The Effectiveness Of Learning Tools In Science Learning

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Abstract. Learning tools are thing that used to help students learn more effectively and efficiently. This study aimed to determine the effectiveness of learning tools to support the science learning process. The Subjects of this study are articles obtained through the search site https://scholar.google.co.id that relevant to the issue. There were 3 selection steps to collect articles used as the main data sources. The first selection based on the title of the article. The second selection arranged through abstract scanning. The third selection conducted by reading the entire contents of the article. Through the selections, 40 accredited articles that analyse learning tools, especially in science education (Physics 65.85%, Chemistry 4.88%, and Biology 29.27%) obtained as the data source. The articles are analysed descriptively to determine the effectiveness of using learning tools in science learning to improve student competency. The learning tools in the articles consisted of innovative tools developed (72.5%) and conventional tools available in schools (27.5%). The learning tools in the articles applied at various levels of education, from elementary school to university. Based on analysis data, the use of learning tools was 100% effective in support science learning, characterized by an increase in student competence after the use of tools in learning. Competencies that developed through the use of learning tools are knowledge (53.3%), attitude (20%), skills (18.3%), mindset (1.68%), metacognitive (1.68%), creativity (1.68%), problem-solving (1.68%), and motivation (1.68%). The benefits that reached from the use of learning tools, specifically in science lessons, have implications for improving student competency.

Keyword: Effectiveness, Learning tools, Science learning

1. Introduction

National Education System in Indonesia, according to Law no. 20 of 2003 aims to educate the nation's life and develop Indonesian people as a whole, namely human beings who have faith and devotion to the Almighty God and noble character, possess knowledge and skills, physical and spiritual health, a solid personality, and social and national responsibility.

Various factors influence the success of the education system, one of which is the teacher. The teacher is a professional position so that he must be able to carry out his duties professionally. Based on the Regulation of educations Minister No. 16 of 2007 concerning Academic Qualification Standards and Teacher Competence, the competencies that science subject teachers must have in junior high school are creative and innovative in the application and development of science. One form of teacher creativity and innovation can use a variety of learning tools to help explain the concept of abstract science learning to be more concrete [1].
Learning tools defined as tools used to educate or teach so that the concepts taught easily understood by students [2]. Learning tools are a means of communication and interaction between teachers and students in the learning process [1]. Tools made as teaching aids to learn abstract materials in science to be more concrete, touchable, and simple [1]. To be concluded, learning tools aimed to make abstract theory into realistic material that see-able, touchable, and understandable for both teacher and student. To put in another way, learning tools in this research defined as the real form of a theory.

Generally, learning tools referred to as the learning models, learning media, or learning aids. The fundamental difference is that learning tools a thing that supports learning through demonstrations and experiments, not a written task. Commonly, learning models take a role to illustrate a theory into 3D or 2D objects, not for experiment purposes. For instance, hydrology cycle flyer and human-skull torso. Learning media aimed to deliver content/learning materials such as books, movies, videos. Meanwhile, a learning aid is something intended to enhance learning and retention by the learner. It may include written materials, visualizations, charts, diagrams, processes, strategies, or any other appropriate item.

The use of tools supported by the theory of cognitive development of middle school-age children who are in the concrete operational stage [3]. The use of learning tools further recommended by the Indonesian Ministry of Education and Culture, which written in the 8th-grade junior high school science teacher's book. It explained that one of the characteristics of learning science is requiring various kinds of tools and materials, especially to assist observation [4]. Tools are necessary because human abilities are limited. Many topics require teaching prop to describe them, especially in abstract learning materials such as human digestion, electricity, and others. Besides, there limited results and processes if the data obtained on observations with the senses. Observation with the senses yields less objective results, while science prioritizes objectivity. For example, to observe the orbits of planets in the solar system, the help of solar system tools is needed. Therefore, learning using learning tools in the subject matter is considered very appropriate to help make it easier for students to understand the material.

