

The Application of Science Teaching during Early Childhood: Equipping Families to Face 21st Century Realities

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This study aims to describe the application of science on early childhood in families to equip them to face the 21st century. It deployed the descriptive qualitative method on field research. The data was obtained from observation, interview, and documentation. The results indicate 2% of participants never applying science, 12% rarely applying science, 39% usually applying science, 37% often applying science, and 10% very often applying science. These will be followed up by a workshop, parenting program, restrictions on using cell phones, and a literacy program. The results achieved will then encourage parents to understand more about the right application of science to good parenting. Besides these, children will develop an interest in reading and be encouraged to be more imaginative and creative.

Key words: *Science, Family Education, 21st Century.*

Introduction

Children are always curious about their surroundings. They are always eager to ask and explore everything around them. For example, they frequently ask “Why is the sky blue?” “Why is the seawater salty?” “Why did the fruit fall down?”, and so forth. These questions are actually related to science. Science is both a body of knowledge that represents current understanding of natural systems and the process whereby that body of knowledge has been established and is continually extended, refined, and revised. Both elements are essential: one cannot make progress in science without an understanding of both. Likewise, in learning science one must come to understand both the body of knowledge and the process by which this knowledge is established, extended, refined, and revised (Duschl, Schweingruber, & Shouse, 2007, in Worth, 2010). Those questions related to science are considered natural to ‘children exposed to science

early in their childhood' (Dejonckheere, Keere, Wit & Vervae, 2016). Hence, science is definitely ideal for complementing children's curiosity.

Considering the early childhood period as a golden period, it is a critical time for children since development obtained in this period significantly influences the development in the next, up until adulthood. While this golden period only happens once, if it is skipped there is no chance to fix it. Consequently, early childhood education in terms of giving children stimulus from their closest environment is absolutely required to optimise their science skills (Waters-Adams, 2006; Newton and Newton, 2009; Bassok et al, 2019; Rönkä et al, 2019; Singer-Brodowski et al, 2019).

While learning science in early childhood has been taught in many schools around the world, many studies have been conducted on dealing with children's curiosity about natural surroundings. The study on learning approach to teach science in early childhood has revealed that the didactic approach has allowed teachers to follow the children's perspective – wonder, inquisitiveness and their own experiences (Broström, 2015). However, this approach tends to fail if the teacher cannot balance them. Another study has found that the inquiry-didactic method was significant in dealing with children's attention for causal events and their understanding at the level of scientific reasoning skills (Dejonckheere, Keere, Wit & Vervae, 2016). Nevertheless, this study only focusses on how to gain knowledge in the classroom aside from its preparation. A study conducted by Hoisington (2010) has suggested that preparing the classroom environment for inquiry and establishing routines that help children apply meaning was important. It also indicates that there is a need to facilitate children's open exploration, and promote children's reflection through representation and conversation. As well, Worth (2010) considered that early childhood education needs to pay attention to content and process. It claimed that content prepared by teachers was considered whether or not children were encouraged to be more curious. Moreover, children needed guidance and structure to turn their natural curiosity and activity into something more scientific. This is why Worth (2010) considered scientific inquiry was needed to be implemented in the learning process. Nevertheless, learning activities cannot be successful without a teacher's involvement. Chalufaur (2010) and Hall (2010) claimed that learning activities are effective since teachers are actively involved and have pedagogical skill.

Since science is considered important to be learnt in early childhood, the Early Childhood Education Program known as *Pendidikan Anak Usia Dini (PAUD)* in Indonesia, also provides science learning. Science learning in *PAUD* is a set of learning activities to stimulate children in exploring their surrounding environment and to reflect their observational results and findings (Ansari et al, 2019). It includes learning about themselves, the natural surroundings, and natural phenomena. The nature of science learning is to give children challenging

experiences (Leden & Hansson, 2019). As a result, children develop curiosity regarding various physical objects, natural surroundings, and events happening in their environment.

Learning science is possibly conducted everywhere since it is related to nature. However, this study focusses on family since many studies rarely pay attention to the learning process outside the classroom (Broström, 2015; Dejonckheere, Keere, Wit & Vervae, 2016; Hall, 2010; Hoisington, 2010; Worth, 2010). The involvement of parents is an important aspect in education, especially in the Early Childhood Education Program (Juwita et al, 2019). This is because parents are the first educators in the family and the first human beings interacting with them. The involvement of parents in childhood education provides positive and/or negative impacts, depending on parents' ability in understanding the meaning, type, and purpose of their involvement.

