EXPLORATION OF THE APPLICATION OF STORY-BASED SCIENCE LITERACY LEARNING STRATEGIES AND EXPERIMENTAL PROJECTS IN EARLY CHILDHOOD

*Qibtiyatul Quro, Choiriyah
Universitas Panca Sakti
Corresponding e-mail: *qibtiyaquroo12@gmail.com

Abstract

The purpose of writing this article is to explore learning strategies through playing science activities for early childhood during the Covid 19 pandemic. Research subjects on two students and teachers in PAUD RA. Al-Mannaan who applies learning strategies to improve early childhood scientific literacy. The results show that the exploratory learning strategy applied consists of two learning strategies through storytelling with pictures and an experimental project. The series of learning strategies are structured based on four aspects, namely: access, interaction, response, and results. During distance learning, children feel unburdened with schoolwork, children feel confident through activities that involve themselves, curiosity arises in children, and independence in making decisions. This article also explores the impact of teachers in such an environment, where teachers feel the importance of inculcating science literacy for early childhood so that children do not find science boring. The investigations carried out in this study also provide an overall indication based on the criteria set by the teacher that the application of the two learning strategies is effective in helping to strengthen scientific literacy in the PAUD RA. AL-Mannaan.

Keywords: Learning Strategies, Science Literacy, Stories and Experimental Projects

Abstrak

Tujuan penulisan artikel ini untuk mengeksplorasi strategi pembelajaran melalui kegiatan bermain sains pada anak usia dini di masa pandemic Covid 19 saat ini. Penelitian ini adalah kualitatif deskriptif dengan metode observasi dan wawancara, subjek penelitian pada dua siswa dan guru di PAUD RA. Al-Mannaan yang menerapkan strategi pembelajaran untuk meningkatkan literasi sains anak usia dini. Hasil menunjukkan bahwa eksplorasi strategi pembelajaran yang diterapkan yaitu terdiri dari dua strategi pembelajaran melalui bercerita dengan gambar seri dan projek eksperimen. Rangkaian strategi pembelajaran tersusun dengan berpedoman pada empat aspek, yaitu: akses, interaksi, respon, dan hasil. Di saat pembelajaran jarak jauh, anak merasa tidak terbebani dengan tugas sekolah, anak merasa percaya diri melalui kegiatan-kegiatan yang melibatkan dirinya, rasa keingin tahuan muncul dalam diri anak, serta kemandirian dalam mengambil keputusan. Artikel ini juga mengeksplorasi dampak guru dalam lingkungan seperti itu, di mana guru merasa pentingnya penanaman literasi sains untuk anak usia dini agar anak tidak menganggap sains membosankan. Penyelidikan yang dilakukan dalam penelitian ini juga memberikan indikasi secara keseluruhan berdasarkan kriteria yang ditetapkan guru bahwa penerapan kedua strategi pembelajaran tersebut efektif untuk membantu menguatkan literasi sains di PAUD RA. AL-Mannaan.

Kata Kunci: *Strategi Pembelajaran, Literasi Sains, Cerita dan Projek Eksperimen*

Introduction

The inability of the school system to engage students effectively may have caused problems in school subjects such as science (Pereira et al., 2019). According to Lowe, (2014), science education is still based on the conventional model, where knowledge is conveyed by the teacher, and students are expected to memorize and re-explain its contents. As a result, many students view science as boring and irrelevant (Singh & McNeil, 2014). In addition to giving science, technology, and mathematics a high national priority in education, the report also suggests the need for high-level research and development (Chandra & Fisher, 2009).

Such a big challenge for educators during the current Covid-19 outbreak (Rapanta et al., 2020). The Indonesian government has taken various measures to prevent the spread of Covid-19. One of them is the government issued a circular on March 18, 2020, ordering the public to carry out all indoor and outdoor activities in all sectors to be temporarily postponed to reduce the spread of the corona virus, not least in the field of education (Abidin et al., 2020). In addition, the Minister of Education and Culture of the Republic of Indonesia on March 24, 2020, issued a circular letter No. 4 of 2020 regarding the implementation of education policies in the emergency period of the spread of the corona virus disease 2019 (Covid 19). It is explained that the learning process is carried out at home through online or distance learning to provide a meaningful learning experience for students (Herliandry et al., 2020).

