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Analysis of Early Childhood Pre-Service Teacher's Science Concepts Comprehension Based on Their Science Process Skill

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Abstract: Science concepts comprehension is a foundation that allows students to create thinking constructions to another related concept or more complex concepts, facts, laws, principles, and theories in science. Understanding the concept of science is one of the important things required by early childhood education pre-service teachers as professional and competent educators in their fields. This research is an ex-post-facto research, with the aim of analyzing science concepts comprehension based on science process skills of the early childhood education pre-service teachers, especially on the subjects of the diversity of living things and environmental pollution. The subjects in this study were early childhood education students in semester VI of the 2021/2022 academic year. Analysis of science concept comprehension was carried out using the *Certainty of Response Index* (CRI) method. The results showed: 1) The Comprehension of Science concepts of early childhood education pre-service teachers with the criteria of understanding the concept (PK) is at 81.75%, not understanding the concept (TPK) at 4,90%, and misconceptions (M) at 13.34%; 2) The comprehension of science concept of early childhood education pre-service teachers based on high category science process skills are better than the science concept comprehension of early childhood education pre-service teachers with low category science process skills. The data obtained confirm that the comprehension of science concepts in early childhood education pre-service teachers is high. The comprehension of science concepts that owned by early childhood education pre-service teachers is directly proportional to their science process skills, the higher the science process skills of early childhood education pre-service teachers, the higher their science concepts comprehension.

Keywords: Comprehension; Early Childhood; Science Concepts

Introduction

One of the most important and fundamental periods throughout the span of human growth is the early childhood stage. This period is commonly known as the golden period, where the child experienced very rapid growth and development and was irreplaceable in the future (Raihana, 2020).

Mursalin & Setiaji, (2021) stated that science learning in early childhood is one of the activities that can develop every aspect of children. Science learning trains children's ability to recognize various phenomena of objects and phenomena of events. Scientific skill is an ability related to various experiments or certain methods to approach it logically and still consider the stages of children's thinking.

Studying science does not only rely on memorization, but places more emphasis on understanding concepts and real applications not only as mastery of a collection of knowledge in the form of facts, concepts, or principles but also as a process of discovery and skill to implement it (Maradona, 2013).

Science learning activities are inseparable from their objectives to optimize knowledge and understanding of science concepts. Science learning should lead students to understand science concepts, and not just let students remember information without knowing the purpose of that information. Science concept comprehension is a component of a product that

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includes science facts, this is in line with (Susanto, 2013) who explains that science concept comprehension is an understanding of an idea that unifies science facts.

According to Sudjana (2011), conceptual comprehension is a level of learning output that is higher than the knowledge obtained, it is necessary to know or know in order to understand. This means that students can understand concepts or content based on the subjects studied. With good concept comprehension, students' understanding of the subject matter will increase. Therefore, understanding the concept is very important for all subjects, one of which is science. This is in accordance with the statement (Septriani, 2014), who said that conceptual understanding has an important role in the implementation of teaching and learning, which is the basis for taking learning outputs.

Understanding (comprehension) is one of the cognitive domain keys in learning. Understanding is an absolute prerequisite for high cognitive abilities in mastering what we learn. Science concept comprehension is all levels of abilities, skills, and thinking skills possessed by students in responding to the learning process through various kinds of evaluation of learning outcomes that are guided by the taxonomy of achievement in the cognitive, affective, and psychomotor domains (Trihono, 2022).

Conceptual comprehension is one of the factors that influence student success in learning. Concepts comprehension can help students remember the material they have learned. Concepts comprehension is important to assess when learning and even better if trained by developing scientific literacy. (Nurwulandari, 2018) research shows that there is a link between science literacy with students' concepts comprehension. She said that scientific literacy can affect students' mastery of concepts and positively influence students' concepts comprehension. According to (Nofiana & Julianto, 2017) a low level of one aspect of scientific literacy will affect other aspects of scientific literacy and a low understanding of students' concepts of scientific knowledge will result in a low application of science.

