

## EFFECTIVENESS OF INQUIRY LEARNING WORKSHOP BASED TO PROVIDE THE ABILITY TO CREATE PRODUCTIVE QUESTIONS OF SCIENCE TEACHER

Muhibbuddin<sup>1\*</sup>, Safrida<sup>2</sup>, Adnan<sup>3</sup> & Israwati<sup>4</sup>

<sup>1</sup>Dr. Universitas Syiah Kuala, Banda Aceh, Indonesia, muhib.bio@gmail.com

<sup>2</sup>Dr, Universitas Syiah Kuala, Banda Aceh, Indonesia, saf\_rida@unsyiah.ac.id

<sup>3</sup>Drs, Universitas Syiah Kuala, Banda Aceh, Indonesia, adnanabdullah408@gmail.com

<sup>4</sup>Dr, Universitas Syiah Kuala, Banda Aceh, Indonesia, israpaud@unsyiah.ac.id

Corresponding author

### Abstract

Asking questions is an essential aspect that both students and teachers must have. Questions raised by teacher affect the learning process, study result and improvement toward students' way of thinking. However, asking positive questions that give massive impact toward the learning process is not an easy way to do. A concrete learning strategy is needed to enable teachers to analyze subjects and come up with these positive questions as common skill in teaching. This study was conducted to test the effectiveness of inquiry learning workshop based in providing the ability to create productive questions for science teacher. The method of this research is *one-group pretest-posttest design*, involving 32 science teachers from senior high school as research subject. The research was conducted for 24 days, from early October to December 2017. This research was conducted at greater Aceh district, Aceh, Indonesia. The aspect that was observed in this research was the ability of science teacher in creating productive questions and taxonomy bloom cognitive thinking skill level. The analysis result of 30 questions asked toward teachers showed that the initial ability of them in creating productive questions is low compared to non-productive questions. The average of productive questions only 33% (10 questions) and the non-productive questions hit as high as 67% (20 questions). The analysis ending result showed a significant improvement with productive questions increase to 58%. The average of 91% (27 questions) generated by teachers are productive questions. However, there 9% of the question remaining non-productive. Inquiry learning workshop based is truly effective in providing science teacher to generate productive question featured with advance thinking skill. The ability to generate productive question during learning process increased 58% and thinking ability decrease to 47% of remembering. The understanding skill improved 31%, analyzing skill improved 14% and evaluating skill improved 2%.

**Keywords:** Inquiry-Based Learning, Workshop, Productive Questions, Science Teachers.

## 1. INTRODUCTION

Asking question is an essential skill during learning process to enhance students' understanding. Teacher often asked question for several purposes including to motivate students, to open learning activity, to estimate students' understanding about the subject, to gain information from students, to improve students' thinking ability, to obtain students' focus toward the subject, to recall the information students obtained, to enable students to use media, to enhance students' thinking pattern and for evaluation. Asking productive question is an essential skill during learning process to stimulate students' understanding. Productive questions is a type of question that made the students to seek for the correct answer through productive process. Productive questions differ from question that asked student to recall what they have learnt. Besides, it can motivate students' thinking ability in learning science with inquiry based that made students to seek for information, to confirm knowledge that student received and lead student attention to aspects they didn't learn yet (Rustaman, 2010). Therefore, the ability of science teacher to create productive question is an essential aspect in science learning process.

Science teacher is recommended to do asking and answer question through productive questions during learning process. Giving productive question gave a massive effect toward students' thinking pattern (Karim, etc., 2011). By utilizing productive question, science teacher has successfully help student to improve their critical thinking and put learning process as their responsibility. Besides generating productive question, science teacher must be able to generate question with cognitive thinking patter based on Bloom Taxonomy Standard (Rustaman, 2010). The ability of cognitive thinking based on Bloom Taxonomy is divided into six thinking skills; remembering, understanding, applying, analyzing, evaluating and generating. The lowest thinking skill is remembering and the most advance thinking skill is generating (Anderson and Krathwoh, 2001).

Especially for formulating productive question, it was known that there was knowledge limitation of the science teacher as well as the role of productive question during science learning process. The limitation of science teacher about productive question was revealed from study result. According to Husnawati etc., (2014), science teacher is lacking skill of generating question during learning process to enable student to think, both process skills, cognitive and affective which resulted to students' learning output less optimum. Science teacher must be able to use various asking skills which are clear and related to the subject that can give positive impact to the students and learning purpose can be achieved. During learning process, science teacher only act as information source while students as the receiver. Teacher in asking question only need a short and valid answer that leads the students to recall the main point that the teacher has explained earlier. Question given neither stimulated students to deliver their own opinion nor to think.

