ISSN: 0215-9643 e-ISSN: 2442-8655

Kindergarten Teacher's Views of Science Learning Practices in Schools

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ARTICLE INFO

Article history
Received 20, 6, 2022
Revised 3, 4, 2021
Accepted 1, 8, 2021

Keywords
Teacher's view
Science learning
Kindergarten
Early childhood

ABSTRACT

This study aims to reveal the views of kindergarten teachers about science learning, the form of activities, the methods used, and the difficulties faced. This research uses descriptive qualitative research. The data were collected using semi-structured interviews with six kindergarten teachers who were selected by purposive sampling technique. Data were analyzed using the interactive model of Miles & Huberman. The results showed: 1) all teachers were of the view that science learning in childhood was very important to implement, 2) activities in science learning are carried out according to the learning theme, but two out of six teachers add activities spontaneously and follow natural phenomena, 3) the children's most preferred experimental method when doing science activities, and 4) difficulties faced by the teacher regarding tools and materials.

I. Introduction

The earliest learning that will be received by children is through early childhood education. Early childhood education or better known as PAUD is education aimed at children from birth to six years of age (Kemendikbud RI, 2014). The purpose of implementing PAUD is to optimize the dimensions of children's development, such as physical-motor, cognitive, socio-emotional, and language to according to the child's age (Walujo & Listyowati, 2017). Optimizing the dimensions of child development is carried out by providing stimulating, directing, and manifested in various forms of meaningful and fun learning activities (Mursid, 2017).

One form of learning activity that is important to carry in PAUD, especially at the kindergarten level, is science activities. Science activities are beneficial for kindergarten children because they serve as a basis for children to have attention to science in the future (Hammer & He, 2014). Kindergarten children also have innate abilities in learning science, such as having a curiosity and enthusiasm to recognize and explore new things around them (Akman & Güçhan Özgül, 2015; Bustamante et al., 2017; Erden & Sönmez, 2011).

According to the 2013 Curriculum, the development of science learning at the kindergarten level is an implementation in an integrated manner through thematic learning (Kemendikbud RI, 2014). The theme chosen was then designed into several activities through the science lesson planning process. For example, on the learning theme of natural phenomenon activities, the teacher plans lessons to introduce the rainbow. The teacher also must determine the right method so that science learning can understand by children from abstract concepts (difficult to understand) to concrete (easy to understand). Given, that kindergarten-level children based on Piaget's cognitive development theory are still at the preoperational or pre-thinking stage (Crain, 2014). Children at this stage still have limited thinking, so they need an explanation of an object or phenomenon in a concrete form (Doherty & Hughes, 2014).

The task of kindergarten teachers is not only to create a suitable and complete science learning environment, but a kindergarten teacher must also provide an understanding of the child about the scientific activities carried out. This understanding will lead children to be able to explore, ask, and find answers involving cognitive, language, socio-emotional, and physical-motoric dimensions (Yilmaztekin & Erden, 2011). Teachers and children will gain new experiences by carrying out scientific activities through this process (Dogan & Simsar, 2018).

The involvement of children from an early age in scientific activities also provides opportunities for children to be able to carry out scientific investigation activities. When learning takes place, the teacher has a role to play in developing active learning and encouraging children with emotional touch (Hodson, 2014). Children will understand basic science concepts making it easier for children to understand advanced science concepts at the next school level (Saçkes et al., 2011; Saçkes, 2014b). Children will

http://dx.doi.org/10.17977/um048v28i1p7-13

also have a better chance of academic success in the future (Kinzie et al., 2014).

The key indicator of activities in science learning to be meaningful to children is when the teacher introduces the child to the scientific process from the start to reveal scientific objects or phenomena which are carried out in stages and simply (Izzuddin, 2019). The goal is that children are not easy to forget when they get new knowledge. Besides, it can build children's self-confidence in uncovering facts (Campbell et al., 2018) and develop problem-solving skills in other fields (Rahman et al., 2018). Children need to gain a better understanding of the concept of knowledge by learning to process the knowledge they acquire using scientific process skills (Andiema, 2016). The skills used in the scientific process of early childhood are "the skills to observe, compare, classify, measure, and communicate" (Charlesworth, 2010).

