INQUIRY LEARNING TOOLS TO TRAIN SCIENCE PROCESS SKILLS AT THE JUNIOR HIGH SCHOOL LEVEL

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Abstract
The inquiry is a core in science learning. One of the learning success factors in the classroom is determined by the existence of learning tools that are appropriate to the learning objectives. This study aims to determine the extent of the feasibility of inquiry learning tools at the junior high school level to drive science process skills by experts. The validation method used is Aiken Index. The validation of the learning tools was carried out by 3 validators consisting of two experts from two different colleagues and one validator from the practitioner (junior high school teacher). Validated learning tools in the form of lesson plans use inquiry learning models with the syntax OMGVA (observation-manipulation-generalization-verification-application). Validation results show that all learning tools have Aiken index 0.8 and 1, it means that inquiry learning tools can be used to train science process skills at the junior high level.

Keywords*: Inquiry learning tools, junior high school level, science process skills*

Abstrak
Penyelidikan adalah inti dalam pembelajaran sains. Salah satu faktor keberhasilan belajar di kelas ditentukan oleh adanya alat belajar yang sesuai dengan tujuan pembelajaran. Penelitian ini bertujuan untuk mengetahui perluasan kelayakan alat pembelajaran inkuiri di tingkat SMP untuk mendorong keterampilan proses sains oleh para ahli. Metode validasi yang digunakan adalah Aiken Index. Validasi alat pembelajaran dilakukan oleh 3 validator yang terdiri dari dua ahli dari dua rekan kerja yang berbeda dan satu validator dari praktisi (guru sekolah menengah pertama). Alat pembelajaran yang divalidasi dalam bentuk rencana pelajaran menggunakan model pembelajaran inkuiri dengan sintaks OMGVA (observasi-manipulasi-generalisasi-verifikasi-aplikasi). Hasil validasi menunjukkan bahwa semua alat pembelajaran memiliki indeks Aiken 0,8 dan 1, itu berarti bahwa alat pembelajaran inkuiri dapat digunakan untuk melatih keterampilan proses sains di tingkat SMP.

Kata Kunci: *Perangkat pembelajaran inkuiri, tingkat sekolah menengah pertama keterampilan proses sains*

INTRODUCTION

Inquiry is the core of science learning (Anderson, 2002). Therefore, science should not only be taught separately between knowledge, process, and product but is a unity (Ningsih et al., 2017). As the nature of science learning itself is as an attitude, process, and product (Patonah et al., 2017; Hartanti et al., 2017). Through inquiry learning, every student acquires real knowledge, they gain knowledge as scientists acquire it (NRC, 2015). Almost all science products are obtained through

the inquiry process. This is because inquiry has the characteristics of acquiring more complex scientific process skills. Through the process of inquiry, students move like scientists find science.

Natural science is known as science. Science is also known as the science of how the universe works, so learning science studies nature itself. Natural science (science) essentially has 3 elements, namely science as a product, science as a process, and science as an attitude. Even Demir clarifies the domain of science into 4, namely: cognitive, affective, process, and product (Aydnlli et al., 2011). As a product, science is generally understood as a collection of concepts, laws, theories and principles. Concerning the process, science is obtained using the stages of the scientific method. While related to the attitude that is universally believed, it requires some skills that underlie scientific processes that can be accounted for. These skills are known as science process skills.

There are 4 skills needed in the 21st century, namely: (1) digital-age literacy, (2) inventive thinking, (3) effective communication, and (4) high productivity. Included in the literacy group are scientific literacy, namely knowledge and understanding of the concepts and processes of science (Dragoş & Mih, 2015). That is, that science process skills are literacy that must be mastered by students in the 21st century. These skills are not only memorized but are realized in everyday life. Science process skills are a series of skills needed to conduct scientific investigations following universally agreed methods, namely the scientific method. The scientific method consists of: observing, defining problems, submitting hypotheses, testing experiments, and making conclusions, obtaining a theory. In carrying out this scientific method, a set of skills is needed. Science process skills are divided into two, namely basic skills and integrated skills. Basic science process skills consist of observing, measuring, predicting, concluding, communicating, and classifying. Included in integrated science process skills are: defining and controlling variables, formulating and testing hypotheses, defining operationally, experimenting, interpreting data, formulating (Aydnlli et al., 2011; Duruk et al., 2017; Aydoğdu et al., 2014; Lestari & Diana, 2018; Mahmudah et al., 2019; Marlena et al., 2019; Ramadhani, et al., 2019; Yunita, et al., 2017). Each skill is needed by students while studying science.

The purpose of science lessons at junior high school level as stated in the curriculum (Permendiknas, 2016) is to admire the order and complexity of God's creation; show scientific behavior in daily activities; Appreciate individual and group work in daily activities; show wise and responsible behavior in daily activities, and show appreciation to others in their daily activities. All activities are based on scientific activities during class and learning can be realized in everyday life.

