

# **TEACHING MATHEMATICS THROUGH PLAY PEDAGOGY IN GOVERNMENT PRE-PRIMARY CLASSROOMS: AN EXPLORATORY STUDY**

By

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A thesis submitted to the BRAC Institute of Educational Development in partial fulfillment of  
the requirements for the degree of  
Master of Education in Educational Leadership & School Improvement

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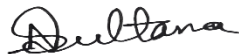
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## **Declaration**

It is hereby declared that-

1. The thesis submitted is my own original work while completing the degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate reference.
3. The thesis does not contain material that has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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## Approval

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## **Ethics Statement**

I, Nazmin Sultana, hereby consciously assure that for the manuscript titled “Teaching mathematics through Play Pedagogy in Government Pre-primary Classes: An Exploratory Study” the following is fulfilled.

- This material is my own original work, which has not been previously published or submitted elsewhere.
- All sources used in this manuscript are appropriately identified and cited. Text that is literally copied must be identified as such by using quote marks and providing suitable references.
- All the participants of this research willingly participated in this research.
- The participants’ identities who have participated in this research are confidential, protected and will not be revealed at any point.
- The findings are suitably contextualized in relation to previous and present research.

## **Abstract**

Play pedagogy is one of the effective pedagogies to teach mathematics to pre-primary students. This study explores Play pedagogy in teaching mathematics in government pre-primary classrooms. The study investigates three areas- the government pre-primary teachers' perceptions of play pedagogy in teaching mathematics, the use of play pedagogy in teaching mathematics, and the support and challenges of implementing play pedagogy in government pre-primary classrooms. A qualitative research approach was used to administer this study. A semi-structured interview and classroom observation were used to collect data from four government primary teachers who take pre-primary classes and their classes. Also, data was collected from two primary teachers' training instructors. The results from the thematic analysis revealed that teachers perceive play pedagogy as a joyful, participatory, and effective strategy for teaching mathematics. Teachers preferred to employ guided play while teaching mathematics. Teachers employed teachers' guide suggested play mostly in teaching mathematics. Moreover, use of play materials/toys is prominent among teachers. Besides, teachers get resources and training support and support from parents for smooth implementation of play pedagogy while teaching mathematics. However, teaching mathematics through play pedagogy has challenges too, including scarcity of separate classrooms for pre-primary, classroom management challenge and lack of after-training follow-ups. This study has implications for teachers' training which may help to improve teaching mathematics through play pedagogy in pre-primary classrooms by informing recent practices, support, and challenges.

**Keywords:** Play pedagogy; teaching mathematics; pre-primary students

## **Dedication**

This Thesis is dedicated to all the respected pre-primary teachers who tirelessly make effort to build a cheerful and caring learning environment for our young students.

## **Acknowledgment**

I would like to show my gratitude to my supervisor Somnath Saha for his guidance and constructive feedback. Also, I want to take this opportunity to thank my friend Md. Tanvir Rahman Bhuiyan and my colleagues Ms. Ayesha Mahmood and Ms. Faria Haque Tuli with whom I spent hours discussing my thesis and sharing research books. Lastly, I want to extend my thanks to the participants of this research who gave their invaluable time for interviews.

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## **List of Acronyms**

PTI	Primary Teachers' Training Institute
ELDS	Early Learning and Development Standards
NCTB	National Curriculum and Textbook Board

# **Chapter 1**

## **Introduction and Background**

### **1.1 Introduction**

Play refers to the activities that are freely sought by individuals or groups entirely for enjoyment. It has an important mechanism on a child's cognitive, social, and emotional development (APA dictionary of psychology, 2022). Play assists children to gain self-regulation, language, mathematics skills, and social and cognitive competencies (Copple & Bredekamp, 2009; Sluss, 2005; Meaney et al., 2014). Children develop knowledge while they are playing which is why Montessori, Reggio Emilia, and Froebel considered play as an effective pedagogy for children's learning (Sluss, 2005; Samuelsson & Carlsson, 2008). As present pleasure and concreteness are children's instincts, the act of children's education zooms in on play and other activity-based learning. For young learners, both the contents and the learning activities are important. The play focuses on learning content that incorporates interactive processes along with demonstrating skills (learned knowledge) (Sluss, 2005). Teachers and learners equally participated in play activities. Previous studies remarked this participation is a significant part in integrating play and learning. However, this participation needs to develop based on specific content (Samuelsson & Carlsson, 2008). The role of teachers in organized pre-primary settings is to enable and scaffold children to learn through play which requires thoughtful planning as well (The Lego Foundation, 2018). Children gain fundamental concepts and appropriate attitudes toward science and mathematics through play pedagogy (Henniger, 2012). Play-based mathematical education develops young students' personal-social, language, fine motor, and gross motor skills. However, teaching mathematics in Chinese preschools often found to be