However, based on the results of research conducted by Karademir et al. (2020) that, learning science in kindergarten that is implement differs between theory and practice, and the problems faced by teachers are related to the views of teachers who are not knowledgeable about scientific activities and the methods that must be using. This issue needs to be studied as an effort to improve the quality of science learning at the kindergarten level. Science learning in kindergarten provides many benefits to implement, then the quality of science learning is closely related to teacher performance in schools (Dogan & Simsar, 2018). Thus, the purpose of this study is to reveal the teacher's views on science learning, the form of activities, the methods used, and the difficulties faced while implementing science learning in schools.

II. Method

A. Design

This research design uses a qualitative approach with a descriptive research type. Descriptive research with a qualitative approach aims to describe an object or phenomenon naturally or as it is without giving treatment (Sukmadinata, 2015). This research design aims to reveal the views of kindergarten teachers about science learning, the form of activities, the methods used, and the difficulties faced during the implementation of science learning in schools.

B. Respondents

Selection of research respondents using purposive sampling technique or selecting of data sources using several criteria and considerations (Sugiyono, 2016). The criteria and considerations in selecting these respondents are 1) kindergarten teacher who taught in the Umbulharjo District, Yogyakarta City, Indonesia, 2) kindergarten teacher who taught children aged 5-6 years, 3) kindergarten teachers who have teaching for more than five years, 4) kindergarten teachers have at least a bachelor's degree and 5) kindergarten teachers who have experience participating in training/workshops on science learning. The following is the profile of the six respondents in this study.

Table 1. Profile of Respondents

Initials	Gender	Education
T1	Female	Bachelor
T2	Female	Bachelor
T3	Female	Bachelor
T4	Female	Bachelor
T5	Female	Bachelor
T6	Female	Bachelor

C. Instruments, Procedures, Data Analysis

Data were collected from October to November 2020. Data collection used semi-structured interview techniques because it included in-depth interviews that used interview guidelines to get more open answers from respondents as needed (Sugiyono, 2016). This research instrument uses interview guidelines with several questions asked as many as twelve questions. The questions are divided into four aspects, namely 1) aspects of science learning (questions number 1-3), 2) aspects of science activities (questions number 4-6), 3) aspects of the science learning method (questions 7-9), and 4) aspects of difficulty in learning science (questions number 10-12).

The interviewer in this study is the researcher himself. Previous researchers asked permission from the principal by providing a research letter. Interviewing with teachers was conducted after obtaining permission from the principal. Researchers conducted face-to-face interviews of approximately 60 to 75 minutes at the school where the teacher taught. Any information an obtaining is then recorded in the form of an interview result. When conducting interviews, researchers were assisted by a recording medium from a cell phone.

Data analysis techniques used the interactive model of Miles & Huberman, including: "data collection, data condensation, data presentation, and conclusion" (Miles et al., 2014). Interview data that have been recorded in text form then enter the data condensation stage. The data condensation stage is carried out to select, simplify, and summarize the data needed to provide a clearer picture of the research results. The research data was made easier to understand by researchers and others. Researchers made a list of codes with the initials T1 to T6. The data that has been given the initial code T1 to T6 are then analyzed and presented in descriptive form. The conclusion is in the form of answers to the research questions that have been compiled by the researcher.

III. Results and Discussion

A. Kindergarten Teacher's Views of Science Learning

Science learning in schools is closely related to teacher performance. Teachers have a role in managing learning activities from planning, implementation, and evaluation. Because of this, it is necessary to investigate the views of

kindergarten teachers about science learning in schools. As explained by the three respondents below:

"Science learning is very needed because it is to develop children's thinking processes. Children will also acquire new knowledge by getting to know the nature around them." (T4)

"Science learning is very needed because it is to hone the thinking power and curiosity of children." (T6)

"Science learning needs to be implementing because it encourages children to think realistically according to facts." (T3)

Barenthien et al. (2020) explain that science learning from the start emphasizes stimulating and facilitating children's curiosity so that children can understand the world around them in a simple way. It is hoped that children will be more sensitive to everything that is happening around them. Science learning that is carried out following children's development can become the basis for science learning, both at the primary and secondary school levels (Leuchter et al., 2014; Saçkes, 2014a; Saçkes et al., 2011). Besides, science process skills need to be introduced from the start by the teacher so that learning is more meaningful for children. As explained by one of the respondents below:

"Like observing changes in the shape of ice that freezes until it melts. Children will have the opportunity to develop skills to compare the observed changes in ice shape. The teacher also provides opportunities for children to communicate the activities that have been carrying out." (T1)

Research conducted by Dewi (2011) found that science learning based on science process skills can increase early childhood scientific abilities. Science process skills in this research through the skills of observing, classifying, summarizing, and communicating. Science process skills developed through science learning need to be prioritized as a provision for children to learn science and mathematics at the next school level (Charlesworth, 2010; Gheith & Al-Shawareb, 2016; Nayfeld et al., 2013). Besides, it will develop higher-order thinking skills in children (Fayez et al., 2011).

