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Instruction of Nature-Based Science to Stimulate Student Engagement in Learning

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Abstract

The purpose of this study is to analyze the importance of nature-based science learning in stimulating student engagement in learning. The importance of science is so that children can build sensitivity to the surrounding environment and be able to solve problems that occur around them. The importance of science in early childhood is that we live in a dynamic and developing world. The development of science is in line with the development of technology in today's globalization era. The methodology in this research is a case study with a qualitative descriptive approach, the data collection technique is by interview, observation, and documentation study, all of which are focused towards getting the unity of data and conclusions. The results of the analysis of this study are in the process of introducing science learning in children seen from the natural material-based learning process that early childhood has an important role in producing children who can increase curiosity, think critically, logically, carefully and creatively. To produce everything, it must be trained from an early age so that it can develop into a positive mentality for children in the future.

Keywords: *Science, engagement in learning, early childhood*

Introduction

Science learning for early childhood is focused on learning about oneself, the natural world, and natural phenomena. Simple science learning is used as a means of conveying messages between teachers and students so that the expected goals can be achieved. In a learning process, the role of simple science learning is very important, especially to apply the learning methods applied by the teacher, and clarify the messages conveyed so that students easily understand the material provided in the teaching and learning process (Mantzicopoulos et al., 2008). Based on the results of (Eshach & Fried, 2005) research, he concluded that science for children is everything that is amazing, something that is discovered and considered interesting and provides knowledge or stimulation to know and investigate it. Science learning for early childhood also has a strategic role in improving the quality of human resources, among others through equipping skills and habits of scientific thinking, as well as the ability to analyze complex problems in life.

Science is something related to abstract ideas or concepts that are arranged hierarchically through deductive reasoning. Science learning in Early Childhood Education (PAUD) is an activity of learning about concepts through play activities in everyday life and is scientific in nature. The purpose of introducing science in early childhood is for children to know the basics of knowledge, so that later children will be better prepared to follow learning at the next, more

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complex level of education. Early knowledge in kindergarten can predict later achievement and reading (Duncan et al., 2007; Watts et al., 2014).

Science learning is learning that relates to the knowledge around us. For early childhood science is an understanding of basic knowledge around the environment. Science is needed in stimulating children's thinking and memory skills and influencing the development of other aspects. Children are required to be able to face the challenges of a globalized life and be able to solve problems that exist in their lives. Therefore, learning science from an early age is useful in preparing children to solve problems in everyday life. However, the results of (O'Connor et al., 2021) say that science learning carried out in various early childhood institutions is sometimes not in accordance with the stages of child development and there tends to be errors in its implementation. Therefore, it is necessary to stimulate the introduction of science that is in accordance with early childhood development such as with natural material-based play methods that are very fun for children so as to increase children's involvement in learning (Campbell & Jobling, 2012; Donmez-Turan & Kiliçlar, 2021; Stanek, 2014).

These results are in line with previous literature which shows that when science activities take place in schools, they are meaningful and help children to increase knowledge and discover concepts through various types of stimuli for student engagement in learning (Abla & Fraumeni, 2019; Ginsburg, 2002; Ginting, 2021; Gray & Diloreto, 2016). A learning model is a pattern or design that describes the process of detailing and creating environmental situations that allow children to interact in learning so that changes occur (Mulyasa, 2014). There are several learning models implemented in PAUD including classical learning models, group learning models with safety activities, learning models with activity corners, area learning models and learning models based on centers.

Nature-based learning model is a suitable learning model in science learning for children. The nature-based learning model approaches learning in circles and play centers and is based on natural materials that are thick with science and art knowledge. The natural materials center is filled with various play materials that come from nature, such as water, sand, rocks, leaves and others. In the natural materials center, children have the opportunity to use play materials in various ways according to their own thoughts and ideas with different results. Center-centered learning is carried out completely from the beginning of the activity to the end and focused by one PAUD age group in one center of activity. Each center supports child development in three types of play: sensorimotor or functional play, role play and constructive play (building children's thinking).

The center of natural materials where children do activities with a variety of tools that are appropriate to the needs of children consisting of dry tools / materials and tools / materials that use water (Bodrova & Leong, 2018). In addition, according to (Kiewra & Veselack, 2016) the center of natural materials is a center that provides opportunities for children to interact directly with a variety of materials to support Sens motor, self-control, and science. Meanwhile, according to (Gurholt & Sanderud, 2016) the center of natural materials is intended to provide opportunities for children to explore with various materials in nature. The natural materials center aims to provide experiences for children to explore with various materials. In this center, children play while learning to be able to demonstrate the ability to show, recognize, compare, connect, and distinguish. By exploring and experimenting, children will have ideas and sensitivity to knowledge and the natural world around them so that they grow motivation and confidence in learning.

