

THE ACTION FOR IMPROVING SCIENCE PROCESS SKILL OF STUDENTS' THROUGH SCIENTIFIC APPROACH AND THE USE ICT SUPPORT IN VOLUMETRIC ANALYTICAL CHEMISTRY AT SMK – SMAK BOGOR

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Abstract

The objective of this Classroom Action Research was to improve science process skill of students at SMK-SMAK Bogor in Volumetric Analytical Chemistry subject matter. The research method followed the CAR of Kemmis and McTaggart model with three cycles. Learning was conducted by scientific approach and assisted by information technology (ICT)-based media. The ICT-based media were power point, Learning Management System (LMS), and/or project video as relevant characteristics of subject matter and reflection finding. The samples were 28 students at the class of grade 11-1. In this research, there were eight aspects of science process skill that were observed, including 1) to observe; 2) to ask; 3) to calculate; 4) to communicate/to answer question; 5) to associate; 6) to respond; 7) to design the experiment; and 8) to conclude. The improvement of science skill process could be seen from the activity of students during learning processes which were observed using checklist paper. The results of the activity observation were 33.90%, 65.18%, and 88.39%, in the end of Cycle I, II, and III, respectively. Therefore, it can be concluded that scientific approach and the use of media can increase scientific skill process of students in 11th grade of SMK-SMAK Bogor.

Keywords: scientific skill process; scientific approach; ICT support.

1. Introduction

In the era of science and technology scientific knowledge has grown exponentially, and technology has progressed at a rapid pace. It has affected all aspects of lives. Science education plays a key role for the futures of societies. As consequently, countries particularly developing countries like Indonesia have been challenged continuously to improve the quality of science education.

According to Indonesian Ministry of Education and culture, curriculum 2013 instructs every school to improve the skill of science during students' learning. By applying scientific approach, three aspects of competencies, e.i. knowledge, skill, and behavior aspects are measured. Chemical Volumetric subject in SMK – SMAK Bogor also applies Curriculum 2013. Basically, Ministry Education and Culture gives its own conception stating that scientific approach on the study includes five components: observing, asking, reasoning, trying/discovering, and serving/communicating. With such approaches it is expected to improve

student's skill on processing science. Scientific process itself focuses on involving students actively and creatively on the process of gaining learning outcome [1], thus the study has to be student centered.

Acquiring science process skills is considered as "learning how to learn" because children learn how to learn by thinking critically and using information creatively and they continue to learn when making discriminating observations, organizing and analyzing facts or concepts, giving reasons for particular outcomes, evaluating and interpreting results, drawing justifiable conclusions and predicting what will happen if anything were to be changed [2].

Process skills describe the types of thinking and reasoning required in learning. Process skills can be divided into two categories, basic and integrated process skills. Basic science process skills help children to expand their learning through experience. Children begin with simple ideas, and expand to form new and complex ideas. It is hoped that emphasis on science process skills helps children discover meaningful information and accumulate knowledge by

constructing their understanding within and beyond the science classroom [2]. And the latter is called integrated science process skills (ISPS), such as controlling variables, formulating hypotheses, and experimenting. These skills are structured on basic skills. Some studies have indicated that there is a positive relationship between SPS and Piagetian development level and finding supports the separation of process skills into a two-level hierarchy, namely basic and integrated [3].

Naturally, the outcome of someone's learning is obtained, start from the direct event, the reality in its environment then through the imitation sign, to the verbal (abstract) expression. One of the most frequent depictions that is used as reference on theoretical basis based on learning process media is Dale's Cone of Experience on [4].

Development of technology in education has ability to answer the questions about the impact of technology in reconstruct the education system and the use of technology, in line with learning theory. While, expanded use of computer facilities and other mass media will lead to the rapid transfer of information. Questions about the use of computers and its relation to aspects of teaching, the ability of students to think actively and critically, and to the formation of a spirit of cooperation among students often occur [5,6]. Educational Technology Media can be categorized from the most common equipment used in schools which is textbook and whiteboard, to modern media such as high-tech computer equipment, LCD, Internet and digital cameras. Multimedia use computers to present, with the integration of text, audio, video with links and tools that allow users

to navigate, interact, create and communicate. It is well known that teaching can be vastly amplified when it is not done in full theory, but also in visualization and interaction instead. By use this way of teaching-learning, students can obtain a deeper understanding of the subject being taught [7].

