UNIVERSITY OF EDUCATION, WINNEBA

ROLE OF PLAY-BASED PEDAGOGY IN DEVELOPNG NUMERACY SKILLS AMONG PRE-SCHOOL LEARNERS WITHING YUNYOO-NASUAN DISTRICT

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ADOKO CHIRAG BIBI

(7251900010)

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DECLARATION

Student's Declaration

I, Adoko Chirag Bibi, declare that this thesis is a result of my original research except for references to other people's work which have been duly acknowledged and it has neither in whole nor in part been presented for another degree in this university or elsewhere.

Candidate's Signature: …….

Date: ……..

Supervisor's Declaration

I hereby declare that the preparation and supervision of this research work were done in accordance with the guidelines for the supervision of research work as laid down by the School of Graduate Studies, University of Education, Winneba.

Mr. Samuel Richard Ziggah (**Supervisor)**

Supervisor's Signature: …….

Date: ……

DEDICATION

To my lovely Family

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ABSTRACT

The purpose of this study was to examine the role of play-based pedagogy in numeracy education among preschool learners in the Yunyoo-Nasuan District. Exploratory case study design was used for the study. A total of 11 preschool teachers were purposively selected based on their teaching experiences, use of play-based methods, and willingness to participate in the study. Data was collected using semi-structured interviews. Thematic analysis was used to identify key themes and patterns emerging from the data. The findings revealed that teachers employed various play-based strategies such as counting games, songs, rhymes, storytelling, role play, and the use of manipulatives to make numeracy instruction engaging and meaningful. These approaches enhanced learners' motivation, participation, and understanding of mathematical concepts more effectively than traditional rote-learning methods. However, the study also found that inadequate teaching and learning materials, overcrowded classrooms, and limited instructional time were major barriers to the effective implementation of play-based pedagogy. The study concluded that play-based teaching is a powerful approach for developing children's numeracy skills through active participation and exploration. It recommended continuous teacher training, provision of child-friendly learning materials, and the integration of play-based methods into the national early childhood curriculum.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Numeracy skills are essential for the cognitive development of preschool learners, forming the foundation for future mathematical understanding and problem-solving abilities (Ginsburg, et al, 2019). The use of play-based pedagogy in teaching numeracy has gained significant attention worldwide as an effective instructional approach that enhances learning experiences for young children. Play-based learning involves structured and unstructured activities that encourage children to explore mathematical concepts in an engaging and interactive manner (Pyle & Danniels, 2017). This study sought to examine the role of play-based pedagogy in developing numeracy skills among preschool learners within the Yunyoo-Nasuan District by identifying the types of play-based pedagogical approaches used, assessing the challenges faced by teachers in implementing these strategies, and suggesting ways to improve play-based teaching for better numeracy skills.

Globally, play-based learning has been recognized as a fundamental approach in early childhood education. Research indicates that children learn best when they are actively engaged in meaningful play experiences that allow them to explore, manipulate, and experiment with numbers and mathematical concepts (Hassinger-Das et al., 2017). In developed countries such as Finland, Sweden, and Canada, play-based pedagogy is integrated into early childhood curricula to promote holistic learning (Lerkkanen et al., 2016). The emphasis on play in these countries allows preschool learners to develop foundational numeracy skills such as counting, sorting, pattern recognition, and spatial reasoning through interactive and hands-on activities.

The Montessori approach, widely used in many countries, also underscores the importance of play in numeracy development. Montessori classrooms use manipulative materials such as number rods, counting beads, and puzzles to enhance children's mathematical reasoning (Lillard, 2019). Studies have shown that young learners exposed to these play-based strategies demonstrate better mathematical understanding and problem-solving skills compared to those taught using rote learning (Sarama & Clements, 2020). Despite the benefits of play-based pedagogy, challenges such as limited resources, lack of teacher training, and rigid assessment structures hinder its effective implementation in some parts of the world.

In Africa, play-based learning is gaining recognition as an important strategy for improving numeracy skills in preschool learners. However, many African countries still face challenges in fully implementing this approach due to inadequate resources, overcrowded classrooms, and traditional teaching methods that focus more on memorization than experiential learning (Mwaura, Sylva et al,). Studies conducted in Kenya and South Africa indicate that play-based pedagogy fosters better engagement and comprehension of mathematical concepts among young learners (Makokha & Githinji, 2019). Children who engage in structured play activities such as building blocks, counting games, and role-playing are more likely to grasp number sense and problem-solving skills than those taught through conventional methods.

Despite its potential, the application of play-based learning in Africa faces several obstacles. A study by Fesseha and Pyle (2016) revealed that many preschool teachers in Ethiopia and Uganda lack adequate training in play-based instructional strategies, leading

to ineffective implementation. Additionally, the lack of appropriate learning materials and insufficient government support pose significant barriers to promoting play-based numeracy learning. Addressing these challenges requires policy interventions, increased investment in early childhood education, and continuous professional development for teachers to equip them with the necessary skills to implement play-based pedagogy effectively.

In Ghana, early childhood education has received increasing attention, with the government making efforts to promote play-based learning in preschools. The Ghana Education Service (GES) and other stakeholders have recognized the importance of play in child development and have incorporated it into the early childhood curriculum (MoE-GES, 2019). However, despite these policy efforts, the implementation of play-based pedagogy in numeracy development remains inconsistent across different districts, including the Yunyoo-Nasuan District.

A study by Osei-Poku and Armah (2021) indicated that many preschool teachers in Ghana acknowledge the benefits of play-based pedagogy in enhancing numeracy skills but struggle with its implementation due to factors such as large class sizes, limited teaching resources, and pressure to prepare learners for formal education assessments. In some rural areas, teachers rely heavily on traditional teaching methods that emphasize rote memorization rather than hands-on learning experiences (Amoako & Kwame, 2020). This has resulted in low engagement levels among preschool learners and limited opportunities for them to develop foundational mathematical skills through play.

The challenges facing play-based numeracy learning in Ghana are further compounded by inadequate teacher training in early childhood education. Many teachers in underserved districts like Yunyoo-Nasuan lack the necessary skills and knowledge to incorporate play effectively into numeracy instruction (Boakye, 2018). Additionally, limited access to educational resources such as counting materials, number games, and interactive learning tools has hindered the successful implementation of play-based teaching strategies.

Play-based pedagogy is a crucial approach for developing numeracy skills among preschool learners, providing an interactive and engaging learning environment that enhances mathematical understanding. Globally, many countries have successfully integrated play into early childhood education, while in Africa, efforts are being made to promote this approach despite challenges such as inadequate resources and teacher training. In Ghana, particularly in the Yunyoo-Nasuan District, play-based numeracy learning faces several obstacles, including limited instructional materials and a lack of professional development for teachers. Addressing these challenges through teacher training, resource provision, curriculum reforms, and parental involvement can significantly improve the effectiveness of play-based pedagogy in numeracy development. By strengthening these efforts, Ghana can ensure that preschool learners acquire strong numeracy skills that will serve as a foundation for their future academic success.

1.2 Statement of the Problem

Early childhood education is crucial for developing foundational numeracy skills, as it sets the stage for mathematical literacy and problem-solving abilities in later years (Ginsburg, et al. 2019). Play-based pedagogy has been identified as an effective approach to fostering

numeracy skills in preschool learners, as it provides hands-on and engaging learning experiences (Pyle & Danniels, 2017). However, despite its benefits, implementing play-based numeracy education faces various challenges, particularly in underserved districts such as the Yunyoo-Nasuan District.

Through personal interactions and observations in the Yunyoo-Nasuan District, the researcher has noted that many preschool classrooms rely heavily on traditional rote-learning methods, where children are expected to memorize numbers and basic arithmetic operations without engaging in interactive activities. Teachers often use direct instruction and repetitive drills rather than incorporating play-based methods that promote deeper understanding and conceptual learning (Osei-Poku & Armah, 2021). The absence of structured play-based pedagogical approaches limits young learners' ability to explore numeracy concepts in meaningful and engaging ways.

Furthermore, the researcher has observed that many preschool teachers in the district struggle to integrate play into their teaching due to inadequate training and limited knowledge of play-based instructional strategies. In discussions with educators, several teachers expressed their willingness to adopt play-based methods but cited a lack of professional development opportunities as a key barrier (Boakye, 2018). Many early childhood educators have not received sufficient training on how to use manipulatives, number games, and interactive learning materials to enhance numeracy skills. Consequently, play-based pedagogy remains underutilized, and children are deprived of the opportunity to develop strong mathematical foundations through exploratory and experiential learning.

Another major issue observed was the lack of adequate teaching and learning resources to support play-based numeracy education. Schools in the Yunyoo-Nasuan District often have limited access to essential materials such as counting beads, number charts, puzzles, and building blocks, which are critical for engaging children in play-based mathematical activities (Makokha & Githinji, 2019). The researcher visited several preschool classrooms and found that most of them had few or no resources specifically designed for interactive numeracy instruction. Teachers frequently reported that budget constraints and insufficient government support made it difficult to acquire the necessary materials, leading to a heavy reliance on chalk-and-talk teaching methods.

Additionally, the researcher observed that large class sizes further hinder the effective implementation of play-based pedagogy. Many preschool classrooms in the district are overcrowded, with a single teacher handling a large number of learners. This situation makes it challenging for teachers to facilitate play-based learning effectively, as they struggle to provide individualized attention to each child (Fesseha & Pyle, 2016). In interviews with teachers, many expressed concerns that managing group activities and hands-on learning in large classes is overwhelming, leading them to revert to teacher-centered instruction that does not fully engage learners in numeracy exploration.

Cultural perceptions and parental attitudes toward play-based learning also contribute to the challenges associated with implementing this pedagogical approach. Some parents in the district view play as a mere recreational activity rather than an educational tool, leading them to prefer traditional rote-learning methods that emphasize memorization and formal instruction (Amoako & Kwame, 2020). The researcher interacted with parents who

expressed skepticism about the effectiveness of play in numeracy development, stating that structured lessons and repetition are the best ways for children to learn mathematics. This mindset often influences school policies and teaching practices, discouraging teachers from fully integrating play-based strategies into their numeracy instruction.

Moreover, curriculum constraints and assessment practices further limit the adoption of play-based numeracy learning. The researcher noted that preschool assessments in the district largely focus on written tests and formal evaluations rather than observational and performance-based assessments that align with play-based learning (Duncan et al., 2017). Teachers reported feeling pressured to prepare learners for standardized assessments, leading them to prioritize direct instruction over exploratory learning experiences. This assessment-driven approach reduces opportunities for young learners to engage in meaningful play that fosters mathematical reasoning and problem-solving skills.

Despite these challenges, there is strong evidence that play-based pedagogy significantly improves numeracy skills among preschool learners. Studies have shown that children who engage in play-based learning activities, such as sorting, matching, and number-based games, demonstrate better mathematical understanding and retention compared to those taught using conventional methods (Sarama & Clements, 2020). The researcher observed instances where children who were given opportunities to explore numbers through play exhibited greater enthusiasm and confidence in solving numerical problems.