This situation makes learning to be carried out, even though it is carried out at home through online or distance learning (Firman & Rahayu, 2020). Educators work together with parents in carrying out online learning to develop and optimize development through six aspects of development and if it develops optimally it will form a good character in children (Bauer & Booth, 2019; Sa et al., 2019). One of them, namely: literacy that is important to develop from early childhood is scientific literacy (Bauer & Booth, 2019; Khishfe, 2014; Reinoso et al., 2019). Scientific literacy in Indonesia was introduced in 1993 by UNESCO (Aeni et al., 2020). Scientific literacy has begun to be accommodated in the 2006 curriculum (KTSP) and is more clearly visible in the 2013 curriculum through inquiry activities and scientific approaches (Fadlika et al., 2020).

Applying scientific literacy should start as early as possible (Bybee et al., 2009). Childhood is the most important period in the process of developing all aspects of development, such as cognitive, language, physical, motoric, religious, and moral values, so it is called the golden age (Hasanah, 2018). Carin, A.A. dan Sund, (2016) early childhood is someone who is growing rapidly in development and growth. Scientific literacy is a part of science, practical in nature, which deals with scientific issues and ideas. Science in early childhood learns knowledge in the form of facts or

symptoms from the surrounding environment and also how this knowledge becomes useful for everyday life (Bauer & Booth, 2019). Scientific literacy has the potential to be nurtured and developed in early childhood (Şentürk, 2017b). Scientific literacy for early childhood is where children know, are aware of, and care about the surrounding environment, so that children can protect the environment and even solve problems in their environment (Gerde et al., 2018).

Early childhood education should be a forum for developing literacy for early childhood through integrated science activities or learning in themes according to the PAUD curriculum (Wingsi, 2020). Atta et al., (2020) revealed that science learning in early childhood, in general, has not been as expected. This can be seen from the method used by the teacher, namely lecturing which causes children to tend to be passive, while the characteristic of learning for early childhood is to provide interactive challenges to fulfill their curiosity (Rahmi & Hijriati, 2021). Less friendly science learning in early childhood causes the development of Indonesian children's scientific literacy (Maison et al., 2021).

Compared to other countries in the world, the literacy rate of children and adults in Indonesia is very low (OECD, 2019). The reading, arithmetic, and science knowledge of Indonesian children are below Singapore, Vietnam, Malaysia, and Thailand based on the results of the PISA test (The Program of International Student Assessment) released by the Organization for Economic Co-Operation and Development (EOCD) in 2016 (Pholphirul, 2017; Schleicher, 2019). The survey results of The World's Most Literate Nations in its publication March 9, 2016, from 61 countries, revealed that the Nordic countries (Finland, Iceland, Denmark, Sweden, and Norway) ranked the highest. Meanwhile, Indonesia is ranked 60th (one level above Botswana), below Thailand, Malaysia, and Singapore. Low literacy is a fundamental problem that has a very broad impact on the progress of the nation (OECD, 2019).

Science and technology have become a priority in various policies such as the strategic plans of the government and the ministry of education for the near future placing significant emphasis on Information and Communication Technology (ICT) and science (Ghavifekr & Rosdy, 2015). Adri et al., (2020) shows that all innovative approaches, no matter how simple or complex, must be designed with students in mind. Students' perspectives on such innovations are very important. New initiatives can be sustained as long as there are appropriate research and development mechanisms in place to evaluate them. By applying several research techniques related to the learning environment, the success of such innovative practices can be adequately ensured (Ratheeswari, 2018).

Therefore, educators, especially PAUD teachers have other alternatives to design learning strategies in applying a strong understanding in early childhood

about the importance of scientific literacy to learn (Mansur, 2018). Some of the research that has been done, namely: Febiharsa dan Djuniadi, (2018) that the storytelling method using serial image media can help improve scientific literacy in early childhood. (Şentürk, 2017b) states that to optimize the introduction of scientific literacy in early childhood, a strategy or approach is needed that is following the principles of early childhood learning. Koparan dan Güven, (2015) found that the influence of scientific literacy on students' cognitive abilities on the concept of ecosystems contributed 46.9% to cognitive abilities. So that some of these relevant studies became the basis for this research by exploring several alternative learning strategies through science play activities in early childhood during the current Covid 19 pandemic. The purpose of writing this article is to explore learning strategies through playing science activities for early childhood during the Covid 19 pandemic.

