

Examining Teachers' use of Play-Based Pedagogy in Mathematics Learning in Basic Schools

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Abstract:- This study examines the use of play-based pedagogy by basic school mathematics teachers in the Ho West district, addressing a significant gap in the existing literature. Through a comprehensive review of previous studies, the study identifies key insights and informs the investigation. Employing a descriptive survey design with a quantitative approach, the study surveys a stratified random sample of 400 basic school teachers in the Ho West District, collecting data through a reliable questionnaire and analyzing it using various statistical methods. The findings reveal that teachers perceive play-based pedagogy as effective in enhancing students' mathematical understanding, promoting creativity, and fostering collaborative learning. However, the study also identifies challenges faced by teachers, including time constraints, curriculum alignment, resource inadequacy, behavior management, and assessment difficulties, despite the implementation of diverse play-based activities. Based on these findings, the study recommends targeted workshops and seminars for teachers, emphasizing the benefits of play-based pedagogy, introducing a range of activities, and allocating resources to address the identified challenges.

Keywords:- Basic School, Mathematics Teachers, Perception, Play-based Pedagogy, Learning.

I. INTRODUCTION

The globalization of educational systems has precipitated a growing demand for reform across a range of educational levels, from early childhood education to higher education. As a result, many countries have sought to incorporate global research findings and trends into new pedagogies that align with these patterns (Hagan & Laing, 2018). Play-based pedagogy is an effective tool for promoting social-emotional learning in early-grade children, regardless of their backgrounds or mental health (Toub et al., 2021). However, despite the growing body of research on the benefits of play-based learning, playtime in United States kindergarten classes is progressively diminishing (Eberle, 2011). The Ghanaian government has implemented an array of legislative policies and measures to increase access to high-quality early learning strategies, including play-based pedagogy, given the significant impact it has on children's cognitive development, including language, perception, thinking, and memory (Schweinhart & Weikart,

2016; Barnett, 2018). However, Ghana has paid little attention to the Early Childhood Development (ECD) program over the last three decades, resulting in casual and unstructured early learning and stimulation for children (Opoku-Amankwa & Nyarko, 2017). This has left children under the age of eight invisible in the country's educational system, preventing them from achieving scholastic and social success (Amankwah & Koomson, 2015).

Incorporating play into the daily curriculum at the primary and kindergarten levels can provide learners with the opportunity to explore their learning environment through both free play and teacher-initiated play (Graue, 2009). Free play, defined as play initiated by the child, can help children form friendships with other learners, determine their level of difficulty, and improve their capacity for independent decision-making (Ashiabi, 2007). Teacher-initiated play, on the other hand, is the responsibility of the teacher to lead discussions, provide feedback, and bring in appropriate resources (Graue, 2009). Play-based learning is effective at the preschool level, providing children with advantages in social interaction exposure, social interaction development, and conceptual thinking (Bodrova & Leong, 2013; Vygotsky, 1996). Despite the Ghanaian government's commitment to enhancing the early childhood education sector, challenges related to access and quality persist (Ali et al., 2018). The inadequate training of early childhood instructors, coupled with limited learning materials, hampers the effective execution of teaching practices (Ministry of Education). A mismatch between teaching methods and educational goals further complicates the situation (Right to Play Ghana, 2016). However, this situation has not deterred us. We have taken the initiative to investigate basic school mathematics teachers' views on the use of play-based pedagogy in Ghana. The findings revealed that while teachers acknowledge the effectiveness of play-based pedagogy in enhancing students' understanding and fostering creativity and collaboration, they face various challenges, including resource inadequacy, behavior management, and assessment difficulties. Our study recommends workshops and seminars for teachers to address these challenges and promote the positive aspects of play-based pedagogy. Our research emphasizes the importance of understanding teachers' perspectives and practices to ensure effective and well-informed instructional strategies that align with children's developmental needs.

II. PURPOSE OF THE STUDY

The study sought to examine teachers' use of play-based pedagogy in mathematics learning in basic schools in the Ho West District of the Volta Region of Ghana.

➤ *Research Questions*

The research questions of the study were:

- What are the perceptions of mathematics teachers in the use of play in teaching and learning in the Ho West district?
- What kinds of Play-Based activities do mathematics teachers use in teaching and learning in the Ho West district?
- What challenges do mathematics teachers encounter in the use of Play-Based Pedagogy in the Ho West district?