Concept comprehension can be seen from the student's ability to solve a problem which can be seen from the difference in the level of thinking before and after the learning process is carried out. Some students feel that the concept is difficult. (Juhji, 2016) explains that the creation of a boring, monotonous, and rigid classroom atmosphere is because students receive a lot of material transfers from the teacher and memorize too much material instead of doing the process of finding it themselves. Thus, in order to understand a concept, strong mental and reasoning processes are needed by students in science learning (Wisudawati & Sulistyowati, 2015).

The ability to be directly involved in the discovery process is also important for students. KPS (science process skills) helps improve students' mindsets through experimental activities. (Gazali et al., 2015) explained that applying KPS can help improve students' understanding of concepts. (Gultepe, 2016) also argues that KPS is a skill that students use to find solutions to a problem and are able to develop their scientific skills. (Osman, 2012) explained that KPS will help students to be active in learning because of the activities carried out such as observing, making temporary answers, carrying out experimental activities, analyzing data, making conclusions, and presenting the conclusions obtained.

Chabalengula et al., (2012), said that there are two abilities in science process skills, which are basic abilities including observation, inference, measuring, communicating, classifying, predicting, using numbers, and integrity abilities (controlling variables, being able to make operational definitions, formulating hypotheses, designing models, interpret, conduct experiments).

Integrated science process skills are needed to become someone who is scientifically literate, Integrated science process skills are the ability to understand science concepts, and to realize the relevance of science and technology in life. Scientific literacy is more influenced by the mastery of science process skills, not just understanding the main concepts (Özgelen, 2012).

A teacher is the main factor of success in science learning. It is necessary to test the quality of scientific literacy, integrated science process skills, and reading comprehension skills of teaching staff, including prospective biology teacher students. This needs to be done in order to realize the goal of implementing the 2013 curriculum, which is increasing students' scientific literacy achievement. Students will have a learning experience that contains a scientific literacy component if the teacher who educates them has good scientific literacy (Handayani et al., 2018). The order of world society in the 21st century requires superior human beings in the field of science. 21st-century education is no longer focused on memorizing subject matter (core subjects), but also places an emphasis on life skills, learning skills and thinking (learning & thinking skills), and literacy in information and communication technology (ICT literacy). There has been a transformation of the educational paradigm that yearns for the birth of a younger generation with a mindset like scientists. A critical generation that does not necessarily accept the knowledge provided but also understands the process (Sadiqin et al., 2017). Through this research, it is hoped that it will be able to find out Early childhood Pre-service teachers' science comprehension based on their science process skills. The results of this research are expected to be used as evaluation material in the process

of science education lecturers in tertiary institutions in advance to produce professional graduates in the field of education in the future.

Method

This research is an ex post-facto research. The ex post-facto method is taking data from symptoms that already exist or have occurred, so there is no treatment. The research was conducted in August 2022 at the PGPAUD Study Program FKIP, University of Mataram. The research subjects were PGPAUD FKIP University of Mataram students in semester VI of the 2021/2022 academic year with a total of 95 students. The research instrument used was a test sheet for science concepts comprehension and a science process skills questionnaire. Analysis of science concepts comprehension was carried out using the CRI method. Table 1 is a scale of six CRI criteria according to (Hasan et al., 1999), table 2 is a way of changing the concept of understanding, and table 3 is a modification of CRI according to (Kholifah et al., 2015).

Table 1. CRI Criteria

CRI Scale	Criteria
0	Totally Guessed Answer
1	Almost Guess
2	Not Sure
3	Sure
4	Almost Certain
5	Certain

Table 2. Determination of Conceptual Understanding in CRI

Answer's Criteria	Low CRI (< 2.5)	High CRI (>2.5)
Correct Answers	Correct answers but low at CRI means they don't understand the concept	Correct answers and high CRI means they understand the concept well
False Answers	False answer but low CRI means they don't understand the concept	False answer and high CRI means misconception