Methods

This study uses a descriptive qualitative methodology based on interpretive philosophy, which is used to examine the condition of a natural object that is currently happening (Patel & Patel, 2019). The descriptive approach is in which research can describe a symptom, or phenomenon of events, events that occur at this time and can use the approach according to conditions and situations (Nur, 2018). The method used is through observation of the learning environment with applied strategies, interviews, and documentation of each child's activities carried out. Then the data from the observations were assessed by quality standards trustworthiness by the author. This is done to assess and evaluate the application of learning strategies in early childhood.

This research was conducted in PAUD Ra. Al-Mannaan Jakarta, the research subject is the teacher who teaches at the school. The reason for choosing the subject is motivated by the necessity of teachers who play an important role in early childhood to see how the subject or teacher in implementing scientific literacy learning during the COVID-19 pandemic can run well. And here, the researcher wants to find out to what extent the learning strategy can run as expected during the covid 19 period. Dimensional guidelines that are measured in the application of science learning strategies as developed by Chandra dan Fisher, (2009), namely: access, interaction, response, and result. These four aspects are aimed at studying how teachers can apply science learning strategies to early childhood.

Taking the subject as a data source is done purposively and snowball, data analysis using Miles And Huberman triangulation Aeni et al., (2020) who argues that to analyze qualitative data, it is necessary to have activities carried out interactively and continuously until complete, so that the data already exists and has been fulfilled. Activities for data analysis are the need for data reduction, data display, and conclusion drawing. The data that has been collected then we conclude so that the various problems that exist can be described accurately and clearly according to the information received.

Results and Discussion

Scientific literacy is scientific knowledge and skill that encourages an individual to be able to identify questions (Fang & Wei, 2010), acquire new knowledge, explain scientific phenomena (Golumbic et al., 2020), draw conclusions based on facts, understand the characteristics of science (Şentürk, 2017b), awareness of the continuity between science and technology in shaping the natural environment, intellectual (Mantzicopoulos et al., 2013), and culture, as well as the ability to engage and care about science-related issues (Reinoso et al., 2019). This statement became the basis that children in PAUD RA. Al-Mannaan has been introduced to the importance of scientific literacy. Referring to the 2013 PAUD curriculum, the approach used is a scientific approach that encourages children to be more active during learning. Results should be clear and concise. The results should summarize (scientific) findings rather than provide data in great detail. Please highlight differences between your results or findings and the previous publications by other researchers. In addition, it is hoped that children will gain new experience and knowledge from the results of observations and experiments carried out directly by children so that children will interpret these things and build their learning concepts.

Competencies that should be mastered are that children can think critically or be able to solve problems, be able to hone creativity through several scientific experiments, be able to communicate findings from observations or experiments orally, in writing, and visually, and be able to work together in a team when conducting experiments science. The success achieved by children in developing aspects of development in PAUD RA. Al-Mannaan cannot be separated from the role of the teacher. The teacher who is the facilitator in the school makes the design of learning activities along with appropriate and appropriate learning strategies for the achievement of learning objectives. All respondents answered very importantly about the application of early childhood science literacy learning, according to the results of interviews that have been carried out during the Covid-19 pandemic that teachers need parental help to improve scientific literacy learning during this pandemic so that it continues to run as expected.

The results of observations were obtained through activities carried out during science learning during the Covid-19 pandemic, namely through two science learning strategies in which the teacher applies learning by telling stories about natural phenomena in everyday life with the help of pictures. Next, the teacher invites children to play while learning in an open space and get to know the natural environment that they often encounter. Therefore, teachers who apply these two learning strategies continue to participate as important informants by paying attention to the classification that has been determined as a measuring guide for this research, namely: assessing aspects of access, interaction, response, and results. To

better understand it, the following is explained in detail based on the results of observations:

Learning Strategies by telling stories about natural phenomena

The teacher tells about the process of the occurrence of rain to children through pictures while telling stories so that when children listen and catch what the teacher is telling (Panjaitan, 2017), and the teacher asked the child again about the process of the occurrence of rain, it was a sign that the child was able to observe what the teacher was telling. The classification of observations based on observations is described as follows:

