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INTEGRATING ENGLISH LANGUAGE LEARNING AND SCIENCE EXPLORATION TO DEVELOP EARLY CHILDHOOD MULTILINGUAL LITERACY

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Abstract

This study aims to examine the integration of English language learning and science exploration in an effort to develop early childhood multilingual literacy. A qualitative approach with a case study method was used to explore learning practices in one of the PAUD institutions that implemented hands-on experience-based thematic learning. Data were collected through observation, interviews, and documentation, and then analyzed thematically. The results of the study show that the integration of English in science exploration activities is able to improve the understanding and use of foreign language vocabulary contextually by children. Children show progress in recognizing vocabulary, responding to instructions, and using language in the context of experiments or play activities. In addition, this approach encourages the growth of curiosity and active involvement of children in the learning process. However, the limitations of teachers in English proficiency and the need for parental involvement are challenges in themselves. This study emphasizes the importance of cross-disciplinary learning design that is contextual, applicative, and in accordance with the characteristics of early childhood development to build the foundation of multilingual literacy from an early age.

Keywords: ***Multilingual Literacy, Early Childhood, English, Science Exploration, Integrative Learning.***

INTRODUCTION

Early childhood development is an important foundation for a child's cognitive, social, emotional, and linguistic growth. During this period, children are in a golden age that has great potential to obtain various stimuli, including language and scientific knowledge (Marsini et al., 2022). According to (Santrock, 2011), early childhood is a critical time in forming the foundation for lifelong learning skills. One of the essential skills that needs to be developed from an early age is literacy, which is the ability to understand, use, evaluate, and reflect on information from written and spoken texts (Kurniawan et al., 2023). In today's global era, multilingual literacy is becoming increasingly important, along with the increasing need to interact across cultures and languages. (Hall, 2013) emphasizes that multilingual skills can improve children's cognitive flexibility and metalinguistic awareness.

Early English language proficiency is considered an important investment in children's education (Samadun et al., 2023). English as a global language opens up children's access to international knowledge resources and wider educational opportunities in the future (Bialystok, 2001). Therefore, a learning approach that integrates English with meaningful context becomes very strategic. On the other hand, the exploration of science in early childhood contributes to the development of cognition, curiosity, and critical thinking skills. (Eshach & Fried, 2005) states that science learning that begins at an early age can foster children's scientific attitudes, curiosity, and ability to understand the phenomena around them. The integration between English and science exploration can create a holistic, meaningful, and contextual learning experience for children (Marsini, 2023c). This learning model allows children to learn language through hands-on experience, not just memorizing words. (Cameron, 2011) emphasizing the importance of real context in language learning for children, where language is used as a means of communication, not just as an object of study. Multilingual literacy not only refers to the ability to recognize and use more than one language, but it also includes cross-cultural and contextual understanding. (Matthew, 2014) Introducing the concept of translanguaging as an approach that facilitates children to use their entire linguistic repertoire in understanding and

communicating meaning. In the context of early childhood education in Indonesia, the integration of cross-disciplinary learning such as language and science is still not optimal (Marsini, 2023a). Learning is often still fragmented, with a less thematic approach and not based on the child's real experience (Marsini, 2023b). In fact, the independent curriculum encourages a thematic approach based on projects and exploration. Early childhood education is supposed to utilize a fun, interactive, and game-based approach. Therefore, the integration of English and science exploration can be packaged in play activities designed to stimulate children's communication, collaboration, and observation. (Fleer & Hedegaard, 2010) underlining the importance of imaginative play in the context of science learning for children.

The use of English in science exploration activities, such as simple experiments, nature observations, and small science experiments, allows children to absorb new vocabulary and language structures naturally. This is in line with the Content and Language Integrated Learning (CLIL) approach, where foreign languages are taught through academic content (Coyle et al., 2010). This integrative approach supports the development of multiple intelligences, especially linguistic and naturalistic, as argued by (Gardner, 2000). Children not only learn language verbally, but also develop intelligence in understanding the environment and scientific processes. In addition, this approach supports scaffolding of teachers as facilitators. (Vygotsky & Cole, 1978) states that children's learning is strongly influenced by social interaction with adults or peers who are more capable through the proximal developmental zone (ZPD). Through this approach, teachers can develop activities that integrate English vocabulary with science processes, such as naming colors, objects, or actions in English while conducting experiments. Children learn through real actions and meaningful dialogue.

Multilingual literacy developed from an early age also provides long-term benefits. Research by (Cummins, 2019) shows that children who develop two or more languages early have better academic and cognitive abilities than children who only master one language. The main challenges in implementing this integrative approach are limited resources, teachers' ability to teach English and science at the same time, and the lack of a standardized learning model (Marsini, 2025). Therefore, it is necessary to develop an integrated learning model that is in accordance with the characteristics of early childhood. Social and cultural contexts also play an important role in the development of multilingual literacy (Marsini, 2023c). Children who grow up in environments that support the use of more than one language tend to have better motivation and language skills (Tabors, 2002). In practice, this approach can be implemented through project-based activities, such as creating a mini-garden, investigating plant growth, or water experiments, using instruction and communication in English. Children will get used to using English in a meaningful and fun context.