The use of tools provides various advantages in the education process. Prasetyarini stated that learning tools clarify the teaching material given by the teacher so that students more easily understand the material or questions presented by the teacher [5]. Tools help to demonstrate/display/verify the concepts or symptoms studied. The use of learning tools expected to be able to reduce the students' difficulties and help teachers in learning science so that the delivery of concepts becomes more meaningful and can improve students' understanding of the concepts learned. Thus a quality learning process will be created.

Various studies prove the effectiveness of learning tools in science learning, including in the fields of chemical physics, and biology. One study explained that the use of learning tools enlivens the learning atmosphere and improves communication between teachers and students [2]. Various studies state that there is an influence between the learning atmosphere [6,7] and the teacher's teaching method [8,9] on children's performance. It suspected able to help students to improve their learning achievement in science.

However, there are still several schools that do not use teaching aids in the science learning process. Various factors cause the situation. One of them is the teacher's ignorance of the benefits of using teaching tools in increasing student competency. Some teachers conclude that the use of teaching tools has no significant impact on student development. Some think that learning from the book is enough for children. The fact is, it widely believed that learning by doing is more effective than only by reading. Based on the results of the research data found, the researchers made a literature study related to the effectiveness of the use of learning tools in science learning.
2. Methods
This research was a literature study that investigates the effectiveness of using learning tools in science learning. The Subjects of this study are articles obtained through the search site https://scholar.google.co.id. Through the search site, 80 articles that examined the effectiveness of using learning tools in science learning obtained, including on physics, chemistry, and biology at various levels of education, from elementary school to college. Articles are selected based on the following criteria, 1) Discuss science learning tools, 2) accredited and recognized nationally in Indonesia or internationally, 3) published in the span of 2015-2019. There 3 stages of selection for articles used as primary data sources. The first selection based on the title of the article. The second selection was done through abstract reading. The third selection was done by reading the entire contents of the article. As an emphasis, the articles in this study investigated by researchers randomly based on findings without equalization efforts in terms of origin, fields of science, types, levels of application, research results and other aspects. As a result, 40 accredited articles chosen as the primary data sources reviewed in this study. The articles are analysed descriptively to determine the effectiveness of using learning tools in science learning to influence student competency. The aspects that analysed in this study are the articles’ accreditation, knowledge field, type of tools, level of application, enhanced competence, and the effectiveness of improving student competency.

3. Results and Discussion
The data in this study obtained based on an analysis of 40 accredited articles that examined the use of learning tools in science learning. Based on the analysis, the data concentrated on the table below.

| No | Aspect                  | Amount | Percentage (%) |
|----|-------------------------|--------|----------------|
| 1  | Accreditation           |        |                |
|    | National                | 30     | 75             |
|    | International           | 10     | 25             |
| 2  | Knowledge discipline    |        |                |
|    | Physics                 | 27     | 65.85          |
|    | Chemistry               | 2      | 4.88           |
|    | Biology                 | 12     | 29.27          |
| 3  | Type of tools           |        |                |
|    | Innovative              | 29     | 72.5           |
|    | Conventional            | 11     | 27.5           |
| 4  | Level of application    |        |                |
|    | Elementary School       | 5      | 12.5           |
|    | Junior High School      | 12     | 30             |
|    | High School             | 18     | 45             |
|    | College                 | 5      | 12.5           |
|    | Knowledge               | 32     | 53.2           |
|    | Attitude                | 12     | 20             |
|    | Skills                  | 11     | 18.7           |
|    | Mind-set                | 1      | 1.68           |
|    | Meta-cognitive          | 1      | 1.68           |
|    | Creativity              | 1      | 1.68           |
|    | Solution to problem     | 1      | 1.68           |
|    | Motivation              | 1      | 1.68           |
| 6  | Effectiveness           |        |                |
|    | Effective               | 40     | 100            |
|    | Ineffective             | 0      | 0              |

3.1 Accreditation
The articles are accredited nationally (75%) and international (25%). Variations in the sources of accreditation analysed to strengthen the role of learning tools in science education. The use of
teaching tools globally shows that the use of tools needed in education. This indicated that teaching tools have a positive influence on the educational process. Not only in developing countries like Indonesia but also in developed countries like America. The economic level of a country implicated the level of education that sustains in that country. The use of teaching tools at various levels of education indicates that teaching tools are flexible and adaptable to students' abilities. Various studies showed that learning tools can be remade in an innovative way with simple tools without reducing the effectiveness of the tools [26]. Therefore the effective use of teaching tools in education, especially science, becomes an intriguing issue that gains researchers' attention.