Access

So that students can use the image media presented by the teacher, they must successfully access the material and images provided by the teacher, where the child must understand what the teacher is telling. As a result, the Access scale determines the extent to which the variables associated with accessing the media meet student expectations (Chandra & Fisher, 2009). The following shows the image media used.
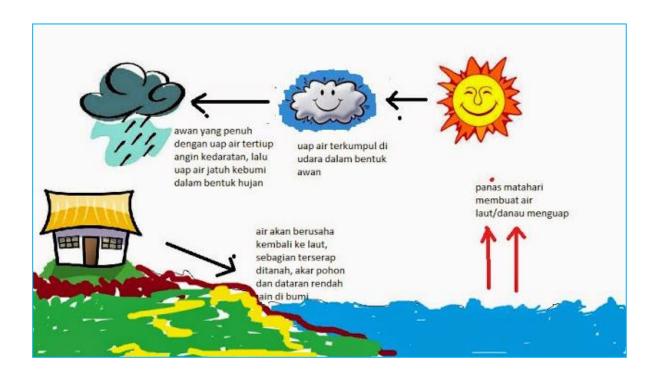

Figure 1. Media pictures tell stories

The media images that are presented to help teachers tell stories are adapted to the needs of early childhood and are compatible with curriculum components. In addition, the teacher feels that the media image can help provide convenience to access children's understanding of learning material. Children will try to understand what components are in the picture presented by the teacher (Febiharsa dan Djuniadi, 2018), see pictures with components that are easy for children to

understand, and the application of colors that are adjusted to the component objects. Seen there are components of Clouds, Rain, Houses, Land, Sun, and Seawater.

Interaction

After students succeed in understanding what the teacher is telling them, students must be able to interact productively with their peers and teachers (Chandra & Fisher, 2009). Therefore, the Interaction scale explores the extent to which this is achieved from a student's point of view (Taylor & Leung, 2020). This interaction is carried out through discussion, where the teacher begins to stimulate students with small questions, this is done to strengthen students' understanding of what they are learning. Like the teacher asking "How does the rain process happen?", "What is the role of the sun in the rain process?". Questions like this will stimulate student responses, where students feel curious about the questions asked by the teacher. Opportunities are given to students to ask questions about the topic being told, this is done by the teacher to see feedback from students in understanding what the teacher is telling. What is seen is not only the interaction of teachers and students, even students and students ask each other questions with other students, of course, this phenomenon shows that alternatives with learning strategies through storytelling are able to invite students to interact well.

Response

The Response Scale indicates how students feel about the use of image-based media used by the teacher (Chandra dan Fisher, 2009), based on the results of interviews with teachers at the school that Ananda Nadhira Nurhasanah (6 years) has been able to retell how the process of rain, while Ananda Nasywa hanum anindya and Ananda nadalisya have not fully been able to tell the process of the occurrence of rain. But, Ananda Hanum and Nadha have understood what the teacher said in explaining the phenomenon of rain.

Results

While the resulting scale provides an overview of the extent to which students' learning objectives are achieved through the use of learning resources that are accessed through the image media (Chandra & Fisher, 2009). Before assessing the child, the teacher conducts an evaluation stage in advance how during the process of implementing learning strategies by telling stories. There are several obstacles that the teacher found, namely: 1) Teachers are still not good at attracting children's attention by telling stories about a natural phenomenon; 2) The teacher still has difficulty in compiling storytelling pictures to match the child's learning topic; 3) Teachers still have to re-learn in responding to children's questions, so that children do not feel confused; 4) Teachers must generalize attention in telling stories to all children so that children's attention remains focused.

Learning strategies by playing experimental projects

The teacher began to design several other learning strategies to show that scientific literacy can be done in various ways that are easy for early childhood to understand (Bauer & Booth, 2019). Playing experimental projects with early childhood is a new thing to be implemented in PAUD RA. AL-Mannaan, This experimental project was made as easy as possible due to time and space considerations during the current Covid-19 pandemic. The following presents the results of the experimental projects that have been carried out.

Access

Students can use other media, such as playing in the open, especially those related to science. Children are introduced to how to grow vegetables while playing under the supervision of the teacher. As a result, the Access scale determines the extent to which the variables associated with accessing these media meet student expectations (Chandra & Fisher, 2009).
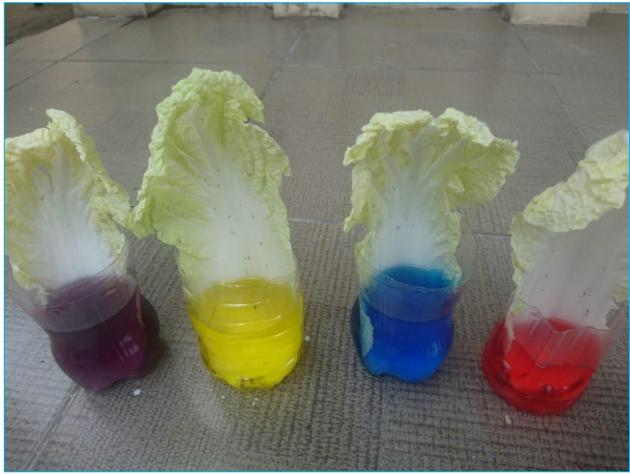