Learning based on natural materials, children learn to utilize a variety of tools and media made from nature or that are already available from nature. This is in accordance with

constructivism learning theory, one of the applications in learning is by utilizing the environment as a learning resource where children are encouraged to explore by finding a discovery and solving the discovery (Malone & Tranter, 2003; Obaki, 2017). Based on this explanation, to develop children's science skills can be done in the natural material center learning model by doing some activities in introducing science to children.

In the initial observations conducted by researchers at PAUD located in Sumedang Regency. The results of initial observations found that the process of learning science with a natural material center model that can generate children's interest, attention and involvement in science learning materials that have a positive impact on early childhood development, so that researchers can see children's development better with a high level of confidence. Science learning familiarizes children with the stages of experimentation and with not hiding a failure. This means that science can train positive mentality, logical thinking, and systematic. In addition, it can also train children to be careful, because children must observe, make predictions, and make decisions. Based on this, the researcher intends to conduct further analysis related to science learning in PAUD Sumedang Regency.

Methodology

Research Design

The approach used in this study is a qualitative approach used to observe nature-based science learning in PAUD Sumedang District. Qualitative approach is a research approach to understand the phenomenon of what is experienced by the research subject holistically in a descriptive way in the form of words and language in a natural context (Lexi J. Moleong, 2011). The method used in this research is a case study, in the case study method, the case does not represent the population at all and is not intended to obtain conclusions from the population. Conclusions in case study research apply only to the case and in the case study.

According to (Robert K Yin, 2014) explains that case studies are an empirical knowledge search process to investigate and examine various phenomena in the context of real life. The case study method according to Robert K. Yin can also only be applied when the boundaries between phenomena and real-life contexts tend to be vague. So that it does not look so clear, which certainly raises a research topic that must be found an answer or solution.

Sample and Data Collection

Research participants are the main components that have an important position in research. In this study, the participants to be studied consisted of two parts, namely: 1) As research subjects, early childhood students who are studying at PAUD groups A and B in the 2021-2022 academic year, totaling 38 students consisting of 18 girls and 20 boys to be observed in the learning process. 2) Other sources of information as a complement on matters that need to be revealed regarding science learning in early childhood are 6 school principals, and 12 teachers of classes A and B to be interviewed. The place of research in PAUD Sumedang Regency.

The data collected in this research is qualitative data. Qualitative data includes data from interviews, direct observation, and photo documentation studies of learning. The data obtained in this study were interviews with 6 principals and 12 teachers of class A and class B in PAUD Sumedang Regency. Instruments that use interview grids based on the main theory of science are two aspects of educational development in early childhood. Both fields must be viewed in

three perspectives, namely developmental perspectives, activity perspectives and subject matter perspectives or the content of learning materials.

Observation is done through direct observation to the field to find out the teaching and learning process in the introduction of science with the natural material center model when children carry out learning and documentation is done by taking photos of activities when science learning takes place.

Analyzing of Data

Data analysis begins with transcribing the interview results followed by coding to find the focus and sub-focus, namely on the learning process of the importance of introducing science with the center model of natural materials in early childhood. The impact on students of this research is to be able to increase curiosity, think critically, logically, carefully, and creatively. Data analysis in this study used taxonomic analysis.

Results and Discussion

Nature-based science learning in children in groups A and B was studied with data collection techniques by means of observation carried out by directly observing when learning takes place, interviews conducted by researchers 6 principals, 12 teachers in classes A and B and documentation studies are complementary to observation and interview methods by collecting photos of activities during science learning. Data describing lesson planning to analyze emerging science in early childhood is obtained and collected through interviews, observations and documentation obtained from schools in the form of KTSP, Semester Program (Prosem), Weekly Learning Implementation Plan (RPPM) to see the readiness of teacher learning related to science development for children, Daily Learning Implementation Plan (RPPH) to see children's understanding of science and mathematics that appear in early childhood, class teacher notes and child development books.

Nature-Based Learning Process

The learning process runs logically and systematically following the agreed rules and those listed in the curriculum (KTSP), so that in its implementation it can achieve the expected results, it is necessary to plan. In planning the teacher determines the learning method and learning model that is in accordance with the theme of the activity, besides that the teacher must choose and determine the right media. One of the learning models that is in accordance with science learning is the natural material center learning model, because the natural material center is thick with science learning. The natural materials center is filled with various play materials that come from nature, such as water, sand, rocks, leaves and others. In the natural materials center, children could use play materials in various ways according to their thoughts and ideas with different results.