➤ *Hypotheses*

- Ho₁: There is no statistically significant difference between male and female mathematics teachers' perceptions of the use of play in teaching and learning.
- Ho₂: There is no statistically significant difference between the years of teaching experience of mathematics teachers and their perceptions of the effectiveness of play-based pedagogy.
- Ho₃: There is no statistically significant relationship between mathematics teachers' perceptions of play-based pedagogy and the challenges they encounter in teaching and learning.

➤ *Significance of the Study*

It is anticipated that this groundbreaking study on Play-Based Pedagogy being carried out in mathematics education in the Ho West district holds great potential as it aims to offer valuable insights into the perceptions and practices of mathematics teachers regarding play-based approaches. By employing evidence-based strategies to enhance instructional methods, teachers will be better equipped to implement play-based pedagogy successfully. It is of paramount importance to grasp the challenges that teachers face when implementing play-based pedagogy, and the information on head teachers' and teachers' views on promoting such an approach will offer vital guidance for creating a conducive learning environment. Policymakers can draw upon a deeper comprehension of the current status of play-based pedagogy, using empirical evidence to inform evidence-driven policies and guidelines. The results of this research would lead to targeted interventions that address the challenges and serve as a foundation for further research to advance educational practices and improve student learning outcomes.

➤ *Theoretical Framework*

The social constructivist theory serves as the theoretical underpinning for this study on play-based pedagogy in mathematics education in the Ho West district. Emphasizing collaborative learning and the social construction of knowledge, the theory aligns with findings

indicating that play-based activities enhance students' understanding of mathematical concepts and foster creativity. The reported challenges in implementing play-based pedagogy are viewed through a social lens, acknowledging the impact of systemic factors. The recommendations for workshops and seminars reflect a collective, social approach to addressing challenges and improving instructional practices. The application of the social constructivist theory provides a comprehensive framework for understanding, interpreting, and enhancing play-based pedagogy in mathematics education.

➤ *Research Design*

The utilization of descriptive design in the study is commendable, as it enabled the researcher to obtain a wealth of useful information from a large group of individuals. This design facilitated the acquisition of broad and accurate responses from Basic school teachers about their use of play-based pedagogy in teaching and learning. Furthermore, the descriptive design allowed the researcher to employ a questionnaire to obtain information and generalize the views of Basic school teachers on the use of play-based pedagogy in teaching and learning. Descriptive research design is a common approach used to gather data on knowledge, characteristics, or options in a population or sample population through questionnaires and interviews (Babbie, 2015). Researchers can gather valuable information, summarize, interpret, and present it for clarification using this design. The valuable information gathered through the use of descriptive design became meaningful in diagnosing Basic school teachers on their use of play-based pedagogy in teaching and learning since this research involves describing, recording, and interpreting existing conditions (Creswell, 2014). The utilization of a descriptive research survey in this investigation was most suitable and relevant since the researcher aimed to gather information about Basic school teachers and their application of play-based pedagogy in teaching and learning.

• *Population:*

In conducting research, the selection of the target population is a critical factor that cannot be overlooked. In this study, we confidently identified the target population as basic school mathematics teachers in the Ho West District of the Volta Region of Ghana. We then proceeded to employ a stratified random sampling technique to select a sample size of 400 public basic school mathematics teachers. This method was chosen to ensure that the sample accurately represented the broader target population, providing a robust and unbiased representation in our study. Our sample size comprised of 263 primary school teachers and 137 Junior High School mathematics teachers in various educational circuits in the district. We aimed to reflect the diversity within the basic school teaching population, recognizing the unique roles and experiences associated with each group. We used the Krejcie and Morgan table of sample size determination to establish the appropriate sample size, ensuring that our findings were statistically sound and could be generalized to the broader population of basic school teachers in the district. Overall, our confident approach to selecting the target population and sample size enabled us to

draw meaningful conclusions and contribute to the field of play-based pedagogy in teaching and learning.