In Indonesia, science subjects are studied at the elementary and junior high school level, where at the elementary level they use a thematic approach while at the junior high school level use an integrated approach. This means that science lessons can be approached in various aspects of the natural sciences, namely physics, biology, and chemistry. For example in basic competencies that have basic competencies 3.4 class VII junior high school (Permendiknas, 2016): *"Analyzing the concepts of temperature, expansion, heat, heat transfer, and its application in everyday life including the mechanism of maintaining body temperature stability in humans and animals"* These basic competencies imply the integration of concepts about temperature and heat in terms of aspects of biology, physical aspects, and chemical aspects.

In addition to paying attention to aspects of integration, natural science learning in junior high schools must also pay attention to the characteristics of students at the junior high school level. According to Piaget's development theory, junior high school students are in a concrete operational position, which is the beginning of rational thinking. In this phase individuals have begun to be able to make decisions from every problem faced. That is students at the junior high level need interesting learning, interacting with nature, and concrete things. Students at the junior high school level are transitions between childhood and adolescence. Less varied learning and memorized monotony are boring for students. In this case, it is necessary to use the technique to bring science learning that is fun for students, one of which is to make learning tools (lesson plans).

The existence of a learning implementation plan (lesson plan) in each subject is part of the learning process standard in Indonesia (Direktorat Pembinaan Sekolah Menengah Atas, 2017). Learning Implementation Plans (lesson plan) are plans for face-to-face learning activities for one or more meetings to direct the learning activities of students to achieve Basic Competencies (BC). Preparing a lesson plan is the obligation of every educator in Indonesia. The lesson plan is prepared completely and systematically so that learning takes place in an interactive, inspirational, fun, challenging, efficient, motivating students to actively participate, as well as providing sufficient space for initiative, creativity, and independence according to their talents, interests, and physical and psychological development learners. The lesson plan is compiled based on BC or sub-themes which are carried out at meetings or more. Permendikbud no. 22 of 2016 is a continuation of Permendikbud No. 103 of 2014, concerning learning in basic education and secondary education. The components that must be in the lesson plan following the 2016 Minister of Education and Culture Regulation are: a. school identity, b. identity of subjects or themes/sub-themes; c. class/semester; d. subject matter; e. Time Allocation; f. learning objectives; g. basic competencies and indicators of achievement of competencies; h. learning materials; i. learning methods; j. instructional Media; l. learning steps; and M. assessment of learning outcomes.

Through a good learning plan, it can help the teacher to have preparation and help the teacher carry out the learning well. However, the conditions in the field show that compiling learning tools to train science process skills is difficult (Kusumastuti & Sudiyanto, 2016; Ernawati & Safitri, 2017; Kinasih, 2017). So that it is not uncommon for science process skills to be understood as the stages of a scientific method that is only memorized at the first science learning sessions and then never applied in science learning. Teachers are more interested in teaching science only with memorization methods. Therefore the existence of inquiry learning tools to train science process skills for teachers is important. Teachers must use inquiry in science learning to help students conduct investigations (Diawati et al., 2016) and to practice process skills (Sulistyorini et al., 2016).This study aims to validate the inquiry learning device developed to train science process skills. Inquiry learning tools have been validated by experts, so they can be used in classroom learning.

RESEARCH METHOD

This research is part of research on developing inquiry learning tools. The validation method used is the expert validation method using Aiken techniques (Retnawati, 2016). The validator consists of 3 people where 2 people as academics expert academics (professors from 2 different campuses) and 1 science teacher practitioner. There are 33 sets of learning devices for grades 7 to 9. Inquiry learning is used using inquiry lessons developed by Wenning (2011) where the learning syntax consists of observation-manipulation-generalization-verification-application. While the science process skills used are basic process skills which consist of: observing, measuring, predicting, concluding, communicating, and classifying. There are 24 questionnaire items to assess the feasibility of a lesson plan with 3 rating scales, namely 1 (not appropriate), 2 (according to part), and 3 (in full).

RESULTS AND DISCUSSION

In this study the lesson plan of science subject was developed for each level in junior high school using an assessment instrument in the form of a lesson plan assessment questionnaire. Assessment results are divided into 9 components, namely: (A) identity of subjects, (B) formulation of indicators, (C) formulation of learning objectives, (D) selection of teaching materials, (E) selection of learning resources, (F) selection of learning media, (G) learning model, (H) learning scenario, and (I) assessment. The results of the validation of 9 aspects of lesson plan assessment for the three grade levels in junior high school are shown in Table 1.

