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Science Concepts in Early Childhood Education

Diah Nurkholisoh✉[1]

[1]Early Childhood Education Postgraduate Program, Indonesia University of Education, Bandung, Indonesia
✉ diahnur@upi.edu

Abstract. The concept of science in early childhood programs is an abstraction that represents objects, events, activities or relationships that have the same sign that is related to scientific knowledge (science). This concept is oriented to the process of recognition and mastery process about scientific material that is appropriate to the age level. Includes facts, theories, concepts, principles, laws, terms, processes and problem solving. Therefore, the realm of science for early childhood includes two study points namely the first, the contents of the study material and the second field of development or ability to be achieved. To achieve the concept of science as a whole, requires the efforts and competence of teachers in loading aspects of the nature of science in the learning process. One of the main factors is the low understanding of teachers related to early childhood science concepts, this is due to teachers who do not gain clear knowledge about science concepts. This article aims to provide understanding and mastery related to science concepts for early childhood, so as to reduce the occurrence of misconceptions or concepts that are not in accordance with scientific understanding.

Keywords: Science, Concept Science, Early Childhood, Education

INTRODUCTION ~ This article deals with science learning in the context of early childhood education. Science learning can be defined as all concrete experimental activities carried out by children in social interactions, contributing to children's interests and slowly emerging understanding of nature, technology, health, mathematics, biology, chemistry and physics (Broström, 2015). Through such activities, children gain knowledge about plants, animals, natural structures, natural phenomena plus natural order and hence understand subjects such as light, water, magnetism, electricity, air flow, and so on. Children develop a fundamental understanding of observed phenomena and important scientific process skills during their early years (Eshach & Fried, 2005)

Trundle & Saçkes (2015), said that science learning in early childhood education provides enormous benefits for various aspects of child development, so researchers emphasize how important science learning begins early. Science learning for early childhood can provide positive experiences for children who help themselves to develop an understanding of a science concept, develop thinking skills, curiosity, instill positive attitudes, influence competence, values, and provide a strong foundation for concept development science in further education (Eshach & Fried, 2005). Scientific concepts may be difficult to understand even by adults; However, this does not mean that children cannot think abstractly about scientific concepts. In contrast, the literature shows that children can think about complex concepts (Eshach & Fried, 2005). The significance of science education in early childhood has been widely recognized (Butzow & Butzow, 2000; Eliason & Jenkins, 2003). The problem of

how scientific concepts are obtained plays an important role in the implementation process in the classroom, where the teacher is able to explain to children the material presented in accordance with scientific concepts.

Early childhood teachers have an important role in science education. However, previous research revealed that the lack of teacher knowledge in science. Many preschool teachers report limited scientific knowledge (Greenfield et al., 2009) and recent research has identified preschool teachers to have low self-efficacy related to science education (Greenfield et al., 2009). In addition, preschool teachers in many countries report feeling uncomfortable teaching science to young children (Conezio & French, 2002). As a result, teachers can provide inadequate or inaccurate explanations for scientific phenomena, sometimes describing events as things that happen by themselves, rather than providing factual information about how or why something happened. The concepts taught to children also tend to be rigid and less adapted to the stages of child development, so they tend to force children to understand these scientific concepts. In fact, basically good learning for children is learning that is able to provide hands-on experience and is able to stimulate child development in an integrated manner, not just for the development of just one aspect (Suyadi & Ulfah, 2013; Santrock, 2007).

Fleer & Robbins, (2003) suggested that teachers do not recognize their own formal scientific knowledge other than through interests, hobbies, learning in secondary schools and ultimately they are not supported by professional experience. In line with other studies that show that teachers themselves do not have scientific competence and are not accustomed to using science equipment to follow children's science questions and wonders (Greenfield et al., 2009, Nayfeld, Brenneman, & Gelman, 2011). However, a review by Edwards and Loveridge (2011) explains more factors that influence the tendency of preschool teachers to support children's science learning. The main significant factors seem to lie in individual teaching professionals: Teacher attitudes, beliefs, level of knowledge of science subjects and understanding of natural science.

