IMPROVING STUDENTS' SELF-EFFICACY AND LEARNING OUTCOMES USING ARGUMENT DRIVEN INQUIRY LEARNING MODEL

Tukiran[1*], Choirun Nikmah[1], Harun Nasrudin[1]

Science Education, Post Graduate, Universitas Negeri Surabaya

Article history	Abstract
	This research aimed to improve students' self-efficacy and learning outcomes on electrolyte and electrolyte and non-electrolyte topic using Argument Driven Inquiry (ADI) learning model. The test was applied to 34 students of X-6 graders in Senior high school 7 of Surabaya. The Development model of this research used four stages 4D model from Thiagarajan (define, design, develop, disseminate). The implementation stage in the class used pre-experimental, pretest – posttest design. The evaluation of this research used the self efficacy questionnaire, motivation questionnaire and pretest –posttest questions. The result of the research showed that the increase of students' self efficacy average was 0.6 and the increase of students' motivation average was 0.6. In addition, the increase of students' earning result average was 0.7 in the category of high increase. Based on the data analysis, it can be concluded that using ADI learning model can improve self efficacy and student learning outcomes.

Introduction

The regulation of education minister number 70 of 2013 year stated that the education process under 2013 curriculum must develop the balance of spirituality and social awareness, the curiosity, creativity, teamwork with the intellectuality and psychomotor. The objective can be achieved by the developing the teaching instrument. The development is aimed to increase students' curiosity and creativity.

Teacher has a great role in detecting students' characteristics especially in increase the students' achievement. Lack of self-efficacy is worth to consider in order raising the student's effectiveness in learning. Farah (2018) stated that the lack of self efficacy can be solved by applying Argument Driven

Inquiry (ADI) learning method. While, Andriani (2015) confirmed that ADI significantly increase students' understanding of concept.

ADI is a learning method which focuses on the students' participation. It leads the students to construct and validate knowledge trough activity of investigation. This model is constructed to help the student understand how to build an scientific explanation, At the end, the students could reflect their work (Sampson et. 2016). In other way, ADI is a directed to a laboratory activity which hoped to make the students to be more scientific. This model also can be used to establish a logic argument (Annisa, 2015)

ADI is suitable to apply in science subject like chemical. In chemical, the student

*Corresponding Author:

Nama   : Tukiran

Lembaga   : Science Education, Post Graduate, Universitas Negeri Surabaya

Email   : tukiran@unesa.ac.id

is hoped to increase their self understanding and around (Depdiknas, 2006). The student is not only gain the knowledge but also able to apply the principles to their surroundings. Chemical subjects also lead the student to have scientific attitude like honest, objective, open – minded, tough, critical, and team-player. Chemical is also a media to construct students' thinking construction so they can develop their logical and analytic thought in inductive and deductive ways to chemical principles and concept.

Chemical is a complex subject which not only about calculating but also a series of experiment in order giving the students a meaningful learning experience directly for everyday life (Sastrawijaya, 1998). The experience appears in some chemical materials. One of them is the material of electrolyte and non-electrolyte. By experiencing the material, hoped the students could understand the concept of electrolyte liquid, non – electrolyte liquid, chemical reaction, and ionized.

ADI learning model used in learning is expected to be able to increase self-efficacy and also student learning outcomes on electrolyte and non-electrolyte material. The ADI learning model used can train students' thinking by emphasizing the importance of argumentation skills in increasing and validating scientific knowledge (Sampson et al., 2010)

Research Method

The research design used is a experimental design using 4D development learning method. This method is established on 3 stages. There are define, design, develop (Thigarajan, Semmel and Semmel. 1974). The setting of the research is in grade X-6 Senior High school of Surabaya with 34 students as the research subjects with 22 males and 12 females ranging in age from 17 until 18 years old. The effectiveness of teaching instruments is observed from the self-efficacy questionnaire, motivation questionnaire and pretest – posttest. The data collected is analyzed using descriptive and quantitative way. The following are the technique of data analysis for each aspect.

Learning Result Improvement Analysis

The learning result test instrument developed consist with pretest and posttest. instrument consist 10 multiple choice question, the learning outcome test validation are compiled with modus 4 with a very valid

category and the reliability is 90,6% with reliable category.