Table 3. Modification of Determination of Concept Understanding

Answers	Reasoning	CRI Scale	Score
Correct	Correct	>2.5	3
Correct	Correct	<2.5	2
Correct	False	>2.5	1
Correct	False	<2.5	0
False	Correct	>2.5	1
False	Correct	<2.5	0
False	False	>2.5	1
False	False	<2.5	0

Result and Discussion

This research was conducted in August 2022 at the PGPAUD Study Program FKIP, University of Mataram. The research subjects were PGPAUD FKIP University of Mataram students in semester VI of the 2021/2022 academic year with a total of 95 students. The research instrument used was a test sheet for science concepts comprehension and a science process skills questionnaire. Analysis of science concepts comprehension was carried out using the CRI method. Science concepts of early childhood education pre-service teachers are categorized into three categories, which are: Understand concept (PK), Not understand concept (TPK), and Misconception (M). More details are shown in Table 4.

Table 4. Student's Science Comprehension Based on CRI

Concept / Subject	Item	PK (%)	TPK (%)	Criteria M (%)
Diversity of Living Things	15	81.50	5	13.50
Environtmental Pollution	15	82	4.81	13.19
Average		81.75	4.905	13.34

Based on Table 4, shows that the percentage of early childhood pre-service teachers who have correctly understood the science concepts is high (up to 80% in each subject). This indicates that early childhood pre-service teachers are competent to carry out their role as professional teachers in the future. Concepts comprehension is a very important skill that must be owned by teachers and pre-service teachers when studying science (Hasnawati et al., 2022).

There are 5% of students that not understood (TPK) the concept in the diversity of living things subject and 4,82% in the environmental pollution subject. In the misconception category, there are 13.34% of students experience misconception on average of both subjects. Misconceptions in science learning that are experienced by students will lead to concept change, can be an obstacle to achieving learning goals, and decrease the quality of education (Syuhendri et al., 2019).

If we analyze based on subject, the highest science concept comprehension for early childhood pre-service teachers is Environmental Pollution at 82%. But generally, both of the subjects have not significantly different in terms of science concept comprehension. This confirms that early childhood pre-service teachers can understand both science subjects well.

Scientific reasoning, which is cognitive skills in understanding and evaluating scientific information, has a positive relationship with understanding scientific

content (Sigiro et al., 2017). Scientific concepts comprehension is meaningful for students to solve problems in new conditions which is the essence of scientific literacy. This is in accordance with research conducted by (Azrai et al., 2017), that a good understanding of environmental knowledge makes students aware of the environment. Knowledge of additives has a positive relationship with the attitude toward selecting student snacks (Rahayu et al., 2016). Based on the results of these studies, indicates that well-understood scientific knowledge is a provision to be able to solve problems and make decisions related to science in everyday life.

Science concepts comprehension will be more meaningful if students discover the concepts themselves learned through the scientific process. One of the activities carried out in the science process, namely conducting experiments or experiments. Experimental activities carried out during the learning process can train science process skills and develop scientific attitudes in students.

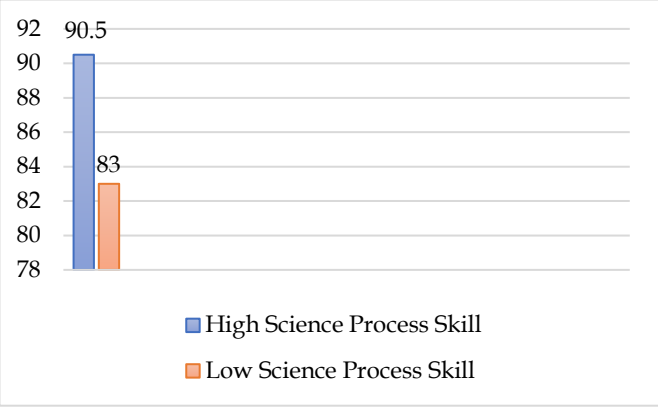

Figure 1. Mean Score of Science Concept Comprehension Based on Science Process Skill

Figure 1 shows that students who have high-category science process skills are better than the students who have low-category Science Process Skills in terms of science concept comprehension. Early childhood pre-service teachers who have high category Science Process Skills are able to understand science concepts better. This is happen because students who have high Science Process Skills are able to process observations, interpret observations, make hypotheses, design experiments properly and correctly, conduct experiments properly and thoroughly, analyze data with banners thoroughly, and able to communicate results well in the form of reports and presentation of results with more responsibility. Students who are able to master all indicators of Science Process Skills well are better able to understand science concepts well too. Therefore, Science Process Skills must be developed in learning science because they can improve memory and help learn science concepts. This result is in line with research that conducted by (Fatimah, 2017).