During the interview with the teacher, it was revealed that the curriculum used in PAUD in the meeting of the principal and teachers to compile the Education Unit Level Curriculum (KTSP) in which there is an annual, semester, monthly, weekly, and daily program, in RPPH there are basic competencies and daily assessments.

"..... the KTSP curriculum is adjusted to the characteristics and needs of children in PAUD..... (Teacher A, interview, October 7, 2021)

" we meet the curriculum first (Teacher A, interview, October 7, 2021)

"...determine basic skills, RPPM, RPPH, daily assessment..... (Teacher A, interview, October 7, 2021)....."

The principal and teachers create and prepare the curriculum (KTSP) which includes the annual program (Prota), semester program (Prosem), RPPM and RPPH (01-1.1).

Learning in PAUD is basically a process of activities carried out in an organized and regular manner, running logically and systematically following the agreed rules and those listed in the curriculum, so that in its implementation it can achieve the expected results. Any planning is always concerned with estimates or projections of what is needed and what will be done.

Learning Methods in Science Introduction

The results of interviews with principals and teachers of Class A and Class B in PAUD related to the methods used during learning the introduction of science based on natural materials, namely.

"..... learning methods in the introduction of science (Principal, interview, October 7, 2021)

"..... simple experiments..... (Principal, interview, October 7, 2021).

".... method of question and answer, play, project, and experiment (Teacher A, interview, October 7, 2021)

"...play storytelling method, assignments, experiments..... (Teacher B, interview, October 7, 2021)

In applying these learning methods, it must pay attention to the orientation of learning to children's needs, learning while playing and playing while learning, being creative and innovative, a conducive learning environment, using a theme system so that it can develop life skills by means of integrated learning and paying attention to the principles of child development. The learning activities as shown in Figure 1.



Figure 1: Learning Methods at Arasy Kindergarten.

Nature-Based Learning Model in Science Introduction

From the principal, we get information that the nature-based learning model also requires teachers to be more creative in choosing activities and constructing attractive activities. Teachers are facilitators, children who are less able to be motivated and given more activities that spur the spirit of learning. There are 5 center models that exist in PAUD.

learning model used in PAUD is with the Sentra model there are 5 centers, namely 3 indoor centers such as: preparation center, role play center, IMTAQ (religion) center and 2 outdoor centers such as: Natural material center, and cultural arts center (Principal, Interview, October 7, 2021). " The model can be seen as in Figure 2.



Figure 2: Learning Model in Paud, Namely, Preparation Center, Role Play, Imtaq, Natural Materials, and Cultural Arts.

Likewise, information obtained from class A teachers and class B teachers about the center learning model used in PAUD.

".... learning model used in PAUD is with the Sentra model there are 5 centers, namely 3 indoor centers such as: preparation center, role play center, IMTAQ (religion) center and 2 outdoor centers such as: Natural material center, and cultural arts center (Principal, Interview, October 7, 2021)." The model can be seen as in Figure 2.

The natural materials center learning model is a very effective approach developed in individual and group science learning. This approach is very helpful for children to experiment, explore, and make observations in learning to recognize, in this natural material center children are given the task of classifying leaves, rocks, animals, plants and others in the schoolyard environment. Thus, the child's ability to learn is more optimal, the child is busier moving to do or actively learning that he has chosen. With this center model, children have more learning experiences and children are more creative.

Media Used in the Introduction of Science

According to class A teachers and class B teachers in PAUD, learning is never fixated on media tools as aids, because science tools such as magnifying glasses or magnets are only helpful because science continues to exist in everyday life.

".... in the Natural Materials center, such as plants," pets: rabbits, fish in the pond (Teacher A, interview, October 7, 2021)."

".....LKA (Children's Worksheet)..... (Teacher A, interview, October 7, 2021), ...

".....examples of science-related videos (Teacher A, interview, October 7, 2021)

"...teachers prepare media and teaching materials...(Teacher B, interview, October 7, 2021)." Some kinds of learning media can be seen in Figure 3



Figure 3: Various Kinds of Learning Media and LKA (Children's Worksheet).

The media used are all sources around the school that can bring out the attitude of science, how teachers and children use the media around the school to introduce science to children, because when children ask questions automatically we as teachers must be able to explain questions from children, by providing media so that children's questions can be answered clearly, learning media do not all have to be purchased but can use the school environment as a source that can be used to answer children's questions. With the media, it will make it easier for teachers to convey learning for children. Media can increase children's understanding of learning.

