Integration of Scientific Literacy and Technology in Designing Early Childhood Learning

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ABSTRACT
This research is motivated by the problems and difficulties experienced by kindergarten teachers in designing learning through developments and technology as the implementation of 21st-century learning policies. This research aims to improve kindergarten teachers' ability to design and implement quality learning to realize the nation's next generation in a future full of challenges. The method used is classroom action research, with the Eliot model carried out through four stages. The research subjects are postgraduate students and early childhood education teachers. The results of this study indicate an increase in the ability of teachers to design and implement learning by integrating technology and scientific Literacy. by the age and level of development of early childhood to realize fun, meaningful, and innovative learning that can help children to live an authentic life in a future full of challenges. In addition, scientific Literacy helps children to form patterns of thought and behavior and build character to care and be responsible for themselves, society, and the universe, as well as prepare themselves to deal with problems faced in modern society that are very dependent on technology. Scientific and technological Literacy functioned as a unitary ability to obtain, evaluate, and then obtain strategies to process information and use it systematically in their duties as professional teachers.

Keywords: Problem-Based Learning model, Literacy and technology, Designing Learning

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1.   INTRODUCTION

The development of science and technology is so fast and rapid in the era of the 21st century today is a condition that demands changes that aim to improve the quality of life of future generations (Asrizal et al., 2022; Dunwoody, 2021; Sheng et al., 2019). The 21st century is marked by a massive transformation of knowledge from an agrarian society to a knowledge society (Ahmed et al., 2021; Castronova, 2002; Silva, 2009).

This is in line with the 2010 Education Standard, which states that "National Education in the 21st century aims to realize the ideals of a prosperous and happy Indonesian nation with an honorable and equal position with other nations in the global world, through the formation of quality resources, namely individual who is independent, willing and able to realize the ideals of his nation (Aud et al., 2010; Putman & Walsh, 2021; Thomm et al., 2021). In addition, the 21st century is marked by the rapid and rapid development of science and technology, which has an impact on all aspects of human life, especially education (Umriani et al., 2020).

Education in Indonesia faces extraordinary challenges, so a paradigm shift in the education system is needed that can provide a set of 21st-century skills needed by students to face every aspect of global life (Walid et al., 2019). Based on several studies on 21st-century education, showing that there are enormous demands and challenges for teachers in conducting learning that can lead students to live in their era, one of the skills that teachers need to have is mastery of scientific and technological Literacy (Kristyowati & Purwanto, 2019).

Science and technology literacy is reading and writing about science and technology and applying and processing science and technology concepts in society. Scientific Literacy is needed in the 21st century among 16 other skills (Aldowah et al., 2019; Claro et al., 2012; Leward & Hirata, 2011). Given the importance of scientific Literacy, it is essential to prepare teachers with scientific and technological literacy skills to apply in designing, learning, and implementing them, especially in early childhood institutions, to prepare the next generation, which is full of challenges.

2.   METHOD

This study uses the method of classroom action research. This research reflects taking specific actions to improve and improve classroom learning practices professionally (Suarni, 2019; Ekici & Erdem, 2020; Niff, 1992). Furthermore, Niff suggests that the purpose of classroom action research is to improve or improve practice learning to become more effective. In the handbook in Research and Education, Isaac suggests that action research aims "to develop new skills or new approaches and solve problems with direct application to the classroom or world setting." Based on the opinion above, the classroom action research method is by the research objectives to be achieved.

This research was carried out using the John Elliot model. This model was chosen based on consideration because it is more detailed and detailed. Each cycle can consist of several actions, while each can consist of several steps, which are realized as learning activities. The research procedure is through the following stages: (a) Finding and Fact Analysis Stage At this stage, and the researcher conducts preliminary research, the aim is to find out various facts related to the implementation of the learning process, using documentation (b) Planning stage, namely making an overall plan based on The initial findings are trying to improve the quality of the learning process through the Problem-Based Learning (Pbl) learning model to improve Problem-Solving Ability to be used in the methodology course for early childhood science development, covering various kinds of problems encountered in the development of science in early childhood learning that carried out

