

IMPROVING EARLY CHILDHOOD COGNITIVE ABILITIES THROUGH SCIENCE-BASED LEARNING IN RA NURUL YASIN MEJOBLO KUDUS DISTRICT

Ismartoyo¹, Aini Indriasih², Yuli Haryati³, Dian Ratu Ayu Uswatun Hasanah⁴

¹Universitas Terbuka, Semarang, Indonesia

²Universitas Terbuka, Semarang, Indonesia

³Universitas Terbuka, Semarang, Indonesia

⁴Universitas Terbuka, Semarang, Indonesia

¹ismartoyo@ecampus.ut.ac.id, ²aini@ecampus.ut.ac.id,

³yuliharyati@ecampus.ut.ac.id ⁴dian.khasanah@ecampus..ac.id

Abstract

The purpose of the study is to test how science learning can measure the congenital development of early childhood. So from these problems, researchers need to know whether the implementation of science-based learning has an effect and can improve early childhood cognitive development in RA Nurul Yasin, Kudus Regency. The sample of this study was 17 early childhood children in RA Nurul Yasin, Mejoblo District, Kudus Regency in 2022. The design of experimental research was explored using activity experiments with observations. The analysis used is the analysis of different tests before and after the experiment. The results showed that there was an influence of 0.411 with a sig of 0.128. This indicates an increase in the ability of cognitive abilities after being given treatment.

Keywords: Early Childhood, Science learning, cognitive abilities.

Abstrak

Tujuan dari penelitian ini adalah untuk menguji bagaimana pembelajaran IPA dapat mengukur perkembangan bawaan anak usia dini. Maka dari permasalahan tersebut peneliti perlu mengetahui apakah penerapan pembelajaran berbasis sains berpengaruh dan dapat meningkatkan perkembangan kognitif anak usia dini di RA Nurul Yasin Kabupaten Kudus. Sampel penelitian ini adalah 17 anak PAUD di RA Nurul Yasin Kecamatan Mejoblo Kabupaten Kudus tahun 2022. Desain penelitian eksperimen yang digunakan adalah eksperimen aktivitas dengan observasi. Analisis yang digunakan adalah analisis uji beda sebelum dan sesudah percobaan. Hasil penelitian menunjukkan bahwa terdapat pengaruh sebesar 0,411 dengan sig sebesar 0,128. Hal ini menunjukkan adanya peningkatan kemampuan kognitif setelah diberikan perlakuan.

Kata kunci: Anak Usia Dini, Pembelajaran IPA, kemampuan kognitif.

INTRODUCTION

Early childhood education is a coaching effort aimed at children from birth to the age of six. It is carried out through the provision of educational stimuli to help physical and spiritual

growth and development so that children have readiness to enter further education.¹ This education is carried out through the provision of stimuli to help further growth entering education, which is organized on formal, non-formal, and informal pathways. The age of 0-6 years is the golden age period, at which time the child's brain develops rapidly.²

Early childhood education is the most basic education occupying a very strategic position in the development of human resources.³ Early childhood development includes several aspects including aspects of motor growth and development, aspects of cognitive development, aspects of socio-emotional development, aspects of language development, and aspects of moral development. In this paper the author only explores the problems regarding aspects of cognitive development in early childhood.⁴

Early childhood development aimed at children from birth to the age of six years is carried out through the provision of educational stimuli to help physical and spiritual growth and development, so that children have readiness to enter further education.⁵ Early Childhood Education is a form of education that focuses on laying the foundation towards physical growth and development, intelligence, social emotional, language and communication in accordance with the uniqueness and stages of development that early childhood goes through, so that children have readiness to enter basic education and further education.⁶

Science learning has an important role in improving the quality of education, especially in producing quality students, namely humans who are able to think critically, creatively, and logically. Nugraha stated that the development of science learning in children, and other areas of development has a very important role in helping to lay the foundation of the expected ability and formation of human resources.⁷ This is because science learning is a child's activity that is carried out by exploring various objects around them. The improvement of cognitive abilities through the study of science in practice is often carried out less in accordance with the objectives and less touching on the essence. This is often done by selecting materials, methods, strategies, and techniques that are not in accordance with the child's abilities. Science learning is often delivered by the lecture method so that the teaching and learning process is only one direction centered on

¹ Yuliani Nurani, *Strategi Pembelajaran* (Jakarta: Pusat Penerbitan Universitas Terbuka, 2008).

