SCIENCE PROCESS SKILLS IN PRE-SCHOOLERS THROUGH PROJECT APPROACH

Norazizah Abdul Rahman
Noor Ashikin Mohd Yusop
Sopia Md Yassin

ABSTRACT

The purpose of this research was to discover science process skills through project approach in pre-schoolers. The research was constructed holistically in a kindergarten in Perak through a qualitative case study methodology in multiple cases that involved Organic Fertilizer Case and Chocolate Gallery Case. Participants of the study involved two focus groups, including twenty children and two instructors. The involvement of participants was based on a framework called Responsive Participatory Framework. Research data were obtained through three methods, including unstructured interview, observation, and documentation. The overall data research showed that the science process skills in children were dominated by observation skills using senses, followed by classifying, inferences and measuring. Hence, exposing science process skills from early childhood can help children in mastering a science concept. Therefore, project approach activity was an approach for child brain development towards scientific thinking by the year 2050.

Keywords: Science Process Skills, Project approach, Early Childhood Education, Environment Education, Preschool.

INTRODUCTION

Preschool education is a basic eduction for children and an important aspect of the education process and child development for early stage school. Emphasis on basic learning in children is a main catalyst to promote greater individual growth and development because the children are developing their attitude and skills (KSPK, 2009). For the purposes, there are six main elements need to be incorporated for a balance personal growth. One of the leading aspects is a foundation in science and technology that stresses on scientific knowledge, science process skills, and attitude towards science.

However, the majority of teachers believe that by constructing critical thinking skills through the strategies of different teaching approaches can have a positive effect during the learning session (Soper et al., 2003). On the other hand, if a teacher understands a lesson strategy, it will give an overview of the students' understanding and how the students respond to problem solving questions (Akinoglu, 2008). This statement is in line with the results of the Program for International Student Assessment (PISA) test 2012 report that Malaysia is ranked 39 with the participation of 44 countries in the PISA problem-solving test proving that the mastery of science concepts is less dominated by students. A science concept can be obtained through the skills of a science process that has been learned by children.

In the meantime, the beginning of science learning also touches on the basis of science process skills that needs to be learned by children through investigation activity. A list of the basic elements of science process skills include observing, classifying, inferring, measuring, predicting, and communicating (KSPK, 2016). Apart from that, the contexts of teaching and learning the projects activity is a way that is adequate in letting the children to practice science process skills through exploration.

During the early stage of children education, a project is an open research in daily life that is being integrated into the education program. Project starts when developing children are asking questions based on their interests. Usually, instructors are able to give an instant answer to the questions asked by the children. However, through the project approach activity, instructors will be able to prepare a knowledge-based experience that is out-of-the-box, which then allow the children to find the answers on their own by making an investigation when running a fieldwork or questioning the experts and parent involvement (Helm & Beneke, 2003).

PROJECT APPROACH

In general, project has three phases that are indirectly linked to one another. The design frame is created to help instructors to focus systematically on the attention and the interest of children on the topic to be discovered. In fact, this design is similar to an interesting book's narrative that starts with introduction plot, which is Phase I (Beginning), then intermediate story Phase II (Investigation) and end with a highlight or a finishing of a storyline (Inaugiral Exhibition). Other than that, this design is also helping the process of project creation with a story

quality in narrative and an increase in the productivity at an optimum stage and easy to be memorized (Katz, 2013).

Katz and Chard (1994) state that the main goal for Phase I is to set up an interaction between the children through information sharing, ideas, and existing experience about a discussed topic. During the time, teachers or instructors can help the children to develop basic understanding to start an investigation about the discussed topic in details. Even though it is still in a pre-discussion stage, according to Helm and Katz (2011), instructors should be encouraging the children to talk about the topic through playing and to draw the existing experience about the discussion according to their styles.