subject-centered and teacher-led which limited the young students' active participation and meaningful learning (Ma et al, 2023). Considering the effective educational implication of play, pre-primary curriculum of Bangladesh also emphasizes play pedagogy in teaching and learning practice (National Curriculum & Textbook Board [NCTB], 2011). Hence, this study sets out to explore the teachers' perceptions of play pedagogy in teaching mathematics and their classroom practices.

## **1.2 Research Topic**

The title of this research is 'Teaching mathematics through play pedagogy in government pre-primary classrooms: An exploratory study'. Play is an important aspect of teaching and learning. Preschoolers get a meaningful opportunity to develop and use mathematics while playing (Meaney et al., 2014). Therefore, the pre-primary curriculum of Bangladesh emphasizes play pedagogy in teaching mathematics to pre-primary students (National Curriculum & Textbook Board [NCTB], 2011). I set out to explore government pre-primary schoolteachers' perception of play pedagogy in teaching mathematics, their classroom practices, and the challenges of employing play pedagogy in teaching mathematics.

## **1.3 Statement of the problem**

With the increasing international concern about early childhood education, mathematical understanding, and skills are also recognized and emphasized (Anthony & Walshaw, 2009). Learning mathematics in early childhood helps to build a strong base for understanding higher mathematical concepts (Bakar, 2017). Previous research has shown that developing the early foundation of mathematical concepts is relevant for future educational outcomes (Vogt et al., 2018). Mastery of number concepts in preschool provides a foundation for advanced mathematical skills in primary and secondary schools. Teaching mathematics through play

activities at early grades is recommended by researchers and child education experts. Moreover, problems regarding number concepts and operations in the early stage can be solved through organized play pedagogy (Chin & Zakaria, 2015). Neuroscientists have discovered that play builds new neurons and synapses whereas deprivation of play impedes brain development and problem-solving skills (Parker et al., 2022). Aligned with this educational sphere, early childhood education in Bangladesh emphasizes gross and fine motor development, literacy, language, numeracy, and social-emotional development (Spier et al., 2020). One of the objectives of the pre-primary curriculum of Bangladesh which is designed for 5+ years old children, is to assist students to achieve the competencies of elementary mathematical concepts, logical thinking, and problem-solving skills (National Curriculum & Textbook Board [NCTB], 2011). This curriculum introduces elementary mathematics that incorporates pre-mathematical concepts, number concepts, comparison of numbers, and the concept of addition and subtraction. And play is one of the key pedagogies to instill these mathematical competencies in children (NCTB, 2011). Although the curriculum advocates play-based pedagogy, a previous study has found that early childhood education follows rote memorization and a teacher-centered approach (Rashid & Akkari, 2020). The extant studies are conducted on the gap between the perception of play pedagogy and practice at the pre-primary level. These studies found that government primary school teachers who take pre-primary classes have an ambiguous perception of play. This leads to traditional rote learning and less scope for child-directed play. The reasons behind this perception and practice gap are lack of playful curriculum, insufficient training, teachers' unawareness about play pedagogy, unsuitable classroom environment and scarcity of play materials (Rahman, et al., 2020; Rashid & Jahan, 2021). However, limited research has been found on teaching mathematics through play pedagogy in government pre-primary classrooms in



Bangladesh. My study sets out to explore the teacher's perception of play pedagogy and classroom practices in teaching mathematics along with the scope of employing play pedagogy in government pre-primary classrooms.

#### **1.4 Research Question**

This study is guided by three research questions which intend to explore the perception, practice, and challenges of employing play pedagogy in teaching mathematics-

1. What is government pre-primary teachers' perception of play pedagogy in teaching mathematics?
2. How is play pedagogy implemented in teaching mathematics by government pre-primary schoolteachers?
3. What are the support and challenges of teaching mathematics through play pedagogy regarding materials and classroom management?