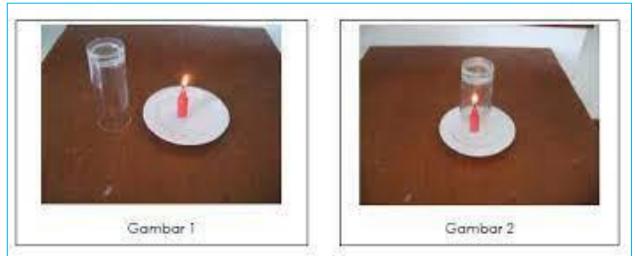Figure 2. Learning Science by playing with plants

Figure 3. Learning Science by Playing with Candles

Figure 2 shows that the strategy of learning to play through plants can help improve the quality of children's scientific literacy. First, children must be taught that it is important to respond to the surrounding environment in their daily lives. When children are actively involved in a positive activity, children feel that they are getting meaningful learning (Trundle, 1999). The child will issue an expression as he pleases, the child feels he must be able to do something. Therefore, the things found are the basis that scientific literacy in children will appear naturally because children are included in learning (Gerde et al., 2018). The components needed are chicory, dye, glass, and water. This experiment was conducted to show and introduce that science can be done with easy materials by early childhood.

Figure 3 invites children to experiment with playing with candles, the experiment is carried out with monitoring from the teacher. This game needs supervision and is very challenging which of course the child will be very curious about (Bauer & Booth, 2019). The components used are candles, glasses, small plates, and matches. This science experiment was conducted to find out how early childhood can know the phenomena around their living environment.

Interaction

Playing through plants, here the teacher first prepares chicory and food coloring after that the teacher explains to the children that the stems of mustard greens are white and in front of the child there is colored water, after that the teacher explained again and the children listened. Then the teacher instructs the child to experiment with these plants by instructing the child to take one mustard stalk, after that it is dipped in the colored water and the child waits for a few minutes to see the results.

Playing candles this game is very much needed supervision and very challenging which of course children will be very curious. Here the teacher first

explains to the child that this game is dangerous or the teacher gives the child a foothold first (Pholphirul, 2017). First, the teacher prepares a candle, and glass, after that the teacher lights the candle and the child is helped to experiment, namely closing the lit candle with a glass. Previously, the teacher explained to the children that in a few moments, the candle will dim or die, a sign that the oxygen supply in the glass is decreasing, but if the candle is closed for a while and the fire does not go out, it means that the oxygen has not decreased.

Response

Because with children doing experiments directly, they can grow their curiosity (Chandra & Fisher, 2009). While waiting for the teacher to explain to the child that when the mustard stem is dipped in the colored water and the stem changes color then the mustard or the plant needs water but, when the mustard stem does not change color then the plant does not need water. Through this game, you can train patience, critical attitude, and cultivate curiosity. Based on the results of interviews with teachers at the school, Ananda Nadhira, Hanum and Nadha were able to understand and tell how the mustard stems can change color after being dipped in the colored water and the children can repeat it or practice it again at home with their parents.

This game can create a sense of courage, curiosity, and children will feel happy when doing experiments directly. Based on the results of interviews with teachers at the school that Ananda Nadhira and Hanum could understand well and Ananda Nadha had not been able to understand well. Therefore, during the current pandemic, parents are greatly helped by learning at school even though it is not as usual. Because that way children can understand learning faster, as well as the processes of conveying learning through play, it turns out that children are easier to understand and research directions. So that it can be applied in learning at home when online as well as the teacher can more easily practice science learning to children directly and both children and teachers are not easily bored (Bauer dan Booth, 2019; Şentürk, 2017a). Science literacy learning at the school can also run smoothly and teachers can convey the learning directly.

