

Improving Scientific Literacy and Science Process Skills for Prospective Teachers of Islamic Education Science (PAI) through Microteaching Class

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Abstract

This study aims to improve the ability of scientific literacy (SL) and science process skills (SPS) for the Islamic education science (PAI) students who will be a teacher in the future through microteaching activities. The approach used in this study is action-based research involving 34 students of PAI. Based on the data obtained, it can be concluded that the implementation of the microteaching method with the approach of LS and SPS has a positive impact on the improvement of LS and SPS for PAI students. For the ability that belongs to a high category, the LS aspect has reached 50%, while the SPS has reached 35.29%. For abilities with medium category, LS reaches 44.11% and SPS reaches 61.76%. The rest are the students with LS and SPS abilities with low categories. The results of this study recommend that it is necessary to have LS and SPS development training for all non-science teacher candidates, such as language teacher candidates, economics teacher candidates and so on through the same pattern (microteaching).

Keywords: *Microteaching; Scientific literacy (SL); Science process skills (SPS)*

1. Introduction

Science and technology continue to develop in several countries. They also become an indicator of the progress of a county. Countries with good scientific and technological developments will be developed countries, while those with slow scientific and technological progress will be left behind. Besides, the development of science and technology has also influenced all aspects of human life. Hence, humans could not be separated from the development of science and technology.

The development of technologies causes both positive and negative impacts. To know and follow the development of science and technology and find out how much the impacts of the developments, it requires literacy skills and science awareness. Scientific literacy is defined as the ability to know

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and understand various concepts, processes and products of science (natural science) and make decisions based on that understanding (Yuliati, 2017). While Arohman, Saefudin, & Priyandoko, (2016) define scientific literacy as an ability to utilize the understanding and knowledge of science that has been obtained in order to identify problems related to science, draw conclusions based on available data, and make decisions to do something that is consistent with the data and conclusions.

Based on the above definition, it can be said that scientific literacy is very important for human life, both for those who work in the field of science directly or indirectly. Rahayu, (2017) states that the students must equip themselves with scientific literacy so that they are able to live and grow well in the 21st century. In developed countries, the implementation of learning based on scientific literacy has been going on for a long time (Zuriyani, 2011) so that the people of developed countries are generally very literate about science. Therefore, the people of developed countries are generally more literate about science than those of developing countries. It proves that to improve the quality of life of a country requires its citizens who are literate about science.

Apart from scientific literacy, to follow the development of science and technology, it requires a set of skills related to scientific processes that are science process skills. Science process skills are defined as a set of scientific knowledge and skills to understand the scientific process (Sukarno, Rosadi, & Samsudin, 2019). According to Juhji, (2016) science process skills are the ability to gain knowledge through the five senses, process it and formulate it into thinking skills.

Simply speaking, scientific literacy and science process skills are very important for human life. Therefore, various efforts have been and continue to be conducted to improve both of them. Some efforts to improve the ability of scientific literacy, for example, by developing appropriate teaching materials (Paramita, Rusilowati, & Sugianto, 2017), developing learning devices (Irmida & Atun, 2017), using a certain excellent learning process (Nofiana & Julianto, 2018), using an innovative learning model (Asyhari & Hartati, 2015), and so on. Therefore, Pertiwi, Atanti, & Ismawati (2018) remind that scientific literacy-oriented learning is needed in this century.

While related to science process skills, various efforts are also being made with the aim that students would have good scientific process skills. Some efforts to improve the science process skills such as the development of teaching materials (modules) (Dewi & Prayitno, 2014), students worksheet development (Mahfuziannor, Suyidno, & An'nur, 2014), (Ikramatul Atiyah, Roviati, 2016), the use of the natural environment as a medium for the development of science process skills (Asih, 2017), the use of certain learning models, for example, problem-based learning (Yuliati, 2016), cooperative based learning (Sari, 2016), and so on.