To address these challenges, it is essential to develop strategies that enhance the implementation of play-based numeracy education in the Yunyoo-Nasuan District. Strengthening teacher training programs, increasing resource allocation, and raising

awareness among parents and educators about the benefits of play-based learning can contribute to improving numeracy development in preschool learners (Pyle et al., 2018). Additionally, modifying assessment practices to align with play-based approaches can create an enabling environment for interactive and experiential numeracy instruction.

1.3 Purpose of the Study

The purpose of this study was to examine the role of play-based pedagogy in numeracy education among preschool learners in the Yunyoo-Nasuan District.

1.4 Research Objectives

The objectives of the study are to;

1. identify the types of play-based pedagogical approaches used in developing numeracy skills among preschool learners in the Yunyoo-Nasuan District.
2. assess the challenges faced by teachers in implementing play-based pedagogy for numeracy development in preschool classrooms in the Yunyoo-Nasuan District.
3. suggest ways to improve play-based teaching for better numeracy skills among preschoolers in the Yunyoo-Nasuan District.

1.5 Research Questions

1. how does play-based pedagogical approaches are used to develop numeracy skills among preschool learners in the Yunyoo-Nasuan District?
2. What challenges do teachers face in implementing play-based pedagogy for numeracy development skills in preschool classrooms in the Yunyoo-Nasuan District?

3. What strategies can be adopted to improve play-based teaching for better numeracy skills among preschoolers in the Yunyoo-Nasuan District?

1.6 Significance of the Study

The findings would contribute to the improvement of early childhood education by highlighting the benefits, challenges, and best practices of using play-based methods to enhance numeracy skills.

The study would provide valuable insights to preschool teachers and early childhood educators on the effectiveness of play-based pedagogical approaches in numeracy instruction.

The study would inform policymakers and education authorities about the need for stronger support for play-based learning in preschool curricula.

The study would help parents and guardians understand the importance of play in their children's cognitive and numeracy development.

The study would contribute to the body of knowledge on early childhood education, particularly in the Ghanaian and African contexts.

1.7 Delimitations of the Study

This study focused on the role of play-based pedagogy in developing numeracy skills among preschool learners within the Yunyoo-Nasuan District. The delimitations define the scope and boundaries within which the research was conducted.

The study was delimited to preschools within the Yunyoo-Nasuan District. This geographical focus was chosen to allow for an in-depth analysis of play-based numeracy teaching within a specific educational setting.

This research was confined to preschool learners, specifically those in early childhood education settings. It does not extend to primary or higher levels of education, where numeracy skills were developed through different instructional methods.

The study employed qualitative research methods, including teacher interviews, classroom observations. It did not use large-scale quantitative surveys or experimental research designs, which yielded different types of data.

1.8 Operational Definition of Key Terms

Play-Based Pedagogy – A teaching approach that incorporates structured and unstructured play activities to facilitate learning and skill development in young children.

Numeracy Skills – The ability to understand and work with numbers, including counting, recognizing number patterns, performing basic arithmetic operations, and problem-solving

Preschool Learners – Children enrolled in early childhood education programs, typically between the ages of 3 and 5 years. In this study, preschool learners refer to young children in the Yunyoo-Nasuan District who are developing foundational numeracy skills through play-based pedagogy.

Early Childhood Education (ECE) – A branch of education focusing on the learning and development of children from birth to about 8 years old.

Teaching and Learning Resources – Materials, tools, and aids used by educators to facilitate effective instruction.

Teacher Training – The process of equipping educators with the necessary knowledge, skills, and methodologies to enhance classroom instruction.

Educational Challenges – Barriers or difficulties that hinder effective teaching and learning.

Interactive Learning – An approach to education that engages students in active participation rather than passive listening.

Assessment Methods – Techniques used to evaluate students' learning progress and understanding.

1.10 Organisation of the Study

This study has five chapters, with the first chapter being the introductory part. It discusses the background to the study. Statement of the Problem, research objectives, research questions, significance of the study, delimitations, operational definition of terms and the Organisation of the study. The chapter two focuses on review of related literature on the phenomenon under study. The review centres on concepts, empirical studies and theoretical framework. Chapter three of this study discusses to the methodology employed. The chapter discusses the details of the research paradigm, research approach, research design, the study area. population, sample and sampling techniques instrumentations, data collection procedures, data analysis procedures and ethical consideration. Chapter four presents the analysis of the data obtained from Participants and the results from the

analysis. The final chapter, dealt with the summary of findings, conclusions, recommendations and suggestions for further study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0. Overview

This chapter reviews literature that are relevant to the current study.

2.1 Theoretical Framework

Cognitive Development Theory by Jean Piaget (1952)

Jean Piaget's Cognitive Development Theory (1952) provides a strong foundation for understanding how preschool learners develop numeracy skills through play-based pedagogy. Piaget's theory explains that children actively construct knowledge by interacting with their environment. He identified four stages of cognitive development: sensorimotor (0-2 years), preoperational (2-7 years), concrete operational (7-11 years), and formal operational (11 years and above) (Piaget, 1952). This study focuses on preschool learners, who fall within the preoperational stage.

During the preoperational stage, children begin to develop symbolic thinking, which allows them to use objects and language to represent concepts. However, they still struggle with logic and abstract thinking (Piaget, 1952). Numeracy skills, such as counting, recognizing numbers, and understanding basic mathematical relationships, require children to move from simple sensory experiences to more structured cognitive processes (Ginsburg, et al, 2019).

Piaget argued that learning should be active and hands-on because young children learn best through exploration and play. He emphasized that numeracy development in preschool should not be based on rote memorization but on activities that allow children to interact with their environment (Piaget & Inhelder, 1969). In this study, play-based pedagogy serves as a tool to help preschool learners in the Yunyoo-Nasuan District develop number sense, problem-solving skills, and logical thinking through engaging activities such as counting games, sorting objects, and role-playing.

Piaget's theory highlights the importance of experiential learning, where children gain knowledge through hands-on activities rather than passive instruction. In a play-based

learning environment, preschool learners engage in activities that allow them to manipulate objects, recognize patterns, and develop a sense of numbers (Sarama & Clements, 2020).

For example, using building blocks to create towers helps children understand concepts of height, quantity, and comparison. Similarly, playing with counting beads enhances their ability to recognize numbers and understand one-to-one correspondence. Piaget (1952) suggested that such activities allow children to construct their own knowledge by discovering mathematical relationships through play. This study examines how teachers in the Yunyoo-Nasuan District implement structured play activities to support numeracy development in preschool learners.

According to Piaget, children in the preoperational stage exhibit egocentrism, meaning they see the world only from their own perspective (Piaget & Inhelder, 1969). This affects their ability to understand numbers abstractly. Play-based pedagogy helps bridge this gap by providing concrete experiences that make mathematical concepts more relatable.

For example, role-playing activities such as pretend shopping allow children to practice counting, recognizing numbers on price tags, and making simple calculations in a meaningful context. By engaging in such activities, children develop a practical understanding of numeracy that goes beyond memorization. Studies have shown that role-playing activities improve children's mathematical reasoning because they allow learners to apply numeracy skills in real-life situations (Ginsburg, et al,2019).

Piaget's concept of conservation explains that young children struggle to understand that quantities remain the same even if their appearance changes (Piaget, 1952). For example,

if a teacher pours water from a short, wide cup into a tall, narrow cup, preschool learners often believe the taller cup has more water, even though the amount remains the same.

Similarly, children may struggle with the idea that five counters remain five counters whether they are spread out or grouped together. Piaget argued that children develop conservation skills through hands-on experiences. Play-based activities such as grouping objects, counting with fingers, and using number lines help children recognize that numbers remain constant despite changes in arrangement. This study explores how teachers use such activities to help preschool learners in the Yunyoo-Nasuan District develop a strong foundation in numeracy. Piaget identified classification and seriation as key cognitive abilities that contribute to numeracy development (Piaget & Inhelder, 1969).

Classification refers to the ability to group objects based on common characteristics, such as shape, size, or color. Play-based activities like sorting objects, matching games, and pattern recognition exercises help preschool learners develop classification skills, which are essential for understanding numbers and sets (Sarama & Clements, 2020).

Seriation is the ability to arrange objects in a specific order, such as from smallest to largest. Activities such as arranging sticks by length or stacking blocks from shortest to tallest allow children to practice sequencing, a critical skill for understanding numerical order.

This study examines how teachers integrate classification and seriation activities into play-based numeracy lessons to enhance preschool learners' mathematical reasoning.

Piaget described learning as a process of assimilation and accommodation (Piaget, 1952). Assimilation occurs when children incorporate new experiences into their existing

knowledge, while accommodation happens when they adjust their thinking to understand new concepts.

For example, when a child who knows how to count from 1 to 10 learns to count backward, they assimilate this new skill into their existing counting knowledge. However, when they encounter the concept of addition and subtraction, they may need to adjust their thinking (accommodate) to understand that numbers can be manipulated in different ways.

Play-based pedagogy supports these cognitive processes by providing opportunities for children to experiment with numbers in a low-pressure environment. Games such as number puzzles, board games, and interactive storytelling allow children to refine their numerical understanding through repeated practice and exploration. This study investigates how teachers design play-based activities that facilitate assimilation and accommodation in numeracy learning.

Piaget emphasized that children should be active learners rather than passive recipients of knowledge. He argued that teachers should act as facilitators who provide opportunities for exploration rather than directly instructing children (Piaget, 1952).

In a Piagetian classroom, teachers use open-ended questions, hands-on activities, and problem-solving tasks to encourage children to think critically and develop their own understanding of mathematical concepts (Ginsburg, et al 2019). This study explores how teachers in the Yunyoo-Nasuan District apply Piaget's principles by using play-based teaching strategies that promote active learning and cognitive development in numeracy.

Several studies have confirmed the effectiveness of play-based pedagogy in numeracy education.

Ginsburg, et al, (2019) found that preschool learners who engaged in structured play activities developed stronger numeracy skills compared to those who received only direct instruction.

Sarama & Clements (2020) emphasized that hands-on experiences, such as playing with number blocks and participating in counting games, significantly improved children's understanding of number relationships.

Kamii & DeVries (1993) reported that children exposed to Piagetian-based play activities demonstrated better problem-solving abilities and mathematical reasoning.

These studies support the argument that play-based pedagogy, grounded in Piaget's Cognitive Development Theory, is essential for developing numeracy skills in preschool learners.

Piaget's Cognitive Development Theory provides a strong foundation for understanding how play-based pedagogy supports numeracy development in preschool learners. His emphasis on hands-on learning, symbolic thinking, classification, seriation, conservation, and active exploration aligns with the principles of play-based education. This study examines how teachers in the Yunyoo-Nasuan District apply Piaget's theory by using structured play activities to enhance preschool learners' mathematical understanding. By integrating Piaget's insights, educators can create engaging learning environments that foster critical thinking, problem-solving, and number sense in young children.

2.2 The Concept of Play

The perspective of children`s play was initially considered in education as a yardstick for development of pedagogy (Sommer, et al. 2010). There has been lots of research and

findings produced over the years relating to the definition of play. Several researchers and theorists define play differently, however, many different perspective views on what play is overlapped with other views. Play can be viewed, conceptualized, and defined from many different theoretical and ideological perspectives.