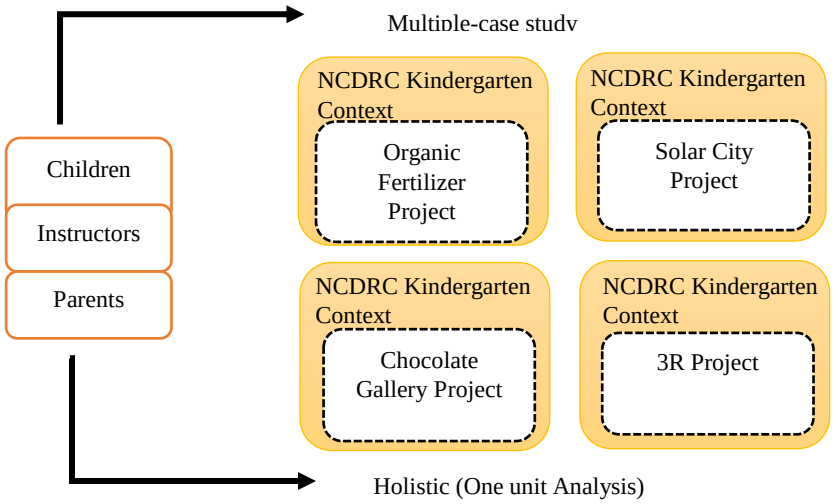
The second phase of the project is a phase to carry out an investigation to find an answer to the question that is initiated at the end of Phase 1. Therefore, Phase 2 has many methods to collect a data and to acquire new information. One of the approach that is used by instructors to get an information is by planning a trip outside the class, inviting an expert to talk with the children and demonstrating an expertise on a topic (Helm & Katz 2011; Katz, 2010).

Phase III is a time to reflect on the level of the new knowledge and the comprehension that has been mastered by the children. This is due to the level of knowledge shown by the children is not only through playing, but also through display materials, drama and dance, scrapbook, model, and games (Katz, Chard & Kogan, 2014). During the highlighted event, parents are also being invited to see and to listen to the explanation from their children about the concept that have been learned by them during the project and the way they master the subject of interest and procedure to construct and to deliver the project (Katz, Chard & Kogan, 2014).

METHODLOGY

The case study used multiple-case design by Yin (2015), to connect empirical data to research questionnaire and conclusion. The goal of this research was to explore the process of implementing the Environmental Education through Project approach on preschoolers.

Diagram 1: Multiple-Case Study

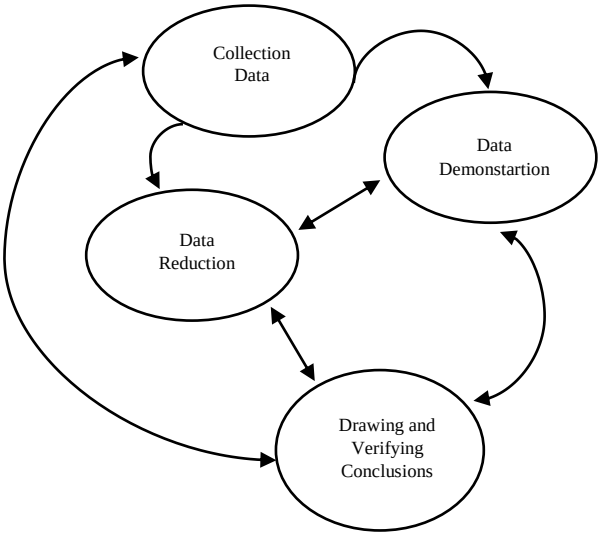


The multiple-case study included a compilation of single cases. Four matrices in Diagram 1 were the single cases that had been conducted in this research. These single cases had their own similarities in terms of characteristics (gender), environment (school), and category (KSPK standard). However, the dotted line in the above matrices showed the limit of the researched cases and contexts might be the same. Therefore, the compilation of these single cases was a description of the whole conducted research. (Yin, 2015). Researched participants included children aged 5+ with two instructors from a kindergarten in Tanjung Malim, Perak.