#### **1.5 Purpose of the Study**

The study intends to explore the teachers' perceptions of play pedagogy in teaching mathematics along with their teaching practices in the classroom. This study sets out to learn about the teachers' understanding and how they define play pedagogy in teaching mathematics. In addition, this also investigates how play pedagogy is being implemented while teaching mathematics. Lastly, the support and challenges confronted by teachers are also explored.

#### **1.6 Significance of the Study**

There is enough research on effective pedagogy for teaching mathematics in the school sector, however, limited evidence has been found in preschool effective mathematics teaching (Anthony & Walshaw, 2009). Experimental research by Opel et al.,(2006) found that play activities are very effective in teaching and learning big mathematical concepts for preschoolers. Play

pedagogy is also suggested by the pre-primary curriculum (2011) for teaching pre-primary mathematics in Bangladesh. Hence, the study is needed to understand how the play pedagogy is being implemented in government pre-primary classrooms. My study will inform teachers, early childhood education trainers, and policymakers about the training gap, challenges, and effective play activities for teaching mathematics. The findings of this study will help to inform how play pedagogy is being implemented in teaching mathematics in government pre-primary classrooms along with the support and challenges to the teachers, teachers' trainers, and the policymakers.

## **1.7 Summary**

Play pedagogy is useful for teaching mathematics in preschools which has a long-lasting positive effect on learning a higher level of mathematics. Play pedagogy is considered one of the effective strategies in teaching mathematics. Hence, teaching pre-primary mathematics through play is also suggested by the pre-primary curriculum of Bangladesh. Lack of play pedagogy in the pre-primary curriculum leads to traditional rote learning. The present study is guided by three research questions which includes government primary teachers' perceptions of play pedagogy in teaching mathematics, how teachers implement play pedagogy in teaching mathematics in pre-primary classrooms and support along with challenges. The findings will inform teachers' perceptions of play pedagogy in teaching mathematics and classroom practices along with the support and challenges to the different stakeholders.

## **Chapter 2**

### **Literature Review and Conceptual Framework**

#### **2.1 Introduction**

In this chapter, I reviewed different kinds of literature like books, articles, and documents related to play pedagogy. This includes a review of the literature regarding the teachers' perceptions of play pedagogy in teaching mathematics, classroom practice, and theories. I reviewed the literature for my further research progress which incorporate developing a conceptual framework, interview guide and writing discussion. I have organized this chapter into the following sections- Play, play pedagogy, Play related theories, Pre-primary education in Bangladesh, Teachers' perceptions of play pedagogy in teaching mathematics, Teaching mathematics through play pedagogy in early grades, and conceptual framework.

#### **2.2 Play**

Play is a concept which is difficult to define. The definition of play is quite ill-defined, elusive, controversial, and unfashionable (Sluss, 2005). One of the first definitions was given by Friedrich Froebel who is the founder of kindergarten. He defined play as the highest expression of human development. Through play, children freely express their inner thoughts (Froebel, 1887/2016). According to Vygotskian definition, play refers to make-believe play, which is characterized by creating an imaginary situation, talking on and acting out and following the rules demanded by the roles (Bodrova & Leong, 2015). Another prominent play theorist Piaget stated that play is not a distinct behavior which can be identified in observable way. He viewed play as cognitive development or act of intelligence through which children equilibrate between assimilation (the process of incorporating or making similar) and accommodation (changing the

existing schema to fit in the new information) Play is primacy of assimilation over accommodation where children seek similarities and include events and object into their existing mental structure (Nicolopoulou, 1993). John Huizinga was the proponent of the most respected and used definition of play which was further developed by Rubin, Fein, and Vandenberg. They considered play as a behavioral disposition, as observable behavior as well as a context. Based on this viewpoint, Rubin, Fein and Vandenberg characterized play as follow-

- I. Play is voluntary
- II. Play requires active involvement
- III. Play is symbolic
- IV. Play is free of external rules
- V. Play focuses on action rather than outcomes
- VI. Play is pleasurable (Sluss, 2005)

However, play has been redefined as a spectrum or a continuum that includes child-directed activities, adult-directed, and adult-guided activities in recent years (Parker et al., 2022).