Science process skills elaborated in science learning can involve a variety of intellectual, manual, and social skills. Scientific attitudes are formed through the formation of knowledge products through this scientific work process. Students' scientific attitudes such as curiosity, critical thinking, open thinking, and honesty will emerge and develop through experimental activities and discussions between students so that students have a good and deep understanding of the science concept.

Science process skill needs to be developed in science learning because Science process skill has the following roles: (a) helping students learn to develop their minds; (b) providing opportunities for students to make discoveries; (c) improving memory; (d) provide intrinsic satisfaction if students have succeeded in doing something; (e) help students learn science concepts. In addition, Science process skill is able to increase student motivation and learning outcomes.

Therefore, it can be confirmed that high science process skills and scientific attitudes have a positive influence on students' understanding of science concepts compared to low science process skills and scientific attitudes. The scientific attitude observed in this study is the attitude that is attached after studying science (attitude to science) and includes several aspects of positive behaviours such as curiosity, critical thinking, open thinking, and honesty. Based on the research that has been done, it is known that in the learning process, the teacher's ability as a mediator and facilitator in managing learning is an important part. Good classroom management can make the learning process run effectively, so that the predetermined learning plans, both in providing stimulus, student discussion activities in groups, and class presentations can be carried out properly (Putra et al., 2015).

Science accustoms children to following experimental stages and cannot hide a failure. Therefore, science can train children to have positive mental, logical thinking, and sequential (systematic). Besides that, it can also train children to be careful, because children must observe, make predictions, and make decisions. Children's lives cannot be separated from science, creativity, and social activities. Eating, drinking, and using various objects at home such as radios, TVs, and calculators cannot be separated from science and technology. Therefore, teachers should be able to stimulate children with various activities related to science and technology. For this reason, a teacher needs to learn scientific concepts and ways of teaching. Introduction to science for pre-schoolers is more emphasized on the process than the product. For pre-schoolers, science process skills should be carried out simply while playing. Science activities allow children to

explore various objects, both living and non-living things around them. Children learn to find symptoms of objects and symptoms of events from these objects. Science also trains children to recognize various objects and events using their five senses. Children are trained to see, touch, smell, feel, and hear. The more involvement of the senses in learning, the more children understand what is learned. Children acquire new knowledge as a result of their senses with various objects around them. The knowledge gained will be useful as capital for further thinking. Through the process of science, children can perform simple experiments. The experiment trains children to connect the causes and effects of treatment so that it trains children to think logically (Kurnia, 2019).

Professional teachers not only must master the principles of learning, selection and use of learning media, selection and use of learning methods, skills in assessing student learning outcomes, and selecting and using learning strategies or approaches but also some other skills that have a very big part in students life such as concept comprehension and science process skill. Based on the description above, it is known that in the process of science learning in early childhood, concepts comprehension and science process skills of the teacher took a very important part. Teachers' good concepts comprehension and science process skills can make the learning process run effectively, so that the plans and objectives of science learning that have been set, both in providing stimulus, student discussion, experiment activities in groups, and class presentations can be carried out properly.

Conclusion

The results of this research found that 1) The Science concepts comprehension of early childhood education pre-service teachers categorized as high 2) The science concepts comprehension of early childhood education pre-service teachers based on high category science process skills are better than the science concept comprehension of early childhood education pre-service teachers with low category science process skills. Therefore, the science concept comprehension of early childhood pre-service teachers is directly proportional to their science process skills and has a positive impact on science concept comprehension.