Results

The results of the two experiments show that it is important for early childhood to be taught and introduced to science as early as possible. By placing children as the center of learning, children will feel that they are not burdened with learning tasks. The active participation of children will underlie that the learning carried out is very meaningful so that children will later choose and dare to make decisions in determining what their life choices will be (Park et al., 2016).

Both experiments teach that science can be done with components that are easily found in everyday life. The notion that science is considered difficult and boring will be lost in the child, even the independence that will arise when the child has tried how science is easy to do (Tzuo et al., 2015). This learning strategy through play is enough to give positive things to teachers and students, so the teacher feels that he can teach science in different ways, especially in conducting experimental projects outside the classroom. In addition, various obstacles were found by teachers in implementing these learning strategies, namely: 1) Teachers do not feel confident that experiments can be carried out in early childhood; 2) The teacher must think repeatedly about what experiments or experiments should be taught or practiced in early childhood according to the learning topic;

The teacher is worried that experiments conducted with children will cause problems with the children's parents, therefore it is important to consult with parents first.

Conclusion

Learning strategies to support scientific literacy in early childhood are important to do, the Covid-19 pandemic condition is one of the obstacles in limiting student and teacher learning interactions. This condition does not become weak to carry out learning innovations for early childhood. The teacher's way of implementing early childhood science literacy learning during the Covid-19 pandemic in Ra. Al-Mannaan, two learning strategies are considered important by the teachers who teach at the school, namely: learning strategies through storytelling with pictures and learning strategies through playing experimental projects. The two learning strategies have been implemented following the needs of the PAUD curriculum to support children's scientific literacy, so the overall results conclude that the implementation of learning strategies in supporting children's scientific literacy has been running smoothly. Cumulatively determined by the criteria for teachers who teach at the school where 70% of students in the school can understand and retell what is explained by the teacher and the other 30% do not fully understand.

Aspects that become benchmarks, namely: access, interaction, response, and results as a classification in determining that the evaluation carried out by the teacher on the applied learning strategy can achieve the specified learning objectives. Four aspects of measurement that show that teachers apply learning strategies are carried out in a structured and systematic manner. Thus, it would be better if this research was followed up again, there was even a broad opportunity for further research to develop based on a review of children's characteristics.

References

Abidin, Z., Rumansyah, & Arizona, K. (2020). Pembelajaran Online Berbasis Proyek Salah Satu Solusi Kegiatan Belajar Mengajar Di Tengah Pandemi Covid-19. *Jurnal Ilmiah Profesi Pendidikan*, *5*(1), 64–70. https://doi.org/https://doi.org/10.29303/JIPP.V5I1.111

Adri, H. T., Yudianto SA, Mawardini, A., & Sesrita, A. (2020). Using Animated Video Based on Scientific Approach To Improve Students Higher Order Thinking Skill. *Indonesian Journal of Social Research (IJSR)*, *2*(1), 9–17. https://doi.org/10.30997/ijsr.v2i1.23

Aeni, K., Widhanarto, G. P., & Astuti, T. (2020). Strengthening character education in elementary schools: Learning technology in school culture. *International Journal of Scientific and Technology Research*, *9*(2), 898–902.

Atta, H. B., Vlorensius, Aras, I., & Ikhsanudin. (2020). Developing an instrument for students' scientific literacy. *Journal of Physics: Conference Series*, *1422*(1). https://doi.org/10.1088/1742-6596/1422/1/012019

Bauer, J. R., & Booth, A. E. (2019). Exploring potential cognitive foundations of scientific literacy in preschoolers: Causal reasoning and executive function. *Early Childhood Research Quarterly*, *46*, 275–284. https://doi.org/10.1016/j.ecresq.2018.09.007

Bybee, R., Mccrae, B., & Laurie, R. (2009). *PISA 2006 : An Assessment of Scientific Literacy*. *46*(8), 865–883. https://doi.org/10.1002/tea.20333

Carin, A.A. & Sund, R. . (2016). STEM Education: Inovasi dalam Pembelajaran Sains. *Prosiding Seminar Nasional Pendidikan Sains*, 2016–2023. https://media.neliti.com/media/publications/173124-ID-stem-education-inovasi-dalam-pembelajara.pdf

Chandra, V., & Fisher, D. L. (2009). Students' perceptions of a blended web-based learning environment. *Learning Environments Research*, *12*(1), 31–44. https://doi.org/10.1007/s10984-008-9051-6