Gülşeker (2019) defined play as, "an activity that is symbolic, meaningful, active, pleasurable, voluntary, rule-governed and episodic" (Nowak, et al, 2009). Play as pleasurable and an activity, is seen as a situation by which children learn and interact with the environment and the world around them. Gordon (2009) also argues that "play is the voluntary movement across boundaries, opening with total absorption into a highly flexible field, releasing tension in ways that are pleasurable, exposing players to the unexpected and making transformation possible." (p. 8). Through play children learn informally and relate their play to real life experiences. The voluntary movement of children which includes exploration, playing and learning according to their interests, offer them the opportunity to satisfy their curiosity and level of maturation.

Additionally, Wood (2009) indicated that characteristics of play include intrinsic motivation, engagement; dependence on internal rather than external rules, control and autonomy, and attention to means rather than ends". Children formulate their own rules to suit and match with the play situation. Therefore, children experience the joy and skills development through self- motivation. According to Pramling-Samuelsson and Carlsson (2008) play is considered as a learning situation or an activity initiated by children, on the other hand, learning is regarded as a result of a practice or activity initiated by any adult to help children to learn. They further state that play activities as well as learning situations are as joyful since both play and learning are seen as an activity that is transgression. Play

and learning are interrelated; the two words touched on each other in an early childhood setting and further serves as an important process for promoting children's learning and development (Kieff & Casbergue, 2000). Play provides children the opportunity to discover the world and find new answers through voluntary learning. Also, children`s play promotes and enhances socio-emotional development, cognitive and physical skills that cannot be taught through formal classroom instruction (Ministry of Education Science and Sports, 2007).

Fromberg (1992) is also of the view that play enhances language development, social competence, creativity, imagination, and thinking skills. He talked about how play can support a child's learning such as concepts and ideas, interactions, emotional well-being and physical development. Play provides children with the opportunity to discover the world and find new answers through voluntary learning. Children are likely to be engaged in play activities that are relevant to them and can play and have an active participation. Additionally, play is pleasurable and can be defined as an activity requiring no end or goal only participation and fun (Nowak, et al., 2009).

One important aspect of children`s play to be considered is the use of play in early years setting. Combining play in the teaching process in the early years setting, there is the need for greater confidence among practitioners in approaching problems without fear and taking risks needed in the search for new ideas to help the development of children. Play is often being regarded as cognitively challenging process, which requires the child to make use ability, memory, signs and symbols, cultural tools which includes development of language, social skills such as negotiations, communication, planning and sharing and prediction (Fleer, 2010). Many skills that are needed for later life are developed through

play and also are very important in a pre-school setting. Children will continue to make use of different learning situations, experiences and in remembrance for further learning. In general, play is considered as an important learning activity and developmentally appropriate which is considered valuable for all children (Bodrova & Leong, 2003; 2003b). In contrast, however, play can also be seen as an unimportant or even harmful practice or activity both in the home and the school environment (Johnson, Christie & Wardle, 2005; Scarlett, Naudeau, Salonius-Pasternak & Ponte, 2005; Sutton-Smith, 2001). Although play is very important for children and its usage in the school`s context or early year settings, (Hyvonen, 2011) expresses similar sentiment that it should be restricted by hindrances. The discourse of play both in theory and practice in early childhood education is very vital as stages of human evolution.

2.3 Types of Play-Based Pedagogical Approaches for Developing Numeracy Skills

Play-based pedagogy is an effective teaching method that enhances numeracy skills in preschool learners by making learning more engaging and meaningful (Pyle & Danniels, 2017). This approach allows children to explore mathematical concepts in a natural and enjoyable way, fostering problem-solving skills and logical thinking (Ginsburg, Lee & Boyd, 2019). Various play-based pedagogical approaches can be used to develop numeracy skills in young children. These approaches include guided play, free play, manipulative-based learning, role-playing, digital play, storytelling with numeracy elements, and outdoor play.

Guided Play

Guided play is a structured form of play where teachers provide direction while allowing children to explore numeracy concepts independently. This approach ensures that children

remain engaged while receiving subtle guidance to enhance their understanding of mathematical concepts (Weisberg et al., 2016). For example, a teacher may set up a number-matching game where children match objects to the corresponding numeral while offering hints to help them arrive at the correct answer. This method encourages active learning, as children can experiment, ask questions, and discover solutions at their own pace. Research has shown that guided play leads to better retention of numeracy concepts because children associate learning with enjoyable experiences (Hassinger-Das et al., 2021).

Free Play

Free play allows children to engage in unstructured activities without direct teacher intervention. This approach enables children to use their creativity and curiosity to explore mathematical ideas naturally (Pyle et al., 2018). For example, during free play, children may use building blocks to construct towers of different heights, unknowingly practicing counting, estimation, and spatial reasoning. While free play may not have a specific learning objective, it provides opportunities for children to develop problem-solving skills, recognize number patterns, and understand concepts like measurement and balance (Fesseha & Pyle, 2016). Teachers can enhance free play by providing materials such as number charts, puzzles, and counting objects to encourage mathematical thinking.

Manipulative-Based Learning

Manipulative-based learning involves the use of physical objects to represent mathematical concepts, making abstract ideas more concrete for young learners (Sarama & Clements,

2020). This approach includes tools like counting beads, number cubes, measuring cups, and shape puzzles, which allow children to interact with numeracy concepts through hands-on experiences. Studies have shown that preschool learners who use manipulatives develop a better understanding of numbers, arithmetic operations, and spatial relationships (Boakye, 2018). For example, using counting beads, children can practice basic addition and subtraction by grouping and removing beads. This method improves fine motor skills while reinforcing mathematical principles in an engaging way.

Role-Playing and Dramatic Play

Role-playing is a play-based approach where children assume different roles and act out real-life situations involving numeracy concepts. This method enhances mathematical thinking by integrating numbers into everyday experiences (Amoako & Kwame, 2020). For instance, setting up a "grocery store" in the classroom allows children to practice counting money, identifying prices, and making simple calculations when buying or selling items. Similarly, a "restaurant" role-play scenario can help children understand concepts like addition, subtraction, and portioning. Research suggests that role-playing improves children's ability to relate numeracy concepts to real-life situations, making learning more meaningful and practical (Duncan et al., 2017).

Digital Play and Educational Games

The integration of digital play in early childhood education has gained popularity, as technology offers interactive and engaging platforms for numeracy learning (Makokha &

Githinji, 2019). Digital play involves the use of educational apps, games, and online activities designed to teach mathematical concepts in a fun and interactive way. For example, children can play number-matching games, solve simple arithmetic puzzles, or engage in virtual counting activities through mobile or tablet applications. Research has shown that digital learning tools can enhance numeracy skills by providing instant feedback, personalized learning experiences, and motivation through gamification (Pyle & Danniels, 2017). However, it is important for teachers to balance digital play with hands-on activities to ensure holistic learning.

Storytelling with Numeracy Elements

Storytelling is a powerful educational tool that enhances literacy and numeracy skills simultaneously. Incorporating numeracy elements into storytelling allows children to visualize mathematical concepts through engaging narratives (Sarama & Clements, 2020). For example, a teacher may tell a story about animals collecting fruits, prompting children to count along with the characters. Using stories with number sequences, patterns, or simple problem-solving challenges helps children develop early mathematical reasoning. Research has shown that integrating numeracy into storytelling improves children's ability to understand numerical relationships and enhances memory retention of mathematical concepts (Weisberg et al., 2016).

Outdoor Play and Nature-Based Learning

Outdoor play provides an opportunity for children to experience numeracy concepts in a natural environment. This approach involves activities such as counting stones, measuring

plant growth, creating patterns with leaves, or jumping in numbered spaces drawn on the ground (Boakye, 2018). Engaging with nature allows children to explore mathematical concepts such as classification, sorting, estimation, and comparison in a hands-on way. Studies suggest that outdoor numeracy play enhances problem-solving skills, improves spatial awareness, and increases engagement by making learning more dynamic and interactive (Ginsburg, et al,, 2019). Teachers can incorporate numeracy into outdoor play by setting up scavenger hunts that require children to count, sort, and compare collected objects.

Music and Movement-Based Learning

Music and movement activities are highly effective in reinforcing numeracy concepts among preschool learners. Songs, rhymes, and dance routines that incorporate numbers help children develop counting skills and numerical fluency (Fesseha & Pyle, 2016). For example, singing counting songs such as "Five Little Ducks" or "Ten in the Bed" helps children learn number sequences in a fun and memorable way. Similarly, movement-based activities like hopscotch, clapping patterns, and rhythmic counting enhance coordination while strengthening mathematical understanding. Research indicates that integrating music and movement into numeracy instruction improves memory retention and makes learning more enjoyable for young children (Hassinger-Das et al., 2021).

Construction and Engineering Play

Construction play involves activities where children build structures using materials like blocks, sticks, or LEGO pieces. This type of play supports numeracy development by

encouraging problem-solving, spatial reasoning, and geometric thinking (Pyle et al., 2018). For instance, children can explore concepts of symmetry, measurement, and balance while constructing towers or bridges. Research has shown that construction play enhances mathematical creativity and strengthens foundational skills in geometry and problem-solving (Makokha & Githinji, 2019). Teachers can facilitate construction play by providing materials and challenges that encourage children to think critically and experiment with mathematical ideas.

Board Games and Card Games

Board games and card games offer structured yet engaging ways to develop numeracy skills. Games such as "Snakes and Ladders," "Dominoes," and "Uno" help children practice counting, number recognition, and strategic thinking (Duncan et al., 2017). These games also promote social interaction and cooperative learning, as children take turns and follow numerical rules. Research has found that playing board games enhances numerical fluency, strengthens logical reasoning, and improves concentration among preschool learners (Sarama & Clements, 2020). Teachers can incorporate such games into classroom activities to provide an enjoyable way for children to practice numeracy skills.

Play-based pedagogical approaches provide young learners with interactive and meaningful ways to develop numeracy skills. Guided play, free play, manipulative-based learning, role-playing, digital play, storytelling, outdoor play, music and movement, construction activities, and board games all offer unique opportunities for children to explore mathematical concepts in enjoyable and engaging ways. Research has consistently shown that integrating play into early childhood education enhances numerical fluency, problem-solving skills, and mathematical confidence (Weisberg et al., 2016; Pyle &

Danniels, 2017). To maximize the benefits of play-based pedagogy, educators should ensure that these approaches are effectively implemented in preschool classrooms while addressing challenges such as resource constraints and teacher training.

2.4 Challenges Faced by Teachers in Implementing Play-Based Pedagogy for Numeracy Skills Development

Play-based pedagogy is widely recognized as an effective approach for developing numeracy skills in preschool learners. It helps children understand mathematical concepts through hands-on activities, exploration, and interactive learning (Pyle & Danniels, 2017). However, despite its benefits, teachers face several challenges in implementing play-based teaching methods, particularly in resource-constrained environments such as the Yunyoo-Nasuan District. These challenges include inadequate training, lack of resources, large class sizes, curriculum constraints, assessment pressures, cultural perceptions, and limited parental support.

Lack of Teacher Training and Professional Development

One of the primary challenges faced by teachers is insufficient training in play-based pedagogy. Many early childhood educators lack the necessary skills and knowledge to integrate play into numeracy instruction effectively (Boakye, 2018). Training programs often focus on traditional teaching methods, emphasizing rote memorization and direct instruction rather than experiential learning. As a result, many teachers are unfamiliar with

how to design and implement play-based activities such as number games, role-playing, and hands-on manipulatives.

