



Science Literacy in Early Childhood: Development of Learning Programs in the Classroom

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Abstract

The importance of science literacy in early childhood greatly influences the development of scientific thinking ability. Early childhood is the most critical learning goal that can be done with a student-centered approach to the classroom. The purpose of this study is to discuss the need for science literacy at an early age. Various investigative processes have been carried out by uncovering qualitative methodology. The interview method was conducted to five early childhood teachers. Data analysis techniques using Heurmeutical analysis and Miles and Huberman models. The results showed that early childhood in the application of science literacy as a learning development program in the classroom requires three aspects that need to be considered, namely: attitude, skills, self-competence in children's cognitive ability, and participation in classroom strategies mapped by teachers. While the needs of learning in the classroom are very important to be done as an effort to improve the competence of teachers to the quality of teaching. In the long term, this research has implications in the field of education, namely the development of teacher competencies on the ability to manage science literacy at an early age. Innovative strategies are important for teachers to master in improving the quality of learning in the classroom, because this will be very much needed in encouraging children's independence in the future.

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INTRODUCTION

Quality in early childhood education has been a major focus of research and program improvement efforts for the past 20 years worldwide [1]. Positive or negative interactions that children experience with teachers, materials, and peers are the best way to determine and measure quality in a classroom or program [2] [3] [4] [5]. Teaching experience and teachers' awareness of the importance of science as well as potential in the classroom. Science, technology, engineering and mathematics education is an integrated approach that teaches science and mathematics-based technology and techniques in kindergarten through grade 12. Although the context of science education is generally described as starting from kindergarten through grade 12, it emphasizes the primary and senior secondary education setting. As a result, limited attention is paid to the teaching of science in early childhood education. However, their research emphasized the need to include kindergarten through third grade in advancing science education and specifically suggested some goals for successful K-12 education. One of them is increasing students' scientific literacy at all grade levels, because scientific literacy is necessary for individual decision making, cultural progress, and economic productivity. This applies to all students at all levels. Therefore, educational institutions must endeavor to produce scientific literate citizens who are able to think critically and creatively to solve complex problems.

Also stated that early childhood needs to acquire scientific literacy [6]. Early science experiences from preschool to third grade play an important role in enhancing children's knowledge, skills and dispositions [7] necessary for future jobs and preparing students for an economy that demands innovative solutions to complex problems [8] argue that science education [9] should start in early childhood because the concepts taught encourage curiosity, creativity, collaboration, critical thinking that children need. Although the increasing need for children (ages 3-8) to initiate science education at preschool has been justified [10], the inadequacy of science education in early childhood causes ECCE teachers to avoid science teaching and thus fail to develop self-confidence. them to teach related subjects in the classroom [11] [12]. Teachers' beliefs about teaching have been studied from various points of view, including how teacher beliefs influence (a) decision making and instructional practice [13] [14], (b) classroom interpretation and prac-

tice [15] [16].

In particular, the development of teacher learning programs in the classroom towards the subject matter being taught, subject matter knowledge, and teaching practices can be changed or developed. Teacher readiness is also seen as a significant predictor of change in practice [17]. Teacher readiness in teaching has special elements, including knowledge, attitudes, and interests which are important components that directly contribute to the effectiveness of the creation and application of teaching methods [18].

This study seeks to review the development of ECE teacher learning programs in terms of readiness to teach science, in relation to teacher awareness of the importance of early childhood science literacy and the challenges that teachers may face in teaching science.

A recent National Academy of Sciences report entitled "Science Literacy: Concepts, Context, and Consequences" (2016) noted that measures of scientific literacy have traditionally focused on a limited set of content and procedural knowledge questions and the importance of broadening the conceptions of scientific literacy. Science and technology at the present time is an undeniable need for education [19]. Scientific learning is basically a methodological approach in finding complex scientific thinking patterns [20], so that it becomes the basis for developing learning strategies. Learning in the classroom according to a study [21] is mostly carried out based on the needs of scientific literacy, even with the pattern of student center and teacher center. The need for scientific literacy in the present shows that today's learning process is increasingly advanced and requires innovation in teaching strategies in the classroom.

States that scientific literacy is a connection to the ability to be a technologist, economist, and politician [22]. Which reveals that scientific literacy is needed in the classroom because it is actual [23]. Stated that the ability of scientific literacy is expected that students are able to detect and identify social problems and solutions to problems faced by students [24]. An understanding of scientific concepts and scientific facts is the goal of scientific literacy [25], the reconceptualization of scientific literacy is a requirement so that students are not only able to read, write and speak scientific texts, but also have the ability to analyze, interpret, and make reasons in the course of science [26]. Furthermore, the development of scientific literacy needs to be done so that students can discuss scientific issues that have an impact on technology and culture [27]

[28].