Scientific literacy and science process skills are two important aspects and bound to each other. Both have a strong relationship (Handayani, Indrayanti, 2018). Therefore, various efforts to increase scientific literacy and science process skills as discussed above do not solely follow the development of science and technology but also to minimize the negative impacts of the development of science and technology. Some of the negative impacts are, among others, humans (students) become more antisocial (Fitri, 2017), addicted to the use of technology (Muduli, 2013), the environmental damage caused by scientific products, such as plastic (Karuniastuti, 2013), natural damage as a result of mismanagement (Akbar, Sartohadi, Djohan, & Ritohardoyo, 2017), ecosystem damage (Uar, Murti, & Hadisusanto, 2016) and so on.

In the opinion of (Asyhari, 2017) that Islam is a perfect religion and integrating science and Islam is a must. Besides, Rahim, (2008) that in Islam, science is the best way to achieve the perfection of life. While (W., 2014) states that religion should be a guide in scientific theory. Sa'dan, (2015) states that science with the basis of Islamic values (Al-Qur'an and Hadith) could reduce the materialistic nature of science and ecological damage. This is in line with the opinion of Hasyim, (2013) one of the characteristics of Islam is to emphasize the importance of science and encourage people to seek knowledge with wisdom. Likewise, (Akil, 2017) states that Qur'an gives very high attention to science and gives high status to people who master science.

Considering the importance of the relationship between religion (Islam) and science as explained above, various efforts to integrate religion (Islam) with science are continuing. Some of these efforts are, for instance, the Islamization of science to avoid the dichotomy between Islam and science (Salafudin, 2013), the development of a science-based Islamic boarding school (trensains) carried out by the Pesantren Tebuireng in Jombang (Yusuf, 2015). Integrating science (mathematics) in learning (Maarif, 2015). Othman, Noh, Lubis, & Wan Nurul, (2017) in his research also states that Quranic science is an effective method of recognizing God as the creator of the Universe. Science-Qur'an education would produce a generation of experts in managing nature through science that he is mastering and at the same time providing benefits for human welfare.

Thus, it is clear that science (scientific literacy and science process skills) has a close relationship with Islam (Qur'an and hadith). This is the reason why the teachers of Islamic education science (PAI) have a very important role in terms of developing scientific literacy skills and students' science process skills. They teach Islamic religious content that has a very close relationship with science. Teaching Islam is automatically teaching science, but teaching science is merely teaching part of the teachings of Islam.

To be able to participate in developing the scientific literacy and science process skills of the students, PAI teachers must first have these skills. Therefore, training or briefing is needed to equip the prospective PAI teachers to be able to actively participate in developing the scientific literacy and science process skills of the students through Islamic religious learning. The debriefing process must be integrated with the teaching practice preparation subject. The subject that is considered the most suitable and appropriate in this case is the microteaching. Microteaching is one of the subjects that prepares prospective teachers so that they are successful in implementing teaching practices in schools.

As stated by Bell, (2007) that microteaching is an effective way to help prospective teachers to understand good teaching methods. This is also in line with the opinion of Remesh, (2013) that microteaching is an effective method in preparing prospective teachers to have effective teaching skills. Microteaching is aimed to improve the self-efficacy of the students of prospective teachers (Arsal, 2014) and also to improve the critical thinking skills of prospective teachers (Arsal, 2015). Besides, Chookaew, Howimanporn, Pratumswan, Sootkaneung, & Wongwatkit, (2019), also stated that microteaching can be a teaching training medium for prospective teachers, including preparing lesson plans, teaching materials, methods and media that they use as well as appropriate models and ways of assessing students.

Thus, the focus of this study is to answer the question of how to improve scientific literacy and science process skills of prospective teachers of PAI through microteaching subjects?

2. Research Methods

Based on the research question that is how to improve scientific literacy and science process skills of prospective teachers of PAI through microteaching subject, so it is actually action-based research. This research is intended not only to obtain certain knowledge but also the teachers are expected to be able to apply that knowledge (Skinner, 2016). Action research is a process related to the problem with a systematic approach to monitoring developments over time (Rose & Grosvenor, 2013). Therefore, this research consists of several research cycles.

The subjects in this study consisted of 34 students of prospective PAI teachers who were taking part in the microteaching class. The microteaching activity is carried out for half of a semester (8 meetings). Thus, this research was carried out in two cycles, and each cycle consists of four meetings. Before conducting microteaching activities to students, a test was given to them to see how deep their former ability in scientific literacy and science process skills is.