• *Instrumentation:*

Questionnaires were used for data collection for the study. The instrument was developed by the researcher from the literature. Closed-ended statements were used for the questionnaire. Section B to section E comprised – points Likert-type scale items ranging from Strongly Agree (SA) = 5, Agree (A) = 4, Neutral =3, Disagree (D) = 2, and Strongly Disagree (D) = 1. The Likert-type scale was used in the data collection because it uses a universal method of collecting data, which means it is easy to understand. Because the Likert type uses a scale, people are not forced to express an opinion rather allowing them to be neutral should they so choose (Joshi et al., 2015). The questionnaire was used in this study because it allows the researcher to collect a substantial amount of data from a large group of Basic school teachers on their use of play-based pedagogy in teaching and learning. Also, it is cheaper and cost-effective. Notwithstanding, questionnaires have some level of weakness.

➤ *Validity and Reliability*

The validity of this study was ensured by using face and content validity procedures. The questionnaire was validated by the researchers’ supervisor to make the necessary corrections before the instrument was administered. This was done to determine whether the instrument measured what it was supposed to have measured and again, suggestions from the research supervisors were duly done before the instrument was administered. Pre-testing of the instrument was done on 20 Basic school mathematics teachers. Results from the pre-testing offered the researcher the opportunity to improve and modify the instrument, where there were problems, however, the developed questionnaire items were re-worded based on the outcome of the pre-testing. The researcher used a simple random sampling technique to select the teachers on whom the pre-testing was done. After pre-testing the instrument, the data was entered into the statistical product services solution (SPSS), Specifically, IBM version 26 as to calculate Cronbach’s alpha reliability coefficient. The reliability coefficient for the questionnaire for the study was 0.81. According to Cohen et al. (2017) posited that a Cronbach alpha coefficient of at least 0.70 is indicative of reliability.

➤ *Data Analysis Method*

The completed questionnaires were serially numbered and coded into the SPSS software specifically, IBM version

26. The analysis involved coding, organizing, describing, interpreting, cross-tabulating, and drawing conclusions. The data was synthesized and transformed into tabular form to illustrate the relative proportions where applicable. An item-by-item analysis of data was conducted. All items of the questionnaires were coded. Items in the form of five-point Likert scale were rated between 5-1, with 5 being the highest and 1 being the lowest. The analysis focused on descriptive statistics such as frequencies, percentages, means and standard deviations for the research questions, and inferential statistics (independent samples t-test, and Pearson’s moment correlation) were used in testing the hypotheses. The research questions were analyzed using means and standard deviations, and the hypotheses were tested using Independent samples t-tests, ANOVA, and Pearson’s moment correlation.

• *Ethical Considerations:*

It is imperative to prioritize ethical considerations in quantitative research, as highlighted by Creswell (2016). Informed consent, confidentiality, and anonymity are among the key ethical issues that require careful attention. The researchers in this study ensured that these issues were addressed appropriately, demonstrating a strong commitment to protecting the privacy of the study participants. By taking measures such as securing physical and electronic data and guaranteeing confidentiality and anonymity, the researcher was able to safeguard the data of the participants from unauthorized access, use, or disclosure. It is essential to recognize that prioritizing ethical considerations is fundamental to conducting research that is respectful, fair, and safe for participants. Therefore, researchers must make every effort to prioritize the protection of participants' privacy and ensure that ethical guidelines are adhered to throughout the research process.

III. RESULTS AND DISCUSSIONS

A. Research Question 1: What are the Perceptions of Mathematics Teachers in the use of Play in Teaching and Learning in the Ho West District?

Research Question 1 delved into the attitudes, beliefs, and perspectives of mathematics educators regarding the incorporation of play-based strategies in the educational landscape of the Ho West District. Through a comprehensive analysis of these perceptions, this study aims to unravel the dynamics and implications associated with the integration of play in the instructional practices of mathematics teachers in the specified district. Table 6 presents the results of the perceptions of mathematics teachers in the use of play in teaching and learning

Table 1 Perceptions of Mathematics Teachers in the use of Play in Teaching and Learning

Statement	M	SD
Play-based pedagogy enhances students’ engagement in mathematics learning.	3.3	0.6
Integrating play-based activities improves students’ understanding of mathematical concepts.	4.2	0.5
Play-based approaches help students develop problem-solving skills.	3.0	0.4
Integrating play-based activities in lessons improves students’ understanding of complex mathematical concepts.	2.9	0.3
Play-based pedagogy fosters a positive classroom environment that encourages collaborative learning.	3.8	0.7
Play-based activities provide students with practical and real-life applications of mathematical concepts.	4.1	0.6