Students who are educated in science have a realistic perspective on science [29] [30] and show that knowledge formed through science learning supports the literacy of students engaged in practice. Australia as a developed country also has research which states that literacy in language learning is also more effective using a scientific approach [31]. With this, we can analyze that scientific literacy is an actual pattern that is needed in the world of education to form a quality personality. Early childhood learning is the main asset for the application of scientific literacy [32].

At an early age the learning process requires a mature grand design [33] so that the concept of learning carried out can provide long-term benefits. Referring to the statement of a study [34] that the use of learning strategies in the classroom at an early age requires a concept that is easy to implement so that scientific literacy is easily carried out without a psychological burden. Adaptation of children in the classroom to various applicable and easy to understand sciences is needed, this requires the support of all parties, namely teachers, parents and school policies.

Learning Development in Classroom

Conventional learning that has long been applied in Indonesia makes it difficult for students to have an opinion, thus limiting the development of students' critical thinking skills. Recently, the task of teachers is not only to transmit knowledge, but also to be able to reflect on themselves and apply various learning methods that support students to develop the necessary skills [35]. Classroom activities and assignments are designed to facilitate critical thinking and to increase understanding through interdisciplinary learning, which has become an increasingly important way to engage students in the classroom [36] [37] [38]. Interdisciplinary learning has been found to have a number of different educational benefits, including capacity building, namely:

1. Recognize bias;
2. Think critically;
3. Tolerate ambiguity;
4. Appreciate ethical concerns.

The competency needs of teachers to teach in the classroom uses scientific literacy, from various points of view of the field of study, but no one has yet revealed the need for scientific literacy in early childhood. The development characteristics of children aged 5-6 years are intellectually able to do many things, namely

mentioning and counting, recognizing number symbols, connecting concepts with numbers, recognizing the same concept, more, less, recognizing addition with objects. At this age children should also be introduced to science learning, because children are more literate in science when engaged in activities related to science [25].

METHOD

This research uses descriptive qualitative methodology, the goal of qualitative descriptive studies is a comprehensive summarization, in everyday terms, of specific events experienced by individuals or groups of individuals [35]. This study was proposed to analyze the development of classroom learning programs that focus on the development of early childhood scientific literacy. Interviews were given to determine factors in the development of early childhood scientific literacy as a development of learning programs in the classroom. In this study, the selection of subjects used purposive sampling. This is done based on the opinion of [23] the view of how to understand science in everyday life as measured through qualitative tools such as in-depth interviews and observations.

The research subjects selected five early childhood teachers who were in a ECE school in Bekasi, based on the consideration of the counseling teachers based on teacher competence in monitoring student learning outcomes, daily scores and classroom activities. In this study, researchers were directly involved as a key instrument. Interviews were recorded, transcribed, and analyzed using Hermeneutical analysis techniques and using the Miles and Huberman model [39], namely data reduction, display data, and conclusion drawing / verification.

In this study, interviews were conducted based on three factors, namely: attitudes, skills, and self-competence of early childhood [8]. This was inspired by PISA 2015 (OECD, 2016) which emphasized the importance of assessing scientific literacy competencies in the personal context of children. These categories serve as the initial code for classifying each text segment and are further reviewed and expanded during the analysis to form the final code. Data taken from the end of May to the end of June 2020.

RESULT AND DISCUSSION

The results of research from five early childhood teachers who were observed through interviews were based on the factors in develo-

ping scientific literacy as a learning program in the classroom, so that the data were obtained as follows:

4.1. Attitude

The results of the interview showed that the five teachers revealed, teachers' qualitative responses provided additional evidence on this issue, namely:

ECE Teachers' 1: The importance of being believed to be one of the main points in early childhood changes after experiencing scientific literacy learning.

ECE Teachers' 2: A child's attitude towards science and the environment is complex and difficult to measure.

ECE Teachers' 3: Educational material that does not include persuasive enough content will result in a change in attitude.

ECE Teachers' 4: Science learning provides meaningful experiences for early childhood.

ECE Teachers' 5: Through science, learning is more child-centred than teacher

Therefore, this was also conveyed that the scientific literacy approach to learning greatly helps early childhood in improving kinesthetic, cognitive, and attitudes related to independent learning [40]. This attitude is manifested in scientific learning through a creative process in order to apply scientific literacy. Therefore, changing the way the material is presented can have different results on student attitudes [41].

Thus, the questions raised regarding the attitudes experienced by early childhood reveal that attitude is one of the impacts of social change with the existence of scientific literacy. Guided by attitudes that have had the impact of change, scientific literacy is successful in increasing individual abilities of early childhood.

4.2. Skills

Through the results of interviews with teachers, important information was obtained to assess children's process skills in science, namely:

ECE Teachers' 1: in which the teacher had to consider how to collect the necessary data strategies.

ECE Teachers' 2: Judging all the kids in a class in one day can be overwhelming and frustrating.