Studies indicate that teachers who receive specialized training in play-based learning demonstrate greater confidence and competence in using this approach (Ginsburg, et al.s 2019). However, in the Yunyoo-Nasuan District, professional development opportunities for preschool teachers are limited, making it difficult for educators to acquire the skills needed to effectively incorporate play-based methods into their teaching.

Inadequate Teaching and Learning Resources

Another major barrier to implementing play-based pedagogy is the lack of adequate teaching materials. Play-based numeracy instruction requires resources such as counting beads, number blocks, puzzles, measuring tools, and interactive charts. However, many preschools in the Yunyoo-Nasuan District struggle with resource shortages due to limited funding and government support (Makokha & Githinji, 2019).

During classroom observations, teachers often report that they have to rely on improvised materials, such as bottle caps and sticks, to teach numeracy concepts. While improvisation is beneficial, the lack of standardized learning materials makes it difficult to maintain consistency in teaching and to fully engage learners in meaningful play-based activities (Pyle et al., 2018). The absence of quality learning materials reduces opportunities for children to explore mathematical concepts in creative and engaging ways.

Large Class Sizes and Limited Teacher Support

Many preschool classrooms in the Yunyoo-Nasuan District have high student-teacher ratios, making it challenging to implement play-based pedagogy effectively. In

overcrowded classrooms, teachers struggle to provide individualized attention to each child, which is essential for play-based learning (Fesseha & Pyle, 2016). Managing play-based activities in large classes requires careful planning and supervision, which becomes overwhelming for teachers who lack additional support.

For example, in a class of over 50 learners, it is difficult for a single teacher to facilitate interactive numeracy games or group activities effectively. Instead, teachers often revert to traditional whole-class instruction, where children passively listen rather than actively engaging in hands-on learning. Research suggests that small class sizes create better opportunities for interactive and exploratory learning (Duncan et al., 2017). However, due to infrastructural limitations, many preschools cannot accommodate smaller groups, forcing teachers to adapt to less effective instructional methods.

Rigid Curriculum and Time Constraints

Curriculum structure and rigid instructional schedules also pose challenges to implementing play-based pedagogy. In many educational systems, including Ghana's, the preschool curriculum is designed to introduce early numeracy skills through structured lessons. However, the emphasis on covering specific content within a set timeframe often leaves little room for play-based exploration (Amoako & Kwame, 2020).

Teachers frequently express concerns that they are pressured to complete syllabi rather than allowing children to learn at their own pace through discovery and play. Play-based learning requires flexibility, where children can engage in repeated experiences to build numeracy understanding gradually. However, the demand to follow strict lesson plans limits the integration of exploratory learning methods. Research indicates that a more

flexible curriculum that accommodates play can significantly enhance numeracy skill development in young learners (Sarama & Clements, 2020).

Assessment and Examination Pressures

The mode of assessment in preschool education also affects the implementation of play-based pedagogy. Traditional assessment methods prioritize written tests and formal evaluations rather than performance-based and observational assessments that align with play-based learning (Duncan et al., 2017). In the Yunyoo-Nasuan District, many teachers report that they feel compelled to prepare learners for standardized assessments, which focus on correct answers rather than understanding mathematical concepts through exploration.

Because formal testing remains a key criterion for academic progression, teachers often emphasize drilling and memorization rather than interactive problem-solving. This approach contradicts the principles of play-based pedagogy, which encourages children to develop numeracy skills through hands-on engagement and real-life applications (Pyle & Danniels, 2017). A shift toward alternative assessment strategies, such as portfolio-based and observational assessments, could help promote play-based numeracy instruction.

Cultural and Parental Perceptions of Play-Based Learning

Cultural beliefs and parental attitudes toward play also influence teachers' ability to implement play-based pedagogy. In some communities, play is viewed as an unstructured and non-educational activity rather than a critical component of learning (Amoako & Kwame, 2020). Many parents prefer formal teaching methods that involve direct instruction, repetition, and written exercises.

Teachers in the Yunyoo-Nasuan District have reported that some parents express concerns when they see children engaged in playful activities rather than sitting quietly in classrooms. These parental expectations sometimes pressure schools to prioritize traditional instructional methods over interactive learning. Research has shown that parental awareness and involvement play a crucial role in the successful implementation of play-based pedagogy (Boakye, 2018). Therefore, efforts to educate parents about the educational benefits of play-based learning could help reduce resistance to its adoption.

Lack of Administrative and Policy Support

The successful implementation of play-based pedagogy requires strong administrative and policy support. However, in many developing regions, including Ghana, early childhood education policies do not always prioritize play-based learning (Makokha & Githinji, 2019). Schools often lack clear guidelines and frameworks on how to integrate play into numeracy instruction effectively.

Additionally, inadequate funding for early childhood education means that schools cannot invest in the necessary resources, teacher training, or infrastructure to support play-based learning environments. Government initiatives that promote active learning methodologies and provide adequate financial resources could significantly enhance the adoption of play-based numeracy instruction.

Teachers' Workload and Burnout

The multiple responsibilities of preschool teachers can also hinder the effective implementation of play-based pedagogy. Many teachers in the Yunyoo-Nasuan District handle administrative tasks, lesson planning, and classroom management in addition to

their teaching duties. This heavy workload limits the time and energy available for planning and facilitating engaging play-based activities (Pyle et al., 2018).

When teachers are overburdened, they are more likely to resort to traditional teaching methods that require less preparation and supervision. Addressing teacher workload through additional support staff or reduced administrative burdens could help create an environment where play-based pedagogy can thrive.

Although play-based pedagogy is highly effective in developing numeracy skills among preschool learners, its implementation faces numerous challenges. These include inadequate teacher training, lack of resources, large class sizes, rigid curricula, assessment pressures, cultural perceptions, lack of policy support, and teacher workload. Addressing these barriers requires targeted interventions such as improving teacher professional development, increasing resource allocation, raising parental awareness, and revising educational policies to prioritize play-based learning. By overcoming these challenges, educators in the Yunyoo-Nasuan District can create more engaging and effective numeracy learning experiences for preschool learners.

2.5 Ways to Improve Play-Based Teaching for Numeracy Development in Preschool Learners

Improving play-based teaching for numeracy development among preschool learners requires a comprehensive approach that addresses teacher preparation, resource availability, classroom management, technology integration, parental involvement, and curriculum alignment. Strengthening teacher training and professional development is essential, as many educators lack the necessary skills to implement play-based pedagogical strategies effectively. Boakye (2018) asserts that early childhood teachers need continuous

training in guided play, storytelling with numbers, and the use of manipulatives to enhance numeracy instruction. Incorporating play-based pedagogy into pre-service teacher education and organizing in-service training workshops can equip educators with practical skills to facilitate meaningful learning experiences (Pyle et al., 2018).

Providing adequate teaching and learning resources is necessary for effective play-based numeracy instruction. Many preschools, particularly in underserved areas, struggle with limited access to essential materials such as counting beads, number puzzles, and building blocks (Makokha & Githinji, 2019). Increasing government funding for play-based materials, encouraging the use of locally available resources like bottle caps and sticks, and partnering with NGOs to support schools can significantly enhance resource availability. Training teachers to create their own low-cost teaching materials can further promote interactive learning experiences.

Reducing classroom overcrowding and improving teacher-learner ratios are critical factors in enhancing play-based teaching. Fesseha and Pyle (2016) emphasize that large class sizes limit teachers' ability to engage children in meaningful play-based activities. Recruiting more teachers, implementing small-group learning strategies, and introducing rotating play stations can help ensure that every learner receives adequate attention and support. Smaller class sizes promote better engagement and facilitate hands-on numeracy instruction.

Integrating technology into play-based numeracy learning provides opportunities for interactive and engaging instruction. Sarama and Clements (2020) highlight the benefits of digital learning tools, such as educational apps and interactive games, in developing numeracy skills. Schools should incorporate child-friendly educational software, train

teachers on the effective use of technology, and collaborate with technology companies to access affordable digital learning resources. A balanced approach that combines traditional play methods with digital tools can create a more dynamic and effective numeracy learning environment.

Encouraging parental involvement is essential in reinforcing play-based learning at home. Amoako and Kwame (2020) argue that when parents actively participate in their children's learning, play-based numeracy instruction becomes more effective. Organizing workshops to educate parents on play-based learning, providing simple home activities such as counting during daily routines, and fostering a supportive home environment can enhance children's mathematical development. Strengthening the school-home connection ensures that play-based learning extends beyond the classroom.

Promoting a positive attitude toward play-based learning is necessary to overcome misconceptions that play is not a serious educational activity. Duncan et al. (2017) note that some educators and parents believe that structured lessons and memorization are more effective for numeracy development. Schools should showcase the success of play-based learning through student progress demonstrations, integrate play-based strategies into curriculum development, and actively engage stakeholders in play-based activities. Changing perceptions will create a more supportive environment for interactive learning approaches.

Aligning curriculum and assessment methods with play-based learning is essential to ensure consistency in educational practices. Ginsburg et al. (2019) argue that traditional assessment methods, such as written tests, do not effectively measure the outcomes of play-

based pedagogy. Implementing observational assessments, incorporating performance-based evaluations, and designing flexible lesson plans that naturally integrate play can enhance the effectiveness of numeracy instruction. Aligning assessments with play-based teaching methods allows educators to monitor and support children's learning progress more effectively.

Improving play-based teaching for numeracy development in preschool learners requires a multifaceted approach that involves strengthening teacher training, ensuring resource availability, reducing class sizes, integrating technology, increasing parental involvement, promoting positive attitudes, and aligning curriculum and assessment methods. Research consistently supports the role of play-based learning in enhancing children's mathematical abilities and cognitive development (Pyle & Danniels, 2017; Sarama & Clements, 2020). Collaborative efforts from educators, parents, policymakers, and community stakeholders are essential in strengthening play-based pedagogy to provide preschool learners with a strong foundation in numeracy skills.

2.6 Summary of Literature Review

The Cognitive Development Theory by Jean Piaget (1952) provides a foundational framework for understanding how preschool learners develop numeracy skills through play-based pedagogy. Piaget posits that children actively construct knowledge through interaction with their environment, with the preoperational stage (ages 2–7) being particularly relevant for preschool learners. During this stage, children develop symbolic thinking, allowing them to represent concepts using objects and language, though they still face challenges with abstract reasoning and logical thought (Piaget, 1952; Ginsburg et al.,

2019). Numeracy skills such as counting, number recognition, and basic mathematical operations require concrete experiences, which can be effectively facilitated through play. Play-based activities, including counting games, sorting, role-playing, and manipulative use, allow children to construct knowledge, develop problem-solving skills, and enhance logical reasoning (Piaget & Inhelder, 1969; Sarama & Clements, 2020). Key cognitive abilities for numeracy, including conservation, classification, and seriation, are reinforced through structured play, enabling children to understand numerical constancy and sequencing.