The involvement of parents on science learning in their children is by optimising their children's senses (Pomerantz et al, 2007). Through these senses, children are trained to see, to touch, to smell, to hear, and to feel what is happening in the environment (Geers et al, 2003). By optimising senses, children will be stimulated to have five basic science skills, in terms of observation, communication, classification, measurement, inference, and prediction. These skills are significant for children as their assets to think further about any solution in answering various challenges in further education levels. These become one of the demands in facing the 21st century, in which children have to possess the 21st century skills, including critical thinking and problem solving, creativity and innovation, communication, and collaboration. The importance of mastering these skills is to prepare the generation with confidence and motivation to develop themselves optimally, so they have the ability to compete with others globally.

Research Methodology

The study deployed the descriptive qualitative method (Moleong, 2011). It was conducted in Ciamis Regency, West Java Province. Data collection techniques were observation, interview, and documentation. The instrument was a questionnaire based on the Likert scale. The participants were fifty parents from five schools, including RA Generasi Rabbani located in Sindangrasa, Ciamis District, RA Al-Mu'minin located in Sindangrasa, Ciamis District, PAUD Kasih Ibu located in Sindangrasa, Ciamis District, PAUD Bintang Al-Iman located in Imbanagara Ray, Ciamis District, and RA Al-Fadiliyyah. These participants were selected by a systematic random sampling technique (Fraenkel & Wallen, 2006). The data obtained were then analysed by data reduction, data display, and drawing conclusions (Miles dan Huberman, 1984).

Results and Discussion

Questionnaire Results Applying Science on Early Childhood in the Family

As science learning has been implemented in the classroom, it is also important for children to acquire basic science knowledge from their family as their first environment. Applying science learning in the family actually has been informally conducted by parents in their family. It is considered important to encourage children to be curious. The investigation of how parents apply science learning in their family has been done by giving questionnaires to parents in some early childhood schools. The study shows that most parents apply science in their family as shown in figure 1.

Figure 1. Questionnaire Result of Applying Science on Early Childhood in Family

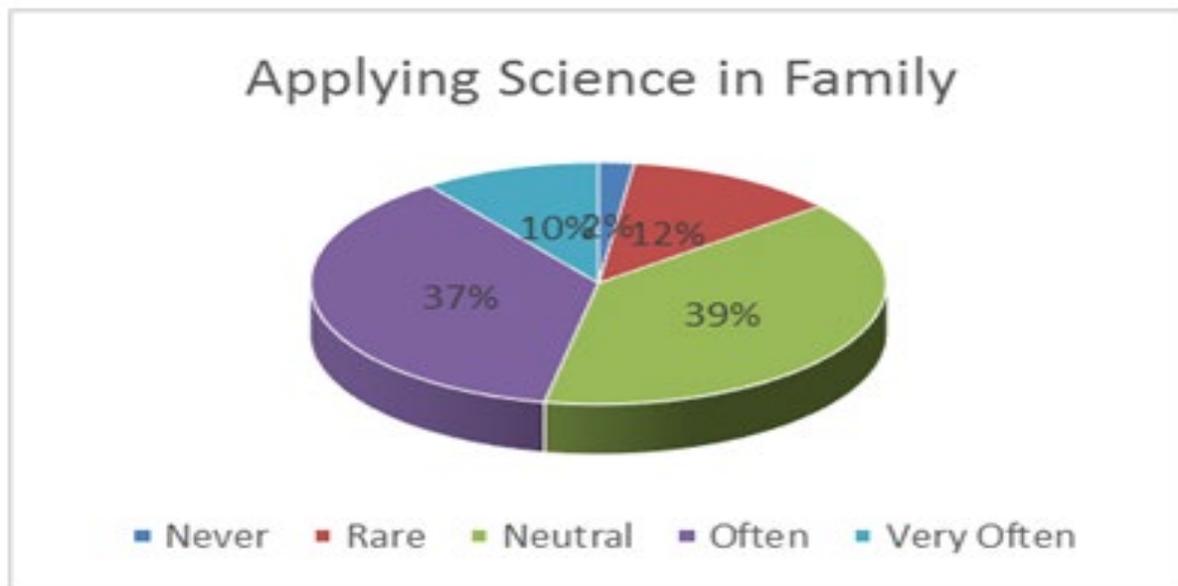


Figure 1 shows that there are 2% responses that never apply science in the family, 12% responses that rarely apply science, 39% responses that usually apply science, 37% responses that often apply science, and 10% responses that very often apply science. These indicate that parents usually apply science in their family. However, parents give different responses for each statement.

In the first statement, parents introduce a part of the body to their children. The responses show that 17 parents are neutral, 22 parents are often, and 11 parents are very often. Based on these responses, the first statement is categorised strong with the result of 76.6%. This means that parents usually tell their children about the part of the body.