### **2.3 Play Pedagogy**

Play pedagogy often refers to ‘Play-based learning’, playful learning, and purposeful learning, Eduplay, intentional teaching (Parker et al., 2022; Flear, 2018). One of the colleagues of Vygotsky named Daniel Elkonin gave a comprehensive theory on play which later became the foundation of play pedagogy in preschool and kindergarten classrooms. Denial Elkonin viewed that the main element of play in preschool is the roles, pretend actions, using props, and relationship among play partners (Bodrova & Leong, 2015). Play pedagogy is emphasized in pre-primary curricula in many countries (Department of Education, Employment and Workplace Relations [DEEWR], 2009). In Australia, play pedagogy considers as a context where children

organize and make sense of their social world through active participation, representation, and engaging with objects. According to the Singapore curriculum, play pedagogy is a mechanism through which children interact and explore their immediate world (Ministry of Education, 2013). Other than these concepts of play pedagogy, a useful definition of play pedagogy should be derived from contemporary on children experience of play, adult-children interaction while playing, and learning outcome. Based on these factors, research found five characteristics of play pedagogy that includes meaningful, actively engaging, joyful, iterative and socially interactive (Parker et al., 2022).

## **2.4 Theories Related to Play Pedagogy**

Children's learning occurs through the natural inquiry process of play (Whitebread, 2012). Years ago, John Dewey postulated that natural experimentation in play and the scientific inquiry process are interrelated (Dewey, 1910). According to Vygotsky, play has an influence on children's language development, cognitive processing, self-regulation, and self-awareness (Parker, Thomsen & Berry, 2022). Piaget believed that children's intellectual development reflects through play (Sluss, 2005). Apart from these theories, Marilyn Fler research-based model for teaching STEM through imaginative play gives a more contemporary insight. Her conceptual play world is based on Vygotsky's sociocultural theory which found that learning through play increase girls' engagement in STEM (Science, technology, engineering, and mathematics) education, motivate children to learn and improve problem solving skills of children from disadvantaged background (Fler's Conceptual PlayWorld, 2021). In the following section, play pedagogy related theories and a research-based model are presented to understand their impact on play pedagogy.

### **2.4.1 Cultural-historical concept of play by Vygotsky**

Play is the leading activity of a child in preschool years. Also, play is considered a purposeful activity for a child. They start to play with an imaginary situation that is very close to the real one (Vygotsky, 1966/2016). While playing, zone of proximal development is created. Children always act a head taller during play. Children engage in pretend play when they cannot do things in real life (Sluss, 2005). Children create imaginary situations where they are motivated to make real-life plans voluntarily (Vygotsky, 1977). Also, when children create an imaginary scene using different play objects, they change the objects from their usual meaning to concrete reality. Distinguishing imaginary scenes from reality aided children in stimulating their capacity to regulate their actions and relying on their thoughts which benefits them in becoming self-regulated and responsible persons (Berk, 2018). According to Vygotsky, play is a key component of a child's early development because it helps them to achieve challenging skills and cultural competencies, which ultimately strengthen the capacity of their self-regulation (Berk, 2018).

### **2.4.2 Piaget's stages of play and children's cognitive development**

Piaget believes that when children play, it reflects their cognitive development (Johnson, Christie & Wardle 2005). Piaget's Theory of cognitive development includes four stages of play which are 1. functional play 2. constructive play 3. symbolic/fantasy play and 4. games with rules.

**Functional Play:** In this stage, young children use their senses to understand objects clearly. During functional play, children are more likely to engage themselves in various types of activities using their physical movements which help them develop their physical and cognitive abilities. Through this play, children learn to interact with the outside world in a meaningful way.

**Constructive play:** This stage involves children using objects (blocks, Legos, or different materials like sand, modeling clay, paint, blocks, etc.) in a more purposeful meaning. For example, instead of banging or throwing blocks, a child starts to stack and build.

**Symbolic/fantasy play:** In this stage, children can transfer their imagination into more concrete thinking while playing. Role play and make-believe play become more prominent on this stage.

**Games with rules:** This stage involves understanding and following different rules while playing which leads to learning about cooperation and competition (Sluss, 2005).

