

Creative Science Literacy Learning Methods for Early Childhood

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ABSTRACT: Literacy is the foundational element in developing various aspects of growth through the integration of the concept into the learning process based on existing knowledge. Therefore, this research aims to describe and analyze literacy learning strategies for early childhood science, from planning and implementation to assessment stages. The method used is a literature review, serving as the initial step in designing the framework. In this context, the success of science literacy learning is evident when the material studied is understood and applied in daily life. The results show that science literacy learning strategies in early childhood education (ECE) start from the planning stage, such as setting objectives, selecting materials, and creating a suitable environment. The implementation process is supported by the use of learning media, while evaluations are conducted according to developmental indicators..

KEYWORDS: Learning Methods, Science Literacy, Creative, Early Childhood

I. INTRODUCTION

Various elements are integrated from daily notes related to personal experiences, thoughts, and reflections on daily activities to enhance the research background. These elements are related to self-development, emotional management, and adaptation to routines supporting productivity and learning. This research is inspired by personal experiences in facing daily challenges related to time and emotional management, as well as the need for adaptation to routines supporting personal and professional success. Different strategies used to overcome fatigue, boredom, and motivational challenges are stated in daily notes, such as meditation, physical exercise, and the use of productivity tools including Notion and Focusmate. Furthermore, the research explores the influence of physical and social environments on productivity and emotional well-being, showing the importance of selecting work locations and social interactions in supporting performance and job satisfaction (Wahyuseptiana, 2021). The importance of science literacy and adaptability in facing the modern era full of changes and challenges is reported. The roles of critical thinking skills, problem-solving, and self-management in overcoming obstacles and achieving personal goals are also reported through observations of daily life. In this context, the research connects individual experiences with the broader context of human resource development and educational innovation, focusing on science literacy to prepare individuals in facing challenges (Cremin et al., 2018).

Integrating science literacy into early childhood education (ECE) curriculum is a strategic step in addressing complex global challenges. An early-age introduction equips students with basic knowledge about the surroundings and stimulates the development of scientific thinking skills highly beneficial in all aspects of life. Student-centered learning processes and active exploration promote the development of important skills such as observation, inquiry, experimentation, and reflection, which are key components of science literacy (Westhisi et al., 2020). Moreover, developing science literacy in early childhood also promotes adaptability and resilience in addressing problems and challenges. Students accustomed to a scientific method to problem-solving will be better able to adapt to changes and find innovative solutions. This is not only relevant in an academic context but also in daily life where the ability to think critically and make evidence-based decisions becomes important. An interdisciplinary method in the application allows integration with other fields such as mathematics, technology, and arts, providing rich and diverse learning experiences for students. Therefore, science literacy is not limited to learning scientific concepts but also develops an understanding of the interaction and integration with various aspects of life (Westhisi et al., 2020). To strengthen the implementation of science literacy in ECE, collaboration between teachers, parents, and the community is necessary. Teachers need to be equipped with resources, training, and support to design and implement learning activities that stimulate curiosity and imagination. Parents and the community also play a crucial role in enriching learning experiences through daily activities related to science, such as exploring nature, conducting simple experiments, and discussing scientific phenomena.

This research aims to serve as a comprehensive and practical source of information for all stakeholders, guiding how to effectively integrate science literacy into ECE. Through a holistic and collaborative method, a strong foundation can be built for future generations that possess broad knowledge in the field of science as well as critical thinking skills, creativity, and adaptability required for success in the 21st century (Dianti et al., 2023).

II. METODE

This research is based on a literature review method regarding the application of science literacy in the context of ECE, considering various relevant and diverse sources. The method aims to summarize initial understanding and gather the necessary information as a preliminary step in planning further research, using available sources to gain a deeper understanding of the discussed topics (Ridwan et al., 2021). The sources include various types of references, such as primary sources comprising scientific journals, research data, and research reports, as well as secondary sources, namely books, regulations, and other legal literature. The information obtained from the sources forms the basis of thinking in the development of this research. A synthesis of ideas and solution concepts from various relevant problems is systematically conducted. Therefore, this research aims to present the best solutions that can contribute to readers, specifically academics and practitioners in the field of ECE (Adlini et al., 2022).

