IMPLEMENTATION OF ARGUMENT-DRIVEN INQUIRY LEARNING TO TRAIN STUDENTS' EXPERIMENTAL SKILLS

Cucu Cahyati[*], Parsaoran Siahaan[**], and Setya Utari[***]
Physics Education Program, Graduate School, Universitas Pendidikan Indonesia
cucucahyati13@yahoo.com

Key Words:
Argument-driven inquiry
Experimental skills.

ABSTRACT

The result of preliminary study shows that the students 'skill in conducting the experiment is not much trained and facilitation in the learning process whereas in the standard of graduate cultivation in the curriculum 2013 in Indonesia has given illustration of the development of students' skill competence in SMA level besides knowledge competence and attitude competence which in physics learning is called Also as an experimental skill that can help students apply their knowledge competence. The purpose of this study is to see how far students' skills in conducting experiments through argument-driven inquiry. This research was conducted in SMA with one group pretest-posttest design. The results of this study indicate that in physics-based learning argument-driven inquiry can improve and trained students' skills in experimenting that includes aspects of observing, predicting, planning experiments, experimenting, measuring, using tools, interpreting data and concluding.

INTRODUCTION

Physics Learning is something that should be done by students not something done to students as proposed by national science educational standard (1996: 20) that learning science is an active process. Learning science is something student to do, not something that is done to them.

In addition, in the competency standards of 2013 revision curriculum graduates, learners should be able to achieve the competence of knowledge, skills competence and attitude competence. In physics learning itself more emphasis on the achievement of knowledge competence and skills competencies, where knowledge competence is achieved through activities remembering, understanding, applying, analyzing, evaluating, and creating. While skill competence is obtained through activity observing, asking, trying, reasoning, menyji, and create (permendikbud, 2016). The two competencies are related to each other as suggested in previous research which suggests that skills in laboratory experiments are essential for developing students' thinking habits in various scientific practices such as designing and building experiments, collecting and Interpreting data, and communicating scientific content (BM Zwickl, *et all*, 2015).

However, in reality in the field, the learning process has not been able to present situations and activities that enable students to achieve the competence of knowledge and skills competence.

Just as in a preliminary study conducted in one of the high schools in Karawang regency, West Java Province, Indonesia showed that the students' cognitive and practical outcomes in physics are still very low, which is caused by less involving students in direct learning activities such as experiment or demonstration.
The results of the preliminary study also indicate that most students are not able to properly carry out experiments either in the experimental planning process, the use of tools, even in the process of making the conclusions of the experimental results even though the experiments were conducted using the cookbook method.

Therefore, further research on students' skill in conducting experiments through argument-driven inquiry will be applied to the subject of dynamic electricity.
The purpose of this study is to trill the students' experimental skills in argument-driven inquiry learning and to find out the extent of improving students' experimental skills in argument-driven inquiry learning. Experienced experimental skills are basic skills that include observing skills, predicting, planning experiments, conducting experiments, measuring, using tools, interpreting data, and summarizing (Wenning, 2010).

RESEARCH METHODS

This research uses poor-experiment design method with the research design that is the one group pretest-posttest design (Fraenkel, et all, 2012). So in this study conducted pretest and posttest to the students' experimental skills in argument-driven inquiry learning. Pretest and posttest data on student experimental exertion are used to see a picture of improving students' experimental skills through the same instrument test and tested by a normalized gain test.
The instrument test used in this study was developed in the form of multiple choice questions adapting from the science process skills test (SPST) (Monica, 2005; Ngoh, 2009). Then, to see students' experimental skills during the argument-driven inquiry process, an observation sheet developed was developed by adapting the experimental design skills test (EDAT) (Sirum, 2011). Sample in this research is high school student of class X from one of high school in Karawang regency of West Java Province which consist of 36 students selected by purposive sampling technique.

FINDING AND DISCUSSION

The argument-driven inquiry (ADI) learning model in this study is an inquiry learning model that emphasizes argumentation activities. The argument-driven inquiry (ADI) learning model in this research is done by four stages, namely problem identification, data collection stage, tentative argumentation stage, and argumentation phase.
The application of the argument-driven inquiry model to the students 'experimental skills on the subject of dynamic electricity in this study obtained the result that the students' experimental skills increased with the results of N-gain score calculation of 0.68 in the medium category, as shown in Table 1 below.