Based on that analysis, researcher argued that it is needed to facilitate scientific approach and innovation on instructional media that is used on teaching Volumetric Analytical Chemistry. The instructional media also has to utilize ICT that enables students to understand the materials of learning. As the consequences, science process skill of the student is expected to improve significantly.

This research was done by Classroom Action Research following Kemmis & Mc Taggart model. Kemmis & McTaggart model is naturally in the form of devices or chains with one device consist of four components, which are: planning, acting, observing and reflecting. The four components that form the chains are seen as one cycle [8].

2. Method

The subject of this research was the student on class XI-1 in SMK-SMAK Bogor. While the object of this research is the increase of student's science process skill on Volumetric Analytical Chemistry subject through scientific approach and assisted by ICT-based media. The research of this class chose Kemmis & Mc Taggart method as it was easier to be applied on the research. The research plan is seen through Figure 1.

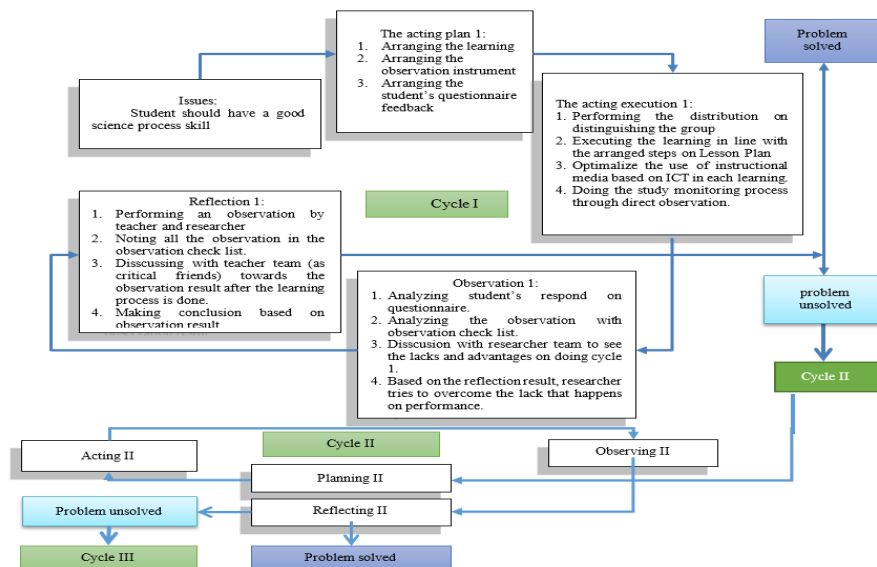


Figure 1. Procedures of research based on Kemmis and Mc Taggart's Model

The instruments that were used in this research was observation checklist. The data was descriptive qualitative from observation checklist. Science process skill is observed through observation checklist paper. There were eight aspects that were observed. The components were activities of students; to observe, to ask, to calculate, to communicate/answer the question, to associate, to respond, to design the experiment, and to conclude. These eight aspects can be observed during learning process, report of scientific activities, and media that were generated by the students. The enhancement of scientific skill of students was obtained from observation of students in each learning activity in every cycles, and the data were calculated using the equation:

$$\%Activity\ of\ student\ through\ science\ process\ skill = \frac{\sum\ students\ do\ activity}{\sum\ student's\ total\ x\ science\ process\ skill\ aspect}$$

From the observation of the activity, it can be concluded that students have done each aspect on science process skill. The success indicator of the research was shown by the criteria of at least 70% of students actively did eight aspects of science process skill in learning process.

3. Results

This research was conducted in three cycles with three different subjects and included three different multimedia of learning. The first cycle was applied on the Iodometry and Iodimetri subjects, the second cycle was applied on Argentometry, and the third cycle was on Water Analysis Application. The time allocation on the first cycle was 3 X 2 lesson hours, the second cycle is 2 X 2 lesson hours, while the third cycle is 2 X 2 lesson hours. The first cycle discussed the Iodometry and Iodimetri used learning media of Power Point presentation that was prepared and presented by the students based on the experimental data they collected in the laboratory activities. The second cycle was delivered by using e-learning with Learning Management System of Moodle platform administrated officially by the school and completed by power point presentation by the teacher. Third cycle was on the Water Analysis Application using the media of video project that was developed by students in a group. The samples on this research were 28 students at the class of grade 11-1.