"The hope is that after the children participate in science learning to be more open-minded, have high motivation to explore knowledge, have courage, and be confident in communicating the results of scientific activities that have been carrying out so far." (T2)

Science learning provides many benefits for early childhood because science is a part of children's daily activities (Akman & Güçhan Özgül, 2015). The experience gained will be meaningful until adulthood. Children will get used to using science process skills when finding and uncovering scientific facts so that they acquire new knowledge through clear stages. Children's understanding will continue to increase as cognitive abilities develop in exposing objects or scientific phenomena around them (Siry et al., 2012).

B. Kindergarten Teacher's Views of Activities in Science Learning

The science learning that is practiced at the kindergarten level is different from the science learning at the primary and secondary school level. Science learning activities at the kindergarten level are carried out in an integrated manner with other activities. As explained by one of the respondents below:

"In this plant-themed activity, children were asking to plant green bean seeds. Once every two days child observes his development. Children to report their observations in the form of pictures. Children draw and color green bean seed growth in a picture book. The child then shows the results of the drawing and tells it to another friend." (T1)

Science learning by prioritizing the essence of play can directly involve children through various forms of activities, such as drawing, reading, playing music, and playing roles (Bulunuz, 2013). These activities will provide understanding to children that science activities carried out are something fun (Akman & Güçhan Özgül, 2015). Besides the development of early childhood science learning in Indonesia, especially at the kindergarten level, planning of science activities is adjusting to the themes that have been set in schools. The determination of the learning theme is not rigid but adapts to the surrounding environment, socioculture, children's preferences, and the infrastructure owned by each school (Yulaelawati & Suminah, 2015).

The implementation of science learning is also adjusting to the learning model used in PAUD units. There are three types of learning models used in Indonesia, especially at kindergarten levels, namely "learning models for angles, areas, and centers" (Yusuf et al., 2015). The PAUD learning model has its characteristics, but the principles of learning remain the same. In its implementation, science-learning activities are integrated with other activities. The teacher must plan the lesson carefully because the applied science activities also adjust to the learning model used in each school. As explained by the two respondents below:

"Science activities also adjust to the learning area used. Every day four learning areas are used. At least two learning areas have scientific activities." (T2)

"The scientific activities that are carrying out are planned and listed in the Prosem, RPPM, and RPPH because scientific activities cannot be spontaneous in their implementation." (T6)

Planning and designing science activities requires special skills from teachers in schools. Experience from scientific activities implemented through understandable syntax will be easily absorbed and attached to children (Izzuddin, 2019). This finding is in line with the results of research conducted (Munawaroh, 2017) that activities in

science learning are carried out following the lesson planning outlined in the RPPH (Daily Learning Implementation Plan).

This finding is also in line with the results of research conducted by Azhari et al. (2018) that teachers are in the very frequently category of preparing science lesson plans as contained in the Prosem (Semester Program), RPPM (Weekly Learning Implementation Plan), and RPPH (Daily Learning Implementation Plan). The learning activities carried out are also following the learning theme. The themes in science learning activities include the learning theme of plants, animals, water, air, fire, and natural phenomena.

In addition to scientific activities carried out according to plan, two out of six respondents in this studying, sometimes also added scientific activities spontaneously and naturally. Science activities are naturally carried out by natural phenomena that are happening. However, in practice, it does not change the RPPH that has been making. As explained by the two respondents below:

" There are also spontaneous science activities, such as after morning exercise, in the schoolyard, there are grasshoppers. The children then observe while the teacher explains." (T4)

"For example, when it rains, the teacher explains to the children about natural phenomena that are happening." (T3)

The findings in this study are slightly different from the results of research conducted by Doğan and Simsar (2018) on 32 pre-school teachers in Kilis Province, Turkey. The results showed that as many as 87.50% of teachers carried out science activities naturally and spontaneously by adding or changing activities in the RPPH. The teacher in the study is of the view that the ongoing natural phenomenon is a useful phenomenon to be introduced to children.