Play-based learning promotes creativity and imagination among students.	3.4	0.4
Play-based pedagogy accommodates diverse learning styles and preferences of students.	3.2	0.7

Source: Fieldwork Data, (2024)

Table 1 presents a comprehensive overview of mathematics teachers’ perceptions regarding the incorporation of play in teaching and learning. With a mean score of 3.3 and a standard deviation of 0.6, the statement “Play-based pedagogy enhances students’ engagement in mathematics learning” indicates a moderate level of agreement among teachers. Similarly, the statement “Integrating play-based activities improves students’ understanding of mathematical concepts” receives a higher mean score of 4.2, suggesting a stronger consensus among teachers, supported by a low standard deviation of 0.5. Contrastingly, the statements “Play-based approaches help students develop problem-solving skills” and “Integrating play-based activities in lessons improves students’ understanding of complex mathematical concepts” yield mean scores of 3.0 and 2.9, respectively, accompanied by relatively low standard deviations (0.4 and 0.3). These findings hint at a more dispersed range of opinions among teachers regarding the efficacy of play-based strategies in enhancing problem-solving skills and understanding complex mathematical concepts. Moving forward, the statement “Play-based pedagogy fosters a positive classroom environment that encourages collaborative learning” attains a mean score of 3.8, signifying a generally favorable perception among teachers, with a moderate standard deviation of 0.7. Similarly, the statement “Play-based activities provide students with practical and real-life applications of mathematical concepts” garners a high mean score of 4.1, indicating a strong consensus and is supported by a relatively low standard deviation of 0.6. Finally, the statements “Play-based learning promotes creativity and imagination among students” and “Play-based pedagogy accommodates diverse learning styles and preferences of students” receive mean scores of 3.4 and 3.2, respectively, along with standard deviations of 0.4 and 0.7. These results suggest a moderate level of agreement among teachers regarding the positive impact of play-based learning on creativity and its adaptability to diverse learning styles. The results in table 1 sought to examine the perception of mathematics teachers in the Ho West District regarding the effectiveness of play-based pedagogy in different aspects of teaching and learning mathematics. Analysis of the data obtained from Table 1 revealed varying degrees of

agreement among the participants. Despite the differences in opinions, the teachers generally agreed on the perceived effectiveness of play-based pedagogy in enhancing students’ understanding of mathematical concepts, fostering creativity, creating a positive classroom environment, and promoting collaborative learning. The mean scores, coupled with standard deviations, provided a nuanced understanding of the consensus and dispersion within the participants’ perceptions of the integration of play in mathematics education. The findings of this study are consistent with social constructivist theory and the views of scholars such as Vygotsky, emphasizing the significance of collaborative and experiential learning in cognitive development. The views of Fler and Raban (2012) on play-based pedagogy as a supportive approach to children’s development and its role in providing practical applications align with the social constructivist perspective of impactful learning within real-world contexts. Similarly, McInnes, Howard, and Miles (2017) affirm play-based pedagogy as an effective holistic approach to teaching and learning. Therefore, acknowledging the variations in opinions among teachers and exploring nuanced reasons could offer valuable insights into the effectiveness of play-based pedagogy in mathematics education. In conclusion, the consensus among the mathematics teachers in the Ho West District regarding the effectiveness of play-based pedagogy aligns with the established findings in educational psychology and social constructivism, highlighting the potential benefits of this approach in enhancing students’ learning outcomes.

B. Question 2: What kinds of Play-Based Activities do Mathematics Teachers use in Teaching and Learning in the Ho West District?

Research Question 2 examined the diverse instructional approaches employed by mathematics teachers in the Ho West district, specifically focusing on the utilization of play-based activities in their teaching and learning methodologies. This question sought to uncover the various types of play-based activities integrated into mathematics instruction, providing a comprehensive understanding of the pedagogical strategies adopted by educators in the district. Table 2 presents the results of the kinds of Play-Based activities use in teaching and learning.