The study result of forty science teacher (Muhibbuddin, 2015) showed that the ability of teacher in asking productive question was very low. The question asked by teacher cannot categorized as productive question. Besides, the teacher understanding related to cognitive thinking skill based on Bloom Taxonomy thinking skill was also very low. The questions asked generally (95%) categorized as remembering question while the other types of question related to thinking skill such as understanding, applying, analyzing, evaluating and creating/generating are very low. It was also revealed there were six bad habit of teacher while asking question toward the students; (1) repeating students' answer and answering the question given to the students, (2) asking question that acted as a complementary of the answer with one syllable, (3) question which answered together with students, (4) not enough waiting time to answer, (5) the way of giving turn that was not nicely coordinated, (6) the distribution of question that was not prevalent. The study result also revealed that science teacher was not qualified to formulate productive question. This was due to lack of skills and knowledge of the science teacher in formulating the productive question.

Knowing the importance of asking productive question in science learning process, the lack of skills of teacher to create productive question as well as lack of skills of teacher in creating question based on cognitive thinking level, there is an urgent need of effective learning strategy that able to provide science teacher with ability to create productive question with thinking skill level that based on Bloom Taxonomy standard.

Inquiry is one of learning strategies that can be used to provide teacher and student in improving asking question skills (Amos, 2002). Several studies about learning inquiry that discussed about teacher ability in asking question has been done (Anderson, 2002; Chin, 2007; Marshall, et al., 2009; Oliveira, 2010a; Oliveira, 2010b; Braaten & Windschitl, 2011; Kawalkar & Vijapurkar, 2013; Van Booven, 2015; Arias, et al., 2016;

Chambers et al., 2017). The study result only discussed about teacher' habit and weakness in asking question in inquiry learning process. While studies that discuss about how to provide and training teachers to be able creating productive question is still limited. Therefore, this research was conducted to test the effectiveness of inquiry learning process workshop based in providing ability of creating productive question for science teacher.

## 2. RESEARCH METHOD

The method used in this research was experiment method with One-Shot Case Study design (Gall et al., 2003). The research of the design was shown bon Table-1.

Table-1 : One-Group Pretest-Posttest Design

Group	Pretest (initial ability)	Treatment	Post Test (ending ability)
Treatment Class	O <sup>1</sup>	X	O <sup>2</sup>

X = Learning with strategy inquiry workshop based

O<sup>1</sup> = Pretest (initial ability)

O<sup>2</sup> = Post Test (ending ability)

The resaerch was conducted with four steps. First, conducted evaluation toward teacher initial skill in creating question. At this stage the teacher was asked to create 30 essay questions related to biology. Data obtained from this step will be used as initial knowledge data before applying inquiry learning workshop based. Second, implement inquiry learning workshop based with folowing steps (1). Enhancing teacher with knowledge about asking question strategy in laerning process, (2) made teacher to formulate 30 essay question with thinking level skill based on Bloom Taxonomy, (3) guide teacher to plan productive questions through workshop activity using biology as the content, (4) reporting and presenting workshop result, (5) to do revision of qustion planning, (6) reporting and presenting revision result. Third teacher was instructed to report workshop result in written document which contain number of questions that have been revised. Fourth, conducted final evaluation after learning process. Final reulst evaluation was conducted toward question created by teacher. This reserch involved 32 science teacher of senior high school from Greater Aceh district. The research was conducted for 24 days long which started on October and finished on December 2017.

## 3. DATA AND ANALYSIS

Indicator measured during the research was initial ability and endinf ability of teacher in generating question. Types of question resulted from teacher experience dive into two types, productive and non-productive question. While based on Bloom Taxonomy, cognitive category was divided into six thinking skills; remembering, understanding, applyling, evaluating and creating. Question made by teacher was analyzed by estimating the average of numbers of questions based on two type of question mentioned earlier, productive and non-productive, also based on Bloom Taxonomy thinking skill cognitive dimension. To test the effectiveness of inquiry lerning workshop based implementation, comparison of questions based on types (productive and non-productive) and Bloom Taxonomy cognitive dimesion thinking skills of initial ability and ending ability.

## 4. FINDINGS AND DISCUSSION

Analisis result toward 30 questions created by teacher (Figure-1) showed that initial ability of teacher in creating productive question was lower compared to non-productive question. The average of productive question created by the teacher achieve 33% (10 questions) while non – productive question achieved 67% (20 questions). Analysis result of ending ability of the teacher in creating productive question increased as high as 58% from their initial ability. The total of 27 question which made it 91% of the total question created by teacher were productive. The other 9% of the total question was non-productive.