² Yesi Novitasari, "Analisis Permasalahan" Perkembangan Kognitif Anak Usia Dini," *PAUD Lectura: Jurnal Pendidikan Anak Usia Dini* 2, no. 01 (2018): 82–90.

³ Departemen Pendidikan Nasional, *Pedoman pembelajaran bidang pengembangan pembiasaan di taman kanak-kanak* (Departemen Pendidikan Nasional, 2007).

⁴ Ubaidillah, "Pengembangan minat belajar kognitif pada anak usia dini," *JCE (Journal of Childhood Education)* 3, no. 1 (2020): 58–85.

⁵ Ahmad Susanto, *Perkembangan Anak Usia Dini: pengantar dalam berbagai aspeknya* (Kencana Prenada Media Group, 2011).

⁶ Bambang Sujiono dan Yuliani Nurani, "Menu pembelajaran anak usia dini," *Jakarta: Yayasan Citra Pendidikan Indonesia*, 2005.

⁷ Ali Nugraha, *Pengembangan pembelajaran sains pada anak usia dini* (Jakarta: Depdiknas, 2005).

the teacher. Children are less trained to develop cognitive abilities, so learning less touches on the needs and potential of children to develop optimally.

The nature of science is not only a product but also a process and affective, demanding that science learning is not only in the form of knowledge transfer but a process of constructivism.⁸ Husdarta and Nurlan state that science process skills make students learn to think like a scientist. Science process skills will help students to learn about nature well, and contribute to the mental development and attitudes of students.⁹

Yulianti mentioned that the purpose of science activities in children aged 5-6 years is to develop the ability of students in: (a) Exploration and investigation, namely activities to observe and investigate objects and natural phenomena (b) Develop basic science process skills, such as making observations, measuring, communicating the results of observations, and so on. (c) Develop curiosity, a sense of excitement and willingness to carry out inquiry or discovery activities. (d) Understand knowledge of various objects, both their characteristics, structure and function.¹⁰

At the ECCE level, science learning emphasizes learning that is directed at learning experiences to design and create a work through the application of science concepts and scientific work competencies wisely, that way through the understanding of science obtained students can solve various problems experienced in everyday life.¹¹ The skill of solving various problems is planning experiments including the ability to determine the variables to be observed and measured, determine the tools and materials to be used in the experiment, and determine the experimental steps to be taken.¹² But unfortunately there are still problems in science learning that are still unresolved, including for aspects of the context of science applications, it is proven almost certainly that many students are unable to relate the knowledge of science they learn to phenomena that occur in everyday life, because students do not gain experience to relate to them.¹³ It is feared that this will have an impact on the quality of students as a whole, where in the end students will have difficulty in competing with human resources from other countries in facing various global issues.

With these scientific abilities it allows the child to construct his own knowledge as a result of sensory experiences that are then passed on with his thought processes. Nurmasari, et al that

⁸ Adelia Alfama Zamista dan Ida Kaniawati, "Pengaruh model pembelajaran process oriented guided inquiry learning terhadap keterampilan proses sains dan kemampuan kognitif siswa pada mata pelajaran fisika," *Edusains* 7, no. 2 (2015): 191–201.

⁹ J. S. Husdarta dan Nurlan Kusmaedi, "Pertumbuhan dan Perkembangan Peserta Didik: Olahraga dan Kesehatan," *Bandung: Alfabeta*, 2010.

¹⁰ Dwi Yulianti, "Bermain sambil belajar sains di taman kanak-kanak," *Jakarta: PT indeks*, 2010.