Analysis on the learning result is a posttest after finishing the project. The accumulation of score is formulated as the following:

Final Score = $\dfrac{\text{Score Gained}}{\text{Maximum Score}}$ x 100%

The gained score is converted with the following formula:

Score converted : $\dfrac{\text{Final Score}}{\text{Maximum Score}}$ x 4

The converted score is cited based on the Minister of education regulation number 104 Year 2014. The score range is noted as the following:

Table 1. Range Value of Knowledge
         Competence

Interval Score	Category
3,85 -4,00	A
3,51-3,84	A-
3,18-3,50	B+
2,85-3,17	B
2,51-2,84	B-
2,18-2,50	C+
1,85-2,17	C
1,51-1,84	C-
1,18-1,50	D+
1,00-1,17	D

(Minister of education regulation RI No.104, 2014)

The student learning ability is analyzed using N-Gain. N – Gain how the different ability before and after treatment. N – Gain was formulated by Hake (1999) as following:

$$<g> = \frac{S\,post - S\,pre}{S\,max - S\,pre}$$

Note:
$<g>$ = gained score
Spost = posttest score
Spre = pretest score
Smax = Maximum Score

The result of N-Gain will be converted using the following categories:

Table 2. Category of Normalized Gain

Score N-Gain	Category *Normalized Gain*
0,7 < N-Gain	High
0,3 ≤ N-Gain	Medium
N-Gain < 0,3	Low

(Hake,1999)

The Analysis of Self Efficacy and Motivation Questionnaire

The questionnaire of self efficacy and motivation questionnaire consist of 25 question with modus validity is 4 and reliability 98,6% and 98,72%.

The questionnaire result of self efficacy is categorized as the followings:

0 10 20 30 40 50 60 70 80 90 100
Never   sometimes   always

Based on the category above, if the students answer "never" in the instruments that have been provided, they will be given score "0", and if the students answer "sometimes" in the instruments that have been provided, they will be given score "50", while if the students answer "always" they will be given score "100".

The score of self efficacy and motivation gained is categorized into the following:

Table 3. Categorize of Self Efficacy and motivation

Score	Category
81 -100	Very High
61 – 80	High
41 – 60	Hingh Enough
21 – 40	Low
0 – 20	Very Low

(Arikunto,1997)

The different between self efficacy and motivation questionnaire in posttest and posttest after the application of ADI was analyzed by counting the average used the following formula:

$$< g > \quad = \frac{S\ post - S pre}{S\ max - S\ pre}$$

Note:
< g >	= gained score
Spost	= posttest score
Spre	= pretest score
Smax	= Maximum score

The result of N-Gain will be converted using the category of Table 2.

Results and Discussion

Self Efficacy Questionnaire

The self efficacy questionnaire were filled by 34 students of Grade X-6, the questionnaire is applied to find the increase of students' self efficacy. The following is the data of self efficacy increase presented on picture 1.
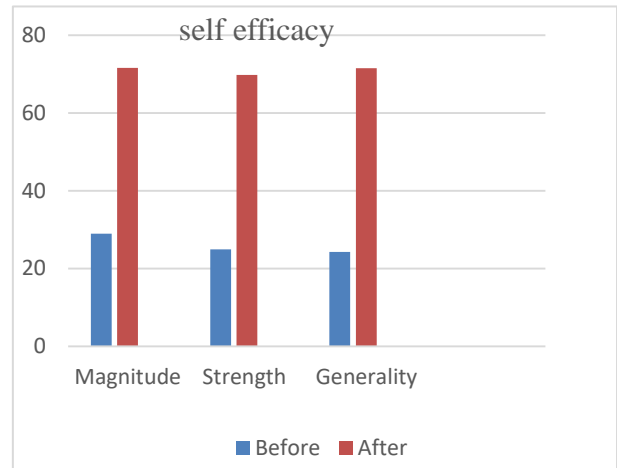

Figure 1. Self Efficacy of Students in sub scale

Based on the graphic above, the average score of self efficacy for three dimension before the learning process was 28,98; 24,92; and 24,25 and the self efficacy for three dimension after the process was 71,6; 69,84; and 71,56 with the average n-gain score is 0.61.

The score of self efficacy of each student can be seen in figure 1. Before the treatment, the average score was 26.529 with low criteria. After the treatment, the average score was 71, 94 with high criteria. The score increase by using the N-gain calculation. The average n-gain score is 0.61 with medium criteria. The increase of self efficacy gained is proper to the statement of (Farah et,al. 2018) if the lack of self efficacy can be solved by using ADI learning model. This is in accordance with the adi syntax at the argumentation stage.