### **2.4.3 Fleer's conceptual playworld**

Formalizing early childhood education raises a concern of limiting children's opportunity of play. Marilyn Fleer's Conceptual Playworld establishes pedagogical circumstances to effectively develop a dynamic relationship between play and learning. According to Fleer, children are intrinsically motivated to work with real objects and imagined (or abstract) concepts that represent reality. Stepping inside and outside of an imaginary situation is beneficial for developing not only the play, but it enhances children's competence by practicing moving in and out of reality (Fleer, 2018).

According to Fleer, imagination acts as a bridge between play and learning (Fleer, 2011). Play-based programs that foster imagination will improve children's ability to perform current and future cognitive tasks, especially in the areas of literacy and numeracy (Fleer, 2011).

Marylin fleer proposed five steps to build a conceptual playworld where student learn STEM concepts. Following is the brief description of five step conceptual playworld-

**Selecting a story:** Choose a complex story which has lots of characters. This kind of story helps engaging children.

**Designing a space:** Use materials to create a space based on the storybook. Educators need to change the space according to their lesson.

**Entering and exiting the playworld:** Educators can use magic wands to help young students' imagination. They can move their wand which signals students that they are going into the playworld.

**Plan your problem to be solved:** Put a problem that is going to be solved by the children in the conceptual playworld.

**What role will you, as the teacher, take in the playworld:** Educator can take a role of play partner where educator is trying to solve the problem with children. Also, teachers can take the leading position to guide children to solve the problem.

## **2.5 Pre-primary Education in Bangladesh**

In 1974, Dr. Qudrat-e-Khuda education commission first introduced and recommended early childhood education to the country which was later encouraged by the Mafizuddin Ahmed education commission in the year of 1988. Then around two decades later in the “National Education Policy 2010”, pre-primary education was introduced. At first, one-year pre-primary schooling was suggested for 5+ children, later it was extended to 4+ children (Aktar, 2013). A substantial number of NGOs were already involved in running some pre-primary schools.

Additionally, there are some classes of pre-primary levels conducted by madrasas, mosque-based maktabas, mandir-based pre-schools, and privately owned Kindergartens (Directorate of Primary Education [DPE], 2012).

In June 2011, the Ministry of Primary and Mass Education designed and approved a competency-based national pre-primary curriculum (Aktar, 2013). These competencies placed



emphasis on the skills that support being developmentally appropriate, activity-focused, inquiry and problem-solving-based, inspiring creativity, and encouraging imaginative play and innovative ideas.

### **2.5.1 Elementary Mathematics in pre-primary curriculum**

Pre-primary curriculum focused on three major areas- Teaching learning process, assessment strategies, and inclusiveness. Regarding the teaching and learning process, play and play materials are emphasized. Play is considered a joyful learning experience in the pre-primary curriculum of Bangladesh. One of the learning domains in the pre-primary curriculum is elementary mathematics which includes mathematical concepts (size, shape, simple categorization), concepts of numbers, comparison of numbers, writing numbers, and concepts of addition and subtraction. The curriculum suggests various play for teaching mathematics including- ‘Number Rhyme in pair’, ‘Playing in groups’, ‘Stepping game’, ‘Making number group game’, ‘Matching play’, ‘Play with chart’, ‘Role-play’, ‘Play with play materials’, ‘Playing with number cards’, problem-problem game’. Some supporting materials for play pedagogy like teachers’ guide, workbook, number cards, real materials and toys, crayon, color pencils, glue, color paper, scissors etc. are suggested as well. Regarding classroom environment, the pre-primary curriculum proposes a classroom that is joyful, comfortable, and warm, safe. The pre-primary classrooms support children to participate spontaneously in different play and move freely. In addition, classrooms have sufficient play materials to increase interaction (National curriculum & Text Board [NCTB], 2011).

### **2.5.2 Play pedagogy in teaching mathematics in teachers’ guide**

The teachers’ guide for pre-primary classes suggested two types of play for teaching all the contents- free play and guided play. Free play refers to four corners in the classroom- sand and

water corner, books and drawing corner, block corner, and imagination corner. Young students will play on their own without any instruction or guidance. There are 22 guided plays suggested by teachers' guide (NCTB, n.d.). Among them *Railgari Jhik Jhik* (Students create imaginary train), *openti bioscop*, *Joto paro tule nao* (pick as much as you can), *Guess what I see/think*, *akriti banai* (Building shapes)- are suggested for teaching mathematics. Through these guided plays the attainable competencies of elementary mathematics which are-

1. Identify right-left, small-big, fat-thin, tall-short, heavy-light.
2. Count substantial materials from 1 to 10.
3. Classify the materials according to their shapes (triangle, rectangle, circle) and colors;

are achieved. Apart from these guided plays, teachers are also suggested to employ traditional plays as well.