This article explains the importance of science for young children with appropriate concepts, science concepts for early childhood, and strategies that teachers can use in explaining these science concepts. The first part of this paper discusses the importance of science for early childhood and the literature on teacher beliefs and competencies in teaching science is fully reviewed. The second part of this paper introduces the research design and discusses the findings.

METHOD

This type of research is library research, which is a series of studies relating to library

data collection methods, or research whose research objects are extracted through various library information (books, encyclopedias, scientific journals, newspapers, magazines, and documents) (Syaodih, 2009). Literature research or literature review is research that studies or critically reviews knowledge, ideas, or findings contained in an academic-oriented literature body, and formulates theoretical and methodological contributions to specific topic (Cooper & Taylor, 2000) The focus of library research is to find various theories, laws, propositions, principles, or ideas used to analyze and solve research questions that are formulated.The nature of this research is descriptive analysis, namely regular decomposition. data that has been obtained leh, then given an understanding and explanation so that it can be understood properly by the reader.

Data source

Source of data obtained from secondary data. Secondary data is data obtained not from direct observation, which means not from the results of direct research but from the results of previous studies. According to UCSC (2012) the selection of sources is based on four aspects, namely: (1) Provenance, namely aspects of the author's credentials and supporting evidence, for example the main sources of history; (2) Objectivity, namely whether the perspective ideas of the author have many uses or are actually detrimental; (3) Persuasiveness (degree of confidence), i.e. whether the writer is included in the group of people who can be trusted; and (4) Value (contributive value), i.e. whether the author's argument is convincing, and has contributed to other significant studies.

Method of collecting data

Data collection method used in this study is the documentation method. The documentation method is a method of collecting data by searching for or digging up data from the literature related to what is intended in the formulation of the problem (Arikunto, 2006) Data that has been obtained from various literatures is collected as a unified document that is used to answer problems that have been formulated.

RESULTS

There are several important reasons for the implementation of science activities at the level of early childhood education. In science activities children have fun, enjoy observation and think about nature (Eshach & Fried, 2005). They participate in science activities with a strong presence, are involved and absorbed in creative experimental activities (Davies 2011). This is due to the fact that science activities are built on something that is considered magical and the child's curiosity about the world around them. Research shows that young children aspire to understand their world, and they are not afraid of foreign words and concepts (Thulin, 2011). Furthermore, some children can expand and understand scientific concepts by

linking theory and practice (Eshach & Fried, 2005).

At least children have a biological basis and need to explore and conduct experiments to find answers to the challenges they encounter (Gopnik, 2012). Through these scientific experiences children can form positive attitudes towards science.

In this section, according to Eshach & Fried, (2005) we consider six reasons as to why even small children should be exposed toscience. These reasons are as follows:

(1) Children naturally enjoy observing and thinking about nature.

(2) Exposing students to science develops positiveattitudes towards science.

(3) Early exposure to scientific phenomena leads to better understanding of the scientific

concepts studied later in a formal way.

(4) The use of scientifically informed languageat an early age influences the eventual developmentof scientific concepts.

(5) Children can understand scientific conceptsand reason scientifically.

(6) Science is an efficient means for developingscientific thinking.

Early educators can conceptualize science education as a process of acquiring knowledge rather than disseminating facts (Gelman&Brenneman, 2004). Science provides an interesting context in which children develop skills for language, and mathematics. Furthermore, learning about science helps involve children in the development of concepts, a key component of teacher instructional support related to children's academic and language skills (Hamre, Pianta, Mashburn, & Downer, 2007). Because experiences that are conceptually related provide context for children's learning (Gelman&Brenneman, 2004), it is important to provide opportunities for rich conceptual growth that comes from scientific exploration, reflection, and question development (Gelman and Lucariello 2002). Perhaps most importantly, scientific inquiry provides meaningful opportunities for children to engage in experiences that integrate language, mathematics, and science education.