In the second statement, parents teach children about the function of parts of the body. Their

responses are 1 of rare, 18 of neutral, 23 of often, and 8 of very often. Hence, the second statement is categorised strong with the result of 75.2%. It reflects that parents usually tell their children about functions of the parts of their body. The function of the parts of the body is usually learnt by children when their parents tell them about the parts of the body. This knowledge is usually given by parents to differentiate each part of the body.

In the third statement, parents teach children about the importance of taking care of their bodily parts scientifically. They respond never as much as 1, rare as much as 8, neutral as much as 20, often as much as 16, and very often as much as 5. Based on these results, the third statement is categorised as strong with a 66.4% result. It indicates that parents always tell children to be careful. This statement is naturally told by parents to their children as an expression of their love.

In the fourth statement, parents introduce plants or animals surrounding the house to their children. They give responses 10 of rare, 17 of neutral, 20 of often, and 3 of very often. This indicates that the fourth statement is strong with the result of 66.4%. This strong statement toward introducing plants and animals surrounding the children's house cannot be separated from children's curiosity itself. Children are usually excited about new things when they first discover them.

In the fifth statement, parents teach their children to take care of plants or animals surrounding their house. They respond never as much as 4, rare as much as 19, neutral as much as 20, and often as much as 7. Based on these responses, the fifth statement is categorised as enough with the result of 52%. It represents that about half of parents are not aware about the importance on taking care of plants and animals, so they also do not teach their children.

In the sixth statement, parents teach their children about the importance of taking care of plants or animals surrounding their house. They give responses never of 5, rare of 22, neutral of 18, and often of 5. This indicates that the sixth statement is enough with the result of 49.2%. Very similar to the fifth statement, a half of parents demonstrate their lack of awareness in telling their children about the importance of taking care of plants and animals. Both the fifth and sixth statements generally reflect the idea, so that reflects a somewhat similar result.

In the seventh statement, parents introduce the solar system to their children in a simple way. The result shows that 10 parents are never, 14 parents are rare, 22 parents are neutral, and 4 parents are often doing that. This indicates that the seventh statement is categorised as enough with a 48% result. Unlike the fifth and sixth statement, the seventh statements reflects the lowest result, indicating less than a half of parents have no awareness in telling their children about the solar system. This might be due to the fact that the solar system is considered difficult to explain, so parents tend to avoid it.

In the eighth statement, parents introduce objects in their children's surroundings. They give different responses in terms of never of 2, rare of 5, neutral of 29, often of 13, and very often of 1. This indicates that the eighth statement is strong with 62.4% result. As children grow up, they will start to recognise objects surrounding them and become curious. As they become more curious, parents simultaneously teach about objects surrounding their children.

In the ninth statement, parents teach their children about the shapes of their surrounding things. They respond never as much as 1, rare as much as 9, neutral as much as 23, often as much as 16, very often as much as 1. This indicates that the ninth statement is strong with a 62.8% result. It is in line with the eighth statement; children become curious about objects as well as shapes so that both statements show a similar result.

In the tenth statement, parents take their children to parks, gardens, or rice fields. The tenth statements are definitely related to objects in terms of natural landscapes. They respond never of 1, rare of 7, neutral of 21, often of 18, and very often of 3. This indicates that the tenth statement is categorised as strong with a 66% result. It indicates that parents usually teach about natural landscapes to children.

The results above show that parents give good enough responses in teaching their children about their surroundings. It indicates that children have achieved basic knowledge about natural science, in terms of the human body, plants, animals, the solar system, objects, and shapes. Likewise, Broström (2015) suggested that after learning activities about science, children achieve knowledge on plants, animals, the cycles of nature, natural phenomena and nature's regularity.

First, the human body is important to be learnt by children at an early age so that they can understand their body parts and their functions. By knowing the parts of the body and their functions, children will naturally protect their body. The awareness of protecting one's own body is significant for the prevention of potential abuse. Many cases related to abuse, especially child sexual abuse, are frequently related to the lack of children's protecting their body (Collin-Vézina, Daigneault & Hébert, 2013). In addition, it is also claimed that child sexual abuse can be prevented by educational programs (Collin-Vézina et al, 2013), including science learning in early childhood.

Second, plants are also significant for children since they are eager to explore new living creatures different from them. Their curiosity will be even greater once they explore different plants. For example, children will ask about the names of plants, how can they become taller and bigger, why they are different, why some of them live on the ground and some live in the water, why are they unable to move, and so forth. Moreover, exploring plants is considered as experiential learning (Orchid, 2020). It will help children to think independently, improve their

confidence, and deepen parent-child relationships.