III. RESULT AND DISCUSSION

Science Literacy Learning Methods for Early Childhood : Literacy is often understood as skills related to understanding letters and numbers, including activities such as reading and writing. However, based on the Prague Declaration in 2003, the perspective is expanded to include individuals' ability to communicate and interact in social contexts, related to knowledge, language, and culture (UNESCO, 2018). As social beings, individuals have realized the need for information literacy, which is the ability to find, understand, evaluate, and organize information into knowledge (Kelly & Licona, 2018). The focus on literacy related to reading and writing skills is an area of global concern. The United Nations Development Programme (UNDP) report in 2014 shows that Indonesia has recorded significant improvements in literacy rates among adults and adolescents, with percentages of 92.8% and 98.8%, respectively. Therefore, the country has successfully overcome critical challenges in the field of literacy. A survey conducted by UNESCO in 2012 reported an increase in reading interest from the previous year, which was very low at 0.001% (Jamhari, 2016). Central government efforts to raise awareness about literacy in the educational environment have obtained positive results. However, there are obstacles such as the availability of reading materials in physical and digital formats unevenly distributed, as well as limited motivation and interest in reading.

The National Literacy Education Initiative, launched in 2016, aims to stimulate reading interest among elementary to secondary schools through the School Literacy Movement (SLM). Furthermore, SLM is expected to promote students to read diligently, which enriches knowledge and increases the application in daily life. This program aims to improve the quality of life for the Indonesian community, increase national productivity, and strengthen the competitive position internationally. Indonesia can compete with other Asian countries, advance the nation's character revolution, celebrate diversity, and support social recovery (DeJarnette, 2018).

In the context of ECE, literacy activities are positioned as fundamental foundations for advancing various aspects of students' development, integrating literacy activities with other learning elements. The important role of literacy in supporting early mathematical development in early childhood has been significantly proven (Utami & Utami, 2023). Students in the modern era need to be equipped with basic literacy skills, competitive abilities, and character integrity (Utami & Utami, 2023) as well as apply literacy. Learning programs in ECE are designed to engage students in literacy through games and storytelling to face challenges from the simplest to the most complex. These challenges are valuable learning opportunities where knowledge is acquired through experiences and social interactions. Therefore, the experiences instill reading and writing skills as well as shape character traits such as independence, confidence, and honesty. In line with this, literacy skills are considered not limited to mere reading and writing abilities but include 'multiliteracy', a concept introduced by (Febriani et al., 2023) as individuals' ability to express and understand ideas, ranging from innovative and conventional texts to symbols and multimedia. Several core skills support literacy development, such as science. In addition, science literacy includes the ability to use scientific principles and insights to understand the surrounding world and test theories (Sari et al., 2021). The concept refers to knowledge and skills that help individuals recognize issues, acquire new knowledge, describe scientific phenomena, and draw conclusions based on evidence. This also comprises understanding fundamental aspects, recognizing the relationship between science and technology in shaping the natural, intellectual, and cultural environment, as well as the ability to engage with related issues responsibly (Snowling et al., 2022). The concept emphasizes the importance of introducing science literacy to

students from an early age, as targeted by the 2013 Curriculum for ECE with a method that promotes active learning activities. The method aims to acquire new experiences and knowledge through observations and experiments. This is part of the essential competencies to face present challenges, including critical thinking skills, problem-solving, stimulating creativity through scientific experiments, communicating findings from observations or experiments through various means, and collaborating in teams during scientific activities. These activities also aim to develop character traits such as curiosity, initiative, perseverance, confidence, leadership, independence, and others (Musi et al., 2022).

The achievement of students' development in ECE is influenced by the contributions of teachers. As educational facilitators, teachers design and implement suitable learning strategies to ensure objectives are achieved. The concept of learning strategies is a set of activities initiated to achieve desired outcomes effectively and efficiently (Snowling et al., 2022). In the context of science literacy in ECE, this method is implemented in a group setting. Observations in Kindergarten, specifically for Group B, show that teachers tend to organize group learning activities. This learning strategy is conceptual, requiring various concrete and practical methods to achieve the intended outcomes, including tutorials, demonstrations, discussions, role-playing, and problem-solving (Snowling et al., 2022). In the field of science education, learning methods include planning, implementation, and evaluation stages. During the planning stage, teachers determine learning objectives, teaching materials, educational media, and teaching methods to convey scientific concepts through a literacy method. Various forms of the concept include early, basic, library, media, digital, and image literacy (Ridwan et al., 2021). During the implementation of science learning, interaction between teachers and students can take place through the use of images and verbal communication about natural phenomena. Interaction processes such as questioning or discussion serve as the foundation for the development of early literacy skills. The level of basic literacy is reached when students hear explanations about natural phenomena and retell the concept based on experiences in scientific experiments. Teachers are also expected to integrate the use of relevant fiction and non-fiction books with science materials to enhance reading interest and motivation in students. Annual programs that include visits to libraries positively contribute to literacy experiences, enriching students and providing meaningful learning experiences (Widayati et al., 2021).