Table 2 Kinds of Play-Based Activities use in Teaching and Learning

Statement	M	SD
Math games or puzzles	3.1	0.2
Role-playing activities related to mathematical concepts	2.7	0.4
Manipulative and hands-on activities	3.4	0.6
Interactive simulations or digital games	1.9	0.4
Outdoor or physical activities incorporating math concepts	1.8	0.6
Math-related arts and crafts projects	1.5	0.4
Group problem-solving tasks	3.1	0.5
Using real-life scenarios to explore mathematical ideas	3.4	0.3
Incorporating storytelling or narratives with math content	2.8	0.4
Collaborative projects that involve mathematical exploration	3.0	0.7

Source: Fieldwork Data, (2024)

Mathematics teachers consistently incorporate math games or puzzles into their pedagogy (Mean= 3.1), reflecting a widely accepted and practiced approach (SD = 0.2). This suggests a high level of agreement among educators regarding the effectiveness and popularity of using games and puzzles as play-based activities. In contrast, the utilization of role-playing activities related to mathematical concepts is less pervasive (Mean = 2.7). Although the standard deviation (SD = 0.4) indicates some variability in its implementation, there is a moderate consensus among teachers that role-playing has a discernible but not predominant role in their instructional strategies. Mathematics teachers widely embrace manipulative and hands-on activities in their teaching practices (Mean= 3.4). The moderate standard deviation (SD = 0.6) suggests that while this approach is popular, there are varying degrees of emphasis or methods employed by individual teachers. The integration of interactive simulations or digital games is less frequent (Mean= 1.9), with a low mean indicating a relatively uncommon practice. The low standard deviation (SD= 0.4) suggests a shared perspective among teachers about the infrequency of using digital play-based activities. Outdoor or physical activities that incorporate math concepts are less prevalent (Mean= 1.8), with a moderate standard deviation (SD= 0.6) indicating some variability in their implementation. This suggests that while some teachers incorporate such activities, they are not universally adopted. The incorporation of math-related arts and crafts projects is among the less common practices (Mean = 1.5). The low mean and low standard deviation (SD = 0.4) indicate a shared perspective among teachers that this form of play-based activity is not extensively utilized. Mathematics teachers frequently employ group problem-solving tasks in their teaching practices (Mean= 3.1). The moderate standard deviation (SD= 0.5) suggests a shared but slightly varied emphasis on integrating collaborative problem-solving activities in the classroom. Teachers commonly use real-life scenarios to explore mathematical ideas (Mean = 3.4). The low standard deviation (SD = 0.3) indicates a high level of agreement and consistency in the incorporation of real-world scenarios as part of play-based learning. Incorporating storytelling or narratives with math content is a moderately common practice (Mean = 2.8). The moderate standard deviation (SD = 0.4) suggests some variability in the extent to which teachers integrate storytelling into their math lessons. Collaborative projects

that involve mathematical exploration receive a moderate emphasis (Mean = 3.0). The relatively high standard deviation (SD = 0.7) indicates a considerable variation in the extent to which teachers incorporate collaborative projects in their teaching.

It's interesting to note that the analysis of play-based activities in the Ho West district shows a mix of commonly adopted practices and less prevalent practices in mathematics education. Math games, manipulative activities, and real-life scenarios are commonly used, while digital games and arts and crafts are not as frequently used. Teachers have diverse approaches to integrating play into their teaching methods, which is highlighted by the standard deviations. The use of math games is believed to enhance student engagement and understanding of mathematical concepts, as per Gee's (2007) research. Role-playing activities allow students to apply mathematical concepts in simulated scenarios, echoing social constructivist principles (Vygotsky, 1978). Manipulative activities involve tangible objects, offering a hands-on, experiential dimension to mathematical learning, which research has shown to be effective in understanding abstract concepts (Darkwa & Lartey, 2018; Lynch, 2017). These findings show an approach that goes beyond traditional methods and fosters a dynamic and engaging learning environment that accommodates various learning styles and preferences, which aligns with Lynch's (2017) assertion of diverse and interactive pedagogical strategies in mathematics education.

C. Research Question 3: What Challenges do Mathematics Teachers Encounter in the use of Play-Based Pedagogy in the Ho West District?

Research Question 3 explored the obstacles and difficulties faced by mathematics teachers in the Ho West district when employing Play-Based Pedagogy in their instructional practices. By addressing this question, the study sought to identify and understand the challenges that educators encounter while integrating play-based approaches into mathematics teaching. This inquiry is crucial for gaining insights into the practical constraints and impediments that may affect the effective implementation of play-based pedagogy in the local context. The results of the challenges mathematics teachers encounter in the use of Play-Based Pedagogy are presented in Table 3.