Play is widely recognized as a critical medium for learning in early childhood, providing opportunities for children to explore, experiment, and interact with their environment. Defined as voluntary, meaningful, symbolic, and rule-governed activity, play supports cognitive, socio-emotional, and physical development (Gülşeker, 2019; Wood, 2009; Pramling-Samuelsson & Carlsson, 2008). Through play, children develop creativity, imagination, language, social competence, and problem-solving abilities (Fromberg, 1992; Bodrova & Leong, 2003). Play and learning are interconnected processes, with play offering a developmentally appropriate context for children to acquire knowledge while fostering curiosity, autonomy, and motivation (Ministry of Education Science and Sports, 2007; Fleer, 2010).

Play-based pedagogical approaches for numeracy development include guided play, free play, manipulative-based learning, role-playing, digital play, storytelling with numeracy elements, outdoor play, music and movement activities, construction play, and board games (Pyle & Danniels, 2017; Ginsburg, Lee & Boyd, 2019). Guided play provides structured exploration with teacher support, promoting engagement and concept retention

(Weisberg et al., 2016; Hassinger-Das et al., 2021), while free play allows learners to explore mathematical ideas creatively (Pyle et al., 2018). Manipulatives, role-playing, and digital games make abstract concepts concrete, supporting number sense, problem-solving, and spatial reasoning (Boakye, 2018; Amoako & Kwame, 2020; Makokha & Githinji, 2019). Storytelling, outdoor, music, and construction activities further enhance learning by integrating numeracy into meaningful, real-world contexts.

Despite its benefits, the implementation of play-based pedagogy faces significant challenges. These include inadequate teacher training, insufficient learning resources, large class sizes, rigid curricula, assessment pressures, cultural perceptions, limited parental support, and insufficient administrative and policy backing (Boakye, 2018; Pyle et al., 2018; Makokha & Githinji, 2019). Addressing these barriers requires professional development for teachers, provision of adequate learning materials, smaller class sizes, integration of technology, active parental involvement, and alignment of curriculum and assessments with play-based learning (Amoako & Kwame, 2020; Sarama & Clements, 2020; Ginsburg et al., 2019).

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter presents a detailed description of the research methodology used in the study. It discusses the research philosophy, approach, design, the study area, population, sample size, and sampling procedures, instrument, validation of the instrument, data collection procedures, data analysis procedure, and ethical considerations.

3.1 Research Paradigm

The study was grounded in the interpretivist paradigm, which focuses on understanding human experiences and social realities (Creswell & Poth, 2018). Interpretivism asserts that reality is socially constructed and that meaning is derived from individuals' interactions with their environment (Thanh & Thanh, 2015). The study aimed to explore participants' lived experiences, perceptions, and interpretations regarding the phenomenon under investigation. By adopting this paradigm, the researcher sought to gain in-depth insights into how participants make sense of their practices, challenges, and everyday interactions within their specific context.

The interpretivist paradigm was considered appropriate because it allows the researcher to interact closely with participants and to understand issues from their perspectives rather than imposing predetermined categories or assumptions. It emphasizes the importance of context, culture, and social relationships in shaping individuals' views and behaviours. Therefore, data were collected through methods that encouraged rich descriptions, such as interviews and observations, enabling participants to express their thoughts freely.

Furthermore, the paradigm supports flexibility in the research process, allowing meanings to emerge from the data rather than being strictly measured through numerical analysis. This approach helped the researcher to interpret the subjective meanings participants attached to their experiences and to present findings that reflect their voices accurately. Ultimately, grounding the study in interpretivism enhanced the depth, credibility, and contextual relevance of the research findings.

3.2 Research Approach

A qualitative research approach was adopted for this study, as it is well-suited for exploring human experiences, perceptions, and social interactions (Merriam & Tisdell, 2016). The choice of a qualitative approach is justified by its ability to collect rich, descriptive data that reflects preschool teachers' thoughts, experiences, and challenges in implementing play-based numeracy teaching. Unlike quantitative methods, which often rely on numerical data and statistical analysis, qualitative research allows for an in-depth understanding of participants' experiences through open-ended discussions (Creswell, 2014). The qualitative approach also provides the flexibility needed to modify interview questions or explore emerging themes based on participants' responses, ensuring that the study captures teachers' realities as authentically as possible (Braun & Clarke, 2019).

3.3 Research Design

The study employed an exploratory case study design, which, according to Yin (2018), is an empirical inquiry that investigates a phenomenon within its real-life context. This research design was selected because it allows for an in-depth understanding of a specific issue—in this case, play-based pedagogy in numeracy teaching. The case study approach

provides the opportunity to examine real-life classroom experiences, challenges, and teaching strategies, as highlighted by Stake (2013). An exploratory case study is particularly useful when studying a phenomenon that has not been extensively researched, as it allows for the discovery of new insights and patterns. Since this study focuses on preschool teachers in the Yunyoo-Nasuan District, the case study approach enables the researcher to capture the detailed realities of their teaching experiences. Additionally, the exploratory design is appropriate given the limited research on play-based numeracy teaching in rural Ghanaian settings.

3.4 Study Area

The study was conducted in the Yunyoo-Nasuan District, which is located in the north-eastern part of Ghana within the North East Region. The district shares boundaries with the Republic of Togo to the east, which makes it one of the border districts in Ghana. It lies within the Guinea Savannah ecological zone, characterized by a tropical climate with a single rainy season and a long dry season. The vegetation is mainly savannah woodland with scattered trees and grassland. The district capital is Yunyoo.

In terms of socio-economic activities, the district is predominantly rural, and agriculture is the main source of livelihood for the majority of residents. Most households engage in subsistence farming, cultivating crops such as maize, millet, sorghum, groundnuts, beans, and yam. Livestock rearing is also common, including cattle, goats, sheep, and poultry. Farming activities are largely rain-fed, making agricultural productivity highly dependent on weather conditions.

Apart from farming, some residents engage in petty trading, small-scale businesses, and cross-border trading activities due to the district's proximity to Togo. Women are often involved in processing and selling agricultural produce, shea butter production, and local food vending. The district has limited industrial activities, and employment opportunities in the formal sector are relatively scarce. As a result, many young people migrate to urban centers in search of better economic opportunities.

Social amenities such as schools, health facilities, electricity, and road networks are still developing in many parts of the district. These socio-economic conditions influence access to quality education, including early childhood education. Therefore, studying play-based pedagogy in this district provides valuable insights into how teachers implement instructional strategies within a predominantly agrarian and resource-constrained rural context.

3.5 Population

The population of the study comprised all 122 preschool teachers in the Yunyoo-Nasuan District. These teachers were selected as the target population because they are directly responsible for implementing play-based numeracy teaching strategies in their classrooms. Their first-hand experiences with the challenges and benefits of play-based learning make them the most relevant participants for the study. The study sought to capture the perspectives of teachers who are actively engaged in numeracy instruction, as they can provide valuable insights into how play enhances numeracy development among preschool learners.

3.6 Sample and Sampling Technique

A total of 11 preschool teachers were selected for the study using purposive sampling. Purposive sampling was chosen because it ensures that participants meet specific criteria relevant to the study (Patton, 2015). The inclusion criteria for selecting participants required that they be actively teaching in a preschool within the Yunyoo-Nasuan District and have at least Five (5) years of teaching experience in early childhood education. Additionally, participants needed to have experience using play-based teaching methods for numeracy development and be willing to participate in the study and share their experiences openly. These criteria ensured that the study included teachers with practical experience and knowledge of play-based pedagogy, thereby enhancing the reliability of the data collected.

3.7 Research instruments

To collect data, a semi-structured interview guide was used. This instrument was chosen because it allows for an in-depth exploration of teachers' experiences, beliefs, and challenges, as noted by Kvale and Brinkmann (2015). Semi-structured interviews provide flexibility, enabling the researcher to ask follow-up questions based on participants' responses. The open-ended nature of the questions encouraged participants to share detailed insights, ensuring that the study captured a broad range of perspectives. The interview guide was structured to cover three main themes: the types of play-based pedagogical approaches used in numeracy teaching, the challenges teachers face in implementing play-based numeracy teaching, and strategies to improve play-based

pedagogy in numeracy education. Each interview lasted between 30 to 45 minutes and was audio-recorded with participants' consent to facilitate accurate transcription and analysis.

3.8 Trustworthiness

In qualitative research, ensuring reliability and validity is critical to the credibility and utility of the findings. This study addressed reliability and validity through the concept of trustworthiness, which comprises credibility, dependability, confirmability, and transferability, as outlined by Lincoln and Guba (1985). These criteria guided the research design, data collection, and analysis processes, ensuring that the study produced rigorous and trustworthy results that accurately reflected the experiences and perspectives of the participants. The following sections discuss how each component of trustworthiness was applied throughout the research process.

Credibility

Credibility refers to the confidence in the truth of the findings and the extent to which they accurately represent participants' perspectives (Lincoln & Guba, 1985). In this study, credibility was ensured through prolonged engagement with the participants. The researcher spent sufficient time interacting with each participant, allowing rapport to develop and providing opportunities for participants to elaborate on their experiences and perspectives. The extended engagement helped reduce the likelihood of superficial responses and allowed the researcher to gain a deeper understanding of the participants' viewpoints.

Follow-up questions were used during interviews to clarify ambiguous responses and probe further into areas of interest. This iterative questioning process helped ensure that participants' meanings were accurately captured and prevented misinterpretation. Member checking was also employed as a key strategy for enhancing credibility. The researcher summarized participants' responses during and after the interviews and sought confirmation from participants regarding the accuracy of the summaries. This practice allowed participants to verify that their views were accurately represented, thereby enhancing the authenticity of the data and minimizing potential misrepresentation (Creswell & Poth, 2018).

Dependability

Dependability refers to the consistency and stability of the research process over time, ensuring that the study could be repeated under similar conditions with similar results (Lincoln & Guba, 1985). To ensure dependability, the researcher documented the research process in detail. This documentation included the sampling procedures, criteria for participant selection, data collection methods, and the step-by-step process of data analysis. By maintaining a comprehensive audit trail, the study provided transparency regarding how decisions were made at each stage of the research.

The researcher also maintained detailed records of all methodological choices and procedural adjustments that occurred during the study. For example, changes to interview questions or approaches to probing participants' responses were recorded with

justifications, enabling future researchers to understand the rationale behind these modifications. Maintaining such meticulous documentation allowed the study to demonstrate methodological rigor and facilitated replication or evaluation of the research process by other scholars, thereby enhancing its dependability.

Confirmability

Confirmability refers to the degree to which the findings are shaped by participants' responses rather than the researcher's biases or preconceptions (Lincoln & Guba, 1985). To enhance confirmability, the researcher employed multiple strategies to ensure that interpretations and conclusions were grounded in the data. Field notes and audio recordings of interviews were maintained throughout the data collection process. These records allowed the researcher to refer back to participants' exact words and non-verbal cues, ensuring that interpretations were evidence-based and consistent with participants' intended meanings.

The researcher also engaged in reflexivity throughout the study by acknowledging personal assumptions, experiences, and potential biases that could influence data interpretation. Regular reflection and documentation of these reflections ensured that findings were not unduly influenced by the researcher's perspectives. Triangulation of data sources was another strategy used to strengthen confirmability. By comparing and cross-referencing information from multiple participants and data collection methods, the researcher ensured that the conclusions were supported by multiple lines of evidence, reducing the influence of subjective bias.