In the application of science literacy at the Kindergarten level, teachers present materials through various engaging media. The use of colorful images in print, electronic, and digital media has been proven effective in capturing the interest and attention of students to better receive learning materials. According to (Sjöström & Eilks, 2018), this is an important strategy in early education. In the context of science learning, literacy activities can be integrated with other developmental aspects, such as art, where students' understanding of science is manifested in the form of artworks or projects through drawing activities. The results are used as an evaluation to measure the understanding of the taught material. According to (Sjöström & Eilks, 2018), diverse science learning activities enhance students' liveliness and enrich experiences, making the learning process more meaningful. To achieve optimal objectives, teachers should collaborate with parents and caregivers, supporting and promoting students to become critical and scientific thinkers.

Teachers' Pedagogical Competence : Pedagogical competence refers to the art and science of teaching toward specific educational objectives. Teachers' pedagogical competence includes the skills or capacity to effectively guide the education of students in achieving set targets. This competence includes recognition and understanding of educational principles, in-depth knowledge of students, curriculum and syllabus development, planning of teaching and learning processes, implementation of educative and interactive methods, assessment of achievements, and efforts to develop potential (Dini, 2022b)). Each of the elements is important to be integrated in pursuing professionalism. The absence can affect the mismatch between learning outcomes and expected educational goals. Therefore, it is crucial to accurately and deeply understand and apply pedagogical competence. (Zahro et al., 2019) argued that teachers' pedagogical competence included various important aspects, such as (1) Teachers should have a deep understanding of students, including unique characteristics, various types of intelligence, creative abilities, physical conditions, development and growth stages, as well as interests and abilities possessed, (2) Teachers should be competent in planning and implementing effective learning process, (3) Teachers should be efficient in using educational technology to support the learning process, (4) Teachers should have the ability to evaluate students' outcomes, including various assessment methods such as class evaluations, basic skills tests, end-of-program evaluations and certifications, standard comparisons, and learning program evaluations, and (5) Teachers should be active in identifying and developing students' potentials through extracurricular activities, enrichment, and remedial programs, as well as educational guidance and counseling. These elements are key to ensuring that teachers can educate and guide students holistically,

Creating a conducive learning environment and stimulating the growth and development of students' potential to the fullest. The exposition outlines the importance of pedagogical competence. This includes educating students through a deep understanding of characteristics, educational principles, curriculum and syllabus development, strategies for planning and executing teaching and learning processes, the application of technology in education, and strategies to optimize students' potential according to predetermined learning objectives. Increasing awareness of the relevance of teachers' competence in the education sector should be promoted through a series of training programs. These programs, organized by relevant agencies or departments, aim to enhance teachers' motivation, enrich the understanding of existing competence, broaden knowledge of skills, and enhance skills to become more professional. In the context of ECE, the Competence-Based Integrated Training Program (CBITP) is an initiative with the potential to have a positive impact on enhancing competence (Kelly & Licona, 2018). Meanwhile, (Noor, 2020) emphasized several important factors in pedagogical competence for teachers. These include understanding the phases and aspects of students' development at an early age, basic learning principles for early childhood, effective strategies, selection of appropriate media, and the ability to plan a learning session as well as conduct an assessment. This knowledge should be mastered both theoretically and in practical application. Before starting a learning session, teachers should be able to determine the most suitable strategies for students' characteristics, to achieve objectives maximally. During the implementation of learning, the media used should be relevant to the material being taught, specifically when teachers design the media. An effective learning plan is key to achieving desired outcomes. This plan includes the concept of learning, theme determination, the organization of semester learning programs, as well as the preparation of weekly and daily lesson plans. In designing lesson plans, teachers should also be able to create assessment criteria for learning activities. This requires teachers to understand the assessment principles applicable to early childhood and be able to design accurate assessments to measure learning progress according to the development stage (Syaodih et al., 2021). Teachers' pedagogical competence is also related to the ability of teachers to plan, implement, and evaluate the teaching and learning process.