Increasing Curiosity

In fulfilling the high curiosity of children, class A teachers and class B teachers in PAUD provide information that they facilitate children to recognize science with a natural material center model. Some science activities such as observing pencils being put into a glass, mixing colors, making soap foam, and water seeping into tissue paper (capillarity). The activity can be seen in Figure 4.



Figure 4: Activities Such as Observing of Students.

. "their curiosity can be fulfilled (Principal, interview, October 7, 2021).....

.... "children have a high inquisitive attitude (Principal, interview, October 7, 2021)....

"Stimulating curiosity in children, (Teachers A and B, interview, October 7, 2021)....

Children have a high attitude of curiosity helping children to think logically, carefully, and creatively in color mixing activities (01-1.2).

With the existence of science activities with the natural material center model in PAUD can stimulate children's involvement in learning which will lead to attitudes and actions that always strive to know more deeply and broadly from something that children learn, see and hear.

Be Careful

For preschool children, science process skills should be done simply while playing. The introduction of science at kindergarten age emphasizes the process rather than the product.

The results of interviews with the school obtained information about the introduction of science in the natural materials center in activities.

....." *sorting dry leaves ... (Principal interview, October 7, 2021) ...*

....." *Collecting leaves of various shapes and sizes in the schoolyard and being careful in sorting the leaves.... (Teacher A, interview, October 7, 2021)..."*

.... " *Sorting leaves from small to large),.... carefully they pay attention to..... (Teacher B, interview, October 7, 2021)"...*

The child is given a stimulus to collect leaves of various shapes and sizes in the school yard (02-1.2). The child is given a stimulus to categorize the stones he/she finds (03-1. 2). The activity is as shown in Figure 5.



Figure 5: Children are Stimulated to Carefully Sort Leaves and Stones.

PAUD facilitates children to recognize science with activities in the natural materials center and uses natural materials around the school yard such as in children's activities to collect, classify and sort leaves and rocks, this aims to train children to be careful.

Being Creative

The development of science skills in early childhood also has a very important role in helping to lay the foundation for the ability and formation of expected human resources. Many benefits can be obtained if children from an early age have been introduced to science, thus directing and encouraging children to be creative and full of initiative. Science introduced from an early age will encourage them to become children who are rich in inspiration, be creative and rich in initiative and can foster an innovative mindset in children.

According to information when interviewing principals and teachers, information was obtained

that children's creativity will emerge when children do science activities in the natural materials center.

..... *"Creativity will emerge, helps children to think critically as well as dare..... (Principal, interview, October 7, 2021)*

.... *"Children learn to be creative in counting... (Teacher A, interview, October 7, 2021), being creative,..... (Teacher B, interview, October 7, 2021)*

Teachers stimulate children with tools and materials that are safe for children to use when introducing the science of making foam bubbles (O2-1.1).

The child is given a stimulus to group and count the number of stones he gets (03-1. 2), the activity is as shown in Figure 6.



Figure 6: Children Being Creative in Science Introduction Activities.

The nature center learning model implemented in PAUD is a very effective approach developed in individual learning. This approach is very helpful for children in collecting objects that have been arranged around one or more school yards where children can interact directly with nature. Thus the child's ability to learn is more optimal, the child is more busy moving to do or actively learning that has been chosen. With this natural material center model, children's learning experiences are more numerous and children are more creative. This center system also requires teachers to be more creative in choosing activities and constructing attractive activities.

Discussion

Planning is a satisfactory way to make activities run well, accompanied by various anticipatory steps to minimize gaps that occur so that these activities achieve predetermined goals, as expressed by (Reigeluth & An, 2021). According to (Straessle, 2014), the limitations of lesson planning will be appropriate according to the number of aspects, if the aspects related to science and math learning include objectives, material support needed, preparing children, developing activities, reinforcement and rewards, children's worksheets and evaluation. The activity of projecting what actions will be taken in learning (PBM), by coordinating (organizing and determining) teaching components so that the direction of activities (objectives), the content of activities (materials), how to deliver activities (methods and techniques) and how to measure them (evaluation) becomes clear (Dourado & Leite, 2013), so the limit of learning planning is to project or predict and estimate the things needed as needed from the identified elements.