Based on observations conducted by the researchers, the results obtained science process skills as follows:

a. Cycle I

By using the scientific approach in the cycle I consisting of 3 meetings, the results of science process skills of students on eight aspects that were observed were given in the Table 1 below:

Table 1. The Students' Activity or Students' Science Process Skill on each Aspect in the Cycle I

No	Science Process Skill	1 st Meeting	2 nd Meeting	3 rd Meeting
1.	Observe	100%	36%	21%
2.	Ask	36%	36%	21%
3.	Calculate	61%	21%	18%
4.	Communicate / answer the question	0%	64%	36%
5.	Associate	100%	64%	36%
6.	Respond	36%	32%	21%
7.	Design the experiment	39%	43%	18%
8.	Conclude	100%	100%	100%
	Average	58.93%	49.60%	33.90%

Table 1 illustrates that the science process skills of students decreased from the first meeting to the third meeting. Through reflection conducted by Researchers reduction in science process skills of students due to the lack of motivation of students to play an active role in learning. At the first meeting of students enthusiastically participated in learning by using media presentations made by the students

themselves. Because it is a new thing. So that the second and third meetings they feel less enthusiastic because there is no renewal of the first meeting. Therefore, researchers as teachers should look for alternatives of media that can increase the motivation of students in order to raise their science process skills.

b. Cycle II

The observation of science process skills in the second cycle on which learning was assisted

by media of Power Point together with the LMS was depicted in table 2 below:

Table 2. The Students' Activity or Students' Science Process Skill on each Aspect in Cycle II

No	Science Process Skill	1 st Meeting	2 nd Meeting
1.	Observe	43%	64%
2.	Ask	11%	21%
3.	Calculate	18%	93%
4.	Communicate / answer the question	32%	43%
5.	Associate	32%	93%
6.	Respond	11%	21%
7.	Design the experiment	100%	93%
8.	Conclude	100%	93%
Average		43.30%	65.18%

Table 2 shows that there was the increase of science process skills in the cycle II from 43.30% to 65.18%. In this cycle II, beside the use of another instructional media, researchers also provide rewards in the form of value to generate science process skills of students. By using LMS, students become more active. The students even had high curiosity due to the combination of the use of media of LMS and attractive presentation in this cycle. The

increase of the skill had yet to fulfill the minimum criteria of 70% of students. So the cycle still needs to be continued into the next cycle.

c. Cycle III

In the cycle III the results of science process skills using video project media can be seen in Table 3 below:

Table 3. The Students' Activity or Students' Science Process Skill each Aspect in Cycle II

No	Science Process Skill	1 st Meeting	2 nd Meeting
1.	Observe	100%	100%
2.	Ask	11%	54%
3.	Calculate	18%	100%
4.	Communicate / answer the question	0%	100%
5.	Associate	100%	100%
6.	Respond	11%	54%
7.	Design the experiment	100%	100%
8.	Conclude	100%	100%
Average		54.91%	88.39%

Table 3 shows that there is a significant increase of up to 88.39 % for the second meeting. The results indicate the science process skills of students successfully improved. Although the first meeting of science process skills was still relatively low but with the presentation of a video project that students have built in the laboratory make them enthusiastic. It can be seen from the aspect of observe, calculate, communicate, associate, designing experiments, and conclude with a percentage of 100 %. It means that all students perform these activities. It can be concluded by the media that students were required to directly take part to build and to use it, such as to create video projects, science process skills of most students especially on designing experiment, observing directly, finding out the results of the experiment,

associating it and communicating these results in the class can be achieved.

Based on the research results obtained from cycle I to the cycle III indicated that science process skills of students might not grow itself, but it should be practiced and inculcated so that it become habit. The use of multimedia in lab. works can engage science process skills of students. The data on every aspect in three cycles were as the following:

- a. At the end of the cycle I, activity or science process skills that have been mastered by students (over 70%) is the aspect concludes with a percentage of 100%. While aspects of the science process skills the least is designing experiments and calculate.
- b. At the end of the cycle II, students did more aspects of science process skills in which the

aspects of calculate, communicate, design experiments and conclude has the percentage of 93%. While the aspects that poorly observed from students were aspects of asking and responding.