Table 3 Challenges Mathematics Teachers Encounter in the use of Play-Based Pedagogy

Statement	M	SD
Play-based activities take up too much class time.	4.2	0.6
It is challenging to align play-based activities with curriculum requirements.	3.0	1.1
Lack of appropriate resources and materials for play-based activities.	4.4	0.4
Difficulty in managing classroom behavior during play-based activities.	4.1	0.7
Play-based activities are difficult to assess and evaluate.	3.8	0.4
Insufficient training or professional development on implementing play-based pedagogy.	4.1	0.3
Concerns about covering required content when using play-based activities.	4.2	0.5
Resistance from students or colleagues to the use of play-based pedagogy.	4.4	0.3
Play-based activities may not adequately prepare students for assessments.	4.3	0.6
Play-based pedagogy may be perceived as less rigorous by stakeholders.	3.5	0.4

Source: Fieldwork Data, (2024)

Table 3 presents an overview of the challenges faced by mathematics teachers in the Ho West district when implementing Play-Based Pedagogy. Teachers express a notable concern that play-based activities may consume a significant portion of class time, with a relatively high mean score indicating a shared perception of time constraints (SD = 0.6). Aligning play-based activities with curriculum requirements proves challenging for teachers, as reflected by a moderately low mean score and a substantial standard deviation (SD = 1.1), indicating varying degrees of difficulty. A significant challenge highlighted by teachers is the lack of appropriate resources and materials for play-based activities, as evidenced by a high mean score (M = 4.4) and a relatively low standard deviation (SD = 0.4), suggesting a shared concern. Teachers face challenges in managing classroom behavior while implementing play-based activities, with a relatively high mean score (M = 4.1) and a noticeable standard deviation (SD = 0.7), indicating variations in experiences. Assessing and evaluating play-based activities pose difficulties for teachers, reflected in a moderately high mean score (M = 3.8) and a relatively low standard deviation (SD = 0.4), suggesting a shared perception of assessment challenges. Teachers express a need for more training or professional development in implementing play-based pedagogy, as indicated by a high mean score (M = 4.1) and a low standard deviation (SD = 0.3), suggesting a widespread desire for further training. Teachers harbor concerns about covering the required content when employing play-based activities, with a relatively high mean score (M = 4.2) and a moderate standard deviation (SD = 0.5), indicating a shared apprehension. Teachers encounter resistance from both students and colleagues regarding the use of play-based pedagogy, as reflected in a high mean score (M = 4.4) and a low standard deviation (SD = 0.3), suggesting a widespread challenge. There is a concern among teachers that play-based activities may not sufficiently prepare students for assessments, as indicated by a relatively high mean score (M = 4.3) and a moderate standard deviation (SD = 0.6). Teachers express concerns that play-based pedagogy may be perceived as less rigorous by stakeholders, with a moderately high mean score (M = 3.5) and a relatively low standard deviation (SD = 0.4), indicating a shared apprehension.

The results provide a comprehensive understanding of the challenges that mathematics teachers face while integrating Play-Based Pedagogy in the Ho West district.

The mean and standard deviation values provide valuable insights into the level of agreement and variability among teachers regarding these challenges. The research reveals that introducing Play-Based Pedagogy in math instruction is a complex process that involves various factors such as time management, curriculum alignment, resource availability, behavior management, assessment techniques, professional development, content coverage, opposition, and perceptions of rigor. Furthermore, the study highlights time constraints as a significant obstacle, which is consistent with previous research indicating that teachers are under immense pressure to cover extensive material within limited time frames (Clark, 2012). Balancing play-based activities with curriculum demands highlights the tension between innovative pedagogies and standardized educational expectations. Alignment challenges with curriculum requirements emphasize the need for coherent integration of play-based approaches within the existing educational framework, as noted in prior studies (Pounder, 2003). Insufficient resources pose a barrier, reflecting broader issues of resource disparities in education, necessitating attention to resource allocation and equitable access in line with principles of social justice (Gorski, 2013). Classroom behavior management challenges underscore the importance of fostering a positive and focused learning environment during play-based activities, aligning with research on classroom environment and student engagement (Skinner, Williams, & Kindermann, 2003). Assessment difficulties highlight the necessity for innovative and context-appropriate assessment methods, echoing broader discussions on assessment practices in unconventional teaching approaches. These challenges underscore the complexity of implementing play-based pedagogy and emphasize the need to address structural, systemic, and instructional factors to facilitate successful integration (Siraj-Blatchford, 2009).