Early Childhood Science Concepts

Early Childhood Science Concepts

In relation to early childhood science learning programs, science can be developed into three basic substances, namely education and learning science that facilitates mastery of the science process, mastery of science products and programs that facilitate the development of scientific attitudes. First, science as a process ismethod for gaining knowledge. The series of processes carried out in these scientific activities, currently known as scientific methods or scientific methods. Second, science as a product consists of various facts, principles, laws and theories (Nugraha, 2008). Third, science as an attitude, or known as scientific attitude, means the various beliefs, opinions and

values that must be maintained by a scientist, especially when searching for or developing new knowledge. Among these attitudes are a high senses of responsibility, curiosity, discipline, diligent, honest and open to the opinions of others. (Dawson, 2004).

From the description above, we can finally understand that science does not only contain dry formulas or theories; but also contains human values that are universal and deserve to be developed and owned by every individual in this world; even with such a high value of science for life, it is important to provide scientific support at an early age.Tabel 1&Tabel 2.

Learning principles proposed by Witherington and Ausubel that can be used as principles of learning science include the following (Nugraha, 2008: 65-73):

a. Learning will succeed if the child sees a goal, and that goal is born from and is close to the child's life.

b. Learning activities should be able to stimulate all aspects of children's development, both physical and spiritual.

c. The learning environment created must be meaningful and meaningful to the child so as to form a pattern of behavior that is useful for the child.

d. Learning assistance provided is that which supports the effectiveness and efficiency of children's learning and is carried out appropriately.

e. Efforts to integrate previous learning experiences with new experiences so that they become a unified whole experiences, are not easily separated or lost.

f. The presentation of learning should a whole have to be raised first and then to something more specific.

g. Learning always starts with a problem and goes on as an attempt to solve the problem.

h. Learning is realized if a clue (key) or relationship between the elements in the problem has been found, so that insight is gained.

i. Learning progresses from the simple to the more complex, moving from the child to the far, as well as from the concrete to the abstract.

Scientific Process Skill

Science process skills can be divided into two, namely basic science process skills and integrated science process skills. Basic science process skills include observing, classifying, measuring and using numbers, making conclusions, predicting, communicating, and using the relationship of space and time. While integrated science process skills consist of interpreting data, operational definitions, control variables, making hypotheses and experimenting (Curriculum Development Center, 1993).

Basic science process skills must be mastered before one can dominate integrated science process skills. This view

is supported by Piaget (1964 in Yeam 2007), students can master abstract thinking in integrated science process skills given full control of basic science process skills. The science process skills mentioned are one part of the thinking skills that are used either by scientists, teachers or students when studying science. Science process skills are used by scientists to investigate and explore and will play a role only when used in the context of scientific activities such as investigation and interpretation with scientific understanding (Yeam, 2007).

Science process skills must be utilized by the teacher in delivering effective scientific facts. This is because science is not only knowledge but also a way to systematically understand the environment. Science process skills are needed by students to learn about the world of science and technology in more detail. Students can learn science in a meaningful way through exploration of science process skills based on a constructivist approach (Yeam, 2007). The implication of constructivism for teachers of teaching and learning science is that teachers must provide a learning environment with direct activities that enable students to develop and process the skills of the Master of Science. This is because teachers cannot force students to believe in something other than their own students developing an understanding of this problem (Yeam, 2007).

In science teaching and learning, science process skills are used as teaching approaches. Science process skills are behaviors that encourage the formation of skills that are applied to gain knowledge and then disseminate what is obtained so as to increase the optimal use of mental and psychomotor skills. This statement is supported by Wahidin (2004) who explains that this science process skill can train students in the thought process and scientific attitude of the human form. This is because the process of learning and teaching science process skills is a process that is designed so that students can fulfill facts, concepts, and relate to theories using scientific process skills and students' attitudes themselves.

Table 1. Science based on Dimensions Content of Study material

No	Study Materials Group	Main Topic
1.	The earth and the universe	Knowledge of stars, sun and planets, Study of soil, rocks and mountains, Study about the weather or the season.
2.	Life Sciences	Study of plants, Study of animals, Study about the relationship between aspects of life with environment.
3.	Field of Physics-Chemistry Study	The study of power, the study of energy, the study of chemical series and reactions.