Table 1. The Results of The Validation of The Inquiry Learning Tools for Junior High School Science Subjects

Item Code	Validation Results		
	7th	8th	9th
A	1	1	1
B1	1	1	1
B2	1	.8	.8
B3	1	.8	1
C1	1	1	1
C2	.8	1	1
D1	1	1	1
D2	1	1	1
D3	1	1	1
E1	1	1	1
E2	1	1	1
E3	1	1	1
F1	1	1	1
F2	1	1	.8
F3	1	1	1
G1	1	1	1
G2	1	.8	1
H1	1	1	.8
H2	1	1	1
H3	1	1	1
H4	1	1	1
I1	1	1	.8
I2	.8	.8	.8
I3	1	1	1
I4	1	1	1

Based on Table 1, the validation results are at scores .8 and 1, which means that the inquiry learning device is valid to be used to train science process skills. For each validation result is shown in the Figure 1, 2, and 3. Based on Figure 1, as many as 91.6 % are very valid while in sections C2 and I2 (Conformity with basic competence (C2); suitability with indicators of achievement of competencies (I2)), still not very valid criteria. Based on Figure 2, as many as 83 % of the lesson plan are in a valid position while in B2, B3, G2, and I2 (Suitability of the use of operational verbs with measured competencies (B2); suitability with aspects of attitudes, knowledge, and skills (B3); Compliance with trained process skills (G2) and compliance with competency achievement indicators (I2) have not yet reached very valid criteria. In Figure 3, as much as 79 % of the RPP is in a very valid position, while for B2, F2, H1, I1, and I2 (Suitability of the use of operational verbs with measured competencies (B2); Conformity with learning material and scientific approach (F2); Showing preliminary activities, the core and closing clearly (H1); Compliance with techniques and forms of authentic assessment (I1); as well as conformity with indicators of achievement of competencies) have not yet reached very valid criteria.
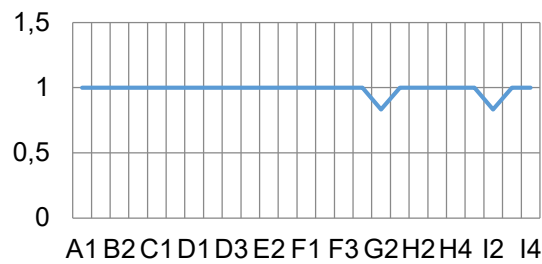
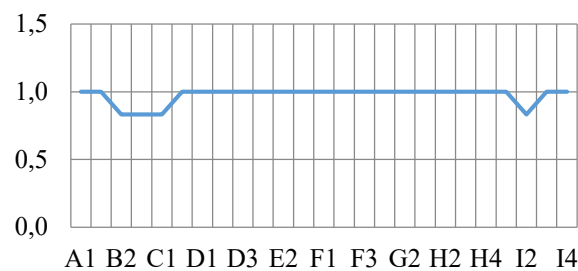**Figure 1.** Validation Results of 7th Lesson Plan

Figure 2. Validation Results of 8th Lesson Plan
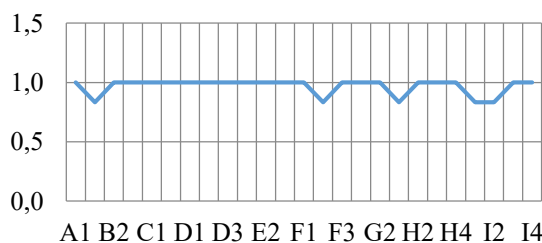

Figure 3. Validation Results of 9th Lesson Plan

The existence of a learning implementation plan is essential for the success of teaching for each teacher. Moreover, the implementation plan of science learning that prioritizes the inquiry process to gain knowledge. The difficulty of the teacher in preparing the learning tools in which he practices the science process skills is needed. Given the science process skills are part of the scientific literacy that every student must master to live in the 21st century.

The learning tool developed in this study uses inquiry lesson learning which consists of 5 syntaxes, namely observation, manipulation, generalization, verification, and application. While the science process skills developed in the learning process consist of basic process skills, namely observing, measuring, classifying, predicting, concluding, and communicating. Learning tools developed in general are valid for use in science learning in junior high schools. An important part that needs to be studied more deeply is how to lower basic competencies into learning indicators. Besides, the selection of operational verb usage also needs to be reviewed so that a better learning tool can be obtained. Based on the results of this validation, the inquiry learning tool developed can be used in science subjects in junior high school following the 2013 curriculum according to the grade level. The learning tools developed have high validity (.8 and 1), so that they can be used to train science process skills in science lessons in junior high school.

CONCLUSION

The difficulty of the teacher in preparing the learning tools in which he practices the science process skills is needed. Given the science process skills are part of the scientific literacy that every student must master to live in the 21st century. Validated learning tools in the form of lesson plans use inquiry learning models with the syntax OMGVA (observation-manipulation-generalization-verification-application). Validation results show that all learning tools have Aiken index 0.8 and 1, it means that inquiry learning tools can be used to train science process skills at the junior high level. The learning tools developed have high validity (.8 and 1), so that they can be used to train science process skills in science lessons in junior high school. Based on the results of this validation, the inquiry learning tool developed can be used in science subjects in junior high school following the 2013 curriculum according to the grade level.

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