DATA ANALYSIS

The process of analyzing data was done when data collection had been completed. After collecting the data, researchers started to classify the data accordingly through the analytical process. The data from this research had been analyzed through content analysis method based on a theme (Miles & Huberman, 1994) and narrative analysis. In this research, the collected data that were obtained through observation, interviews, and proven documents had been analyzed based on an approach that had been presented by Miles & Huberman (1994), which has three main components including, (1) data reduction, (2) data demonstration, and (3) drawing and verifying conclusions.

Diagram 2. Interactive data analysis. Adapted from "Interactive Model" by M.B. Miles and A. M. Huberman, 1994, page 12.



RESULTS

This section answered the question initiated on study case 3 (iii), which was **'How far children use science process skills during their investigation?'** This research concluded nine elements of science process skills that had been developed by the children. To get the data, two children had participated in an unstructured interview. Besides, observation data through video and document were also being collected from both Organic Fertilizer and Chocolate Gallery cases. The objective of the interview, observation, and documentation was to obtain the data needed about their proficiency in science process skills, which include (1) observation, (2) classification, (3) making inferences, (4) prediction, (5) measure using numbers, (6) communication. A list was used in this research as a reference named, indicator checklist of science process skills for children that had been adapted and changed according to the definition of science process skills that was presented by Bahagian Perkembangan Kurikulum (2012).

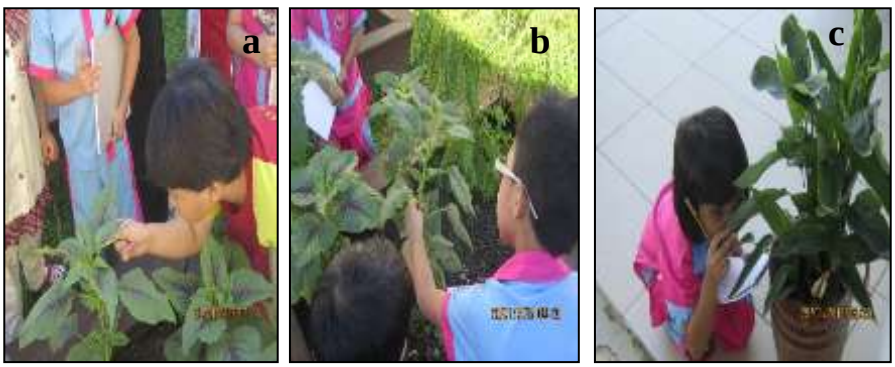
1. OBSERVATION

Observation data showed that proficiency of observation skills in children included (1) obtained data using by using different senses, (2) used suitable device and instrument to help senses to observe in precise, (3) recognized changes that occur due to physical-changed phenomena or chemical-changed phenomena. Proficient skills were crucial because it can develop curiosity and bring the children to the next investigation stage.

USING VARIOUS SENSES

Observation data through video showed that proficiency in observation skills dominated by the children was the utilization of five senses (see, hear, smell, touch, and taste) along the investigation. Observation skill was constructed qualitatively which involves the use of senses on object characteristics and properties or phenomena. Observation RE(2)O/RV-29/1 (paragraph.1), shows that natural instinct in children take place when they were asked to make an observation in the Edible Garden. Some responses that were shown by them were, asking questions, observing leaf surfaces in details, touching tree branches, and smelling trees around the school compound.

Diagram 3. a) Observing leaf surfaces in detailed b) Touching leaves parts c) Smelling by using the sense of smell



Observation data on March 1, 2016 supports the results where the children interacted easily when using different senses during investigation activity through realistic objects around them. Observation through video proved that the children used senses to collect the data of the object that was being studied. Study on plant seeds Diagram 4.