Fadlika, R. H., Mulyani, R., & Dewi, T. N. S. (2020). Profil Kemampuan Literasi Sains Berdasarkan Gender di Kelas X. *Quagga: Jurnal Pendidikan dan Biologi*, *12*(2), 104. https://doi.org/10.25134/quagga.v12i2.2326

Fang, Z., & Wei, Y. (2010). Improving middle school students' science literacy through reading infusion. *Journal of Educational Research*, *103*(4), 262–273. https://doi.org/10.1080/00220670903383051

Febiharsa, D., & Djuniadi, D. (2018). Pengembangan Media Pembelajaran Interaktif 3 Dimensi untuk Pembelajaran Materi Pengenalan Lingkungan Pada Anak Usia Dini di Indonesia. *Journal of Studies in Early Childhood Education (J-SECE)*, *1*(1), 75.

https://doi.org/10.31331/sece.v1i1.590

Firman, F., & Rahayu, S. (2020). Pembelajaran Online di Tengah Pandemi Covid-19. *Indonesian Journal of Educational Science (IJES)*, *2*(2), 81–89. https://doi.org/10.31605/ijes.v2i2.659

Gerde, H. K., Pierce, S. J., Lee, K., & Van Egeren, L. A. (2018). Early Childhood Educators' Self-Efficacy in Science, Math, and Literacy Instruction and Science Practice in the Classroom. *Early Education and Development*, *29*(1), 70–90. https://doi.org/10.1080/10409289.2017.1360127

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, *1*(2), 175–191. https://doi.org/10.21890/ijres.23596

Golumbic, Y. N., Fishbain, B., & Baram-Tsabari, A. (2020). Science literacy in action: understanding scientific data presented in a citizen science platform by non-expert adults. *International Journal of Science Education, Part B: Communication and Public Engagement*. https://doi.org/10.1080/21548455.2020.1769877

Hasanah, U. (2018). Implementasi Pendidikan Multikultural dalam Membentuk Karakter Anak Usia Dini. *Golden Age: Jurnal Pendidikan Anak Usia Dini*, *2*(1), 35–53. https://doi.org/10.29313/ga.v2i1.3990

Herliandry, L. D., Nurhasanah, Suban, M. E., & Heru, K. (2020). Transformasi Media Pembelajaran Pada Masa Pandemi Covid-19. *Jurnal Teknologi Pendidikan*, *22*(1), 65–70. http://journal.unj.ac.id/unj/index.php/jtp

Khishfe, R. (2014). A Reconstructed Vision of Environmental Science Literacy: The case of Qatar. *International Journal of Science Education*. https://doi.org/10.1080/09500693.2014.951980

Koparan, T., & Güven, B. (2015). The effect of project-based learning on students' statistical literacy levels for data representation. *International Journal of Mathematical Education in Science and Technology*. https://doi.org/10.1080/0020739X.2014.995242

Lowe, R. (2014). Embodiment in emotional learning, decision making, and behavior: The "what" and the "how" of action. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, *8515 LNCS*(PART 3), 672–679. https://doi.org/10.1007/978-3-319-07446-7_64

Maison, Kurniawan, D. A., & Anggraini, L. (2021). Perception, Attitude, and Student Awareness in Working on Online Tasks During the Covid-19 Pandemic. *Jurnal*

Pendidikan Sains Indonesia (Indonesian Journal of Science Education), *9*(1), 108–118. https://doi.org/10.24815/jpsi.v9i1.18039

Mansur, N. (2018). Melatih Literasi Matematika Siswa dengan Soal PISA. *Prisma*, *1*, 140–144.

Mantzicopoulos, P., Patrick, H., & Samarapungavan, A. (2013). Science Literacy in School and Home Contexts: Kindergarteners' Science Achievement and Motivation. *Cognition and Instruction*, *31*(1), 62–119. https://doi.org/10.1080/07370008.2012.742087

Nur, C. M. (2018). Bully Phenomenon toward the Appearance of Violence in Educational Institutions (A Case Study in North Aceh). *Asian Social Science*, *14*(4), 23. https://doi.org/10.5539/ass.v14n4p23

OECD. (2019). What Students Know and Can Do: Indonesia. *Oecd*, 1–10. https://www.oecd-ilibrary.org/education/pisa-2018-results-volume-iii_bd69f805-en%0Ahttps://www.oecd-ilibrary.org//sites/bd69f805-en/index.html?itemId=/content/component/bd69f805-en#fig86