C. Kindergarten Teacher's Views of the Method in Science Learning

Teachers in implementing science learning must understand and use the chosen learning method. All respondents in this study are of the view that science learning methods are most often used in schools, such as demonstration methods, experimental, observations, question and answer, and field trips. As explained by the five respondents below:

"Observation is like observing the growth of plants planted in the schoolyard." (T6)

"Experiments, for example, making juice drinks from various fruits." (T4)

"For example, on the theme of natural phenomena, an activity about recognizing volcanic eruptions. The teacher demonstrates in front of the class how a mountain can erupt using various materials, such as dunes, vinegar, food colouring, and baking soda." (T5)

"Using question and answer methods such as after watching videos about marine life." (T2)

"Field trips, usually visiting biological museums, zoos, banana germplasm gardens." (T3)

The method used in science learning is a method that can stimulate children's curiosity and motivate children to be able to find new things (Safira & Ifadah, 2020). When teachers master the learning methods used, science learning can develop dimensions of child development optimally (Izzuddin, 2019). All respondents in this study also held the view that the science learning method that was easy to implement was using demonstration and experimental methods. However, the experimental learning method is the method most preferred by children. As explained by the two respondents below:

"The method is easy to apply when scientific activities use concrete experimental materials. I can easily explain it to children. Usually, demonstration and experiment methods are often using. Children love to have the opportunity to do science experiments." (T1)

"Children understand most easily that they are using experimental and demonstration methods because the tools and materials are concrete. When using the experiment method, children are more enthusiastic because they can do science experiments as the teacher explains." (T2)

The results of this study are in line with the results of research conducted by Susilowati (2016) that in the science of learning, teachers use various methods. The methods used by teachers in science learning, such as experimental methods, demonstrations, investigations, and field trips. The results of this study also found that two learning methods were easy to implement by the teacher, namely the experimental method and the demonstration method.

Meanwhile, research conducted by Doğan and Simsar (2018), 32 preschool teachers in Kilis Province, Turkey found that the three methods most often used when carrying out science activities at school, namely experimental, demonstration, and observation. The results of the study also indicated that the experimental method was the method most liked by children and was easy for the teacher to implement when carrying out science activities.

The experimental method is a learning method that allows children to try to do their experiments so that children can prove the results of their experiments and gain new knowledge (Putri, 2019). Based on the results of classroom action research conducted by Wahid and Suyanto (2015), experimental methods can improve children's science process skills in predicting, observing, classifying, and communicating skills. Science process skills of children have increased from cycle I to cycle III by 19.44%. Scientific experimental activities carried out are in the form of the activities to identify floating and sinking objects, absorbent and non-absorbent, dissolved, and insoluble, balloon rockets, and symptoms of magnetism.

However, there are still other methods suggested in science learning at this time, namely using the inquiry method. The inquiry method is recommended in science learning because it effectively makes it easy for children to understand scientific objects or phenomena (Akman & Güçhan Özgül, 2015; ErgaZaki & ZogZa, 2013; Samarapungavan et al., 2011). The inquiry method is a learning method that provides opportunities for children to be involved in carrying out the process of experimentation and investigation (Llewellyn, 2011). Children who participate in inquiry-based learning activities are required to be active in carrying out activities. Methods that can change children from just listening to children who are directly involved in the process of scientific activities.

D. Kindergarten Teacher's Views of the Difficulties Faced in Science Learning

The difficulties faced by the teacher colored the science learning process. All respondents in this study were of the view that the problems encountered were related to the tools and materials when carrying out science learning. As explained by the three respondents below:

"The difficulty I face is because there are several learning themes where schools cannot concretely prepare tools and materials, such as the theme of sea animals." (T2)

"When there is a learning theme that is difficult to do with the experiment method, I replace it with other media, such as watching videos and using pictorial media." (T1)

"The method I use also adjusts the tools and materials or the medium. For example, not doing experiment activities, I usually use the learning method of observation, question, and answer, and so on." (T5)

The science learning that is carried out must follow a mutually agreed upon a theme in schools. Determining activities and choosing the right method is a challenge for the teacher. Teachers need to master the learning methods used and the activities they want to do with children. Besides, teachers need to make efforts and innovations, so that science activities carried out with children are not saturating.