¹¹ Dudu Suhandi Saputra, Yuyu Yuliaty, dan Reza Rachmadtullah, "Use of ladder snake media in improving student learning outcomes in mathematics learning in elementary school," dalam *Journal of physics: conference series*, vol. 1363 (IOP Publishing, 2019), 012058.

¹² Zamista dan Kaniawati, "Pengaruh model pembelajaran process oriented guided inquiry learning terhadap keterampilan proses sains dan kemampuan kognitif siswa pada mata pelajaran fisika."

¹³ Eka Aprilia Permatasari, "Implementasi pendekatan saintifik dalam kurikulum 2013 pada pembelajaran sejarah," *Indonesian Journal of History Education* 3, no. 1 (2014).

learning activities that are suitable for the development of science learning are to apply abilities at each stage. Meanwhile, not all science skills can be taught to children, so in its implementation it must be adjusted to the level of development of kindergarten children.¹⁴

Generally, children's science learning in kindergarten still has difficulties because teachers only use the assignment method. Children only learn by listening to the teacher's explanation and then the child does assignments in the form of children's worksheets. This task is not yet understandable because the child does not experience direct experience in an experimental process. To gain experience in the trial process requires facilities and methods that support through activities that can include the process. For example: through observation, discussion, experimentation or relevant media.

Science learning in kindergarten should be done with learning methods that can provide opportunities for children to be active in exploring their various ideas. As part of its learning mechanism, children need to develop on their own various hypotheses and continuously prove them. Trains his own thought processtain observing what is happening and what he finds then asks questions as well as formulates answers.

Based on the results of observations, teachers at RA Nurul Yasin learning science still use the method of lectures and discussions in science learning. The child only hears, sits, and is silent, so the child is less given the opportunity to gain real experience or in other words the child becomes passive in teaching and learning activities. In fact, the essence of science learning is to provide challenging experiences so as to facilitate children's curiosity by presenting varied, fun learning, as well as to observe and explore various kinds of physical objects, nature, or events that exist in the child's environment.

In fact, in RA Nurul Yasin Mejobo, Kudus Regency, there is still a learning centered on teachers, children as learning objects. Thus it can be interpreted that learning in schools tends to optimize academic abilities. While the development of critical, creative and innovative thinking, has not been done much. This opinion is supported by the results of Musthafa's research in Yuliani that there are several learning problems that occur in the classroom, namely: (1) the role of the teacher is still very dominant, this is evidenced by the main activity of the teacher in the classroom only conveying information that is one-way so that children tend to be passive, (2) most teachers rely on the selection of teaching materials in standardized textbooks, so that students do not get a realistic and useful perspective for problem solving in daily life, (3) the existence of seating arrangements and assignments that tend to isolate one child from another, thus making it difficult

¹⁴ Zainal Aqib, "Pedoman Teknis Penyelenggaraan PAUD," *Bandung: Nuansa Aulia*, 2011.

to communicate and exchange thoughts between students, (4) the questions raised are more convergent than divergent, thus paralyzing the child's creativity (dis-empowering).¹⁵

In fact, teachers as learning agents should have the competence and authority to realize educational goals in accordance with the law. Accustoming children to have a creative mindset and action pattern, because in the early age range, children experience a golden age, where children are sensitive to influences and changes that come from the surrounding environment including the development of creative talents.

In addition, in the implementation of games for children need to pay attention to the nature of the child who basically likes to play. In connection with the statement above, in this study, play activities for early childhood based on compound intelligence were applied which in turn can increase children's creativity. From the explanation above, this research will focus on how science learning can stimulate the congenital development of students. So from these problems, researchers need to know whether the implementation of science-based learning can improve, affect the cognitive abilities of children in RA Nurul Yasin, Kudus Regency.