To implement play pedagogy effectively, teachers' guide suggests some strategy regarding classroom management which includes organized play materials properly, plan sitting arrangement according to the task. Moreover, parents with some training can support teachers to manage the class (NCTB, n.d.).

## **2.6 Teachers' Perceptions of Play Pedagogy in Teaching Mathematics**

Play pedagogy is appropriate developmentally appropriate for preschoolers since it leverages students' innate curiosity. Play pedagogy is an important strategy for promoting inclusion, holistic development, and student engagement (Parker, Thomsen & Berry, 2022). The perception of play pedagogy widely differs due to social and cultural influences. These influences shape teachers' beliefs and values regarding play. In Japan play pedagogy is highly regarded among kindergarten children. Japanese educators believe children's social skills are more important than

academic skills. Hence, Japanese educators conceptualize play pedagogy as contracting knowledge through interaction which is important for their group-oriented and caring community. In the USA, educators perceive play as the best mode for children to learn. According to them, play is the vehicle that allows young students to engage in cooperative, intellectual, and challenging activities. Swedish teachers attached play pedagogy with possibilities and creativity, and they consider it as a child's work. They view play as the foundation of learning mathematics. Play is regarded as an important component in the early childhood education curriculum by Taiwanese educators which is highly influenced by western perspectives including Piaget, Montessori, Froebel, Reggio Emilia (Izumi & Taylor et al., 2014). Mathematics educators perceive play as a useful viaduct for learning mathematics (Meaney et al, 2014). A study by Holton et al., (2001) views play in teaching mathematics as a necessary component and problem-solving process that includes experimentation, creativity, and using mathematical formulas to reach a conclusion. Play pedagogy in teaching mathematics is also perceived as providing possibilities for children's awareness of quantity and spatial dimensions of reality (Oers, 2014).

## **2.7 Teaching Mathematics through Play Pedagogy in Pre-primary Classrooms**

Learning mathematics in the early years helps young children to build a foundation for understanding complex mathematical concepts in the future (Bakar, 2017). Play pedagogy for teaching mathematics enables students to use mathematics skills for problem-solving in daily life (Cragg & Gilmore, 2014). Teachers should nurture children's spirit of inquiry, interest, interaction with the environment, and children's innovative ways of problem-solving (Izumi & Taylor et al., 2014). Elementary mathematics is taught by using materials like building blocks, sandcastles, measuring water, etc. in early grades (Cragg & Gilmore, 2014).

Different play activities are employed to teach mathematics to preschoolers. Selecting appropriate play for appropriate content is important for the positive development of children's physical, mental, creative, and social skills (Chin & Zakaria, 2015). The following are some examples of using play pedagogy in teaching geometry, number concepts, and mathematical operations in early grades.

Preschool students often find geometry to learn. Mathematical concepts like geometry (shapes), fractions, space, and area can be taught very effectively through constructive play like origami. Children learn problem-solving in a systemic and organized way through origami (Oguz, 2016). Origami increases preschoolers' understanding of formulas, labels, and geometrical concepts by elevating their interest in study (Ku & Jie, 2012).

Like origami, playing with blocks helps children to learn balance and mathematical concepts through eye-to-hand coordination. In addition, children learn to arrange and match blocks by building specific structures. Through block games, preschoolers learn addition, subtraction, multiplication, and division (Goldstein, 2012).

Number concepts and operations can be taught through play pedagogy in preschool. For example, 'Who is big, let's eat' is used for developing the number concept. In this play, there are red cards (1-10) and green cards (1-10) lying face down on the table. Two students are involved in this play where one picks a number from a red card, and another picks a number from a green card. The teacher compares the cards and which number is bigger will be eaten (imaginary). In this way, children learn number concepts (Chin & Zakaria, 2015). Children also learn number concepts through singing and music. This is why counting rhyme, number songs, and finger play are included in the preschool curriculum. Children learn patterns, musical and mathematical concepts by counting steps in dance and playing instruments (Kenney, 2005).