Tools and materials commonly used to support science learning in schools such as scales, magnifying glasses, magnets, various types of leaves, seeds, tree branches, rocks, sand, water, and so on (Gonzalez-Mena, 2011; Jacobs & Crowley, 2007). The difficulties faced by teachers are related to tools and materials. The contributing factor is that there are several learning themes whose tools and materials cannot be presented concretely at school. The teacher then replaced it with other media. The method used is replaced by a simple learning method.

Another contributing factor is the lack of teacher preparation when carrying out science lessons. According to the views of four respondents, this problem is the cause of the difficulty in providing tools and materials. As explained by the two respondents below:

"The reason is that there are several activities, such as meetings, parenting, workshops, so sometimes there is not enough time to prepare the tools and materials that have been planned." (T3)

"Overcome by still looking for tools and materials because the teacher is not alone and can ask other teachers for help, even with other employees. By collaborating with others, tools and materials can be made available at school." (T4)

Efforts to provide tools and materials in science learning need to be pursued if they are not available in schools so that the planned goals and objectives can be achieved optimally (Izzuddin, 2019). The results of this study are in line with the results of research conducted by Roza, (2012) that the difficulties faced by teachers are related to tools and materials. Teachers in overcoming these difficulties replace them by using image media in science magazines at schools. Another study conducted by Winarni (2017) on 35 PAUD teachers in Central Java, Indonesia found several difficulties faced by PAUD teachers in implementing science learning. The problems faced by teachers are not only due to the tools and materials, but teachers also have little time to teach science in schools.

IV. Conclusion

Science activities carried out in schools adjust to the themes and sub-themes of learning and have been listed in the Prosem, RPPM, and RPPH. Sometimes teachers also add science activities spontaneously and naturally but do not change the RPPH that has been made. The learning method is chosen by the teacher to make it easier to carry out science activities with children. Demonstration and experimental methods are easy methods for teachers because they use concrete tools and materials. The experimental learning method is the learning method that is most in demand by children because children are allowed to experiment with various tools and materials, and children can discover new things under the guidance of the teacher. The implementation of science learning is characterized by difficulties related to tools and materials. However, the teacher tries to solve the existing problem. Efforts made by the teacher are finding the tools and materials needed or by replacing them with media that can be reached by schools, such as using images and audiovisual media. Besides, the learning method uses simple methods such as observation and question and answer methods.

References

Akman, B., & Güçhan Özgül, S. (2015). Role of play in teaching science in the early childhood years. *Research in Early Childhood Science Education*, 237–258. https://doi.org/-10.1007/978-94-017-9505-0_11.

Andiema, N. C. (2016). Effect of child centred methods on teaching and learning of science activities in pre-schools in Kenya. *Journal of Education and Practice*, *7*(27), 1–9.

Azhari, N. T., Marhun, M., & Afrianti, N. (2018). Upaya guru dalam mengenalkan sains pada pembelajaran anak usia dini di PAUD gugus 1 dan 2 Bandung Kulon. *Prosiding Pendidikan Guru PAUD*, *4*(2), 142–149. https://doi.org-/10.29313/.v0i0.12473

Barenthien, J., Lindner, M. A., Ziegler, T., & Steffensky, M. (2020). Exploring preschool teachers' science-specific knowledge. *Early Years An International Research Journal*, *40*(3), 335–350. https://doi.org/10.1080/09575-146.2018.1443321

Bulunuz, M. (2013). Teaching science through play in kindergarten : does integrated play and science instruction build understanding? *European Early Childhood Education Research Journal*, *21*(2), 226–249. https://doi.org/10.1080/1350293X.2013.789195

Bustamante, A. S., White, L. J., & Greenfield, D. B. (2017). Approaches to learning and school readiness in head start: Applications to preschool science. *Learning and Individual Differences*, *56*, 112–118. https://doi.org/10.-1016/j.lindif.2016.10.012

Campbell, C., Jobling, W., & Howitt, C. (2018). *The science learning environment. In Science in early childhood* (3rd ed.). Cambridge University Press.

Charlesworth, R. (2010). *Math and science for young children* (6th ed.). Wadsworth Cengage Learning.