Microteaching consist of several activities including making learning plans, implementing learning (peer teaching) and assessment. At each of these stages, the author asked the students of prospective teachers to connect and integrate the scientific concepts they know into Islamic religious material. In this session, the students were accompanied by their lecturer of Islamic education science (PAI) and science education (Physics). Thus, the students must prepare a PAI learning plan with science content. Peer teaching activities include science values and assessment also includes Islamic-scientific integration.

The instrument used in the study consisted of 40 multiple choice questions consisting of 20 questions for the scientific literacy test and 20 questions for the science process skills test. The scientific literacy test is adapted from the questions that have been developed by TIMSS and PISA. While the questions for the test of process skills used a tool developed by Basuki, Jufrida, Kurniawan, Devi, & Fitaloka, (2019) with several adaptations. Thus, both the scientific literacy test and the science process skills are already valid and reliable.

3. Data and Discussion

3.1. Research data

As stated earlier that prior to microteaching, students were given tests to measure their scientific literacy skills and science process skills. The pre-test results could be seen in the following table:

Table 2. Pre-test Results of LS dan SPS

Aspect	Score	Total	Percentage (%)	Category
Scientific Literacy/LS	14-20	1	2,94	High
	7-13	11	32,35	Medium
	0-7	22	64,70	Low
	Total	34	100	
Science Process	14-20	4	11,76	High
	7-13	14	41,17	Medium

Skill/SPS	0-7	16	47,05	Low
	Total	34	100	

Based on table 2 above, it can be seen that the former ability of prospective PAI teachers both in terms of scientific literacy and science process skills is still dominated by students with low categorical abilities by 64.70% (LS) and 47.05% (SPS). Then, the ability with the medium category is 32.35% (LS) and 41.17% (SPS) respectively. The ability with a high category is only 1 person or 2.94% (LS) and 4 people for SPS or 11.76%. The above data proves that efforts need to be made so that the ability of prospective PAI teachers would be better both for LS and SPS skills. Later, they are able to participate in improving the LS and SPS abilities of their students as part of their duties as PAI teachers.

After the pre-test was conducted, all the students were given initial orientation in the microteaching class. Orientation was intended so that they can play an active role throughout the research process. In addition, in the orientation process, the students were also given an explanation that religion (Islam) is very much in line with and provides an opportunity for the development of science and technology. During the orientation, several examples of Qur'anic verses that talk about science and concepts of science that are in line with Islamic values were also given.

Then, at the beginning of the process of microteaching, the students made a lesson plan with Islamic content. During the process of making the lesson plan, the students were accompanied by two mentoring lecturers of PAI and Physics. Then in the process of developing a lesson plan, they are encouraged to involve the elements of science (products, processes, and attitudes) in their assignments. Thus, the end result of this activity was a lesson plan and teaching materials containing science.

The next meeting was peer teaching. Peer teaching activities are still part of the microteaching class. In this activity, each student is given an opportunity to practice teaching by applying his lesson plan and teaching materials that they have made before. This activity was still accompanied by the same lecturers. At the end of the peer teaching session, LS and SPS measurements were made. The results of LS and SPS measurements in the first cycle were presented in the following Table 3:

Table 3. Test Results of LS dan SPS at cycle I

Aspect	Score	Total	Cycle I	Percentage	Percentage	Category
		Pre-test		(%)	(%) I	
Scientific Literacy	14-20	1	9	2,94	26,47	High
	7-13	11	16	32,35	47,05	Medium
	0-7	22	9	64,70	26,47	Low
	Total	34	34	100	100	
Science Process Skill	14-20	4	8	11,76	23,53	High
	7-13	14	21	41,17	61,76	Medium
	0-7	16	5	47,05	14,70	Low
	Total	34	34	100	100	

Based on the data from Table 3 (cycle I) it can be seen that there has been an increase in the ability of LS and SPS. Table 3 shows that the abilities of the students on average belong to the medium category. For the medium category of LS, there are 16 students or around 40.05%, while for the medium category of SPS were 21 students or around 61.76%. Then, the ability of students with high category also increased by 26.47% for LS and 61.76% for SPS. Thus, in general the ability of the students in LS and SPS was increasing very well. However, this increase is not satisfying enough. So, it is necessary to take more effort that is cycle II.