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References

Azrai, E. P., Sigit, D. V., & Puji, M. (2017). The Correlation Between Environmental Awareness and Students Participation In Go Green School Activity At Adiwiyata SchooL. *Biosfer: Jurnal Pendidikan Biologi*, *10*(2), 7-11. https://doi.org/10.21009/biosferjpb.10-2.2

Chabalengula, V. M., Mumba, F., & Mbewe, S. (2012). How pre-service teachers' understand and perform science process skills. *Eurasia Journal of Mathematics, Science and Technology Education*, *8*(3), 167–176. https://doi.org/10.12973/eurasia.2012.832a

Fatimah, S. (2017). *Keterampilan Proses Sains, Kemampuan Multirepresentasi, Jenis Kelamin, Dan Latar Belakang Sekolah Mahasiswa Calon Guru Sd*. *1*(1). Retrieved from http://ejournal.unp.ac.id/index.php/jippsd/issue/archive

Gazali, A., Hidayat, A., Yuliati, L., Smpn,), Utara, B., & Tengah, L. (2015). Efektivitas Model Siklus Belajar 5E Terhadap Keterampilan Proses Sains dan Kemampuan Berpikir Kritis Siswa. In *Jurnal Pendidikan Sains* 3(1). Retrieved from http://journal.um.ac.id/index.php/jps/

Gultepe, N. (2016). High school science teachers' views on science process skills. *International Journal of Environmental and Science Education*, *11*(5), 779–800. https://doi.org/10.12973/ijese.2016.348a

Handayani, G., Adisyahputra, A., & Indrayanti, R. (2018). Correlation between integrated science process skills, and ability to read comprehension to scientific literacy in biology teachers' students. *Biosfer*, *11*(1), 22–32. https://doi.org/10.21009/biosferjpb.11-1.3

Hasan, S., Bagayoko, D., & Kelley, L. E. (1999). Misconceptions and the Certainty of Response Index (CRI). *Physics Education*, *34*. *34*(5), 294. https://doi.org/10.1088/0031-9120/34/5/304

Hasnawati, H., Syazali, M., & Widodo, A. (2022). Analysis of Understanding Science Concepts for Prospective Elementary School Teacher Candidates. *Jurnal Penelitian Pendidikan IPA*, *8*(6), 2954–2960. https://doi.org/10.29303/jppipa.v8i6.2438

Juhji, J. (2016). Peningkatan Keterampilan Proses Sains Siswa Melalui Pendekatan Inkuiri Terbimbing. *Jurnal Penelitian Dan Pembelajaran IPA, 2*(1), 58-70. http://dx.doi.org/10.30870/jppi.v2i1.419

Kholifah, N. A., Rinanto, Y., & Ramli, M. (2015). Kajian Penerapan Model Guided Discovery Learning Disertai Concept Map Terhadap Pemahaman Konsep Siswa Sma Kelas Xi Pada Materi Sistem Imun. *Bio-Pedagogi: Jurnal Pembelajaran Biologi*. *4*(1).

12–18. https://doi.org/10.20961/bio-pedagogi.v4i1.5352

Kurnia, S. D. (2019). Urgensi Pembelajaran Sains Dalam Meningkatkan Motivasi Belajar Pada Anak Usia Dini. *Ya Bunayya*. 1(1). 46-57

Maradona. (2013). Analisis Ketrampilan Proses Sains Siswa Kelas Xi Ipa Sma Islam Samarinda Pada Pokok Bahasan Hidrolisis Melalui Metode Eksperimen. *Prosiding Seminar Nasional Kimia*, 62–70. Retrieved from http://jurnal.kimia.fmipa.unmul.ac.id/index.php/prosiding/article/view/88

Mursalin, E., & Setiaji, A. B. (2021). Pelatihan Pembuatan Alat Permainan Edukatif (APE) Sains Sederhana bagi Guru PAUD. *BAKTIMAS Jurnal Pengabdian Pada Masyarakat*, *3*(4). https://doi.org/10.32672/btm.v3i4.3561