Crain, W. (2014). *Teori perkembangan: Konsep dan aplikasi*. Pustaka Pelajar.

Dewi, A. C. (2011). Meningkatkan kemampuan sains anak usia dini melalui pembelajaran berbasis ketrampilan proses. *Malih Peddas: Majalah Ilmiah Pendidikan Dasar*, *1*(2), 39–63. https://doi.org/10.26877/malihpeddas.v1i2.301

Dogan, Y., & Simsar, A. (2018). Preschool teachers' views on science education, the methods they use, science activities, and the problems they face. *International Journal of Progressive Education*, *14*(5), 57–76. https:-//doi.org/10.29329/ijpe.2018.157.6

Doherty, J., & Hughes, M. (2014). *Child development: theory and practice 0-11* (2nd ed.). Pearson Education.

Erden, F. T., & Sönmez, S. (2011). Study of turkish preschool teachers' attitudes toward science teaching. *International Journal of Science Education*, *33*(8), 1149–1168. https://doi.org/10.1080/09500693.2010.511295

ErgaZaki, M., & ZogZa, V. (2013). How does the model of inquiry-based science education work in the kindergarten: The case of biology. *Review of Science Mathematics & ICT Education*, *7*(2), 73–97. https:-//doi.org/10.26220/rev.2044

Fayez, M., Sabah, S. A., & Oliemat, E. (2011). Jordanian early childhood teachers' perspectives toward science teaching and learning. *International Research in Early Childhood Education*, *2*(1), 76–95. https://doi.org/10.4225/03/58-21a531bdaf0

Gheith, E., & Al-Shawareb, A. (2016). Correlation between kindergarten teachers' attitudes toward teaching science and their teaching practices. *American Journal of Educational Research*, *4*(4), 320–328. https://doi.org/-10.12691/education-4-4-5

Gonzalez-Mena, J. (2011). *Foundations of early childhood education: Teaching children in a diverse society* (5th ed.). McGraw-Hill Companies, Inc.

Hammer, A. S. E., & He, M. (2014). Preschool teachers' approaches to science: A comparison of a chinese and a norwegian kindergarten. *European Early Childhood Education Research Journal*, *24*(3), 450–464. https:-//doi.org/10.1080/1350293X.2014.970850

Hodson, D. (2014). Learning science, learning about science, doing science: different goals demand different learning methods. *International Journal of Science Education*, *36*(15), 2534–2553. https://doi.org/10.1080/09500693.2-014.899722

Izzuddin, A. (2019). Sains dan pembelajarannya pada anak usia dini. *Bintang*, *1*(3), 353–365.

Jacobs, G., & Crowley, K. (2007). *Play, projects, and preschool standards: Nurturing children's sense of wonder and joy in learning* (1st ed.). Corwin Press.

Karademir, A., Kartal, A., & Türk, C. (2020). Science education activities in turkey: A qualitative comparison study in preschool classrooms. *Early Childhood Education Journal*, *48*(3), 285–304. https://doi.org/10.1007/s1064-3-019-00981-1

Kemendikbud RI. (2014). *Peraturan Menteri Pendidikan dan Kebudayaan RI Nomor 137 Tahun 2014 tentang Standar Nasional Pendidikan Anak Usia Dini*.

Kinzie, M. B., Whittaker, J. V., Williford, A. P., DeCoster, J., McGuire, P., Lee, Y., & Kilday, C. R. (2014). My teaching partner-math/science pre-kindergarten curricula and teacher supports: Associations with children's Mathematics and Science learning. *Early Childhood Research Quarterly*, *29*(4), 586–599. https://doi.org/-10.1016/j.ecresq.2014.06.007

Leuchter, M., Saalbach, H., & Hardy, I. (2014). Designing science learning in the first years of schooling. An intervention study with sequenced learning material on the topic of "floating and sinking." *International Journal of Science Education*, *36*(10), 1751–1771. https://doi.-org/10.1080/09500693.2013.878482

Llewellyn, D. (2011). *Differentiated science inquiry*. Corwin.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis a methods sourcebook* (3rd ed.). Sage Publications, Inc.

Munawaroh, H. (2017). Pelaksanaan pembelajaran sains anak di RA perwanida wonosobo. *SPEKTRA : Jurnal Kajian Pendidikan Sains*, *3*(2), 170–177. https://doi.org/10.326-99/spektra.v3i2.35

Mursid, M. (2017). *Pengembangan pembelajaran PAUD*. Remaja Rosdakarya.