Motivation Questionnaire

The motivation questionnaire was filled by 34 students of grade X-6. This process is aimed to find the increase of students' motivation. The following is the data of students' motivation in the form of graphic

Based on the graphic above, the students' motivation before the learning process was 26,58 in average and the score after the learning process was 70,88. The score reflects the increase of motivation. As shown in the picture 2, the raising is 0,60 in average.
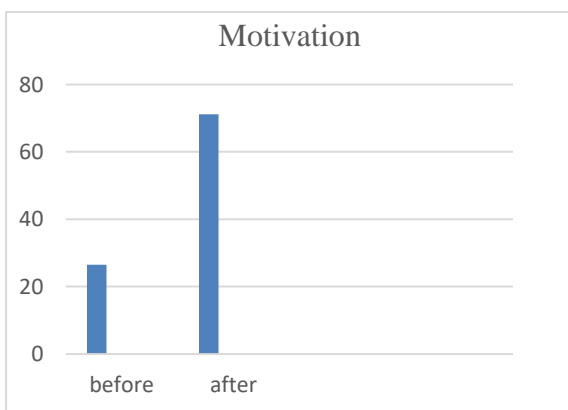

Figure 2. Motivation of student

The score of students' motivation can be seen on the picture 2. Before the treatmen, the average score was 26,58 with low criteria and after the treatment the score was 70.88 with high criteria. The score collected was calculated by using N-gain and indicated the increase of 0.60 with medium criteria.

Bandura (1994) stated that self efficacy had an important role in shaping motivation of someone. The statement was similar as what Pajaes (1996) stated. He (Pajares) stated that self efficacy has strong correlation with motivation, academic choice, changes, and achievement. However, each person is the main controller of her or himself.

The Result of Learning Outcomes

The increase of the student self efficacy is hoped to increase the result of learning outcomes as well on the cognitive aspect. The knowledge ability test (pretest) was proposed before the treatment and the posttest was given after the learning outcomes. The following is the result of analytic test of 34 X-6 students in the form in figure 3.
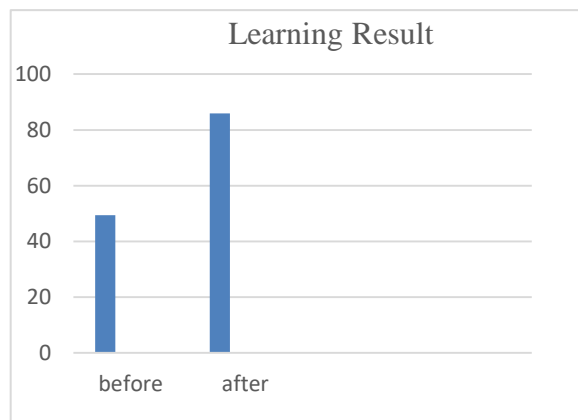

Figure 3. Learning Results

The figure 3 shows that students get higher score in posttest than pretest. The raising has proven the effectiveness of ADI in increasing the result. The increase is in the aspect of knowledge and accumulated using N – gain. The average score of rising is 0.7 with high criteria.

Before the pretest, there were 2.95 % complete while the 97.05 % incomplete. After the posttest, a very significant raise gained. All the students complete classically or 100 %.

The completeness of learning process on the cognitive aspect is aimed to know the students' understanding to the subject. For this, pretest was done in the first meeting and posttest was conducted in the third meeting right after the treatment using ADI on the material of electrolyte and non – electrolyte. Based on the result,

The result of pretest and posttest of knowledge result gained were calculated by using N-gain. The score was 0.74 with high criteria (Hake, 1999). The N – gain of learning result shows that ADI effectively developed self efficacy in cognitive aspect. The finding was similar as Bandura's statement (1994) which stated that the cognitive process was needed in shaping a strong self efficacy dealing with the situation of analytic thinking of doing right action.

Conclusion

As the result of the research conducted in Senior high school of Surabaya 7, the data shows the increase of self efficacy, motivation,

and the result of learning. The development of teaching instrument could increase students self efficacy and the learning result.

Increasing seelf efficacy can make it easier for students in learning activities on other topic because students will be more active in learning activities, so that teachers will be find easier in learning activities because with the increase in existing self-efficacy it is expected that students will be more active in learning activities so that the value obtained will be more high.