Transferability

Transferability refers to the extent to which the study's findings can be applied to other contexts or settings (Lincoln & Guba, 1985). In this study, transferability was addressed by providing rich and detailed descriptions of the research context, participants, and the processes involved in the study. Descriptions included demographic information about participants, the characteristics of the educational setting, and the cultural and social environment in which the study was conducted. These detailed accounts allowed readers to make informed judgments about whether the findings could be applied to similar populations or contexts.

Additionally, the researcher included contextual information regarding the practices and interventions observed, the nature of interactions between teachers and learners, and specific examples of play-based learning activities. By providing this level of detail, the study ensured that readers could understand the conditions under which the findings were generated and determine their applicability to other early childhood education settings, particularly in similar districts or cultural environments (Creswell & Poth, 2018).

3.9 Data Collection Procedures

Data collection involves systematically gathering and measuring information on relevant variables to allow the researcher to address specific research questions, test hypotheses, and assess outcomes (Kabir, 2016). Implicit in the view of Kabir is that data collection demands the use of research tools to collect data with a focus to provide answers to research questions. Before the fieldwork, the researcher obtained an introductory letter from the

Department of Early Childhood Education, University of Education, Winneba to facilitate the process of data collection.

The introductory letter from the University was sent to the Ghana Education Service Yunyoo-Nasuan District for approval, after it was granted, informed consent was obtained from all participants all the schools, ensuring they were fully aware of the study's purpose, procedures, and their rights. Copies of consent note along with the questionnaires were sent to all participants physically in the various public schools. Head teacher and teacher participants were individually assured that responses will be treated with confidentiality, and that the participants would remain anonymous throughout. The questionnaires administered did not require participant's name or other form of identity description. The data collection lasted for one month, starting from 14th of February, 2025 to 17th March, 2025. The researcher personally collected the data from the teachers and head teachers. Some of the Participants answered the questionnaire and handed over immediately, others also returned theirs in days and weeks' time within the given date above. All completed questionnaires were collected and sealed in an envelope. By the end of March 17th, the researcher was out of the various schools visited.

3.10 Data Analysis Procedures

Thematic analysis, as described by Braun and Clarke (2019), was used to analyze the data. The analysis followed a systematic process, beginning with transcription, where interview recordings were converted into written text. This was followed by familiarization, where the researcher read through the transcripts multiple times to gain an overall understanding of the data. Coding was then carried out to identify key themes and patterns in the data.

The emerging themes were categorized into major themes, which were then interpreted and linked to Jean Piaget's Cognitive Development Theory to provide theoretical insights into the findings.

3.11 Ethical Considerations

Ethical considerations were strictly adhered to throughout the study. Informed consent was obtained from all participants before data collection, ensuring that they voluntarily participated with full awareness of the study's purpose. Confidentiality was maintained by anonymizing participants' responses and securely storing data. Participants were assured that their identities would remain confidential and that the information they provided would be used solely for research purposes. Additionally, voluntary participation was emphasized, and teachers were informed that they could withdraw from the study at any time without any consequences.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND DISCUSSION

4.0 Overview

This chapter presents and analyzes the data generated in response to the research questions. It is organized into two sections: the first provides an overview of the demographic characteristics of the Participants, while the second offers a detailed presentation and discussion of the data in relation to the research questions.

4.1 Demographic Characteristics of Participants

Variable	Category	Frequency (N = 12)	Percentage (%)
Gender	Male	5	41.7%
	Female	7	58.3%
Age Range (Years)	20–30	4	33.3%
	31–40	5	41.7%
	41–60	3	25.0%
Class Level Taught	Kindergarten One	6	50.0%
	Kindergarten Two	6	50.0%

The data presented in Table 1 show that the majority of the Participants were female teachers 7(58.3%), reflecting the common gender pattern in early childhood education where women dominate the field. However, the presence of male teachers 5(41.7%) indicates a growing interest of men in the kindergarten teaching profession.

In terms of age, most Participants 5(41.7%) were between 31 and 40 years, suggesting that a significant proportion of the teachers are in their prime working years, capable of combining both experience and energy in classroom instruction. The 4(33.3%) aged 20–

30 years represent young teachers who bring creativity and enthusiasm, while 3(25.0%) aged 41–60 years contribute valuable experience and mentorship.

Finally, the Participants were evenly distributed between Kindergarten One and Kindergarten Two (50% each), ensuring that the study covered both levels within the early childhood education stage. This demographic balance enhances the representativeness and validity of the findings in the Yunyoo–Nasuan District.

Research Question 1: What types of play-based pedagogical approaches are used to develop numeracy skills among preschool learners in the Yunyoo–Nasuan District?

Theme 1: Use of Counting Games and Manipulatives in Numeracy Learning

During the interviews, teachers described how counting games and manipulative play activities were used to support learners' understanding of numbers and quantities.

A teacher shared:

In my classroom, I use bottle tops, stones, and sticks as counting materials. The children group and count them while playing, which helps them learn addition and subtraction in a fun way. (T1)

Another teacher mentioned:

We use number blocks and flashcards to teach counting. The children enjoy arranging them in order, and this practical activity helps them recognize number patterns. (T2)

A third participant explained:

Sometimes we play games like 'count and run' or 'number hopscotch' where children jump according to the number I call. It keeps them active and helps them remember numbers. (T3)

A fourth teacher reported:

During outdoor play, I use local materials like bottle caps for sorting and counting. The children compare quantities and learn concepts like more, less, and equal. (T4)

The responses showed that counting games and manipulatives play a crucial role in enhancing numeracy skills among young learners by making mathematical concepts concrete and meaningful. These tools bridge the gap between abstract numbers and real-life understanding, enabling children to grasp basic mathematical ideas through active engagement. According to Clements and Sarama (2014), manipulatives such as counters, bottle tops, sticks, and beads help children visualize and physically interact with numbers, which strengthens their conceptual understanding of addition, subtraction, and counting. When learners handle objects to represent quantities, they are not just memorizing facts but constructing knowledge through meaningful experiences. This approach aligns with Piaget's theory of cognitive development, which emphasizes that young children learn best through hands-on exploration and concrete experiences before moving to abstract reasoning (Piaget, 1973).

Counting games further enhance this process by integrating play with learning, making mathematics enjoyable and less intimidating. As noted by Geist (2015), play-based

mathematical activities promote problem-solving, logical reasoning, and persistence among early learners. Games that involve counting objects, matching numbers, or arranging quantities in sequence provide opportunities for repetition and reinforcement in a fun and engaging manner. Moreover, through cooperative play, children also develop communication and social skills as they discuss strategies and share ideas while solving mathematical challenges together. This social interaction contributes to deeper learning, as children verbalize their thought processes and listen to others' reasoning (Vygotsky, 1978).

The use of manipulatives and counting games also supports sensory learning by engaging multiple senses touch, sight, and sometimes even hearing thereby reinforcing memory and understanding. Research by Uttal et al. (2018) found that multisensory engagement enhances children's ability to transfer mathematical knowledge to new situations. For instance, using bottle tops or stones to represent numbers not only improves counting accuracy but also aids in developing one-to-one correspondence and number conservation. These sensory-rich experiences are particularly important for young learners who may struggle to understand abstract numerical symbols without physical representation.

Teachers' creativity and adaptability in using locally available materials demonstrate a commendable commitment to inclusive and resourceful teaching, especially in contexts with limited educational resources. By using everyday items such as sticks, seeds, or bottle caps, teachers create meaningful learning experiences that are culturally relevant and cost-effective (Awofala & Lawal, 2020). This practice also reflects constructivist teaching principles, where learning materials are drawn from learners' environments to make

concepts relatable and accessible. It empowers children to connect mathematical ideas to their daily lives, such as counting fruits, sharing food, or grouping objects at home.

Theme 2: Integration of Songs, Rhymes, and Role Play in Teaching Numbers

Teachers also highlighted the use of songs, rhymes, and dramatization as effective methods of developing numeracy through play.

One teacher explained:

We use number rhymes like 'Ten Little Fingers' and 'Five Little Ducks' every morning. The children enjoy singing, and it helps them count forward and backward easily. (T1)

Another stated:

I create simple songs that match the lesson, like singing about fruits or animals and counting them. It helps the children to connect the song to real numbers. (T2)

A third teacher shared:

We use role play, where some children act as shopkeepers and others as buyers. They count toy money and items, which helps them learn addition and subtraction naturally. (T3)

A fourth participant remarked:

Through dramatization, we turn lessons into short plays. When children act out buying and selling, they learn how numbers work in real life. (T4)

Teachers' responses indicated that musical and dramatic play serve as powerful strategies in making numeracy lessons interactive, enjoyable, and meaningful for young learners. These approaches promote active participation, sustain attention, and enhance understanding through creative expression. In early childhood education, integrating music, songs, and drama into mathematics lessons aligns with the holistic learning philosophy that children learn best through play, exploration, and social interaction (Fleer, 2018). When teachers use music and drama to teach numeracy, they make learning more engaging and relevant to children's everyday experiences, thereby supporting both cognitive and emotional development.

Musical play, particularly through songs and rhymes, reinforces mathematical memory and understanding through rhythm, repetition, and melody. According to Anvari et al. (2018), the rhythmic structure of songs helps children internalize counting patterns, number sequences, and mathematical vocabulary. For instance, singing counting songs such as "One, Two, Buckle My Shoe" or "Ten Little Fingers" helps children recall numerical order effortlessly while enjoying the learning process. The repetitive and melodic nature of songs aids memory retention and makes abstract concepts more concrete (Papic, Mulligan, & Mitchelmore, 2011). Additionally, songs often include actions, clapping, or dancing, which engage multiple senses and promote kinesthetic learning, thus supporting children with diverse learning styles (Ginsborg, 2019).

Dramatic play, on the other hand, bridges the gap between classroom learning and real-world application. Through role play and dramatization, children use imagination to explore mathematical concepts in familiar contexts. For example, acting out a "shopping" scenario allows learners to count objects, recognize numbers on price tags, and engage in

basic addition or subtraction when buying and selling items. As Vygotsky (1978) emphasized, play provides a zone of proximal development where children can practice new skills with support from peers and teachers. Dramatic play encourages communication, cooperation, and problem-solving as children negotiate roles, discuss mathematical ideas, and make decisions within the play scenario. This process not only strengthens numeracy but also builds language, social, and emotional skills.

Furthermore, the integration of music and drama in numeracy lessons promotes creativity and collaboration. When children create songs or dramatize number stories, they actively construct meaning rather than passively receiving information. According to Bodrova and Leong (2015), imaginative play fosters cognitive flexibility, enabling children to approach mathematical problems from different perspectives. Collaborative performances also encourage teamwork and peer learning, where children learn from each other's ideas and strategies (Edwards, 2017). This shared learning experience enhances confidence and motivation, especially among children who may find traditional mathematical tasks challenging.

In addition, combining music and drama in numeracy teaching aligns with the principles of inclusive education. These methods accommodate different learning preferences visual, auditory, and kinesthetic ensuring that every child can participate meaningfully (Florian & Black-Hawkins, 2011). By transforming abstract numbers into songs, movements, and stories, teachers make mathematics accessible and enjoyable to all learners, including those with learning difficulties.

Research Question 2: What challenges do teachers face in implementing play-based pedagogy for numeracy development in preschool classrooms?