- c. At the end of the cycle III almost all aspects have been mastered by students, including aspects of observe, calculate, communicate, associate, designing experiments, and conclude. While the lowest aspects observed from students were aspects of asking and responding with percentage of 54%.

It can be concluded that the aspects that still need to be improved was the aspect of questioning and responding, which were an important aspect because asking and responding would cause a critical attitude which can bring many creative ideas to solve a scientific problem. If the terms of instructional media and approaches used in this study by Rose Amnah Abd Rauf et al. [9], the discussion approach managed to inculcate the most science process skills and from the figure it showed that all types of teaching approaches incorporate discussion making it the most suitable teaching approach to provide opportunities for the inculcation of science process skills. The use of various media in teaching approaches, for instance when the teacher uses the discussion, he or she needs to ask question to explore students' ideas and stimulate their thinking while doing the activities. Similarly, the use of open laboratory inquiry, discussions among students, discussion between students and teachers can facilitate explorative questions.

According to Ahamad Asmadi Sakat *et al.* [10], Computer usage can stimulate effective learning and improve the performance of subjects Jawi, enhance high level of interactivity among students. Importance of computers as teaching aids need not be overstated. Ordinary teaching method is no longer relevant today. The teacher's role is no longer as a presenter of information but has become a facilitator for learning and teaching process. The use of computers is not intended to replace the role of the teacher, but it is actually intended to create an atmosphere of teaching and learning more fun and interesting. Computer is used to facilitate teaching and learning process, to enrich teaching techniques and to help teachers in teaching and learning objectives, when it is used in a systematic and sustainable.

4. Conclusion

Based on the analysis of the result and the discussion, it can be concluded that by scientific

approach and ICT media support, students' science process skill increases. The increasing can be seen from percentage of activity was 88.39% in cycle III. It indicates more than 70% students actively do eight aspects of science process skill in the learning process.

REFERENCES

- [1] Cony Semiawan. "Pendekatan Keterampilan Proses". Jakarta: PT Gramedia, 2002
- [2] Martin, R. E., Sexton, C., Franklin, T., & McElroy, D. "Teaching science for all children (3rd ed.)" Massachusetts: Allyn & Bacon, 2001.
- [3] Brotherton, P.N. & Preece, F.W, "Science process skills: their nature an interrelationship". Research in Science & Technology Education, 13, 1995, p 5-11.
- [4] Azhar Arsyad. "Media Pengajaran". Jakarta: PT Raja Grafindo Persada, 1997.
- [5] Esmaelzadeh, S., F. Jahdi, H. Haghani and S.E. Saeieh, "Access to internet and using for health information in women's that referred to Health Centers of Universities in Tehran City" Aus. J. Basic Applied Sci., 5: 1204-1208, 2011.
- [6] Romiszowski, A.J. "The Selection and use of Instructional Media" 2nd Edn., Kogan, New York, ISBN: 0893973769, 1992, pp: 396.
- [7] Dimitrios, A., P. Konstantinos, S. Nikolaos and S. Angelo, "Application of a new network enabled solver for the assignment problem in computer-aided education". J. Comput. Sci., 1: 19- 23. DOI: 10.3844/jcssp, 2005
- [8] Kemmis, S. dan McTaggart, R, "The Action Research Planner, Third Edition. Victoria" Deakin University, 1983.
- [9] Rose Amnah Abd Rauf, Mohamad Sattar Rasul, Azlin Norhaini Mansor, Zarina Othman & N. Lyndon "Inculcation of Science Process Skills in a Science Classroom", Asian Social Science, Vol. 9, No. 8, ISSN, 2013, 1911-20
- [10] Ahamad Asmadi Sakat, Mohamad Zaid Mohd Zin, Rusli Muhamad, Anzaruddin Ahmad, Nurfahiratul Azlina Ahmad and Mohd Arip Kasmoo "Educational Technology Media Method in Teaching and Learning Progress" American Journal of Applied Sciences 9 (6): 874-878, ISSN 1546-9239, 2012.