The scope of science above is related to scientific study materials that can be explored by children. The sciences based on the field of development can be seen in the following table:

Tabel 2. Science based on Field Development (Capability Targets)

No	Study Materials Group	Main Topic
1.	Mastery of science products	Understanding facts, Understanding concepts, Understanding principles, laws and theories
2.	Mastery of the science process	Observing, classifying, predicting, concluding, communicating, using tools and measurements, planning research, applying concepts
3.	Mastery of science attitude	A sense of responsibility, curiosity, discipline, diligent, honest, open to other opinions

DISCUSSION

Appleton (2006 in Fleer 2009) extends his research which mostly uses survey and interview techniques, about the nature of pre-service, beginning, and knowledge of experienced teachers and the practice of teaching science has produced three fields of science that make it suitable for science education:

• Teacher knowledge about science,

• Teacher confidence in their knowledge that is obtained informally, and

• Teacher knowledge about the practice of knowledge about science or knowledge pedagogical content of science - that is, teacher knowledge about science concepts in addition to knowing how to understand these concepts.

American research reports that children's skills that emerge in science learning are not considered in early childhood classes (Saçkes, Trundle, Bell, & O'Connell, 2011). Compared to studies of early literacy and mathematics, children have fewer opportunities to learn science (Early et al., 2010; Greenfield et al., 2009). Other studies show that teachers themselves do not have scientific competence and are not accustomed to using science equipment and to follow the questions and wonders of children's science (Greenfield et al., 2009; Nayfeld et al., 2011). However, a review by Edwards and Loveridge (2011) explains more factors that influence the tendency of preschool teachers to support children's science learning.

The main significant factors seem to lie in individual teaching professionals: Teacher attitudes, beliefs, level of knowledge of science subjects and understanding of natural science.

The above factors were also discovered in a new study by (Trundle & Saçkes, 2015), which investigated how often 3,305 years of early science teachers taught life science, physics, and the concept of earth space in kindergarten (6 years of children). This study shows a number of variables that

influence the focus range of teachers on science education. Among other variables shown by this research: Teachers with science education are more likely to teach science concepts. Similar teachers who have the area of science and nature they have, and also teachers who view children as competent are more likely to teach science. But years of teaching experience and teacher perceptions and control over the curriculum are not variables that influence the frequency of teaching science teachers.

The ability of teachers to teach science to children should be able to convey the basic concepts of science well. No doubt, in the era of the industrial revolution 4.0 scientific literacy became important. Literacy is not only limited to reading writing counting. But also technological literacy and scientific literacy. Science literacy plays an important role in people's daily lives (Turiman, Omar, Daud, & Osman, 2012).

Because modern society is now very dependent on technology. So that in the 21st century it requires a society with knowledge that follows scientific and technological issues. The definition of standards-based scientific literacy for all people as abilities and habits of mind is needed to build understanding of science, to apply these big ideas to realistic problems and problems involving science, technology, society and the environment, and to inform and persuade others to take action based on these scientific ideas (Hand, Prain, & Yore, 2001).

Thus, there are a number of reasons why scientific literacy is considered important. The society we live in depends on which continues to increase as far as technology and scientific knowledge are possible. We live in a country with rich natural resources, but it is endless. When we live in a world with a rapidly growing population, the decisions we make every day have the capacity to influence energy consumption, our personal health, natural resources, and the environment, ultimately our well-being, our community, and the world. In this case science education which includes 21st century skills is very important to develop students' scientific literacy, which gives up the future of scientific literacy citizens. Future research directions, are expected to emphasize the importance of future scientific studies.

CONCLUSION

Early childhood have the same opportunity to get activities that are able to answer their natural curiosity. Through science activities children can explore many of its developments. In science not only can increase their knowledge and skills in the realm of this readiness but also potentially help them in other fields of readiness. The focus on early childhood science education provides a great opportunity to strengthen the curriculum for early childhood by increasing the learning and exploration provided by science. This must be followed by research

evidence using new measurement tools specifically designed to evaluate the effectiveness of early childhood science practices in teachers, classrooms, and children. Teachers are an important factor in the success of early childhood science teaching as an effort to help stimulate an environment where programs routinely seek strong evidence to understand what constitutes best practice in early childhood science. Therefore, the number of teaching science in kindergarten and children's participation in science activities can be important predictors of children's scientific achievement immediately and then because it increases the possibility of children's learning from various basic science concepts and the development of basic science process skills .

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