Diagram 4. Exploration plant seeds

Example 1. Sense of smell using nose:

Teacher Hana	:	*Do you think this fruit has a smell (mango)?*
Fayyad	:	*It has a sweet smell!*
Haifa	:	*Smell like "buah mata kucing"!*
Fayyad	:	*(Take the orange and asks his friend to smell the fruit). "Have a smell! The smells are really nice!!! Emmm. Sara takes the orange from Fayyad, then she smells the fruit.*
Sara	:	*Smells like orange!*
Haifa	:	*So sweet, I like the smell!*

RE (9) O/RV-1/3 (paragraph. 2)

Diagram 5. Smelling apple and mango

Example 2. Sense of taste using tongue

Teacher Hana	:	*Have a try …Don't just eat it! Guess how does it taste like? (While feeding the children).*
Luqman	:	*Oooh, sweet…tasty and sweet!*
Haifa	:	*It's tasty, but a little bit sour!*
Sara	:	*Tasty…a…ah…Really sweet and delicious.*
Muaz	:	*Isn't it not sour? It is sweet, Haifa!*
Haifa	:	*It is tasty, but a bit sour.*

RE (9) O/RV-1/3 (paragraph. 4)

Diagram 6. Tasting mango using tongue


Observation on February 15, 2016 showed that children can spot the differences and similarities on leaves. They were able to discover the difference on the leaf surfaces which was, a different line pattern. In fact, the children were also able to find the difference in colors on the front side and the back side of the leaves. Other than that, children were able to state that a tree has a similar features *"all tress have branches, leaves, and"*RE (6) O/RV-15/2 (paragraph. 4).

Diagram 7. Similarities on leaf lines


When investigating, the different characteristic can be spotted on the leaf surfaces. Observation through videos show that the children started to observe in detailed and begun to ask questions. They said:

Why the spinach does has a purple spot in the middle? It is not the same as the cabbage that is all green!

RE (2) O/RV-29/1 (paragraph. 1)

USING SUITABLE DEVICE AND INSTRUMENT TO HELP SENSES OBSERVE IN DETAILED

Recoded observation data showed that the used of apparatus in a scientific way was limited in children. An apparatus that had been used oftenly and preferable by children was the magnifying glass. The used of magnifying glass was very synonym in children, in fact, they know that the function of the device was to magnify a small object RF (4) O/CP-5/4 (notes m.s. 1). A child said:

This glass is used to make the leaf looks bigger. Small things become huge when it is used!
Digram 8. The usage of magnifying glass in exploration world


CHANGE IN MATERIALS CONDITION PHYSICALLY OR CHEMICALLY

For the Organic Fertilizer Case, the children need to observe the changes in the physical of a material through a decomposition process by microorganisms. The children were able to state that leftover food changed to fertilizer because of the bacteria reacted in the Yakult. They said:

The vegetables had changed to fertilizer because Shirota help to smash it.

RE (22) O/RV-12/4 (paragraph. 2)

Diagram 9. Discussion about the function of microorganisms

Observation on Chocolate Gallery Case showed that the children learned a new concept through the completed activity. The children were able to observe the changing process of material from solid to liquid when heat was absorbed. The activity of chocolate making involved the process of material change that can be observed directly by the children.

Diagram 10. Observation of the process of material change

2. Inferences

In general, both cases showed that children mastered the skills to make inferences. This is clearly shown from the video observation where the children are able to make an initial statement on an observation and used existing evidences to make an explanation. Besides, proficiency in a skill of making inferences also helped children to initiate a hypothesis by investigating RE (2) O/RV-29/1 (paragraph.2).

Interview data supported the observation that children were skillful to make inferences because they were likely to presume and try to make an early conclusion on an observation.

Researcher	:	*Why this leaf does has a hole?*
Fayyad	:	*Because it was eaten by the caterpillar?*
Researcher	:	*How does Fayyad know that it was eaten by the caterpillar?*
Fayyad	:	*Because there is a bite trace here...Have a look Teacher!*
Researcher	:	*Fayyad, who do you think had bitten this leaf?*
Fayyad	:	*Of course the grasshopper! Becasue grasshopper likes to eat the leaf… ha!*

RE2 (1) I-29/01 (line 01-08)