The method is part of the strategy in educational activities, the method is chosen based on the activity strategy that has been selected and determined. The method is a way, which in its work to achieve the objectives of the activity (Shanmugavelu et al., 2020). So that in its use the teacher must have reasons and characteristics of the objectives and factors that support the use of learning methods. The reason for using the method used is that PAUD children generally have the characteristics of always moving, have a strong and high curiosity, have imagination, love to try new things and have a strong urge to get to know the natural environment around because they want to understand everything they see and hear. Characteristic goals are the development of language development creativity, emotional development, motor development, and value development, the development of attitudes and values.

A learning model is a plan or design used to design lessons, learning materials and conduct guidance in the classroom or elsewhere. Learning models in general can essentially be used and developed for learning activities that will be carried out. Learning models have characteristics, including based on educational theory and learning theory, having a specific mission or purpose, can be used as a guide for improving KBM in the classroom, has an impact as its application. The learning model is a pattern used as a guide in planning classroom learning or tutorial learning (Fortner et al., 2016), the learning model implemented in this PAUD is a center learning model. The learning model based on centers has the main feature of providing footing (scaffolding) to build concepts, rules, ideas, and children's knowledge as well as the concept of density and intensity of play. This learning model focuses on children whose learning process is centered in the play center and when children are in a circle.

According to (Gagne et al., 2005) learning media includes tools that are physically used to convey the content of teaching materials consisting of books, tape recorders, cassettes, videos, graphic images, televisions and computers. Media used in science and math learning are provided by schools but are still limited, so teachers often make additional media to add reinforcement of knowledge for children. The media used in science learning in PAUD consists of natural media such as water, air, fire and other complementary media such as magnifying glasses, small buckets, rags and chemicals tailored to the needs (theme) such as dish soap, salt, sugar, vinegar, spiritus, food coloring and other natural materials.

Children are born curious to understand the environment in which they live and their world. They have the potential to learn by interacting with their environment (Sibisi & Warria, 2020). The introduction of science and math for early childhood has an important role in improving the quality of education, especially in producing children who can think critically, logically, and creatively which must be trained from an early age so that it can develop into a positive mentality for children in the future. The development of science skills in early childhood has a very important role in helping lay the foundation for the ability and formation of expected human resources (Nurani & Pratiwi, 2020).

Uniqueness stands out in early childhood, as explained by (Mikus et al., 2021) writing in "Young children are natural scientists", have high curiosity, are interested in everything they see, ask a lot of questions and try to find out what happens if something is done, and want to explore everything that can be reached around them. According to (Pérez et al., 2017), the focus and guideline for encouraging children to do science activities is to follow what the child wants, and not to give instructions or dominate what the child wants.

Science accustoms children to following the steps in every activity and cannot hide a failure. This means that science can train positive mentality, logical thinking, and sequence (systematic).

In addition, it can also train children to be careful, because children must observe, make predictions, and make decisions. According to (Jain & Verma, 2018) meticulous means careful and thorough in carrying out something. A conscientious person is shown to be careful, full of interest, and careful in carrying out something so that no mistakes occur and get good results.

The introduction of science for early childhood has an important role in improving the quality of education, especially in producing children who can think critically, and creatively which must be trained from an early age so that it can develop into a positive mentality for children in the future. According to (Beghetto & Kaufman, 2014)"Creativity is a mental process by which an individual creates new ideas or products, or recombines existing ideas and products, in fashion that is novel to him or her." creativity is a mental process carried out by individuals in the form of new ideas or products or combines between the two which will ultimately be attached to him.

Conclusion

The results of this study in analyzing the process of introducing science learning in children are seen from the planning, methods, models, media used. The introduction of science for early childhood has an important role in improving the quality of education, especially in producing children who can increase curiosity, think critically, logically, carefully and creatively. Children who must be trained from an early age so that they can develop into a positive mentality for children in the future. The development of science skills in early childhood has a very important role in helping lay the foundation for the ability and formation of expected human resources.

Science trains children to use their five senses to recognize various symptoms of objects and symptoms of events. Children are trained to see, feel, smell, taste and hear. The more sensory involvement in learning, the more children understand what they are learning. Children gain new knowledge as a result of their sensing with various objects around them, so that the knowledge they gain will be useful as further thinking capital. Awareness of the importance of science in children is higher when realizing that we live in a dynamic world, developing and changing continuously. Science is increasingly needed along with the development of science technology in the current era of globalization. The novelty of this research is the involvement of students in learning based on natural materials. Research limitations in the use of learning media have not been supported by digital media. Further research is needed with the support of digital media to improve skills in technology.

Ethics Statements

This study involving human participants was reviewed and approved by the Institute for Research and Community Service, Universitas Negeri Jakarta. The participants gave their written informed consent to participate in this study.

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