Nayfeld, I., Fuccillo, J., & Greenfield, D. B. (2013). Executive functions in early learning: extending the relationship between executive functions and school readiness to science. *Learning and Individual Differences*, *26*, 81–88. https://doi.org/10.1016/j.lindif.2013.04.011

Putri, S. U. (2019). *Pembelajaran sains untuk anak usia dini*. UPI Sumedang Press.

Rahman, N. A., Yusop, N. A. M., & Yassin, S. M. (2018). Science process skills in preschool children through project approach. *International Journal for Studies on Children, Women, Elderly and Disabled*, *5*, 104–114.

Roza, M. M. (2012). Pelaksanaan pembelajaran sains anak taman kanak-kanak aisyiyah bustanul athfal 29 padang. *Jurnal Ilmiah Pesona PAUD*, *1*(5), 1–11.

Saçkes, M. (2014a). How often do early childhood teachers teach science concepts? determinants of the frequency of science teaching in kindergarten. *European Early Childhood Education Research Journal*, *22*(2), 169–184. https://doi.org/10.1080/1350293X.2012.704305

Saçkes, M. (2014b). Parents who want their PreK children to have science learning experiences are outliers. *Early Childhood Research Quarterly*, *29*(2), 132–143. https://doi.org/10.1016/j.ecresq.2013.11.005

Saçkes, M., Trundle, K. C., Bell, R. L., & O'Connell, A. A. (2011). The influence of early science experience in kindergarten on children's immediate and later science achievement: Evidence from the early childhood longitudinal study. *Journal of Research in Science Teaching*, *48*(2), 217–235. https://doi.org/10.1002/tea.-20395

Safira, A. R., & Ifadah, A. S. (2020). *Pembelajaran sains dan matematika anak usia dini*. Caremedia Communication.

Samarapungavan, A., Patrick, H., & Mantzicopoulos, P. (2011). What kindergarten students learn in inquiry-based science classrooms. *Cognition and Instruction*, *29*(4), 416–470. https://doi.org/10.1080/07370008.2011.6080-27

Siry, C., Ziegler, G., & Max, C. (2012). "Doing science" through discourse-in-interaction: young children's science investigations at the early childhood level. *Science Education*, *96*(2), 311–336. https://doi.org/10.1002/sce.-20481

Sugiyono, S. (2016). *Metode penelitian kuantitatif, kualitatif, dan r&d*. Alfabeta.

Sukmadinata, N. S. (2015). *Metode penelitian pendidikan*. Remaja Rosdakarya.

Susilowati, N. (2016). Pengenalan sains melalui percobaan sederhana pada anak kelompok b di KB-RA IT Al-Husna Yogyakarta. *Jurnal Pendidikan Anak Usia Dini*, *5*(5), 551–560.

Wahid, S. M., & Suyanto, S. (2015). Peningkatan keterampilan proses sains melalui percobaan sederhana anak usia 5-6 tahun di TK-IT albina ternate. *JPPM: Jurnal Pendidikan Dan Pemberdayaan Masyarakat*, *2*(1), 55–66. https:-//doi.org/10.21831/jppm.v2i1.4843

Walujo, D. A., & Listyowati, A. (2017). *Kompendium pendidikan anak usia dini*. Prenadamedia.

Winarni, D. S. (2017). Analisis kesulitan guru PAUD dalam membelajarkan IPA pada anak usia dini. *Edu Sains: Jurnal Pendidikan Sains & Matematika*, *5*(1), 12–22. https://doi.org/10.23971/eds.v5i1.578

Yilmaztekin, E. Ö., & Erden, F. T. (2011). Early childhood teachers' views about science. *Western Anatolia Journal of Educational Science (WAJES)*, 161–168.

Yulaelawati, E., & Suminah, E. (2015). *Pedoman Pengembangan Tema Pembelajaran PAUD*. Direktorat Pembinaan Pendidikan Anak Usia Dini.

Yusuf, F., Susanti, A., Rumanda, Y., & Maryati, S. (2015). *Pedoman pengelolaan kelas pendidikan anak usia dini*. Direktorat Pembinaan Pendidikan Anak Usia Dini.