Attention to the learning tools is due to the various functions of it in education, especially in a science subject. The learning tools have numerous advantages including 1) giving variety in learning, 2) facilitating students in understanding the concepts, 3) motivating students to be more creative, and 4) increase skills in using learning tools [22]. Tools facilitate students' learning processes to be effective and efficient [10,11,12]. Tools visualize abstract theory in science into a realistic things [13,14,15,16], attract students' attention [17,16], stimulate critical thinking [18,19], and add to student experience [20,21,22, 23]. The educational approach assisted by learning tools develops student skills and knowledge to improve student learning outcomes.

3.2 Knowledge discipline
The tools in the articles analysed in this study applied to science learning. The subjects of Science (Natural Sciences) are a form of unity of materials from the fields of Physics, Chemistry, Biology, and Earth and Space Sciences [6]. It could not deny that every material in science learning has different concepts so that it requires different learning methods. Different material effects different learning tools to be used or created according to the material/concept/principle/law/theory studied.

Based on the results of the analysis, 65.85% of the articles examined physics learning tools, 4.88% examined chemical tools, and 29.27% of articles examined biology learning tools. These results indicate the diversity of the use of learning tools in science education, although they have variations in terms of the number of learning tools studied in each discipline of science.

The most widely developed learning tools were in physics. The development of learning tools in the physics caused by much empirical material, so there is a need for tools to conduct experiments, observations, and measurements [20]. The tools in the biological sciences rank second in terms of the amount of research and development of learning tools. The basis of the analysis of the development needs of tools in biology material that is abstract, complex, and related to the functions of various organs that influence each other so that many problems must be sought, processed, traced, investigated and studied [24]. Learning tools help to realize abstract traits that difficult to observe before becoming concrete, make it easier for students [16]. Chemistry learning tools become learning tools that are lacking in terms of development and research. This condition could be due to various factors. However, chemical tools exist and assist the learning process (25,17). Tools in the field of chemistry can act as simulators of various chemical bonds [25].

3.3 Type of tools
The types of learning tools in this study divided into innovative and conventional learning tools. Innovative learning tools defined as new tools that created, created, or modified from pre-existing general learning tools and used in schools. Conventional learning tools in this study defined as learning tools which generally available, provided and used in schools. Generally, learning tools afforded by the government to facilitate practical activities as well as improve the competencies of science teachers [26].

Based on the articles studied, 72.5% of learning tools were innovative learning tools developed, while the other 27.5% were conventional learning tools. The high number of learning tools developed indicates an awareness of the importance of innovation to improve the quality of education. Innovation in producing tools supports the educational process. This based on the results of the study that the
more varied the tools used, the flexibility and experience earned by students become more complex [21].

Making innovative learning tools can be a solution to the lack of learning tools in schools. Even though the government has distributed learning tools to the school, the unequal distribution cause there are still schools that do not get learning tools [26]. The lack of tools is a problem that must be addressed and is one of the factors that influence student achievement. Abstract object learning often causes students to experience difficulties in abstracting a phenomenon that occurs [13].

Innovative means renewal [27]. Innovative is a person's ability to utilize the skill and expertise to create new products. Thus innovative tools in science education can be interpreted as new learning tools created by someone by utilizing their skill and expertise based on the principle of science. Tools can be developed to be innovative using simple basic materials [26]. The important thing that concerns in create a product is the application of the principles used. The tools imitated the object studied, it consequently must have a similar practical principle [23].