Nofiana, M. (2017). Profil Kemampuan Literasi Sains Siswa SMP di Kota Purwokerto Ditinjau dari Aspek Konten, Proses, dan Konteks Sains. *JSSH (Jurnal Sains Sosial dan Humaniora), 1*(2), 77-84. doi:http://dx.doi.org/10.30595/jssh.v1i2.1682

Nurwulandari, N. N. (2018). N Pembelajaran Fisika Berbasis Literasi Sains terhadap Penguasaan Konsep Mahasiswa pada Pokok Bahasan Energi. *Jurnal Pendidikan: Riset Dan Konseptual*, *2*(2), 205. https://doi.org/10.28926/riset_konseptual.v2i2.51

Osman, K. (2012). Primary science: Knowing about the world through science process skills. *Asian Social Science*, *8*(16), 1–7. https://doi.org/10.5539/ass.v8n16p1

Özgelen, S. (2012). Students' science process skills within a cognitive domain framework. *Eurasia Journal of Mathematics, Science and Technology Education*, *8*(4), 283–292. https://doi.org/10.12973/eurasia.2012.846a

Putra, A.R. Abdurrahman, A., & Suana, W. (2015). *Pengaruh Keterampilan Proses Sains Dan Sikap Ilmiah Terhadap Pemahaman Konsep Ipa*. 20/01/2023. Retrieved from http://jurnal.fkip.unila.ac.id/index.php/JPF/article/view/8861/5560

Rahayu, S., Refirman, R., & Sari, D. R. (2018). Hubungan Pengetahuan Tentang Zat Aditif Dengan Sikap Pemilihan Makanan Jajanan Siswa Smpn 74 Jakarta. *Biosfer: Jurnal Pendidikan Biologi*, *9*(2), 45-53. https://doi.org/10.21009/biosferjpb.9-2.7.

Raihana, A. B. H. I. S. W. J. (2020). Peningkatan Pemahaman Program Bermain Anak Indoor Dan Outdoor Di Desa Koto Tuo Kecamatan Batang Peranap. *Jurnal Pengabdian Untukmu Negeri. 4*(1). https://doi.org/10.37859/jpumri.v4i1.1871

Sadiqin, I. K., Santoso, U. T., & Sholahuddin, A. (2017). Pemahaman konsep IPA siswa SMP melalui pembelajaran problem solving pada topik perubahan benda-benda di sekitar kita. *Jurnal Inovasi Pendidikan IPA*, *3*(1), 52. https://doi.org/10.21831/jipi.v3i1.12554

Septriani, N. (2014). Pengaruh Penerapan Pendekatan Scaffolding Terhadap Kemampuan Pemahaman Konsep Matematika Siswa Kelas Viii Smp Pertiwi 2 Padang. In *Jurnal Pendidikan Matematika,* 3(3).

Sigiro, O. N., Sigit, D. V., & Komala, R. (2017). Hubungan Efikasi Diri Dan Penalaran Ilmiah Dengan Hasil Belajar Biologi Siswa Sma. *Biosfer: Jurnal Pendidikan Biologi*, *10*(2), 30-34. https://doi.org/10.21009/biosferjpb.10-2.4.

Susanto, A. (2013). *Teori Belajar dan Pembelajaran Di Sekolah Dasar* (1st ed., Vol. 1). Kencana Prenadamedia Grup.

Syuhendri, Andriani, N., & Saparini. (2019). Pemahaman Konsep Dan Miskonsepsi Mahasiswa Calon Guru Pada Hukum Kepler. *Jurnal Kependidikan*, *3*(1), 263–275. http://dx.doi.org/10.21831/jk.v3i2.13613

Trihono, T. (2022). Hubungan antara Keterampilan Proses Sains dan Kemampuan Matematika dengan Pemahaman Konsep Sains dalam Pembelajaran Penemuan Terbimbing. *JURNAL PENDIDIKAN MIPA*, *12*(3), 747–753. https://doi.org/10.37630/jpm.v12i3.675

Wisudawati, A. W., & Sulistyowati, E. (2015). *Metodologi Pembelajaran IPA*. Bumi Aksara