In the next session, cycle II, also started by giving orientation. The orientation in the second cycle is intended to further broaden students' knowledge of PAI in the field of science whether in the form of products, processes and attitudes as well. Besides, the second orientation also provided additional explanations related to commands, encouragement from God (in Islam) to humans to learn science and manage nature around wisely.

After the orientation process was completed, then the students were asked to make a PAI lesson plan and teaching materials that they will practice. They were also asked to enrich their lesson plans and teaching materials with scientific content (products, processes, and attitudes). In this process, they were again accompanied by their lecturers of PAI and Physics. The final result of this session was a lesson plan and PAI teaching materials containing science that were ready to be practiced through peer teaching activities. The post-test or final assessment was carried out after all students have carried out peer teaching activities. The results of the post-test can be seen as the following in Table 4:

Table 3. Test Results of LS dan SPS at cycle II

Aspect	Score	Cycle I	Cycle II	Percentage (%) I	Percentage (%) II	Category
Scientific Literacy	14-20	9	17	26,47	50	High
	7-13	16	15	47,05	44,11	Medium
	0-7	9	2	26,47	5,88	Low
	Total	34	34	100	100	
Science Process Skill	14-20	8	12	23,53	35,29	High
	7-13	21	21	61,76	61,76	Medium
	0-7	5	1	14,70	2,94	Low
	Total	34	34	100	100	

Based on the data in Table 3 above, it shows that there is a good improvement in the ability of PAI students in LS and SPS. For the ability that belongs to a high category, the LS aspect has reached 50%, while the SPS has reached 35.29%. For abilities with medium category, LS reaches 44.11% and SPS reaches 61.76%. The rest are the students with LS and SPS abilities with low categories. These results are considered good and have reached the target, so the cycle is stopped.

3.2. Discussion

Based on the data and analysis above, it can be concluded that the microteaching class with science content enrichment can improve the ability of PAI students in the aspect of LS and SPS. For the ability that belong to high category, the LS aspect has reached 50%, while the SPS has reached

35.29%. For abilities with medium category, LS reaches 44.11% and SPS reaches 61.76%. The rest are the students with LS and SPS abilities with low categories.

From the viewpoint of the ability of LS, the results of this study show improvement of the ability of PAI students in terms of identifying scientific issues, explaining an event or a phenomenon through a scientific approach, and using data, facts or scientific evidence to solve a problem (Wulandari, 2016). Thus, an increase in the aspect of LS can also be regarded as an increase in the ability to solve problems. Nokes, (Schunn, & Chi, 2010) states that the ability to solve problems is very important to support tasks in daily life both formal and informal.

Science is not only limited to natural science but also includes social science. It means that the improvement of the ability of scientific literacy can also be used in both situations. Given that Islamic education is part of social science, scientific literacy skills are still useful. As stated by Bernard, (2012) that social science also produces technology, for example, marketing technology, management technology, polling techniques, and so on. These prove that scientific literacy is very supportive for the success of PAI students.

From the point of view of science process skills, the data above show that in general the ability of the students to observe, classify, measure, collect data, process data, and communicate data and information is increasing. According to (Sukarno et al., 2019) that the ability of basic process skills includes: observation, classification, measurement, data collection, data processing, and making reports (communication). By increasing these abilities, they would later be professional PAI teachers. All capabilities of SPS above will support all the competencies needed by professional teachers.

If science process skills are correlated to the main task of the teachers i.e. to plan, carry out, and conduct assessments for students, then the process skills are necessary for carrying out these tasks. All the components of science process skills such as observation, classification, measurement, data collection, data processing, and making reports (communication) can support the tasks of the teachers. Thus, it is obvious that science process skills have a positive impact on the development of teacher assignment skills, including PAI students.