3.4 Level of application
The results showed that the use of learning tools found at various levels of education, from elementary (12.5%), junior high school (30%), high school (45%), to tertiary education (12.5%). This data shows that learning tools can be used and needed at various levels of education, especially in science learning.

The implemented tools in education cannot be divided from the role of the teacher. These results reinforced by a study which reveals that the main factors that determine children's learning interest and motivation are teachers [28]. In order for the use of learning tools to be effective in the learning process, the teacher must understand the learning tools that used so that they can instruct students. The increased in teachers' understanding of learning tools can be done through training, especially in creating innovative learning tools [29]. The results of training on the use of learning tools among teachers conducted by Susilawati showed a positive result. It confirmed by high enthusiasm of teachers in participating in training and increased teacher knowledge in making science learning tools [29].

3.5 Enhanced Competence
The results of data analysis prove that the use of learning tools can improve the various competencies of students. Competencies that can be developed were knowledge (53.2%), attitude (20%), skills (18.7%), mind-set (1.68%), metacognitive (1.68%), creativity (1.68%), problem solving (1.68 %), and motivation (1.68%). This data shows that the use of learning tools has potential in various domains of educational competence, not only to strengthen student competencies in terms of knowledge, skills, and attitudes, according to the 2013 Curriculum design [4] but also in another aspect. Furthermore, learning tools designed to be able to enhance students 'abilities in regulating mind-set, creative thinking, problem-solving, self-motivating, and metacognitive abilities.

The impact of using learning tools showed that it has a positive influence on the learning process. The increase in learning competencies implicated the development of student achievement, both in skill and knowledge. It became one of the reasons to encourage the use of learning tools in the learning process. A common opinion that one tool can’t improve all of the competencies. But it widely accepted that a tool at least can influence one of them. Moreover, it claimed in every article that one tool referred to one theory and it has a specific function. Furthermore, the diversity of learning tools is needed. To put it another way, the more tools used in the learning process, the more competencies that improved. To apply a learning tool, the teacher has to understand the tools itself. That is why the knowledge about learning tools and their effectiveness demanded.

The potential of learning tools in enhances various competent domains creates learning activities that involve all aspects through physical and mental activity so that the learning process can be intact [11]. If the learning process has been intact, then the ideals of education in Indonesia, regarding Law no. 20 of 2003, aimed to educate the nation's life and develop Indonesian people as a whole, namely
human beings who have faith and devotion to the Almighty God and noble character, possess knowledge and skills, physical and spiritual health, a strong personality, and social and national responsibility [30] it is not impossible to achieve.

3.6 Effectiveness
Based on the data review, the use of learning tools in science learning is effective nationally and internationally, in the disciplines of Physics, Chemistry, Biology, from elementary to college, and in increasing student competencies. This data reveals that the use of learning tools is 100% effective in science learning. The data confirmed that learning tools effectively developed students’ competencies. It is indicated that the use of learning tools certainly required in the learning process, especially on a science subject. It has established that learning tools influence learning effectiveness and efficiency. However, there yet teacher that do not aware of these advantages. Therefore, the publication of the effectiveness of learning tools in science learning is needed. Furthermore, it is expected that the use of learning tools in science subjects would be entrenched in the educational system.

The effectiveness of using learning tools in science learning that is so high does not rule out the possibility of obstacles in its application. Various obstacles may occur in the use of tools, including tools that are not functioning accurately [31] and require huge space for storing learning tools [32].

4. Conclusions
Based on the results of the discussion, it concluded that the use of learning tools effectively in science learning in improving the competence of knowledge, attitudes, skills, mind-set, metacognitive, creativity, problem-solving, and motivation. The benefits that can be obtained from the use of learning tools, specifically in science lessons, have implications for improving student competency. Therefore the use of science learning tools is recommended in schools.

The results of data analysis shown that the used of science learning tools is effective for elementary to university levels. There are various types of learning tools that can be used in science learning at various levels of education. Furthermore, it is recommended for researchers to conduct further research on the variety of existing science learning tools, its development, and its application in learning, so that the use of science tools in learning can be entrenched.

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