METHOD

The research design used to analyze "Application of Science-Based Learning to Improve Cognitive Abilities of Early Childhood in RA Nurul Yasin, Mejobo District, Kudus Regency", is quasi-experimental. The purpose of this study is to explain the application of Science-Based Learning in improving Congenital Ability in early childhood. This study focused on 17 ra class B children/students as the researcher considered to determine the research setting. This research was chosen at RA Nurul Yasin, Mejobo District, Kudus Regency, because the first factor, teachers at RA Nurul Yasin learning science still use the lecture and discussion method in science learning. The child only hears, sits, and is silent, so the child is less given the opportunity to gain real experience or in other words the child becomes passive in teaching and learning activities. Second, Teacher-centered learning, children as learning objects. Thus it can be interpreted that learning in schools tends to optimize academic abilities. While the development of critical, creative and innovative thinking, has not been done much.

This research is a quasi-experimental study that explores the Application of Science-Based Learning to Improve Cognitive Abilities of Early Childhood. The data collection methods used in this study are observation / observation methods, deed tests and Observation Documentation Studies carried out during learning activities. Before this instrument is used in research, it is first tested. Based on the results of the trial, reliability is sought using the percentage of agreement formula.

¹⁵ Refi Elfira Yuliani, "Pengembangan mobile learning (m-learning) sebagai model pembelajaran alternatif dalam meningkatkan minat dan kemampuan siswa terhadap matematika," *Kognisi* 1, no. 1 (2010): 52–61.

$$\text{Percentage of agreement} = 100 \left(1 - \frac{A-B}{A+B} \right), \text{ (Sujana. 2002).}$$

The data analysis method in this study is an early stage analysis in the form of a data normality test. The results of the normality test there are used to find out the learning outcomes obtained to form a normal distribution or not. Normality testing using the chi squared test with the formula:

$$\chi^2 = \sum_{i=1}^k \frac{(O_i - E_i)^2}{E_i}, \text{ (Sugiyono. 2010).}$$

The analysis model used in this study is a differential test that aims to determine the difference in learning outcomes between before and after the science-based experimental treatment. The data before being tested to respondents needs to be tested for its function instrument to determine the validity and reliability of the instrument. Data analysis in this study is statistical data analysis by conducting regression tests. Before being analyzed with a regression test, a hypothesis test is carried out, it is necessary to have a prerequisite test for classical assumption tests in the form of normality tests and heterobecticity tests. The hethesis test of this study is the t test to determine the partial relationship of free variables to bound variables, f test to find out the relationship simultaneously between free variables to bound variables.

RESULTS AND DISCUSSION

The research data used in this study is the primary data obtained by direct observation / observation chosen because through observation / observation a picture of development around the research area is obtained. Researchers observed the learning process, children's activities, and the results of improving early childhood cognitive abilities as an influence of learning in children of RA Nurul Yasin Kindergarten, Kudus Regency. The subjects in this study were students of 17 children. Based on gender in the study, the students of RA Nurul Yasin Kindergarten, Kudus Regency, were more male than students who were female, who were male, 10 people or 60.00% while students who were female were 7 people or 40%. Based on the age of students, there are 2 (two) ages who go to school at RA Nurul Yasin Kindergarten, Kudus Regency, namely 5 (five) years old as many as 14 people or 82.35%, the number of students aged 5 (five) years is more than that of students aged 4 (four) years who are 3 (three) students or 18.65%.

The activities observed in learning refer to the existing material, namely Blowing Plasti Then Tied And Hulled, Playing Colors By Mixing Different Colors, Floating Experiments, Drifting And Sinking, Knowing Various Flavors With Sugar, Medicinal Salt And Fruit, Playing Telephone Calls Using Used Aqua Glasses, Experiments On Making Rainbows From Used Vcd Reflected Light / Sunlight, Wipe Abur With Leaves Around The House, Distinguishing Rough and smooth with objects around the house

Test Assumptions On Research Instruments

Researchers have conducted reliability testing, the results of the reliability test are known that the value of Cronbach Alpha on the variable value is greater than 0.173. These results can be concluded that all research instruments can be declared reliable and can be used for subsequent analysis. This means that this experiment has consistent results if measurements are taken in different times and models or designs.

The normality test used to determine the distribution of data on each variable in this study used the chi squared formula (χ^2). The results of the normality test for the six variables in this study showed that the Asymp Sig value of 0.783 for Congenital was greater than 0.05, so the variables used in the study were normally distributed.