ECE Teachers' 3: Therefore, a focus on a number of process skills, including behavioral indicators, and

the number of children to be assessed should be considered.

ECE Teachers' 4: Teachers do not need to assess all process skills at one time, and assessing only two or three children on two or three skills in one

day is sensible work for teachers as they evaluate the process.

ECE Teachers' 5: Teacher strategies are needed in the science learning process

Previous research states that skills to understand something are formed by the process of scientific literacy from an early age. For example, increasing ideological skills related to children's social skills. This skill is very useful in building character in social interactions in society [32].

Thus, when assessing students' process skills, important steps must be considered, namely: (1) Determine the number of science investigation skills to be assessed. Generally, two or three inquiry skills can be managed. (2) Repeat science investigation skills to assess children's science investigation skills. (3) Use a questioning strategy to clarify scientific action. By using action questions, the teacher will be able to better understand student behavior. Thus, this indicates that skill improvement occurs after scientific literacy at an early age. These benefits are felt by early childhood in the long-term development of social life in society.

4.3. Self-competence is related to knowledge

The results of the interviews were obtained from several teachers, who revealed the conditions so far felt in the children's learning process, namely:

ECE Teachers' 1: self-competence can also refer to perceived abilities in the subject area

ECE Teachers' 2: discussing students' beliefs about academic difficulties and the influence of students in the classroom.

ECE Teachers' 3: When a high level of self-competence has a positive effect on achievement, it is important for educators to understand what can be done to maintain this level of self-competence.

ECE Teachers' 4: It is important to note that this does not suggest that we encourage all students to have very high self-perceptions.

ECE Teachers' 5: teachers encourage students to be able to be active in learning activities
Studies have shown that self-perceptions that are slightly higher than performance actually tend to reap benefits on motivation. If this is the case, students can set realistic goals for themselves that they are likely to achieve, and then turn

around and set other, higher realistic goals. In other words, students are not expected to have a self perception that is much lower or higher than their actual ability [30].

In kindergarten, students consistently rate themselves as highly competent, and are among the best students in their class. So educators must care about what happens when children thrive in school. Knowledge increases through scientific literacy, this was revealed by researchers who stated that early childhood becomes more focused in problem solving [42]. Furthermore, it is also explained that the ability to participate in the community increases, even participatory attitudes as the basis for a person's social interaction are well developed. This knowledge is a long-term impact of scientific literacy, according to previous researchers who have expressed a variety of benefits. Embedding scientific literacy from an early age is to train the consistency of scientific attitudes and knowledge in early childhood.

4.4. Classroom strategies

The agreement from the results of the interviews of teachers stated that:

ECE Teachers' 1: science in preschool should not be an obstacle,

ECE Teachers' 2: in learning science it is very important for children to help develop the skills they need in scientific investigation.

ECE Teachers' 3: teachers must design an environment in which scientific activities occur as children explore, play and learn.

ECE Teachers' 4: children are born curious learners

ECE Teachers' 5: action plays a fundamental role in the concept of learning in which children are scientists.

Scientific programs must thus be designed in such a way that children are provided with mature and structured thinking, in which children can explore new experiences [31]. Literature studies from previous researchers state that a teacher needs flexibility to explore knowledge freely [40]. Classroom management at an early age [32] requires strategies such as role playing, drama, visual displays, storytelling, managing pictures and tables, reading, writing. Thus the belief of childhood teachers in their ability to teach science, so that children are able to participate in learning which tends to develop an attitude of curiosity, openness in thinking, critical thinking, and sharing ideas with others. It is often said that strategy activities with science learning, both in the domain of knowledge and in the domain of

scientific skills.

CONCLUSION

The results revealed by this article suggest that it is necessary to apply scientific literacy, considering the importance of scientific literacy in early childhood. Classroom management strategies are important to facilitate the application of scientific literacy in a fun way, because this process will actually instill knowledge, skills, attitudes and knowledge competencies for social provision in society.

The teacher factor greatly influences the application of scientific literacy in kindergarten. Teachers become important to master various strategies in the scientific approach, as an effort to implement classroom learning with careful planning. Applying scientific literacy to an early childhood education institution is possible if all parties work together to understand the learning process openly.

Findings suggest that using children's literature as an invitation to provide context for science inquiry games can be a way for early childhood teachers to develop self-confidence and competence to teach science through inquiry. Relevant research analysis has stated that the teacher's ability to organize the class starts from understanding class strategies. This strategy will be associated with a scientific approach to learning patterns of scientific literacy that are fun for children in the classroom.

Finally, this research can be implied as a suggestion for improvement to improve the quality of education at the level of early childhood education. The role of educators will be very influential in encouraging the growth of children to become individuals who have the characteristics of having a scientific perspective. until finally, the management of strategies and innovations in the implementation of learning are important for teachers to master in the future.

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