Third, animals are also living creatures that usually occupy children's attention. Since animals are different from plants and a little bit similar to humans, exploring animals will definitely give enjoyment to children. For example, children are usually curious about the different sounds animals make, why some animals can fly and some cannot, why animals that live in the water are able to breathe while children themselves cannot, and so forth. It is in line with Franklin (2019) who claimed that involving animals during the learning process results in children's positive behaviour.

Fourth, basic knowledge about the solar system is also important to give children knowledge about where they live. Although 'very young children possess very limited ideas about the solar system (Sharp & Kuerbis, 2005), some questions usually expressed by children relating to the solar system like why there is day and night, why stars do not exist during the day, etc. These questions indicate that basically, children have curiosity about the solar system. By teaching children about the solar system, children will be more curious and aware about the solar system. A study on children's ideas about the solar system found that giving attention to children on learning the solar system shows their progression towards an appropriate and acceptable scientific understanding (Sharp & Kuerbis, 2005). It reflects that the more children learn about the solar system, the better understanding they get.

Fifth, objects are related to non-living creatures around children. Learning about several objects surrounding is considered as the first step of children's exploration phase (Bruce, Elfer, Powell, & Werth, 2019). It indicates that children will naturally observe their surroundings once they have the ability to explore objects. Once they explore a new object, they usually ask 'what is it?'. The more objects presented in front of children the more curious they are. However, this stimulation needs to be complemented by parents' knowledge about objects they present to their children.

Sixth, shapes usually stimulate children's curiosity along with objects they explore. Children begin to discover and develop concepts of space and shape when they can move (Doverborg & Samuelsson, 2001). This is a continuation after they learn to discover objects. As a consequence, parents also need to improve their knowledge about objects and shapes and have better understanding on how to teach them.

As these six concepts of science are learnt by children in their family, it is considered that children are stimulated to be more sensitive and critical toward their natural surroundings. Children's sensitivity and critical thinking are skills required in facing the 21st century. It reflects that applying science to early childhood in the family is an effort to prepare children in facing challenges in the 21st century. As these concepts of sciences are mastered and children's

sensitivity and critical thinking increase, children are considered ready to live in the 21st century, and vice versa.

While parents usually apply science learning in their family, some learning, especially the act and the importance of preserving plants and animals as well as solar system, needs more attention. It indicates that some parents have no knowledge about that matter. As a consequence, there is a need to improve family literacy. This can be done by directly encouraging members of the family to read story books available in their house, and indirectly encouraging them to visit the Local Library (*PerpusDa*) in Ciamis Regency. The Local Library (*PerpusDa*) in Ciamis Regency, from the beginning, provides the facility of a comfortable and fun children's room with various educative games, interesting children's books, and devices to develop children's imagination. Moreover, it is also equipped with a room similar to a Planetarium, designed in such a way to make children able to recognise and understand the existence of the solar system and surrounding natural environment through literacy. The more often parents encourage their children to visit the library and read books, the more children are interested in reading, imaging, and making something of an effort to realise their imagination.

In addition, unapplied science learning in the family is due to parents having no awareness about its importance to be taught to their children. This mostly occurs because parents allow their children to access cell phones without any limitation on content and times. Consequently, parents need to restrict their children in using cell phones by providing children-friendly sites and application. However, parents should limit the times, allowing children to access cell phones in a certain time and for a certain period of time. This is due to the negative effect of radiation, which is harmful for their brain. Besides, long-term use of cell phones will make children addicted to cell phones and kill their curiosity towards natural surroundings. Moreover, there is also a need to conduct workshops or parenting program in terms of how to perform good parenting. This can be executed in collaboration between parents, teachers, and health institutions. By performing good parenting, parents will be able to guide their children in exploring nature in a right way.

Achieved Results

Findings on the application of science on early childhood in the family show good results. However, it still needs the improvement of involving parents in literacy programs, workshops, parenting programs, and cell phone usage restriction. By conducting these improvement efforts, the study will definitely show better results. Besides, it will also help parents to understand more about the application of science and good parenting. This will develop children's interest in reading, imagination, and creativity.



Plan for Next Stage

After conducting the improvement efforts, the plan for the next stage is to socialise the program to the Office of Education and Culture. It is related to proposing a policy related to the increase and improvement of literacy facilities. Hence, parents will find it easy to give and apply science learning during early childhood in their family, to prepare them to face the 21st century.

Conclusions

Science learning in the Early Childhood Education Program (*PAUD*) is definitely important to recognise children's selves, natural surroundings, and natural phenomena different from their environment. This study focusses on family since parents are the first educators and environment for children. However, parents' involvement influences children either positively or negatively. By achieving these goals, science learning in early childhood in families will assist them to face the 21st century.



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