Theme 3: Inadequate Teaching and Learning Resources

A major challenge identified by teachers was the lack of sufficient teaching and learning materials to support play-based numeracy lessons.

One teacher noted:

We do not have enough toys, counting objects, or number charts. I often rely on stones and sticks, which are not always durable. (T1)

Another explained:

Sometimes we share the few materials available among many pupils. This makes it difficult for every child to take part in the play activities. (T2)

A third participant reported:

We need more colorful learning tools to capture the children's attention. The old and few materials make lessons less exciting. (T3)

A fourth teacher shared:

The school lacks enough manipulatives like blocks or puzzles. Without them, it is hard to make lessons practical. (T4)

The responses highlighted that limited resources significantly hinder the effective implementation of play-based pedagogy in early childhood numeracy education. Play-based learning depends heavily on the use of diverse and engaging materials such as counting objects, number cards, blocks, and locally improvised manipulatives. When these materials are insufficient or unavailable, it becomes difficult for teachers to create interactive, learner-centered lessons that stimulate exploration and discovery. According to UNESCO (2021), access to quality teaching and learning materials is a critical factor in ensuring effective learning outcomes, particularly in early childhood settings where hands-on experiences form the foundation for cognitive and mathematical development.

The absence of adequate materials limits children's opportunities for active engagement and problem-solving. Play-based pedagogy encourages children to manipulate, experiment, and interact with objects to make sense of abstract mathematical concepts. However, when such materials are lacking, learning becomes teacher-centered and abstract, reducing participation and motivation among young learners. Research by Clements and Sarama (2014) emphasizes that young children learn best through concrete experiences before moving to abstract reasoning. Without sufficient materials, teachers are forced to rely on verbal explanations, which do not provide the sensory stimulation necessary for deep conceptual understanding. As a result, learners may struggle to grasp basic numeracy concepts such as counting, addition, subtraction, and number relationships.

Furthermore, inadequate resources negatively affect teachers' ability to implement innovative and creative teaching strategies. Teachers who wish to employ play-based numeracy activities often face challenges in maintaining learner interest without suitable materials. Awofala and Lawal (2020) note that in resource-constrained environments,

teachers' creativity is limited by the lack of manipulatives and play tools that make learning engaging and interactive. Although some teachers demonstrate ingenuity by improvising materials using locally available resources like bottle tops, sticks, stones, and seeds, these efforts are not always sufficient or durable enough to support consistent classroom use. Over time, the shortage of high-quality, age-appropriate materials discourages teachers from using play-based approaches, leading to a decline in the overall quality of numeracy instruction.

Limited resources also have implications for inclusive education. Play-based learning provides an avenue for all learners including those with disabilities or learning difficulties to participate actively in numeracy lessons. However, when resources are scarce, it becomes challenging to provide the necessary adaptations or visual aids that support diverse learning needs (Florian & Black-Hawkins, 2011). This can result in exclusion and unequal participation, which contradicts the inclusive goals of early childhood education. Ensuring that all children have access to appropriate materials is therefore essential to promote equity and participation in learning.

To address these challenges, it is crucial for educational authorities, school administrators, and policymakers to prioritize the provision of adequate, durable, and age-appropriate teaching and learning materials. According to Otoo, et al, (2022), collaboration between schools, parents, and communities can enhance the availability of local materials that are both cost-effective and culturally relevant. Encouraging community involvement in producing and maintaining learning resources can help ensure sustainability and ownership. Moreover, teachers should be trained in resource management and

improvisation techniques to make the most of available materials while maintaining the integrity of play-based learning approaches.

Theme 4: Large Class Sizes and Time Constraints

Another major challenge teachers discussed was the difficulty of managing large classes within limited instructional time.

One teacher remarked:

My class has over 40 pupils. It is hard to monitor everyone during play activities. (T1)

Another noted:

Play-based lessons take more time than traditional methods, but our timetable is tight. We sometimes rush through activities. (T2)

A third participant added:

With many children and few teachers, some pupils do not get the attention they need during play. (T3)

A fourth teacher commented:

Sometimes I avoid lengthy play sessions because managing the class becomes stressful, especially when the children become too excited. (T4)

The responses show that overcrowded classrooms and limited instructional time pose significant challenges to teachers' ability to conduct meaningful play-based numeracy

lessons in early childhood education. Play-based pedagogy is an interactive and learner-centered approach that requires adequate space, time, and individualized attention for children to explore, experiment, and construct their own understanding of mathematical concepts. However, when classrooms are overcrowded and time is insufficient, these essential elements of play-based learning are compromised, leading to less effective teaching and reduced learning outcomes (UNESCO, 2021).

Overcrowded classrooms make it difficult for teachers to provide individualized support and close supervision during play-based numeracy activities. Play-based learning often involves children working in small groups or engaging in hands-on activities that require movement, exploration, and interaction with materials. According to Clements and Sarama (2014), young learners develop mathematical understanding most effectively when teachers can observe their actions, provide timely guidance, and adjust instruction based on each child's needs. In overcrowded classrooms, however, teachers are unable to give sufficient attention to each learner, leading to disengagement among slower learners and behavioral challenges due to lack of supervision. Additionally, the physical space available may not be enough to accommodate multiple play stations or activity corners, thereby restricting the range of interactive learning opportunities that can be offered.

Moreover, large class sizes increase noise levels and distractions, which interfere with concentration and meaningful engagement during play. Play-based numeracy lessons require a calm and organized environment where children can manipulate materials, discuss ideas, and reflect on their learning. As noted by Awofala and Lawal (2020), effective numeracy teaching at the early childhood level depends on maintaining a structured yet flexible environment something that becomes increasingly difficult when

teachers are managing too many children at once. Consequently, overcrowding not only strains the teacher but also reduces the quality of learning experiences for children, undermining the very purpose of play-based pedagogy.

In addition to overcrowding, limited time allocations for lessons also restrict teachers' ability to fully implement play-based numeracy activities. Play-based learning is a process-oriented approach that requires sufficient time for exploration, experimentation, and reflection. However, many teachers report that rigid timetables and curriculum demands leave little room for extended play sessions (Fleer, 2018). When time is insufficient, teachers may rush through activities, preventing children from deeply engaging with mathematical concepts. This limits opportunities for creative thinking, problem-solving, and the development of persistence skills that are central to early numeracy learning. Furthermore, time constraints may discourage teachers from preparing or facilitating elaborate play setups, as these often require significant planning, setup, and cleanup time (Edwards, 2017).

Addressing these challenges requires systemic and administrative interventions. First, improving teacher-learner ratios is essential. Smaller class sizes allow teachers to offer individualized attention, foster meaningful interactions, and provide closer supervision during play-based lessons. Research by Darling-Hammond (2019) shows that smaller classes lead to higher learner engagement and better learning outcomes, particularly in early childhood education. Second, schools should ensure that schedules allocate adequate time for play-based numeracy learning, recognizing play as an integral part of the curriculum rather than a supplementary activity. Flexible timetabling enables teachers to design lessons that balance play, exploration, and reflection. Additionally, teacher training

programs should equip educators with strategies for managing large groups through rotational play centers and peer-assisted learning to maximize engagement even when resources are limited.

Research Question 3: What strategies can be adopted to improve play-based teaching for better numeracy skills?

Theme 5: Teacher Training and Professional Development

Teachers identified the need for more training and workshops on play-based pedagogy as an essential strategy for improving numeracy teaching.

One teacher shared:

We need regular workshops to learn new play-based methods and how to apply them in teaching numbers. (T1)

Another mentioned:

Most of us use our own ideas. If we receive proper training, we can plan better activities that help children understand mathematics easily. (T2)

A third participant explained:

The training we have received on play-based learning is limited. More professional development will help us improve classroom practice. (T3)

A fourth teacher reported:

Seminars and demonstration lessons would help us learn from one another and share ideas about play-based numeracy teaching. (T4)

The responses emphasize that continuous professional development (CPD) is critical for the effective implementation of play-based pedagogy in early childhood numeracy education. Play-based teaching requires teachers to possess specialized knowledge, creative instructional techniques, and a deep understanding of child development. Continuous training helps educators to remain updated with modern pedagogical approaches, enhance their classroom management abilities, and develop innovative strategies to make numeracy learning more interactive and engaging. According to UNESCO (2021), professional development is essential for building teacher capacity, improving instructional quality, and ensuring that all children benefit from inclusive and effective learning experiences.

Teachers play a central role in shaping how play is used to promote numeracy skills such as counting, problem-solving, and number recognition. However, many teachers in early childhood settings often lack adequate training in play-based methods and may default to traditional, teacher-centered approaches. Continuous professional development helps bridge this gap by equipping teachers with practical skills to design, facilitate, and assess play-based numeracy activities. As noted by Darling-Hammond et al. (2017), effective teacher development programs should focus on active learning, collaborative reflection, and the application of theory to practice. Through CPD, teachers learn to use songs, games,

manipulatives, and storytelling as effective tools for teaching mathematical concepts in a child-centered and enjoyable way.

Training also enhances teachers' classroom management and assessment skills, which are crucial for implementing play-based numeracy lessons. Play-based classrooms can be dynamic and sometimes noisy, requiring teachers to balance freedom and structure effectively. According to Fleer (2018), well-trained teachers understand how to guide play without dominating it, ensuring that children remain engaged while meeting learning objectives. Professional development provides strategies for organizing play centers, grouping learners appropriately, and using observation as a formative assessment tool to track progress. It also equips teachers with the ability to identify individual learning differences and adapt activities to meet diverse needs, promoting inclusion and equity in numeracy education (Florian & Black-Hawkins, 2011).

Regular workshops, peer learning sessions, and mentoring opportunities further contribute to teacher growth and confidence. These platforms allow educators to share experiences, reflect on challenges, and exchange best practices in implementing play-based pedagogy. According to Avalos (2019), collaborative professional learning communities foster a culture of continuous improvement and innovation. When teachers learn from one another, they develop stronger pedagogical content knowledge and become more confident in applying creative and child-centered approaches. Peer observation and feedback also help teachers refine their techniques and stay motivated to integrate play in numeracy teaching consistently.

Furthermore, continuous professional development encourages lifelong learning and adaptability among teachers. As educational demands and curricula evolve, CPD ensures

that teachers remain responsive to new research, technologies, and pedagogical trends. Otoo, Adu-Gyamfi, and Kankam (2022) highlight that when teachers engage in ongoing training, they become more reflective practitioners capable of evaluating their own teaching practices and making data-driven improvements. This reflective approach enhances both teacher effectiveness and student outcomes in numeracy learning.

Theme 6: Parental Involvement and Provision of Learning Resources

Teachers also stressed the importance of involving parents and improving resource provision to enhance play-based numeracy teaching.