Diagram 11. 'Kedondong' leaves that had been eaten by caterpillars

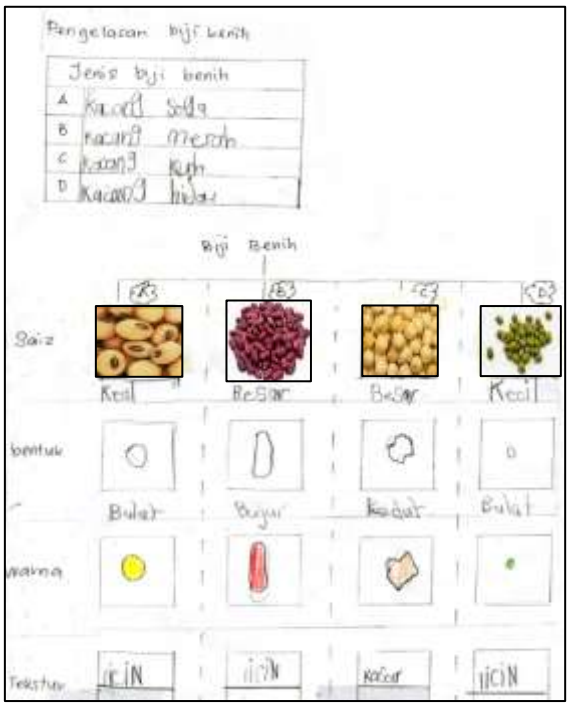
3. Classifying

A document from DTR05 (19/03), children find out that classification skills allow them to learn something new easily by comparing a similar characteristic. Besides that, the children realized that, there were many ways that can be used to classify an object or an event.

When classification activity was performed, two characteristics were detected by the researcher, the children had (1) compiled characteristics according to their category and (2) classified objects in small groups based on the same characteristics.

Diagram 12. Object classification in small groups based on the same characteristics

Diagram 13. Compiling characteristics according to their category



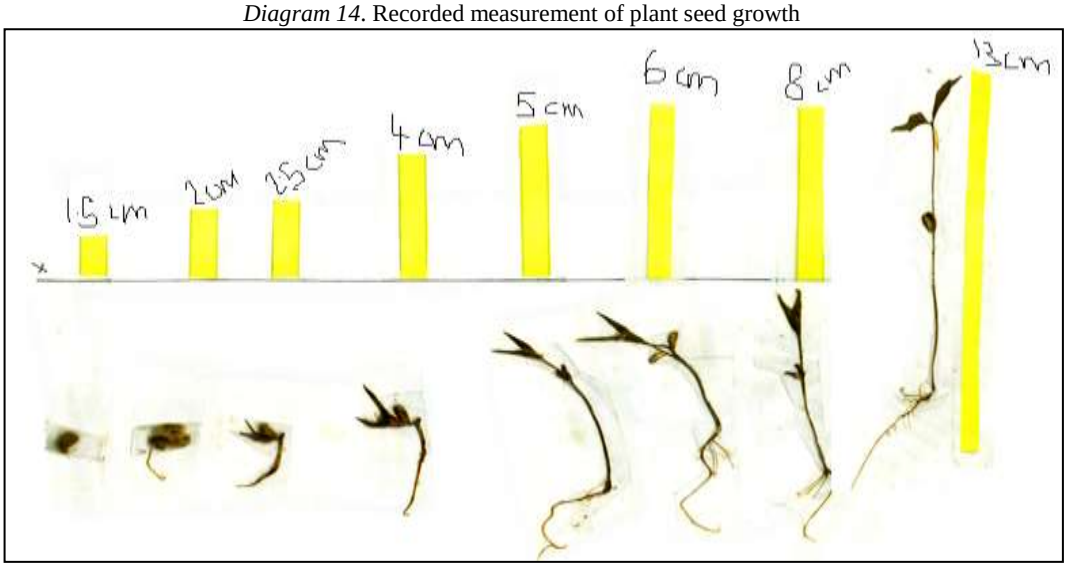
4. Measure using numbers

Proficiency in utilizing numbers is crucial for the children when investigating. This skill allowed the children to use measuring devices such as, rulers, beakers, and measuring cylinders to estimate height, distance, area, and

volume when they are necessary to be used. As a matter of fact, when the children were able to master this skill, they will be able to get used to general measurement that can be practiced in daily life.