While teaching addition and subtraction, imaginative play like selling and buying shoes; help young children to learn meaningful mathematics (Ma et al., 2023). Playing with blocks also helps the young children to understand the concept of addition, subtraction, and division.

## **2.8 Challenges Confronted While Implementing Play pedagogy in Pre-primary Classrooms**

Play pedagogy is a promising pedagogy for early learners, however, it has significant challenges in practice. One of the barriers is related to assessment. There is a scarcity of instruments through which learning outcomes associated with play pedagogy can be measured in early childhood learning (Parker et al., 2022). Other than this, pre-primary teachers confronted challenges regarding noise and lack of suitable place while teaching mathematics through play pedagogy. Young children often become noisy while playing which makes them inattentive to learn mathematics. This distracts children from the main mathematical content at times. Also, lack of suitable place impede mathematics learning since effective mathematical teaching requires quiet environment (Güven & Colak, 2019)

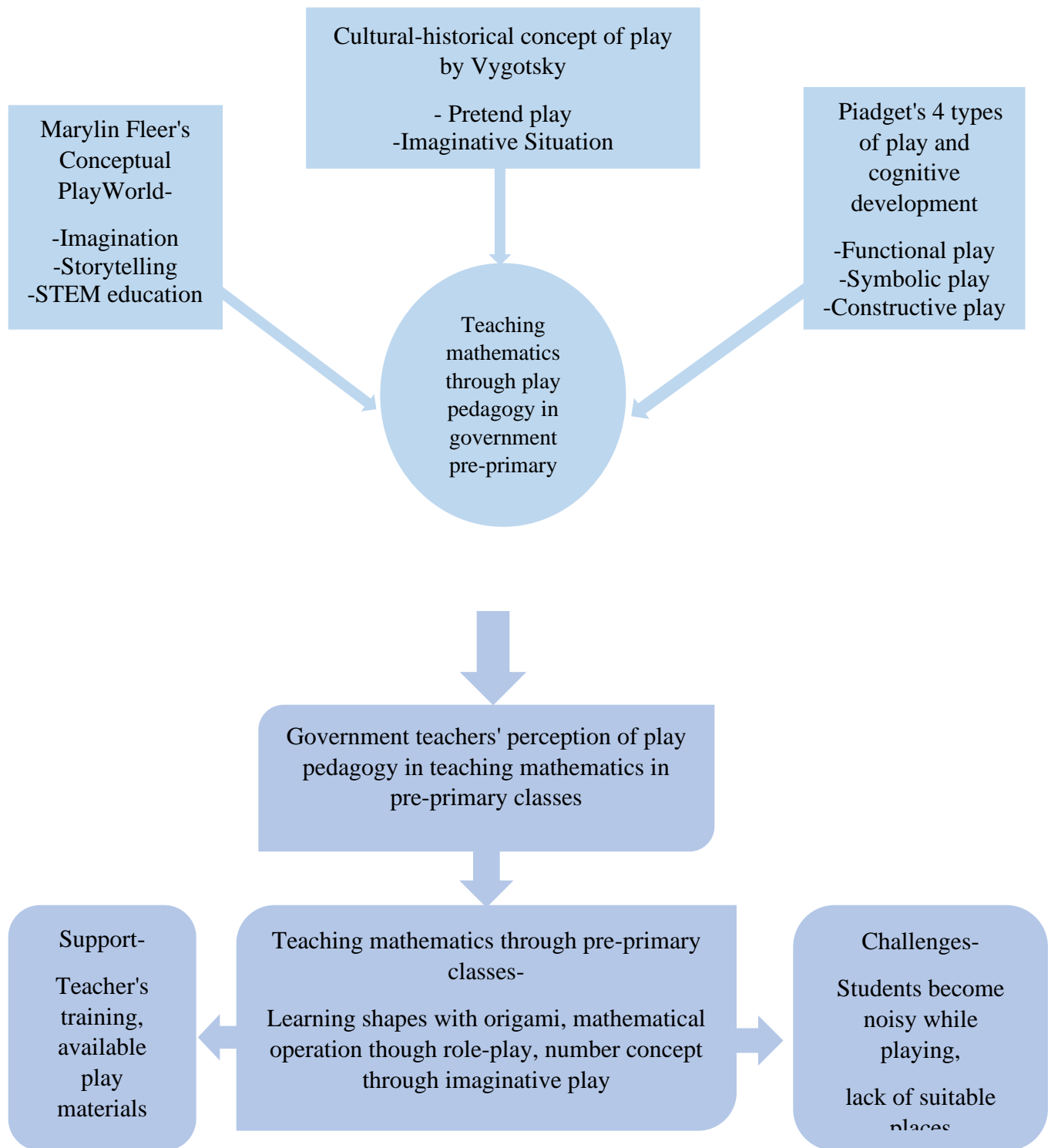
## **2.9 Conceptual Framework**

The conceptual framework of this study is guided by the literature review. From existing literature, teachers' perceptions of play pedagogy in teaching mathematics and classroom practice are found. Psychologists and researchers like Vygotsky, Piaget and Fleer acknowledged that different types of play are appropriate for developing problem solving, reasoning, STEM concepts (Sluss, 2005 & Fleer, 2018). For example- Symbolic play develops foundational arithmetic skills while imaginative play accelerates meaningful mathematical learning in early grade students (Leong & Bodrova, 2012; Ma et al., 2023). In this literature, it is found that teachers use play pedagogy which is aligned with these theories. Additionally, pre-primary

curriculum also takes Piaget, Vygotsky, and Fleer's work as a reference for its foundation (NCTB, 2011).

Figure 1

*The conceptual framework for government teachers' perceptions and classroom practice of play pedagogy in teaching mathematics-*



## 2.10 Summary

This chapter presented the play and play pedagogy in teaching mathematics related perceptions, practice, challenges, support and theories. Definition of play which has been redefined recently

as a broad spectrum of child-directed, adult-directed, and adult-guided activity. Regarding play pedagogy, researchers found five characteristics that say, play pedagogy should be joyful, meaningful, socially interactive, actively engaging, and iterative. Prominent psychologists Piaget, Vygotsky, and contemporary play pedagogy researcher Marilyn Fler posit theories related to play which are cognitive play theory, Cultural-historical theory, and conceptual playworld