in each cycle during the research, (c) Action Implementation Phase, namely implementing the plans that have been prepared with the team with the support of materials and media that have been prepared. All actions, both in cycle one and cycle 2, were implemented in one class. (d) Implementation and Effect Monitoring Phase This phase is carried out simultaneously with the implementation of the action. At this stage, observations are made on the ongoing actions and effects caused by these actions, both by students or lecturers and the learning system as a whole. Observations are carried out by collaborators (team teaching members) and also by researchers directly when carrying out learning (e) Failure Explanation Stage This stage is an evaluation and reflection stage on the results of monitoring that has been carried out, both learning processes and products, discussed together with the research team individually. Objective and open, such as comments, responses, and assessments, are integrated to measure the success of the implementation of Learning in the first cycle, both related to learning strategies and learning content (fields of development), and then the level of success is concluded. If it has not reached the desired level of success, then the cause is sought, improvements and follow-up are carried out in the next cycle, and so on.

This research was carried out in the Postgraduate Study Program of Educational Technology with a concentration of Early Childhood FKIP Bengkulu University, the lecture hall of Gedung Bersama 3, as a lecture room. The research subjects were postgraduate students of the Education Technology Study Program with a concentration in Early Childhood in semester 2, totaling 15 people. The data collection techniques used in this study were (1) observation sheets used to observe lecturers and students in learning using a problem-based learning model, what the ability of students in scientific and technological Literacy in designing early childhood learning, (2) Tests Learning Outcomes in the form of oral and practical tests at the end of each cycle.

3.   RESULTS AND DISCUSSION

Science and technology literacy plays a vital role in developing education in Indonesia. The spearhead who holds this role is the school teacher, which is related to organizing learning in the classroom by applying scientific and technological Literacy so that children have the competencies needed in their competitive lives. In its nation as well as competition with other nations, in line with this result of the achievement of student scientific literacy in the PISA (Program for International Student Assessment), Indonesia is included in the low level, namely the bottom ten position when scientific Literacy is a significant factor in determining the quality of education in Indonesia. a country ((OECD), 2010).

The low level of achievement of scientific Literacy in Indonesia is one of the empirical foundations for creating the 2013 curriculum. In the 2013 curriculum, scientific Literacy is seen through scientific inquiry learning. In scientific inquiry, learning involves the process and attitude of science so that children can construct their knowledge. The approach used in the 2013 curriculum is a scientific approach that consists of five activities (5M): observing, asking, experimenting, associating, and communicating. Based on some literature mentions that the scientific approach is the same as the inquiry approach, so the 2013 curriculum has accommodated the development of scientific Literacy for children; not only that, the 2013 curriculum also required the application of technology, whose success is determined by the role of the teacher.

One of the teachers' roles is as a designer/designer of learning, especially in early childhood. It is the first step to organizing learning. It provides valuable experiences for children in stimulating

their development, including religious and moral values, social and emotional development, knowledge (language and cognitive), and skills (motor skills). Learning in early childhood is carried out holistically and integratively based on the theme as a vehicle for communicating knowledge.

Several things need to be considered by teachers in designing learning by integrating scientific and technological Literacy, namely; Understanding of scientific and technological Literacy, which is the ability to solve problems using scientific concepts, recognize technology and its impacts, be able to use technological products and maintain them, be creative in making simplified technological results, and be able to make decisions based on values" (Dewi, 2016; NUANGCHALERM & El ISLAMI, 2019). The scientific and technological literacy aspect includes understanding concepts, concept application in specific contexts, process skills, and scientific attitudes. This is by understanding the four foundations of scientific and technological Literacy described by the Center of Curriculum Ministry of Education (Puskur, 2007).

Skills in applying Problem-Based Learning (PBL) is an instructional method that challenges students to "learn and learn," working with groups to find solutions to real problems. This problem relates curiosity and analytical and initiative skills to learning materials. Problem-Based Learning (PBL) also prepares students to think critically and analytically and to find and use relevant learning resources. Problem-based Learning (PBL) begins with meaningful real-life problems where students can choose and conduct any investigation inside and outside the school as necessary to solve the problem. The Problem-Based Learning model is closely related to the ability to solve problems; the problem-solving in question is problem-solving in designing learning that teachers will use in kindergarten institutions. The expected learning design is based on early childhood characteristics, science and technology development, 21st-century learning, and the environment of kindergarten institutions. This will be effective if kindergarten teachers design it based on scientific and technological Literacy.