Observation data on March 07, 2016 showed that the children mastered the skill when they used measuring devices correctly when they were investigating. Besides, the children used numbers to record the measurement of the height of plant seeds by using a ruler precisely. Document DTR05 (04-10/3/16), was an observation data that showed proficiency in measuring skill using numbers had been mastered by the children. Diagram 14 was a recorded data by the children by using a precise measuring tool which was a ruler.

Diagram 14. Recorded measurement of plant seed growth



5. Communication

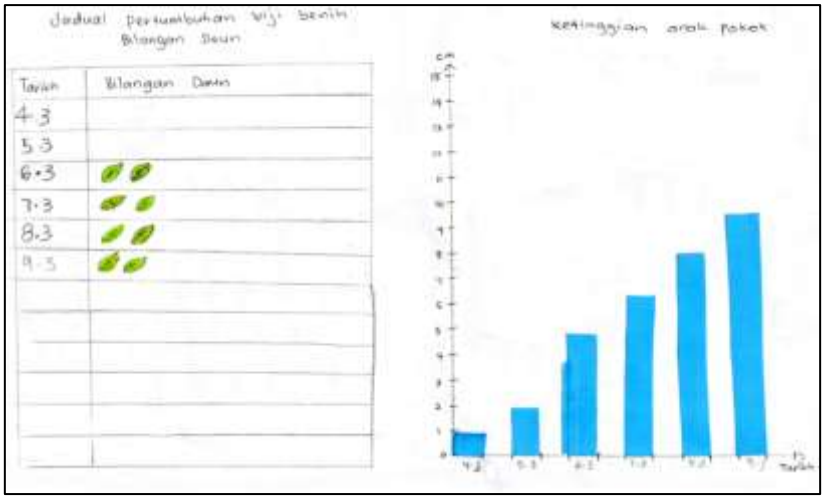
Communication skills occurred when the children started to participate in activity such as receiving information, or spreading information, or sharing information with peers, teachers and parents. Skill proficiency occurred when the children were conversing, listening or writing to deliver ideas, to draw or to record findings through exploration.

The overall research for both cases showed that children used charts, graphs, and tables to deliver information and details. Other than that, based on the proficiency of communication skills, children frequently ask clear questions about a phenomena RE (4) O/CP-3/2 (notes ms 1).

Communication devices were used by the children to explain and to describe an object or event that had been explored. They made an overall summary by describing in verbal, graphics, models, webs, charts, drawings and tables.

For example, the children created a completed graph to show the growth of seeds in Digram 4.9. The collected data was based on observation on the carried out investigation on March 04, 2016.

Diagram 15. Graph of the growth of seeds



CONCLUSION

Project approach was a learning way that emphasized on investigation activity. Investigation explored by children was an activity that rich in knowledge and content of a topic. Besides, every investigation activity involved hands-on activity that allowed children to use realistic resources and materials. Moreover, to ensure that an investigation was explored successfully by the children, thus science process skills were used as a basic element in any exploration. Therefore, to ensure that the development of science process skills was effective, observation data concluded that children used almost all the basics of science process skills which were, to observe, classify, infer, predict, measure using numbers, and communicate.

Brenneman et al., (2007) sees that observing gives children the opportunity to see the world around them, arousing curiosity and exploring phenomena. The constant experience of using senses while exploring and explaining the various ingredients found requires support from adults. In order to ensure success in an investigation activity of the ability to build questions on what children are aware of is capable of forming them as a good observer.

In fact, Padilla (1990) argues that basic science process skills should be mastered by every child through various curriculum branches, which is because he believes that this skill also helps children in mastering a concept about their environment. In addition, Leigh and Rebecca (2006); Baldwin, Adams & Kelly (2009) also support that children more easily master the basic science process skills when an activity is explored across multiple domain domains, especially in science learning. In fact, they argue that scientific exploration in children by scientific means is capable of producing systematic models in life.