D. Testing Hypotheses

➤ *H₀₁: There is no Statistically Significant Difference between Male and Female Mathematics Teachers' Perceptions of the use of Play in Teaching and Learning.*

The null hypothesis (H₀₁) sought to find out whether any observed differences in perceptions between male and female teachers are attributed to random variation and are not indicative of a genuine disparity in their attitudes towards the incorporation of play-based pedagogy in mathematics education. The results are presented in Table 4.

Table 4 Gender Differences in Mathematics Teachers' Perceptions of Play-based Pedagogy

Gender	N	Mean	Std. Dev.	T	Df	Sig-Value
Male	146	16.8	5.3	0.377	398	0.707
Female	254	17.1	5.1			

Source: Fieldwork, 2023

The independent samples t-test was conducted to assess differences in mean perceptions of play-based pedagogy between male and female teachers. Results showed a non-significant difference, $t(398) = 0.377, p = 0.707$, indicating that gender does not significantly influence teachers' attitudes towards play-based pedagogy

in mathematics education. Thus, the null hypothesis was not rejected, suggesting that observed distinctions are likely due to random variability rather than gender-related factors. This aligns with previous research suggesting that gender may not play a substantial role in shaping pedagogical beliefs and practices (Poulou, 2017).

➤ *Ho2: There is no Statistically Significant Difference between the Years of Teaching Experience of Mathematics Teachers and their Perceptions of the Effectiveness of Play-based Pedagogy.*

The null hypothesis (Ho2) aimed to find out whether there is no statistically significant difference between the

years of teaching experience of mathematics teachers and their perceptions of the effectiveness of play-based pedagogy. The analysis employed a one-way ANOVA to examine the statistical significance of the differences in mean perceptions among different groups based on years of teaching experience. The results are presented in Table 5.

Table 5 ANOVA of Years of Teaching Experience and Mathematics Teachers’ Perceptions

Years of Teaching	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	516.139	4	129.035	5.120	0.001
Within Groups	5090.624	396	25.201		
Total	5606.763	400			

Source: Fieldwork, 2023

The results revealed a significant F-value of 5.120 with 4 and 396 degrees of freedom between and within groups, respectively. The p-value associated with the F-test was 0.001, indicating statistical significance. Rejecting the null hypothesis (Ho2) implies a significant difference between the years of teaching experience of mathematics teachers and their perceptions of the effectiveness of play-based pedagogy. This finding suggests that teaching experience may influence educators’ perceptions and engagement with innovative pedagogical approaches, aligning with existing literature highlighting the impact of experience on teaching practices (Wolfe, 2014).

➤ *Ho3: There is no Statistically Significant Relationship between Mathematics Teachers’ Perceptions of Play-based Pedagogy and the Challenges they Encounter in Teaching and Learning.*

The null hypothesis (Ho3) aimed to investigate whether there is no statistically significant relationship between mathematics teachers’ perceptions of play-based pedagogy and the challenges they encounter in teaching and learning. analysis employed a Pearson correlation coefficient (R) to measure the strength and direction of the linear relationship between teachers’ perceptions of play-based pedagogy and the challenges they encounter. The results are presented in Table 6.

Table 6 Correlation between Teachers’ Perceptions and Challenges of Play-based Pedagogy

Variable	N	Mean	Sd	R	P
Teachers’ Perception	400	16.9	5.2	-.580	.000
Play-Based Challenges	400	19.6	5.4		

Source: Fieldwork, 2023

The results revealed a statistically significant negative correlation (R = -.580) at a significance level of 0.000. The negative correlation coefficient (R = -.580) indicates a moderate negative linear relationship between teachers’ perceptions of play-based pedagogy and the challenges they encounter in teaching and learning. This means that as one variable increases, the other tends to decrease. The magnitude of -.580 indicates a moderate strength of the relationship, suggesting that teachers who have more positive perceptions of play-based pedagogy tend to report encountering fewer challenges in teaching and learning, and as teachers’ positive perceptions decrease, the reported challenges in implementing play-based pedagogy tend to increase. This aligns with the tenets of the social constructivist theory, where positive beliefs and attitudes can influence the interpretation and management of teaching challenges (Bandura, 1997).

