kesiapan Mahasiswa Dalam Menempuh Praktek Lapangan Melalui Peer Teaching Dengan Pendekatan Kooperatif Jigsaw. *Jurnal Pendidikan Teknologi dan Kejuruan*. 22.3, 365-371
- Tawardjono Us., Herminarto Sofyan & Gunadi. Peningkatan Mutu Pembelajaran Teknologi Pengecatan melalui Metode Jigsaw Bagi Mahasiswa Otomotif FT UNY. *Jurnal Pendidikan Teknologi dan Kejuruan*. 22.1, 89-98
- Ulrich & Mardji. 2000. *Modul Listrik Otomotif & AC*. Malang: VEDC Malang
- Undang-Undang RI No. 20 Tahun 2003 tentang Sistem Pendidikan Nasional. Presiden Republik Indonesia. (online), (<http://www.jdih.kemenkeu.go.id/fullText/2003/20TAHUN2003UU.htm>), accessed on 20 April 2017
- Widhiarso, W. 2011. *Arti Interaksi pada Analisis Varian*. Yogyakarta: UGM
- Zuhri, M.H. 2008. Pembelajaran Kooperatif Teknik Jigsaw, Motivasi Berprestasi, dan Hasil Belajar Geografi Siswa SMA. *Jurnal Ilmu Pendidikan*. 15.1, 26-34