By increasing the abilities of the teachers, it is expected that PAI learning in schools will be more dynamic and fuller of scientific content. Such an educational process will certainly encourage the formation of scientific and religious personalities (with Islamic content). Concisely, PAI learning with scientific content will simultaneously create an intelligent person spiritually, emotionally, and intellectually. Islamic Education science as the main content of learning activity would encourage the development of spiritual intelligence (SQ) and emotional intelligence (EQ) while the content of science will encourage the development of intellectual intelligence (IQ). The balance of these components in Islam is called *insan syamil* and *mutakamil* (perfect humans). In another research conducted by (Ifa, Hanifah Misbach, 2008) it is stated that the three components above i.e. SQ, EQ and IQ are closely related. The three components are very influential in learning outcomes (Artana, Herawati, & Atmadja, 2014) .

The improvement of scientific literacy and science process skills above cannot be regarded as a skill of the experts in (natural) science. However, it can be understood as the growth of knowledge of awareness that Islam and science are interrelated; Islam opens a vast opportunity for the development

of science, and science opens a way to God (spirituality) more logical and systematic. With that awareness, it is possible for PAI teachers to answer and explain various verses of the Quran and hadith more scientifically. For example, with regard to the issue of "prohibition to live extravagantly in Islam", except the PAI teachers explain with the arguments of naqli (based on Qur'anic verses and hadith) by discussing Surah Al-Isra': 26-27 about the prohibition of being extravagant, they also could explain from a scientific perspective about the importance of being economical and the negative impact of an extravagant life.

Another example, in the Islamic education curriculum for senior high schools there is a topic about "Undergoing lives with honor". In discussing that topic, PAI teachers except delivering material in accordance with competency standards, basic competencies, objectives, and material indicators as standardized in the curriculum, they could also discuss from scientific perspective that is through scientific attitudes (part of scientific literacy). According to N. L. Dewi, Dantes, & Sadia, (2013) scientific attitudes include: honesty and objective, careful in making decisions, open, data-based, want to know seriously, and able to distinguish between opinions and data.

The results of this study also prove that non-science people (natural science) can understand the nature and value of science well. Therefore, if the model of learning in Islamic educational institutions, such as pesantren, uses this approach (science-based religious learning), the pesantren will be more dynamic. The culture of education in pesantren will be more advanced and can dispel the image of exclusivity and underdevelopment of pesantren education and other Islamic educational institutions.

The improvement of scientific literacy and the ability of the science process skills of PAI students shows that the selection of microteaching method as a means to provide skills of prospective teachers is appropriate. As previously explained that the microteaching method can increase the confidence of prospective teachers about their teaching task in the future (Bilen, 2015) and improve the competency of prospective teachers (Zunaidah, 2016).

Of course, in the context of this study, the competency is in the form of LS and SPS. In another study, it is also stated that microteaching method can also improve the ability to manage learning (Mardiyansyah & Suwito, 2018). It means that the implementation of the microteaching method with the LS and SPS approaches also opens the opportunity to be able to improve the ability of prospective PAI teacher to integrate science values in Islamic education.

4. Conclusions and suggestions

4.1. Conclusion

Based on the discussion above, it can be seen that the implementation of the microteaching method with LS and SPS gives a positive impact on the improvement of LS and SPS for prospective PAI teachers. For the ability that belong to high category, the LS aspect has reached 50%, while the SPS has reached 35.29%. For abilities with medium category, LS reaches 44.11% and SPS reaches 61.76%. The rest are the students with LS and SPS abilities with low categories. With these improvements, the opportunity to create dynamic, scientific and constructive PAI learning will be even greater. Besides, this also increases the potential for the growth of SQ, EQ and IQ in a harmonious and balanced way to create a perfect human being (insan syamil and mutakamil).

4.2. Suggestion

Based on the results of this study, some suggestions are needed, among others, the need for LS and SPS development training for all non-science prospective teachers such as language teachers, economics teacher, and so on through the same method (microteaching). With this method, the level of student's literacy is expected to increase more quickly and systematically so that the people of Indonesia would be more literate about science and have good science process skills. With these two components, progress and technology can be achieved and negative impacts can be anticipated.[]

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