The steps in designing learning by integrating science and technology literacy in early childhood are: a) Determine the theme/sub-theme or topic and sub-topic to be discussed, according to the semester program (PROSEM and RPM) of kindergarten institutions; b) Make material mapping from the selected sub-themes/sub-topics, using a spider web (Webbed) for material mapping assisted by 5 question words (what, who, where, when, and why) about the material from the selected topic; c) Analyzing Core Competencies (KI) and Basic Competencies (KD) or Learning Outcomes (CP) or Sub-CP relevant to the chosen theme/topic, then developing indicators for each KD or CP; d) Formulate Learning Objectives, namely the objectives to be achieved in learning activities by fulfilling the following requirements: A (Audience), B (Behavior), C (Condition), and D (Degree) and using operational verbs that build higher order thinking skills / LOTS; e) Developing Learning/Playing Materials or Materials, which are oriented towards Science, Technology, Engineering, Art, Mathematics (STEAM) using various learning resources; f) Developing Learning Activities / Playing Activities Strategies, with a scientific approach, innovative learning methods (including Problem Based Learning, Project Based Learning, Discovery Learning) and using various Playing Media / tools, and determining Children's Worksheets (LKA); g) Developing Assessment Tools, namely determining assessment procedures, assessment instruments both test and non-test, criteria and rubrics, in accordance with the goals that have been set; h) Ratification of the lesson plan by the Teacher and Head of Kindergarten.

Learning designs developed based on these steps and implemented consistently can provide children with meaningful experiences in their lives and optimally improve various aspects of

development. In addition, the learning process is carried out happily so that learning can build new knowledge and understanding with fun (Heggart & Dickson-Deane, 2022; Sulistyaningsih, 2022). In research conducted by Vallori (2014), meaningful learning can easily be obtained from meaningful learning experiences in the classroom product effectiveness means students. Plus, it is surprising to see how unsuccessful it is. Students can work hard and want to increase their knowledge. By working with its Methodology, good results appear from day one.

When teachers from all fields and levels of education are aware of student progress and the results product, they feel motivated to continue the project and do not want to come back again (Agra et al., 2019). Teachers find meaning in teaching because their educational efforts are appreciated. They can get immense satisfaction because all students complete their class assignments daily (Kostiainen et al., 2018). Another explanation in this research reveals that students' cognitive development will be stable and even increase so that students' knowledge can be developed by controlling the learning process (Flavell, 2013).

4.   CONCLUSION

The teacher's role in integrating scientific and technological Literacy in designing and implementing learning in early childhood is the right effort to support optimal child development, in addition to preparing early childhood children to continue their education at a higher level, as well as equipping children to be able to live at a higher level. Public. In addition, the learning design puts forward learning activities in the child (children's center), where children are directly involved in activities by collaborating and interacting to solve their problems, thus encouraging children to have life skills.

There are seven types of life skills needed in the 21st century. Wagner (2010) states the seven skills are (1) critical thinking and problem-solving skills, (2) collaboration and leadership, (3) dexterity and adaptability, (4) initiative and entrepreneurial spirit, (5) able to communicate effectively both orally and in writing, (6) able to access and analyze information, and (7) have curiosity and imagination. Children's activities that are intentionally designed and carried out consistently will be able to lead children to have learning and innovation skills, skills to use technology and information media, and to be able to work and survive by using life skills. This aligns with the concept the Ministry of Education and Culture of the Republic of Indonesia adopted to develop an educational curriculum for Creative Indonesia in 2045. The adaptation is carried out to conform the concept to the capacity of students and the competence of educators and education professionals. 21st-century skills are (1) life and career skills, (2) learning and innovation skills and (3) Information media and technology skills.

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