References

Andriani, Y., A. (2015). Peningkatan penguasaan konsep siswa melalui pembelajaran *argument drivent inquiry* pada pembelajaran IPA terpadu di SMP kelas VII. *Edusains*. Vol 7,pp, 114-120.

Anita, K.aryasa dan Tika. (2013). . *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha*, Pengaruh model pembelajaran kooperatif tipe group investigation (GI) terhadap *self-efficacy* siswa. Vol 3.

Annisa, Hemani, dan Taufik. 2016. *International Conferences of Mathematics and Science Educatioan* "Argument-Driven Inquiry (ADI): The Way to Develop Junior High Schools Student's Argumentation Skill in Science Learning". Vol.57.

Arikunto, S. 1997. Penilaian Program Pendidikan Edisi III. Bina aksara: Jakarta.

Bandura, A. 1994. Encyclopedia of human behavior. 4: 71-81. Tersedia pada http://www.uky.edu. Diakses 15 maret 2019.

Bandura, A. 1997. Self Efficacy; The Exercise of Control. New York: W.H. Freeman and Company.

Depdiknas .2006. Permendiknas No 22 Tahun 2006 Tentang Standar Isi. Jakarta : Depdiknas.

Erika, Farah., dan Praharani, B.K. 2017. Innovative Chemistry Learning Model to Improve Argumentation Skills and

Self-Efficacy. *IOSR Journal of Research and Method in Education (IOSR-JRME)*. Vol.7, 62-68.

Erika, Farah., Praharani, B.K., Supardi, dan Tukiran. 2018. Development Of a Graphic Organizer-baesed Argumentation Learning (GOAL) Model For Improving The Self-efficacy and Ability to Argue of Chemistry Teachers Candidates. *World Transaction on Enginering and Technology Education.* Vol.16, No.2.

Hairida, Marhaeny. 2012. *Self efficacy* dan Prestasi Belajar Siswa Dalam Pembelajaran IPA Kimia. *Jurnal Pendidikan IPA*. Tanjungpura: Universitas Tanjungpura.

Hake, R.R. 1999. American Educational Research Association's Division D, Measurement and Research Methodology: Analyzing Change/Gain Scores. USA: Woodland Hills.

Katelhut, D,J. 2007. The Impact of Student Self efficacy on Scientific Inquiry Skills: An Exploratory Investigation in River City, a Multi-user Virtual Environment. *Journal of Science Education and Technology.*

Kementrian Pendidikan dan Kebudayaan. 2013. *Pengembangan Kurikulum 2013.* Jakarta: Paparan Menteri Pendidikan dan Kebudayaan RI.

Kementerian Pendidikan dan Kebudayaan. (2014). *Permendikbud RI No. 104 Tahun 2014 tentang penilaian hasil belajar oleh pendidik pada pendidikan dasar dan pendidikan menengah.* Jakarta: Kemendikbud.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research*, 66(4), 543–578. doi:10.3102/00346543066004543.

Prastowo, A. 2015. Bahan Ajar Inovatif. Yogyakarta: Diva Press.

Riduwan 2012 *Skala Pengukuran Variabel-variabel Penelitian*. Bandung: Alfabeta.

Sampson, V.E., Grooms, J., and Walker, J.P. 2010. Argument-Driven Inquiry as a Way to Help Students Learn How to Participate in Scientific Argumentation and Craft Written Arguments, An Exploratory Study. *Science Education*. Vol. 95. Pp 217-257.

Sampson, V., Schleigh, S. 2016. *Scientific Argumentation in Biology Book: 30 classroom activities*. USA: NSTA press.

Sastrawijaya, tresna. 1998. *Proses Belajar Mengajar Kimia*. Jakarta : Depdikbud, Dirjendikti, Proyek Pengembangan Lembaga Pendidikan Tenaga Kependidikan.

Thiagarajan, S., Semmel, D., S and Semmel, M., I. 1974. Instructional Development for Training Teachers of Expectional Children. Minneapolis: Leadership Training Institute / Special Education, University of Minnesota.

Westwood, (2008). *What Theacher Need to Know about Theaching Method.* Australia: Acer Press.

Zimmerman. 2000. Self-Efficacy: An Essential Motive to Learn. *Contemporary Educational Psychology*. New York: Graduate School and University Center of City University of Newyork.

Zehra dan Nermin. 2009. The Effect of a Guided Inquiry Method on Preservice Teachers' Science Teaching Self-Efficacy Beliefs. Journal of Turkish Science Education. Volume 6, Issue 2.