Lesson Plans in Science Literacy : The importance of science literacy cannot be ignored considering the role in empowering students to navigate the challenges presented by rapidly evolving knowledge and technology (Werdingasih, 2021). With the presence of science literacy, students can fulfill the needs of the times by becoming individuals capable of solving problems, competing healthily, innovating, being creative, collaborating, and having strong characters, in line with the competence needs in the 21st century (Werdingasih, 2021). In planning science learning for early childhood, several crucial aspects should be considered as analyzed from previous research (Susetyo et al., 2021):

1. Setting learning objectives selected from the applied curriculum. In the 2013 Curriculum for ECE, several science concepts become basic competence, including: a) Recognizing body parts as well as the functions and movements for gross and fine motor development, b) Understanding principles of healthy living, c) Applying problem-solving methods in daily life and acting creatively, d) Identifying surrounding objects including names, colors, shapes, sizes, patterns, properties, sounds, textures, functions, and other characteristics, e) Understanding the natural environment, and f) Knowing basic technology.
2. Selecting materials to be used, including tools and materials to introduce knowledge concepts.
3. Preparing students and arranging the environment, which comprises forming groups, distributing tasks, and preparing spaces or locations for exploration and a deeper understanding of science. This can be performed in various areas such as science zones, school gardens, or agricultural areas.
4. Developing clearly defined activities carried out by students and tasks conducted by teachers during the science learning process.
5. Providing reinforcement and rewards to motivate students.
6. Implementing enrichment activities, such as visits to locations relevant to the science topics discussed.

Implementing Science Literacy Learning : In implementing science learning, the development of various aspects must be promoted in early childhood, including abilities and unique characteristics. This comprises developing scientific thinking skills from an early age realized through the exploration and analysis of information using scientific methods such as observation, measurement, classification, hypothesis-making, problem-solving, communication, and others. Teachers need to show creativity and innovation in selecting learning models and strategies suitable to fulfill the needs and support the growth of students. These science learning activities can be integrated with other themes to create holistic and comprehensive experiences (Aguilera & Ortiz-Revilla, 2021). In supporting the success of implementing science literacy, the role of media is crucial in the effectiveness of the learning process. Media is an essential component inseparable from the learning method, contributing to improving learning effectiveness. The use of media is highly integrated and

serves as crucial support in science literacy learning as well as relevant skills for the 21st century, specifically when used as a tool to develop critical thinking and apply inquiry methods. The selected media should be relevant to the learning themes conducted in an educational institution. The importance of concrete and tangible media for early childhood should not be overlooked, as the selection of appropriate media is crucial for operational ease and accessibility for students. According to (Zahrotin et al., n.d.), the selection of media should be in line with the intended function of representing the media in stimulating students' thinking skills. In the context of evaluating science literacy learning, (Chrismanto et al., 2024) showed the importance of several aspects in assessing science literacy, including the principle that the assessment does not classify individuals as literate or illiterate and should be conducted continuously. Assessment may require different types of questions, which are not limited to curriculum concepts but also include broader understanding. The questions should provide data or information that enables students to perform analysis and synthesis in answers, facilitate information processing, be adaptable to various formats such as multiple-choice or essay, and include contextual application. From a broader evaluation perspective in the context of education, several key indicators include (Anita et al., 2023) the number of training sessions attended by science and non-science teachers, the extent to which science literacy is integrated and applied, the amount of problem-solving and project-oriented science learning sessions, the number of non-science sessions, scores in science literacy in international assessments such as PISA, TIMSS, or INAP, and the number of products generated through project-based learning. Assessment in science literacy includes evaluating students' understanding of science content, the science process, and the application of science content. Furthermore, the materials include curriculum and content focusing on conceptual understanding and the ability to be applied in real-life situations, referring to problem-solving skills (Supriatin & Hayati, 2022).

IV. CONCLUSION

In conclusion, the importance of science literacy for students, specifically from an early age was crucial in providing a fundamental understanding of the world of science. This broadened the insights into the developmental aspects of science and enhanced the capacity for scientific thinking. Implementing science literacy in early education paved the way for the development of analytical and critical skills while also improving the formation of responsible character toward oneself and the environment. The implementation of science literacy in ECE curriculum was expected to equip teachers with strong scientific literacy skills and facilitate student-centered learning. Therefore, students could internalize and apply scientific concepts in daily life through the use of concrete learning media to understand scientific concepts intuitively and applicatively. The integration of science literacy in ECE aimed to sharpen thinking skills in the context of science and facing real-life challenges with a scientific method. This readiness was essential to prepare the younger generation in adapting to the dynamic developments of the times, where technology and science became crucial elements in various aspects of life. Therefore, science literacy served as the foundation that helped early childhood to grow into intelligent, creative, and responsible individuals, ready to face future challenges with innovation.

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