Student’s research skills in middle school of Kuningan district

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Abstract. This exploratory study aimed to analyze the research skills and to explore the authentic research abilities that can support students’ research skills. The study engaged sixty-eight students of science class from two schools in Kuningan district. The data was collected through research skills tests, consist of 11 items of essay questions including seven components of research skills: 1) Understanding phenomena and identifying problems, 2) formulating problems, 3) composing hypotheses, 4) making research designs, 5) implementing experiments and collecting data, 6) analysing data, and 7) making conclusions. The results revealed that the authentic research abilities of students based on, the seven components of research skills were very lacking. The average score of the rubric was 1, it meant that the students were less skilled. The largest percentage of the average test score in both of schools showed that they were in very less category, 72% (first school) and 79% (second school). The analysis on seven components of student research skills was still in the range of the score 0-1.

1. Introduction

Basically, there is no single educational philosophy that can be used specifically for research development producing quality human. For this reason, research skills are developed by following philosophies: (1) The nature of Natural Sciences Education: essentially, science education is the important understanding of learning nature that will bring human to a meaningful life. Philosophically, practicing research skills leads to the formation of human thinking in relation to studying nature; (2) Learning Theory: learning theory always evolves due to the times. The world of education is inseparable from learning theory which is the foundation of achieving educational goals that can be reflected on the students’ success. The development of students’ abilities in science is one of the keys to the success of capacity building in adjusting to the change and entering the world of technology, including information technology. For personal, social, economic and environmental interests; students need to be equipped with adequate competencies to become active participants in the community. The theoretical foundation of contextual science learning is constructivism theory. The principle of constructivism theory is ‘activity should always precede analysis’. In addition, contextual science learning is meaningful learning that allows students to apply high-order thinking skills; (3) The Nature of Natural Sciences: science, a body of knowledge, is formed through an inquiry process which is directed by people engaged in the field of science. Science is a human effort that includes mental operations, manipulating and calculating skills and strategies, curiosity, courage, persistence, which individuals do to uncover the secrets of the universe. Science is also said to be the things
scientists do when conducting scientific investigations. It can be formulated that science is a set of concepts, principles, laws and theories forming through a systematic creative and inquiry process followed by a continuous observation process (empirical); it is a human effort which includes mental operations, skills, and manipulating and calculating strategies, which can be re-tested the truth based on curiosity, courage, persistence by individuals to uncover the secrets of the universe; (4) The development of a science curriculum develops active learning focusing on Hands on and Minds on students’ activities. Hands on activity is a model designed to involve students in gathering information and asking questions, doing activities and finding, collecting data and analysing and making conclusions on their own. Students are free to construct thoughts and findings during activities, so they can do it themselves with no burden, fun and in high motivation. This activity supports active learning that involves research experience to train research skills. In the hands-on activity, an appreciation and experience will be formed to establish an understanding (appreciation) because it is able to teach psychomotor abilities (skills), understanding (knowledge) and affective (attitudes) that usually use laboratory facilities. Along with this, it can provide a deep understanding of what is learned, so that what is obtained by students is not easily forgotten and meaningful. By hands on activity, students will get the knowledge directly through their own experience. It means that authentic research in learning can train students’ hands on and minds on activities.

Certain levels of education that exist in both domestically and abroad defines minimum standards related to the minimum quality that must be possessed by students. For example, Colleges and Universities in America have long emphasized undergraduate research experience as a valuable activity for students. The National Science Foundation (NSF) focused in 2003, recommends all students engage in undergraduate research as early as possible in their college careers (NSF). In addition, The Next Generation Science Standards (NGSS) (2013) outlines recommendations on how to engage K-12 students in science effectively by integrating the ideas of core science disciplines, crosscutting concepts, and the science and engineering practice. Furthermore, this standard describes eight understandings of the nature of science (Nature of Science) including: 1) Scientific Investigation Using Various Methods, 2) Science based on Empirical Evidence, 3) Opened Science for Mild New Evidence Revision 4) Scientific Theory, Laws, Mechanisms and Theories Explaining Natural Phenomena 5) Science is the Way to Know, 6) Science Adheres Discipline and Consistency in Natural Systems, 7) Science is Human Efforts, and 8) Questions about Nature and Material Science World. These ideas are largely in accordance with national standards and previous framework documents, emphasizing that students must be active participants in doing science actively and in science learning processes [1-4]. In line with the vision of the American Association for Advancement of Science (AAAS), it calls on all faculties of science to bridge research and learning by urging the integration of authentic research experiences in lectures including in the laboratory. This is in line with the research of [5], which alludes to the AAAS vision and program which advises all students in universities to have research experience in order to understand scientific research [4].

Research conducted by [6] on how children's imagination arises, develops, and influences their experience in science, showed that the process of children's imagination plays a role when they discover, anticipate, and explore problems that are important and useful in increasing our understanding on children's learning and meaningful learning related to science and sustainability. Research involvement has a positive effect on children's self-development. They all feel empowered by hearing and paying attention to them. Actively involved in research for children has a positive impact in terms of: Increasing self-esteem and a sense of worth; Increased self-confidence; Development of transferable learning skills: organization, management, analysis and evaluation; Sharpen critical thinking skills; Enhancing ethical awareness; Increased problem solving skills; More effective communication; The emergence of independent learning; and Increased participation in other aspects that affect their childhood [7-9].