Test the Difference

Test results with Paired Sample t –Test to test hypotheses using SPSS 25 using a prepared equation model. The significance levels used to test the hypothesis were 1% and 5%. Paired Sample t –Test test results obtained the output results of Paired Sample t –Test obtained a significance value of 0.058 which means greater than 0.05, it can be concluded that H_0 is rejected and H_1 is accepted meaning that there is no difference before treatment with after treatment.

Discussion

The analysis of the research data is intended to find out the truth of the research hypothesis that has been formulated, namely the Cognitive Ability of Early Childhood in RA Nurul Yasin, Mejobo District, Kudus Regency. Furthermore, to find out whether there is an influence, the Paired Sample T-Test formula is used, the Paired-Samples T-test analysis is a procedure used to compare the average of two variables in a group. This also means that this analysis is useful for testing two related samples or two samples in pairs. The Paired Samples T Test procedure is used to test that there is no or absence of difference between two variables. Data can consist of two measurements with the same subject or one measurement with multiple subjects.

The second test can be seen the amount of data each for those before and after being given Training / Observation = 15, the average score before the existence of Training / Observation is 20.87 and after being given Training / Observation is 29.07. Standard deviation before training / observation has a score of 1,685 and after treatment has a score of 1,870. The paired sample correlation table contains data on the correlation between before and after, there is an influence of Science-Based Learning to Improve Cognitive Abilities of Early Childhood in RA Nurul Yasin, Mejobo District, Kudus Regency, which is 0.411 with a sig of 0.128. This shows that science-based learning can improve children's cognitive abilities. Tylor in Masitoh suggests that the exploration of activities from children's knowledge through direct practice because exploration activities allow children to be directly involved in giving decisions. This is in accordance with what is described by

exploratory activities allowing the child to develop direct investigations through spontaneous steps of learning to make decisions about what is done, how to do it, and when to do it. Through exploratory activities children find something related to themselves and choose activities according to their interests.¹⁶

Early Childhood Learning science means learning about knowledge and knowledge related to cognitive abilities. Science in early childhood is learned through interaction with the five senses to construct new knowledge to increase children's experience in getting to know their environment. Early childhood learns science concretely by adjusting their thinking skills. Learning science provides benefits for children to develop cognitive abilities in children. Piaget in Ali Nugraha stated that in science learning children actively process various experiences by disassembling, developing and reorganizing their mental structures through various processes that they carry out in activities. So the child in learning science always develops cognitive abilities and fulfills a high curiosity in themselves.¹⁷ Science learning facilitates a person in developing one's cognitive aspects. Ahmad Susanto states that cognitive development is a process of thinking, that is, the ability of individuals to connect, assess and consider an event or events.¹⁸ Piaget Ahmad Susanto, suggests that educators need to develop the cognitive abilities of students because of the importance of cognitive development so that: (a) Children are able to develop their perceptual power based on what they see, hear and feel, so that children will have a complete or comprehensive understanding. (b) So that the child is able to exercise his memory of all the events and events he has experienced. (c) Children are able to develop their thoughts in order to connect one event with another. (d) So that the child is able to understand the symbols scattered in the surrounding world. (e) The child is able to carry out reasonings, both naturally spontaneous, and through the scientific process of experimentation. (f) The child is able to solve the life problems he faces, so that in the end the child will become an individual who is able to help himself.¹⁹

CONCLUSION

Based on the results of this study, the following conclusions can be drawn: (1) The average score before treatment is 20.87 and after treatment 29.07, (2) The influence of Science-Based Learning is 0.411 with a sig of 0.128. This shows an increase in cognitive ability after being given treatment, (3) There are differences in Early Childhood Cognitive Ability in RA Nurul Yasin before and as much as the experiment is carried out The evaluation of the results of this study must

¹⁶ Dkk Masitoh dan Ocih Setiasih, *Strategi pembelajaran TK*, vol. 3 (Jakarta: Universitas Terbuka, 2007).