Panjaitan, S. (2017). Meningkatkan Hasil Belajar Ipa Melalui Media Gambar Pada Siswa Kelas Iia Sdn 78 Pekanbaru. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, *6*(1), 252. https://doi.org/10.33578/jpfkip.v6i1.4105

Park, M., Patterson, L. G., & Park, D. (2016). *Early childhood teachers ' beliefs about readiness for teaching science, technology, engineering, and mathematics*. https://doi.org/10.1177/1476718X15614040

Patel, M., & Patel, N. (2019). Exploring Research Methodology : Review Article. *International Journal of Research and Review*, *6*(3), 48–55.

Pereira, S., Rodrigues, M. J., & Vieira, R. M. (2019). Scientific literacy in the early years – practical work as a teaching and learning strategy. *Early Child Development and Care*, *0*(0), 1–15. https://doi.org/10.1080/03004430.2019.1653553

Pholphirul, P. (2017). Pre-primary education and long-term education performance: Evidence from Programme for International Student Assessment (PISA) Thailand. *Journal of Early Childhood Research*, *15*(4), 410–432. https://doi.org/10.1177/1476718X15616834

Rahmi, P., & Hijriati. (2021). Berdasarkan Karakteristik Perkembangannya. *Program Studi Pendidikan Islam Anak Usia Dini Fakultas Tarbiyah dan Keguruan UIN Ar-Raniry Banda Aceh*, 141–154.

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online University Teaching During and After the Covid-19 Crisis: Refocusing Teacher Presence and Learning Activity. *Postdigital Science and Education*, *2*(3), 923–945.

https://doi.org/10.1007/s42438-020-00155-y

Ratheeswari, K. (2018). Information Communication Technology in Education. *Journal of Applied and Advanced Research*, *3*(S1), 45. https://doi.org/10.21839/jaar.2018.v3is1.169

Reinoso, R., Delgado-iglesias, J., & Fernández, I. (2019). Pre-service teachers ' views on science teaching in Early Childhood Education in Spain Pre-service teachers ' views on science teaching in Early Childhood Education in Spain. *European Early Childhood Education Research Journal*, *0*(6), 1–20. https://doi.org/10.1080/1350293X.2019.1678720

Sa, B., Ezenwaka, C., Singh, K., Vuma, S., & Majumder, M. A. A. (2019). Tutor assessment of PBL process: Does tutor variability affect objectivity and reliability? *BMC Medical Education*, *19*(1), 1–8. https://doi.org/10.1186/s12909-019-1508-z

Schleicher, A. (2019). PISA 2018 insights and interpretations. *OECD Publishing*, 64. https://www.oecd.org/pisa/PISA 2018 Insights and Interpretations FINAL PDF.pdf

Şentürk, C. (2017a). Science Literacy in Early Childhood. *IOSR Journal of Research & Method in Education (IOSRJRME)*, *07*(01), 51–62. https://doi.org/10.9790/7388-0701035162

Şentürk, C. (2017b). *Science Literacy in Early Childhood Science Literacy in Early Childhood*. *November*. https://doi.org/10.9790/7388-0701035162

Singh, M., & McNeil, J. T. (2014). Do learning environments differ across subjects and nations: Case studies in Hawaii and Singapore using the WIHIC questionnaire. *Learning Environments Research*, *17*(2), 173–189. https://doi.org/10.1007/s10984-013-9145-7

Taylor, S. V., & Leung, C. B. (2020). Multimodal Literacy and Social Interaction: Young Children's Literacy Learning. *Early Childhood Education Journal*, *48*(1). https://doi.org/10.1007/s10643-019-00974-0

Trundle, K. C. (1999). *The Inclusion of Science in Early Science and the Early Childhood Years*. 1–6. https://doi.org/10.1007/978-94-017-9505-0

Tzuo, P. W., Toh, L. P. E., & Liang, J. C. (2015). Early childhood teachers' views towards using constructivist internet-based environments to support Children's learning activities: A mixed-methods study. *Australasian Journal of Early Childhood*, *40*(1), 81–90. https://doi.org/10.1177/183693911504000111

Wingsi, M. S. (2020). *Analisis Percobaan Sains terkait Lingkungan terhadap Kemampuan Berpikir Kritis Anak di Taman Kanak-kanak*. *4*, 1228–1236.