This exploratory study was conducted to analyse research skills and explore the authentic abilities of research that can support students’ research skills.
2. Methods
This research applied exploratory research. A number of students (n = 68) in the Department of Natural Sciences from two selected schools in Kuningan district were included in this study. The data were collected through research skills tests in the form of elaboration questions as many as 11 items which covered seven components of research skills and were validated by experts, including: 1) Understanding phenomena and identifying problems, 2) formulating problems, 3) composing hypotheses, 4) making designs and research design, 5) implementing experiments and collecting data, 6) analysing data, and 7) making conclusions. Descriptive analysis was carried out on research skills data based on the assessment rubric that had been developed.

3. Result and Discussion
Figure 1 shows the average score of students’ research skills in two schools containing seven aspects of research ability. The research capabilities of students in two schools are still in the category of very less indicated by the average score on research skills aspects. The results show the largest percentage, 79% and 72%, respectively in the category of much less.

![Figure 1. The average score of student's research skills in the two sample schools in Kuningan District](image)

The students’ research abilities shown through research skills aspects are: 1) Understanding phenomena and identifying problems, 2) formulating problems, 3) composing hypotheses, 4) making research designs, 5) implementing experiments and collecting data, 6) analysing data, and 7) making conclusions as shown in figure 1, both the first and second schools of students’ research skills in Kuningan District were much less category with the largest percentage numbers of 79% and 72%, respectively in the category of much less.

Table 1. The average rubric score of the research skills two schools in Kuningan District

| School | Average Score | Criteria         |
|--------|---------------|------------------|
| 1      | 1             | Less skilled     |
| 2      | 0.9           | Less skilled     |

Table 1 shows the results of the analysis on the achievement of the seven components of students’ research skills in the range of 0-1. The average score of the ability assessment rubric is in number one, which means less skilled students.
Research skills are skills in conducting scientific research in the framework of scientific truth seeking by applying scientific methods that rely on proven scientific reasoning. Webb, Smith, & Worsfold [10] stated that research skills help students to critically investigate problems, produce and evaluate relevant data, test ideas, theories, and hypotheses, and successfully guide the way for them to navigate the sea of information that characterizes the era information. Research is a systematic investigation to answer questions or solve problems through the application of scientific methods [11]. A research is driven by the desire to know something, or curiosity about something, how something is, and what something is doing or will do [12]. Research is a systematic step in solving problems. Research is a controlled study that contains two main things, logic thinking and data or information that is collected empirically [13]. The logic of thinking appears in systematic steps starting from collecting, processing, analyzing, interpreting and testing the data until a conclusion is reached [14]. Based on this explanation and data on students' research skills in this study, being actively involved in research for children has a positive impact in terms of: increasing self-esteem and a sense of worth; increased self-confidence; development of transferable learning skills: organization, management, analysis and evaluation; sharpen critical thinking skills; enhance ethical awareness; increased problem solving abilities; more effective communication; the emergence of independent learning; and increased participation in other aspects that affect the child's childhood [8]. Therefore, it is important for students to be provided with early research skills as a provision for their education and career in the future in facing the information age and global challenges.

Table 2. Criteria of average score students' research skills in middle school in Kuningan district

| Average Score | Description of Criteria |
|---------------|-------------------------|
| 3             | Skilled                 |
| 2             | skilled enough          |
| 1             | less skilled            |
| 0             | Unskilled               |

Table 2 shows the representation of criteria for the final average score for students' research skills in two middle schools in Kuningan district. Some positive things involving children in research according to Lapatto [5] was research experience has "instrumental value in continuing the career path of students" through increasing their confidence in graduating from school. Another positive advantage of student involvement in authentic research experiences is providing an overview of potential cognitive and interpersonal growth among students participating in the study. According to Strage and Peters, in Stark [15], involving students in research has been shown to give students meaningful learning opportunities in a number of contexts. Another advantage of student involvement in authentic research is having the opportunity to develop their research skills through independent lessons and experiences including designing surveys, collecting data, analyzing and summarizing results, and preparing professional reports and poster to communicate project results to the general public. Overall, involving students in authentic research can develop a better understanding of the research process, improve the ability to write and communicate, and gain experience working effectively with the team. The results of this study illustrate that there is still a lack of student involvement in science activities so that students still have difficulties and are less skilled in research skills aspects including: 1) Understanding phenomena and identifying problems, 2) formulating problems, 3) composing hypotheses, 4) making research designs and designs, 5) implementing experiments and collecting data, 6) analyzing data, and 7) making conclusions.

4. Conclusion
The results revealed that the authentic research abilities of students, shown from the seven components of research skills, were much less. The average score of the rubric was 1, it meant that the students were less skilled. The largest percentage of the average test score in both of schools showed that they
were in very less category, 72% (first school) and 79% (second school). The achievement analysis on seven components of student research skills was still in the range of the score 0-1.

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Acknowledgments
We thank to the Education Fund Management Institute (LPDP) of the Research and Technology Department of Higher Education, Biology Educational Department UNIKU and undergraduate lab students at the participating institution. We also thank to SMA Negeri 1 Kuningan and SMA Negeri 2 Kuningan for their time and support.