Table 1. Normalized Gain Score

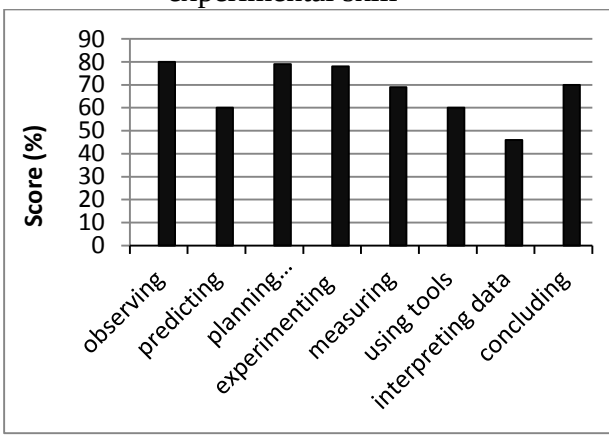
	Score (%)	S_{max} (%)	<g>	Category
Pretest	30,4	100	0,68	Medium
Posttest	78,3	100		

Information:
S_{max} = The maximum score that students can get
<g> = score N-gain

Then based on the observation result of student experiment skill shows that the

average student can perform each stage of experiment with result as follows.

Picture 1. result of observation of experimental skill



Based on the results of the above study, argument-driven inquiry can trained experimental skills with average scores obtained by students in the range of 40 to 80 percent on every aspect of the experimental skill. The results show that students have been able to experiment well but on the interpretation aspects of student data showed the lowest results compared with other apek experimental skills. This is due to the errors of students in identifying problems in the process of problem identification in argument driven inquiry learning where students are still not able to identify what needs to be known and need to be measured in data collection. In general, however, the results of students' experimental skills research in argument-driven inquiry learning on the subject of dynamic electricity can be trained well and can be increased in the medium category.

CONCLUSION AND SUGGESTION

Conclusion

Based on the results of research and analysis conducted in one high school in Karawang regency about the application of argument-driven inquiry model to trained students 'experimental skills, it can be concluded that students' experimental skills in argument-driven inquiry learning are well trained and can be increased in medium category.

Recommendation

Further research is required to train students 'experimental skills, especially on aspects of measuring, using tools, and interpreting data by applying argument-driven inquiry learning with multirepresentation approaches that can assist students in interpreting data, and further investigation of their impact on students' cognition.

REFERENCES

BM Zwickl, *et all.* (2014). Epistemology and expectations survey about experimental physics: Development and initial results, Phys. Rev. ST Phys. Educ. Res.10, 010120.

Tuba Demircioglu. (2015). Investigating the Effect of Argument-Driven Inquiry in Laboratory Instruction. Educational Sciences: Theory & Practice. 15(1). 267-283.

Fraenkel, *et all*. (2012). How to Design and Evaluate Research in Education. ISBN: 978-0-07-809785-0

Ginanjar, dkk. (2015). Penerapan Model Argument-Driven Inquiry Dalam Pembelajaran Ipa Untuk Meningkatkan Kemampuan Argumentasi Ilmiah Siswa SMP. Jurnal Pengajaran MIPA, Volume 20, Nomor 1, hlm. 32-37.

Hake, RR. (1999). Analyzing Change/Gain Scores. *AREA-D-American Educational Research Association's Division, Measurment and Research Methodology.*

Monica, K. (2005). Development and validation of a test of integrated science process skills for the further education and training learners.

Unpublished Master's thesis, University of Pretoria. South Africa.

National Research Council (2012). *National Science Education Standards.* Washington, DC: National Academies Press.

Ngoh, T. (2009). Mastery of the science process skills. Unpublished manuscript.

Permendikbud. (2016). Lampiran Peraturan Menteri Pendidikan dan Kebudayaan Nomor 22 Tahun 2016 Tentang Standar Proses Pendidikan Dasar dan Menengah.

Sirum. (2011). The Experimental Design Ability Test (EDAT). Volume 37(1).

Wenning, CJ. (2010). Levels of inquiry: Using inquiry spectrum learning sequences to teach science. *Journal Physics Teacher Education.* 5 (3).