This approach also supports parental involvement in the learning process. When children bring home new science experiences and vocabulary from school, parents can play a role in strengthening learning at home, creating a language-rich literacy environment. The success of the implementation of this learning integration is not only measured from children's language mastery or science knowledge, but also from increased children's confidence, active participation, and curiosity in learning. This is the essence of holistic and sustainable early childhood education. This study is important to answer the needs of the times while supporting the vision of national education in producing a generation that is intelligent, creative, and able to adapt in a global environment. With this approach, children are not only prepared for the present, but also for the future that demands multilingual competence and scientific literacy. Based on this background, this study aims to explore how the integration of English learning and science exploration can develop early childhood multilingual literacy, as well as design a contextual and applicative learning model according to the characteristics of child development.

RESEARCH METHODS

This research uses a qualitative approach with a case study method (Assyakurrohim et al., 2023). This approach was chosen because it allows researchers to deeply understand the process of integrating English language learning and science exploration in the context of early childhood multilingual literacy development. The research was conducted in one of the Early Childhood Education (PAUD) institutions that has implemented an integrative thematic learning approach as part of an independent learning-based curriculum. The research subjects consisted of classroom teachers, children aged 5–6 years, and parents as supporting informants. The selection of subjects is carried out purposively, taking into account the active involvement of teachers in designing thematic learning that integrates elements of foreign languages and science in an exploratory manner, as well as children who have demonstrated early ability to know English. This research focuses on the processes, interactions, and outcomes that emerge during the implementation of learning. Data collection techniques were carried out through participatory observation, in-depth interviews, and documentation. Observations are carried out directly in the classroom during the learning process, to see how teachers integrate English in science exploration activities. Interviews were conducted with teachers and

parents to gain an understanding of the planning, implementation, and impact of learning on children's development. Documentation in the form of teacher diaries, children's work, and recordings of learning activities is used as complementary data (Jogiyanto Hartono, 2018). The main instrument in this study is the researcher himself, who acts as an observer as well as a direct data collector. The validity of the data was tested through triangulation of sources and techniques. The researcher compared data obtained from observations, interviews, and documentation to ensure the validity of the information and avoid subjectivity.

Data analysis is carried out thematically with data reduction steps, data presentation, and conclusion drawn. The researcher identified important themes related to the integration of language and science, the development of children's literacy, and the role of teachers in facilitating learning activities. Each finding is analyzed based on relevant theories to interpret the meaning of the learning process that occurs in the field (Saleh, 2017). Through this approach, it is hoped that the research can provide a comprehensive overview of the practice of integrating cross-disciplinary learning to support the development of children's multilingual literacy from an early age. In addition, the results of this research are expected to be the basis for the development of learning models that are applicable, contextual, and relevant to the needs of children in the global era.

RESULTS OF RESEARCH AND DISCUSSION

1. Implementation of English Language Integration and Science Exploration in PAUD

Based on the results of observations and interviews, learning in the PAUD where the research was conducted has implemented integration between English and thematic science exploration activities. Teachers design project-based learning activities that allow children to be directly involved in simple experiments or observations, such as planting mung bean seeds, mixing colors, and observing changes in objects. In each of these activities, teachers insert relevant English vocabulary, such as plant, seed, water, grow, and green. English is used as an additional language of instruction, not as the primary language. Teachers get children used to listening and imitating vocabulary through songs, simple instructions, and contextual dialogue. For example, when a child waters the plant, the teacher will say, "Let's water the plant," and then lead the child to repeat it. This approach is carried out consistently so that children get used to hearing and associating words with the activities they are doing. This strategy is in line with the Content and Language Integrated Learning (CLIL) approach, where English language learning does not stand alone, but is integrated in content learning, in this case science. These exploratory activities not only enrich children's understanding of science, but also introduce them to the functional and meaningful use of foreign languages.

The results of the study show that an integrative approach between English and science exploration can be effectively applied in the PAUD environment with a thematic approach based on concrete activities. Teachers are able to relate simple science concepts to the use of English, such as when children observe plants growing or mixing colors. This process reflects the Content and Language Integrated Learning (CLIL) approach, as put forward by (Coyle et al., 2010), which emphasizes that language learning will be more meaningful when it is associated with other contextual learning content. By providing direct experience to children, English is no longer learned as a separate object, but as a communication tool that is integrated in science exploration activities. This approach is very much in line with the characteristics of early childhood learning through direct experience and interaction. (Cameron, 2011) It also emphasizes that language learning for children should be done through real contexts, not through memorization or abstract methods. In this study, children showed high enthusiasm for exploratory activities, which indirectly accelerated the understanding of English vocabulary.