¹⁷ Nugraha, *Pengembangan pembelajaran sains pada anak usia dini*.

¹⁸ Susanto, *Perkembangan Anak Usia Dini: pengantar dalam berbagai aspeknya*.

¹⁹ Susanto.

consider the limitations that may affect the results of the study, including: (1) The difficulty of controlling respondents is that because the experiment was carried out by ECCE children aged 4-5 years, the child's condition was unstable, (2) This study used experimental measurements that might cause perception bias on the experiment to be carried out by students, subsequent studies can use experimental methods to avoid perception bias. Further research suggests the need for non-test instruments such as observations or interviews to determine children's understanding of the performance material.

ACKNOWLEDGMENTS

Thank you to TK RA Nurul Yasin, Kudus Regency, for being willing to become a research site. Thanks also to the Open University for supporting by funding this research.

REFERENCES

- Aqib, Zainal. "Pedoman Teknis Penyelenggaraan PAUD." *Bandung: Nuansa Aulia*, 2011.
- Husdarta, J. S., dan Nurlan Kusmaedi. "Pertumbuhan dan Perkembangan Peserta Didik: Olahraga dan Kesehatan." *Bandung: Alfabeta*, 2010.
- Masitoh, Dkk, dan Ocih Setiasih. *Strategi pembelajaran TK*. Vol. 3. Jakarta: Universitas Terbuka, 2007.
- Nasional, Departemen Pendidikan. *Pedoman pembelajaran bidang pengembangan pembiasaan di taman kanak-kanak*. Departemen Pendidikan Nasional, 2007.
- Novitasari, Yesi. "Analisis Permasalahan" Perkembangan Kognitif Anak Usia Dini". *PAUD Lectura: Jurnal Pendidikan Anak Usia Dini* 2, no. 01 (2018): 82–90.
- Nugraha, Ali. *Pengembangan pembelajaran sains pada anak usia dini*. Jakarta: Depdiknas, 2005.
- Nurani, Yuliani. *Strategi Pembelajaran*. Jakarta: Pusat Penerbitan Universitas Terbuka, 2008.
- Permatasari, Eka Aprilia. "Implementasi pendekatan saintifik dalam kurikulum 2013 pada pembelajaran sejarah." *Indonesian Journal of History Education* 3, no. 1 (2014).
- Saputra, Dudu Suhandi, Yuyu Yuliaty, dan Reza Rachmadtullah. "Use of ladder snake media in improving student learning outcomes in mathematics learning in elementary school." Dalam *Journal of physics: conference series*, 1363:012058. IOP Publishing, 2019.
- Sujiono, Bambang, dan Yuliani Nurani. "Menu pembelajaran anak usia dini." *Jakarta: Yayasan Citra Pendidikan Indonesia*, 2005.
- Susanto, Ahmad. *Perkembangan Anak Usia Dini: pengantar dalam berbagai aspeknya*. Kencana Prenada Media Group, 2011.
- Ubaidillah. "Pengembangan minat belajar kognitif pada anak usia dini." *JCE (Journal of Childhood Education)* 3, no. 1 (2020): 58–85.
- Yuliani, Refi Elfira. "Pengembangan mobile learning (m-learning) sebagai model pembelajaran alternatif dalam meningkatkan minat dan kemampuan siswa terhadap matematika." *Kognisi* 1, no. 1 (2010): 52–61.
- Yulianti, Dwi. "Bermain sambil belajar sains di taman kanak-kanak." *Jakarta: PT indeks*, 2010.

Ismartoyo, Aini Indriasih, Yuli Haryati, Dian Ratu Ayu Uswatun Hasanah : Improving Early Childhood Cognitive Abilities Through Science-Based Learning in RA Nurul Yasin Mejobo Kudus District

Zamista, Adelia Alfama, dan Ida Kaniawati. “Pengaruh model pembelajaran process oriented guided inquiry learning terhadap keterampilan proses sains dan kemampuan kognitif siswa pada mata pelajaran fisika.” *Edusains* 7, no. 2 (2015): 191–201.