Even though this study found out that observation skills were more dominant compared to the other science process skills, this was due to the research findings that shows the children interacted easily with the environment by using their organ senses when investigating. Next, project approach activity encouraged the children to make a prediction based on their knowledge and daily life experiences. Observation data proved that the children were able to predict the effect and the impact in the investigation that they accomplished.

Other than that, the results conclude that children can comprehend the science process skills when they are able to solve a particular problem that relates to to their daily life by making an effective and a concrete when exploring the issue. In the meantime, the results also show that the integrated science process skills are capable of making a hypothesis and ensuring that investigations are more relevant and meet the questions traits.

References

Akinoglu, O. (2008). Assessment of the Inquiry-Based Project Application in Science Education upon Turkish Science Teachers' Perspectives. *Education*, *129.2* (Winter 2008), 202–215.

Helm, J. H., & Beneke, S. (Eds.). (2003). *The power of projects: meeting contemporary challenges in early childhood classrooms--strategies and solutions* (Vol. 87). New York, NY: Teachers College Press.

Helm, J. H., & Katz, L. G. (2011). *Young investigators: The project approach in the early years*. New York, NY: Teachers College Press.

Katz, L. G. (2010, May). STEM in the Early Years. In *STEM in Early Education and Development Conference, Cedar Falls, Iowa, May*. Diperolehi daripada *http://ecrp. uiuc. edu/beyond/seed/katz. html*.

Katz, L. G., & Chard, S. C. (1994). The Project Approach. *ERIC Clearinghouse on Elementary and Early Childhood Education Urbana IL*, 1-6. Diperolehi daripada ERIC database. (ED368509)

Katz, L., & Chard, S. C., & Kogan, Y. (2014). *Engaging children's minds: The project approach* (3rd ed.). ABC-CLIO, LLC: Santa Barbara, California.

Katz, L.G. (2013). Resources For Early Childhood Educators Collage [Peer Commentary on the paper "The Teacher's Role in The Project Approach] diperolehi daripada http://www.communityplaythings.com/resources/ articles/2013/the-teachers-role-in-the-project-approach"

Kementerian Pelajaran Malaysia. (2009). Kurikulum Standard Prasekolah Kebangsaan (Pelaksanaan Pengajaran). Putrajaya: Bahagian Pembangunan Kurikulum.

Kementerian Pelajaran Malaysia. (2016). *Dokumen Standard Kebangsaan Prasekolah*. Putrajaya: Bahagian Pembangunan Kurikulum

Monhardt, L., & Monhardt, R. (2006). Creating a context for the learning of science process skills through picture books. *Early Childhood Education Journal*, *34*(1), 67-71.

Padilla, M. J. (1990). The science process skills. *Research Matters-to the science Teacher*, *9004*.

Soper, J. C., Walstad, W. B., Abrams, L. M., Pedulla, J. J., Madaus, G. F., & Vanfossen, P. J. (2003). Views from the Classroom : Teachers '. *Theory & Research in Social Education*, *28*(3), 391–410. http://doi.org/10.1080/00933104.2000.10505914

Yin, R. K. (2015). *Qualitative research from start to finish* (2nd ed.). New York, NY: Guilford Publications.

Authors:

Norazizah Binti Abdul Rahman
Pusat Penyelidikan Perkembangan Kanak-Kanak Negara
Universiti Pendidikan Sultan Idris
norazizahabdulrahman@gmail.com
017-5557515
Noor Ashikin Binti Mohd Yusop
Pusat Penyelidikan Perkembangan Kanak-Kanak Negara
Universiti Pendidikan Sultan Idris
noorashikinmohdyusop@gmail.com
017-5350242

Prof. Dr. Sopia Md Yassin
Pusat Penyelidikan Perkembangan Kanak-Kanak Negara
Universiti Pendidikan Sultan Idris
sopia@fsmt.upsi.edu.my
015-48797129