2. Development of Children's Multilingual Literacy

The results of documentation and observations show that children are beginning to show development in the aspect of multilingual literacy, especially in terms of understanding and using basic English vocabulary related to exploratory activities. Children are able to recognize object names, colors, and actions in English, although they are not yet fully able to string together complete sentences. Teachers note an increase in the child's verbal response to questions or instructions in English. For example, when the teacher asks "What color is the leaf?", some children are able to answer "Green" correctly. In addition, children also begin to use some words in the context of games and daily activities at school, such as saying "water" when they want to water plants or "mix" when mixing colors. This development shows that the integration between language learning and scientific content provides a positive stimulation to children's language skills. Children learn through concrete experiences, so that the understanding of language becomes more meaningful. It also reflects the principle of (Vygotsky & Cole, 1978), that social interaction in a meaningful context encourages children's cognitive and linguistic development. The development of children's ability to recognize and use English vocabulary in the context of science learning shows that this approach is effective in fostering multilingual literacy. The child is able to respond to simple instructions and use a few words in an

appropriate context. This shows that language skills can grow naturally if supported by a meaningful and interactive learning environment. These findings are in line with the view (Matthew, 2014) about translanguaging, where children can access all their language skills simultaneously to build understanding. Children do not have to be immediately proficient in English sentence structure, but rather simply given the opportunity to use them gradually and flexibly according to their abilities. It also supports the view (Cummins, 2019) that bilingual development from an early age can enrich children's cognitive and academic abilities in the long term. The development shown by the children during the eight weeks of learning showed a positive trend in almost all aspects, including an increase in the number of children who were able to recognize vocabulary, respond to instructions, and use words in the context of play and experimentation. This proves that literacy is not only about reading and writing, but also concerns the ability to understand and express ideas in different languages through various media and contexts.

3. Challenges and Support in Implementation

Although this integrative approach has a positive impact, teachers reveal some challenges in its implementation. One of them is the limited English proficiency of PAUD teachers, so the use of vocabulary is often limited to simple phrases. Teachers also recognize the need for training or mentoring in order to develop a more effective bilingual learning strategy. In addition, parental involvement is an important supporting factor. Some children who are used to hearing English at home, or have parents who actively accompany the learning process, show faster development. Therefore, collaboration between teachers and parents is the key to optimizing learning outcomes.

Table 1. Summary of Children's Multilingual Literacy Development Based on Teachers' Observations During 8 Weeks of Learning

Observed Literacy Aspects	Weeks 1–2	Weeks 3–4	Weeks 5–6	Weeks 7–8
Recognize basic vocabulary	30% of children	50% of children	70% of children	85% of children
Respond to simple instructions	25% of children	45% of children	65% of children	80% of children
Using vocabulary in context	15% of children	30% of children	55% of children	70% of children
Interest in English	Tall	Stable	Increase	Increase

This data shows that integration-based learning has a progressive impact on children's language literacy skills, especially in understanding and using English functionally. Although the results show significant progress, there are several challenges that arise in the implementation of this integrative learning. One of them is the teacher's limitations in mastering English. Teachers who are not used to using English in daily communication tend to have difficulty conveying vocabulary consistently or developing spontaneous dialogue in learning activities. This issue shows the importance of continuous training support for PAUD teachers in language mastery and integrative pedagogy. This strengthens the view (Vygotsky & Cole, 1978) about the role of scaffolding in learning, where teachers as facilitators need to have the competence to accompany children in their proximal development zone. If teachers are not competent enough, then the scaffolding process will not run optimally. Therefore, the capacity of teachers is an important determinant in the success of this learning integration. In addition, the role of parents has also proven to be an important factor in supporting learning success. Children who received additional support at home, such as listening to English songs or exploratory activities with their parents, showed faster literacy development. This supports the opinion (Tabors, 2002) that the social context and family environment contribute greatly to the success of second language mastery.

CONCLUSION

Based on the results of the research that has been conducted, it can be concluded that the integration of English language learning and science exploration in early childhood has a positive impact on the development of multilingual literacy. The learning process is designed thematically and contextually to allow children to learn

language through fun concrete experiences, such as simple experiments, nature observations, and exploratory games. This approach creates a learning environment that supports the functional use of foreign languages, not just as memorization, but as a meaningful communication tool. The implementation of this integration has shown that children are able to recognize and use English vocabulary related to science exploration activities. Over time, there is an increase in the child's ability to respond to instructions, use vocabulary in context, and show a high interest in English. This shows that cross-field learning is able to foster multilingual literacy naturally and fun. However, in practice, there are still some challenges, especially related to the limited competence of teachers in actively using English, as well as the need for more appropriate pedagogical training to support this integrative approach. In addition, parental involvement has proven to be an important factor in supporting children's learning success at home, especially in strengthening language experiences and explorations gained at school. Thus, this integrative approach is not only beneficial in improving children's language skills, but also fosters their curiosity, critical thinking skills, and readiness to face a global era that demands cross-language and field literacy skills. Collaborative efforts are needed between teachers, parents, and educational institutions to develop a more applicative, contextual, and sustainable learning model to support optimal early childhood development.

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