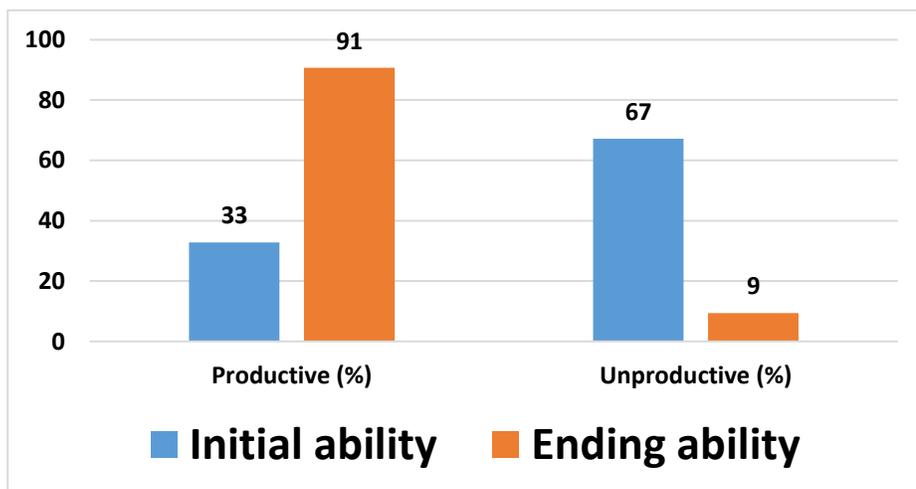


Figure 1 Comparison of mean amount productive and unproductive question of the teacher creation

Analysis result of thinking level based on Bloom Taxonomy toward questions created by teacher (Figure-2) showed that there are four thinking level category; remembering, understanding, analyzing and evaluating. While questions that fall into applying and creating category were not found.

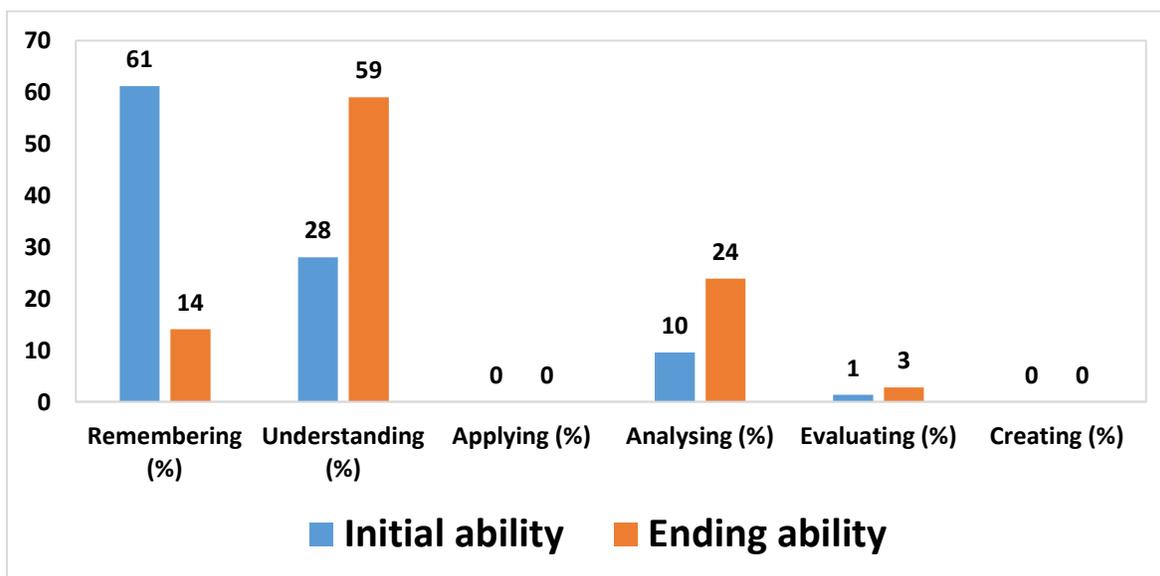


Figure 2. Comparison of mean amount Bloom's taxonomy thinking level on question of the teacher creation

Initial ability and ending ability in creating question based on Bloom Taxonomy thinking level showed different result. Teachers' ability in creating question was dominant (61%) at remembering level. While question with other thinking level was very few which are; understanding (28%), analyzing (10%) and evaluating (1%). Ending ability showed a significant change which a decrease in value occurred in remembering (14%). While there was improvement in other thinking category; understanding (59%), analyzing (24%) and evaluating (3%).

Data obtained from the research clearly showed that implementation of inquiry learning workshop based was really effective in helping science teacher in creating productive questions with advance thinking level (above remembering). Improvement of these skills was due to the teacher actively involved in creating question

experience during inquiry learning process workshop based. Inquiry learning is one of learning strategies that is recommended in science learning process (anonymous, 1996). The study result based on inquiry learning could give direct learning experience and what was learnt could be saved in cognitive structure for a long period of time (Oakley, 2004) and will give impact toward a more meaningful study result (Anderson, 2002).