IV. STUDY FINDINGS

The study examined basic school mathematics teachers’ use of play-based pedagogy in teaching and learning. The findings provide a comprehensive overview of the perceptions, practices, challenges, and strategies related to play-based pedagogy among mathematics teachers in the Ho West district. It was revealed that:

- Despite the variations in opinions, the areas of consensus among mathematics teachers in the Ho West district highlight the perceived effectiveness of play-based pedagogy in improving students’ understanding of mathematical concepts, providing practical applications, fostering creativity, creating a positive classroom environment, and enhancing collaborative learning.
- Mathematics teachers in the Ho West district employed various play-based activities, including math games, role-playing, and manipulative activities.
- Teachers reported challenges such as time constraints, alignment with curriculum requirements, inadequate of resources, classroom behavior management, and difficulty in assessment.
- The analysis showed no statistically significant difference in the perceptions of male (M = 16.8, SD = 5.3) and female (M = 17.1, SD = 5.1) mathematics teachers regarding play-based pedagogy, $t(208) = 0.377$, $p = 0.707$. This result suggests that, based on gender, there is no significant variation in how male and female mathematics teachers perceive play-based pedagogy. The mean scores for both groups are close, with standard deviations indicating relatively similar levels of variability in their perceptions.

- The analysis indicated a statistically significant difference among different groups based on years of teaching experience ($F = 5.120$, $p = 0.001$). This finding implies that teachers with varying levels of teaching experience hold different perceptions regarding the effectiveness of play-based pedagogy. The significant F-value suggests that the differences among groups are not due to random chance.
- A significant negative correlation ($r = -.580$, $p = .000$) was found between teachers' perceptions of play-based pedagogy and the challenges they face. This result indicates that as teachers' positive perceptions of play-based pedagogy increase, the reported challenges in teaching and learning tend to decrease, and vice versa. The substantial negative correlation suggests a moderate strength in this relationship.

V. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study has provided valuable insights into the perceptions, practices, challenges, and strategies related to play-based pedagogy among mathematics teachers in the Ho West district. While the findings are specific to this particular area, the outcomes contribute to a broader discourse on effective pedagogical strategies, particularly in mathematics education. The limitations of this study underscore the need for future research to explore play-based pedagogy in diverse geographical settings, different educational levels, and with a larger participant pool. Overall, this study highlights the importance of considering context-specific factors when implementing innovative pedagogical methods and the significance of addressing challenges to optimize teaching and learning experiences. Based on the extensive investigation into the perceptions, practices, challenges, and strategies associated with play-based pedagogy in mathematics education among teachers in the Ho West district, we recommend the following:

- Basic school headteachers should develop workshops and seminars to facilitate discussions among mathematics teachers, emphasizing the positive aspects of play-based pedagogy. Teachers should also encourage the sharing of success stories and practical tips to further build consensus on its effectiveness.
- Basic school headteachers should promote workshops or training sessions that introduce teachers to a broader range of play-based activities. Teachers should encourage experimentation with various methods to cater to diverse learning preferences and maximize engagement.
- Basic school headteachers should establish a task force or committee to address specific challenges reported by teachers. Basic school headteachers should allocate resources to mitigate issues related to time constraints, curriculum alignment, and resource inadequacy. They should endeavor to provide additional training on behavior management and assessment techniques for play-based learning.
- Basic school headteachers should continue providing professional development opportunities but ensure they are tailored to the needs of both male and female teachers. There should be the promotion of a gender-neutral approach to ensure inclusivity and equal access to training resources.
- Based on the identified significant difference in perceptions among different experience groups, basic school headteachers should tailor professional development programs. Additionally, they should offer targeted sessions for specific experience brackets, addressing their unique needs and concerns.
- Basic school headteachers should launch campaigns within the educational community to highlight the positive correlation between favorable perceptions of play-based pedagogy and reduced challenges. Success stories and testimonials from teachers who have successfully overcome challenges should be showcased.

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