One teacher stated:

Parents should support their children at home by using counting games or singing number songs together. (T1)

Another explained:

We encourage parents to provide simple materials like bottle caps and boxes for classroom use. Their contribution makes learning more fun.(T2)

A third teacher shared:

When parents understand the importance of play, they stop seeing it as just fun and begin to support learning activities at home. (T3)

A fourth participant remarked:

If parents and the community can help supply learning materials, it will make it easier for us to organize more play-based numeracy sessions. (T4)

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4.2 Discussions of Findings

The qualitative findings revealed that play-based pedagogy plays a crucial role in developing numeracy skills among preschool learners in the Yunyoo–Nasuan District. Teachers in the district employ diverse strategies such as counting games, songs, rhymes, storytelling, and role play to make numeracy learning interactive and enjoyable. These play-based approaches provide learners with meaningful experiences that promote understanding, problem-solving, and critical thinking. Play allows children to explore mathematical concepts in natural and engaging ways, making abstract ideas tangible and relevant to their everyday lives. According to Piaget's (1962) cognitive development theory, young children learn best through active engagement with their environment, manipulating objects and experimenting with ideas to construct knowledge. Similarly, Vygotsky's (1978) social constructivist theory emphasizes that learning occurs through social interaction and play, as children engage collaboratively with peers and teachers to co-construct meaning. Thus, play-based pedagogy aligns closely with these foundational learning theories by positioning learners as active participants in their own learning process.

In practice, counting games and the use of manipulatives help learners understand number relationships, sequencing, and operations in a concrete manner. Teachers reported using objects such as bottle tops, stones, sticks, and locally made counting tools to demonstrate mathematical concepts. Clements and Sarama (2014) argue that manipulatives bridge the gap between abstract and concrete learning, helping children to visualize numbers and perform operations with understanding. Through play-based activities, children do not simply memorize mathematical facts but internalize concepts through discovery and

repetition. Moreover, songs and rhymes that incorporate counting sequences or number patterns reinforce learning through rhythm, melody, and repetition. Anvari et al. (2018) note that music and rhythm enhance memory retention and support language development, both of which are crucial for numeracy acquisition. For instance, singing songs like "Ten Little Fingers" or "One, Two, Buckle My Shoe" helps children learn counting in a fun and memorable way.

Dramatic and role-play activities also emerged as effective strategies for developing numeracy skills. Teachers encourage children to act out real-life scenarios such as shopping, cooking, or sharing items, which allows them to apply mathematical reasoning in authentic contexts. Vygotsky (1978) emphasized that such social play creates a "zone of proximal development," where children learn new skills through interaction and guided support. When learners engage in pretend play involving numbers, quantities, and transactions, they not only learn basic mathematics but also develop communication, collaboration, and problem-solving skills. These experiences demonstrate that play-based learning provides a holistic approach to numeracy education, integrating cognitive, social, and emotional development (Fleer, 2018).

Despite these successes, the findings also revealed several challenges that hinder the full implementation of play-based pedagogy in the Yunyoo–Nasuan District. A major issue is the inadequate availability of teaching and learning materials. Teachers indicated that they often lack sufficient manipulatives, number charts, or visual aids to facilitate hands-on numeracy activities. This resource scarcity limits creativity and reduces the effectiveness of play-based teaching. Similar concerns were identified by Osei-Poku (2020), who found that many early childhood centers in Ghana struggle with limited materials, forcing

teachers to rely on rote instructional methods instead of interactive approaches. Although some teachers improvise using locally available resources, these materials are often not durable or sufficient to cater to large groups of learners.

Another major challenge is overcrowded classrooms. Teachers reported that large class sizes make it difficult to organize play-based numeracy activities effectively, as supervision and individualized attention become limited. Overcrowding leads to noise, distraction, and safety concerns during active play. This aligns with the findings of UNESCO (2021), which highlighted that large teacher-learner ratios in early childhood classrooms compromise instructional quality and hinder child-centered learning. Play-based pedagogy requires smaller class sizes to allow close monitoring, individualized feedback, and meaningful participation. When the number of learners exceeds manageable levels, teachers often revert to lecture-style teaching to maintain order, which diminishes opportunities for interactive learning (Darling-Hammond, 2019).

Time constraints also pose a challenge to implementing play-based numeracy lessons. Teachers explained that rigid timetables and overloaded curricula leave limited time for creative exploration. Fleer (2018) observes that meaningful play requires adequate time for experimentation, reflection, and consolidation of learning. However, in many early childhood settings, lessons are rushed to meet curriculum requirements, leaving little room for extended play sessions. Consequently, the depth and quality of numeracy learning are compromised.

In response to these challenges, teachers in the Yunyoo–Nasuan District proposed several strategies to improve play-based numeracy instruction. One key recommendation was continuous professional development (CPD) for teachers. Regular workshops and training

sessions would equip teachers with updated knowledge and practical skills for designing and managing play-based activities. Aboagye (2022) emphasizes that teacher capacity building is essential for sustaining effective play-based instruction, as it enhances teachers' confidence, creativity, and pedagogical competence. Professional learning communities where teachers share experiences, reflect on challenges, and exchange best practices can further strengthen teaching quality (Avalos, 2019).

Teachers also suggested that the government and educational authorities increase the provision of teaching and learning materials. Adequate resourcing would ensure that every classroom has sufficient manipulatives, visual aids, and space to facilitate hands-on learning. Otoo, Adu-Gyamfi, and Kankam (2022) recommend community partnerships to support local production of cost-effective educational materials, ensuring sustainability and contextual relevance. Schools can collaborate with parents and artisans to create culturally appropriate play items that reflect children's lived experiences.

Additionally, strengthening parental and community involvement emerged as another strategy. Teachers observed that when parents understand the importance of play in learning, they are more likely to support children's mathematical development at home. According to Epstein (2018), effective school-family partnerships enhance children's learning outcomes by fostering continuity between home and school environments. Encouraging parents to provide household materials for classroom use, participate in school-based play activities, or reinforce counting games at home can complement teachers' efforts in promoting numeracy.

Moreover, addressing overcrowding through better teacher-learner ratios and infrastructure expansion is critical. Hiring more teachers and providing adequate classroom spaces would

allow for smaller groups, improving interaction and supervision. Darling-Hammond (2019) notes that reducing class sizes enhances the quality of early childhood education by allowing teachers to tailor instruction to individual learners' needs. Schools should also adopt flexible scheduling that allocates more time for exploratory learning and play-based activities.

Overall, the study underscores that integrating play-based pedagogy into numeracy instruction enhances engagement, understanding, and retention among preschool learners. Through play, children actively participate in constructing their own knowledge, linking abstract mathematical concepts to real-life situations. However, successful implementation depends on adequate resources, manageable class sizes, sufficient instructional time, and ongoing teacher training. Addressing these challenges through capacity building, resource allocation, and stakeholder collaboration will ensure that play-based numeracy education becomes a sustainable and transformative approach in Ghana's early childhood centers.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0 Overview

This chapter dealt with the summary, conclusions and recommendations for the study

5.1 Summary of the Findings of the Study

The summary of the study revealed that teachers employ a variety of play-based methods such as counting games, songs, rhymes, storytelling, role play, and the use of manipulatives to make numeracy learning engaging and meaningful. These approaches enable learners to explore mathematical concepts through active participation and sensory engagement. Also, the summary of the findings of the study found that play-based numeracy lessons sustain children's attention and motivation better than traditional rote teaching methods. Again, the summary of the findings of the study found several obstacles that limit the effective use of play-based pedagogy. A major challenge identified was the lack of sufficient teaching and learning materials to support interactive lessons. In many cases, teachers relied on improvised local materials due to resource constraints. Additionally, overcrowded classrooms and limited instructional time hindered teachers' ability to organize and supervise play-based numeracy activities effectively.

5.2 Conclusions

Based on the findings of the study, the following conclusions were drawn:

Teachers in the Yunyoo–Nasuan District effectively use diverse play-based activities that promote engagement, understanding, and skill acquisition. Such approaches make abstract mathematical concepts more tangible, fostering critical thinking and curiosity among young learners.

Overcrowded classrooms, insufficient time, and inadequate teacher training undermine the effective use of play in numeracy teaching.

Continuous professional training and peer collaboration are essential to equip teachers with innovative strategies for planning, managing, and assessing play-based numeracy activities. Supportive learning communities can strengthen teacher competence and foster a culture of reflective practice.

5.3 Recommendations

Based on the conclusions drawn, the following recommendations are made;

1. The District Education Directorate should organize regular, targeted training workshops to enhance teachers' knowledge and skills in play-based numeracy instruction. These programs should focus on designing interactive lessons, classroom management, and formative assessment through play.
2. The District Education, in collaboration with local authorities and NGOs, should invest in supplying durable, child-friendly, and culturally relevant numeracy materials.

3. The District Education Directorate Should Monitor and evaluate systems to develop the quality and impact of play-based numeracy instruction across schools.

5.4 Limitations of the study

The study focused on 4 early childhood teachers from a limited number of centres within the Yunyoo-Nasuan District. The relatively small sample size may not fully represent the broader population of early childhood educators across the district or country. Thus, the findings was not be generalized to all educational settings in Ghana.

The study relied on qualitative data collected through semi-structured interviews, which, while rich in detail, are subjective and was not influenced by the personal perspectives of the Participants. Teachers' experiences and opinions was based on their individual training, school environments, and personal attitudes toward inclusive education.

5.5 Suggestions for Future Research

The study focused on the Yunyoo–Nasuan District; therefore, future research could expand to other regions to compare findings and identify regional variations in implementing play-based pedagogy. Quantitative studies could also be conducted to measure the specific impact of different types of play on children's numeracy outcomes. Furthermore, longitudinal research could explore how early exposure to play-based numeracy activities influences later mathematical achievement in primary school.

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APPENDIX A
UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF APPLIED BEHAVIOURAL SCIENCES IN EDUCATION

DEPARTMENT OF EARLY CHILDHOOD EDUCATION, UEW

INTERVIEW GUIDE FOR TEACHERS

My Name is Adoko Chirag Bibi

You have been selected to take part of this interview as part of my research project, the role of play - based pedagogy in developing numeracy skills among pre - school learners within yunyoo - nasuan district. The purpose of this study was to examine the implementation of play-based pedagogy in numeracy education among preschool learners in the Yunyoo-Nasuan District**.** Agreeing to participate in the interview, you affirm that you give your consent for me, to record this interview and use your answers in my research work. All responses will be kept anonymous and there is no way one can trace responses back to you. You are free to withdraw from this interview at any point in time. If you agree to participate in the study kindly append your signature.

Participant's Signature: _____ **Date:** _____

Researcher's Signature: _____ **Date:** _____

1. Describe some of the play activities you use to help children learn counting and numbers.
2. Explain how you use games to teach shapes, sizes, or patterns.
3. Describe how songs, rhymes, or role play are used to support number learning.
4. Explain how often outdoor play is used to teach numeracy concepts.

5. Give an example of a successful play activity that improved children's numeracy skills.
6. Describe the main difficulties you face when using play activities to teach numeracy.
7. Explain how the availability of teaching and learning materials affects your ability to use play in teaching numbers.
8. Describe how class size affects play-based numeracy lessons.
9. Explain how children's different learning speeds affect play-based numeracy activities.
10. Describe any challenges from parents or school management when using play-based methods.
11. Describe the type of training or workshops that would help you use play more effectively in teaching numeracy.
12. Explain how parents support play-based numeracy learning at home.
13. Describe the resources or materials that make play-based numeracy teaching easier for you.
14. Explain how schools arrange the classroom or timetable to allow more play-based numeracy activities.
15. Suggest new games or activities that make number learning more fun and effective.

APPENDIX B