Rustaman (2010) dan Karim et al. (2011) explained that teachers' quality in formulating question could be improved through well planned training and structured workshop. The study result brought by Emily et al. (2017) and Kang & Keinonen (2017) reported that through inquiry learning, teacher and teachers' candidates were able improving their skill in creating productive question and able to implement them during science learning process.

## 5. CONCLUSION

Combination of inquiry learning and workshop activity was really effective in providing science teacher to create productive questions with advance thinking level. Ability of creating productive questions increased 58% while thinking level decreased 47% of remembering category, increased 31% of understanding category, 14% analyzing category and 2% evaluating category.

## REFERENCE LIST

- Amos, S. 2002. "Teacher questions in the science classroom". *In Aspects of teaching secondary science: Perspectives on practice*, Edited by: Boohan, R. and Amos, S. 5–15. New York: Routledge.
- Anderson, R. 2002. Reforming science teaching: What research says about inquiry. *Journal of Science Teacher Education*, 13(1): p.1–12.
- Anderson, L.W. & Krathwohl, D. (2001). *A Taxonomy for Learning, Teaching and Assessing: a Revision of Bloom's Taxonomy of Educational Objectives*. New York. Longman.
- Arias, A. M., Davis, E. A., Marino, J.-C., Kademian, S. M., & Palincsar, A. S. (2016). Teachers' use of educative curriculum materials to engage students in science practices. *International Journal of Science Education*, 38(9), p.1504–1526.
- Braaten, M., & Windschitl, M. (2011). Working toward a stronger conceptualization of scientific explanation for science education. *Science Education*, 95(4), p.639–669.
- Chambers, A.B.; Sylvie M. Kademian, S.M.; Davis, E.A. & Palincsar, A.S. (2017). Guiding students towards sense making: teacher questions focused on integrating scientific practices with science content. *International Journal of Science Education*, 38(15), p.1977-2001
- Chin, C. (2007). Classroom Interaction in Science: Teacher questioning and feedback to students' responses. *International Journal of Science Education*, 28(11), p.1315-1346
- Emily J. S. K., Julie, A. B. & Kelly, G.J. (2017). Crossing the Border from Science Student to Science Teacher: Preservice Teachers' Views and Experiences Learning to Teach Inquiry. *Journal of Science Teacher Education*, 24(3), p.427-447.
- Gall, M.D.; Gall, J. P. & Borg, W. R. (2003). *Educational Research an Introduction*. Boston: Pearson Education Inc.
- Husnawati, Muhibbuddin & Abdullah (2014). Analisis Teknik Bertanya Calon Guru Biologi Dalam Mengembangkan Keterampilan Berpikir Siswa Untuk Meningkatkan Hasil Belajar. *Jurnal Biologi Edukasi* 6(2), p.48-56.
- Kang, J. & Keinonen, T. (2017). The effect of inquiry-based learning experiences on adolescents' science-related career aspiration in the Finnish context. *International Journal of Science Education*, 39(12), p.1669-1689.
- Karim, S., Rustaman, A. & Rustaman, N. (2011). *Bagaimana Merancang Pertanyaan Produktif*. Jakarta:

Depdikbud, Direktorat Jenderal Pendidikan Dasar dan Menengah.

- Kawalkar, A., & Vijapurkar, J. (2013). Scaffolding science talk: The role of teachers' questions in the inquiry classroom. *International Journal of Science Education*, 35(12), p.2004–2027
- Marshall, J. C., Smart, J. and Horton, R. M. 2009. The design and validation of EQUIP: An instrument to assess inquiry-based instruction. *International Journal of Science and Mathematics Education*, 8(2): p.299–321.
- Muhibbuddin. (2015). Pemetaan Kemampuan Bertanya Guru-Guru IPA dalam Proses Pembelajaran Sains. *Proseding Seminar Nasional Pendidikan Biologi*. Universitas Syiah Kuala, 7 November 2015.
- Oliveira, A. W. (2010a). Developing elementary teachers' understanding of the discourse structure of inquiry-based science classrooms. *International Journal of Science and Mathematics Education*, 8(2), p.247–269
- Oliveira, A. W. (2010b). Improving teacher questioning in science inquiry discussions through professional development. *Journal of Research in Science Teaching*, 47(4), p.422–453.
- Rustaman, N.Y. (2010). *Peranan Pertanyaan Produktif dalam Pengembangan KPS*. Bahan Seminar dan Lokakarya Guru-guru Biologi. FPMIPA. Universitas Pendidikan Indonesia.
- Van Booven, C. D. (2015). Revisiting the authoritative–dialogic tension in inquiry-based elementary science teacher questioning. *International Journal of Science Education*, 37(8), p.1182–1201