model for STEM education. The pre-primary curriculum of Bangladesh took these theories as a theoretical foundation while proposing play pedagogy. Other than these, this chapter also includes the perception, practice, and challenges of play pedagogy in teaching mathematics from other cultures. Mathematics educators perceive play as a useful viaduct for learning mathematics. Building sandcastles, blocks, origami, and role-play seemed widely practice play in teaching mathematics. However, Teachers often confront challenges regarding classroom management while teaching mathematics through play pedagogy.



## **Chapter 3**

### **Methodology**

#### **3.1 Overview**

This chapter explains the research design for exploring teachers' perceptions of play pedagogy, classroom practice, and scope. The following sections discuss the research approach, sample and sample size, sampling technique, data collection techniques, analysis, limitations of the study, ethical issues, and trustworthiness.

#### **3.2 Research Approach**

The study employed a qualitative approach for a detailed understanding of research problems. To address the research concern, I administered my study in a natural setting to get comprehensive and thorough data. In doing so, I chose pre-primary classrooms in government primary schools where I found teachers teaching mathematics through play pedagogy in a natural setting. Also, I chose a research site for gathering multiple forms of data for triangulation. I developed themes through inductive reasoning from the interviews and classroom observation data.

#### **3.3 Rationale for Choosing the Qualitative Research Approach**

A qualitative approach is conducted when researchers want to explore a complex and detailed understanding of an issue (Creswell & Poth, 2018). The present research also explored an in-depth understanding of teachers' perceptions, support, and challenges regarding play pedagogy in teaching mathematics. The research questions of this study attempted to explore the teachers'

perceptions and practices of play pedagogy in teaching mathematics in government pre-primary classrooms which demands an in-depth understanding of teachers and their context.

Qualitative research is conducted in a natural setting, attempting to make sense of phenomena where investigators gather intensive information by talking to participants (Creswell & Poth, 2018). This is why the study employed a qualitative approach and administered one-on-one interviews with government teachers and primary teachers' training instructors to get an up-close understanding of the perception of play pedagogy in teaching mathematics, and classroom observation to get an insight into mathematics teaching practices through play pedagogy.

### **3.4 Research Site**

A qualitative investigation often requires data from a natural setting to understand participants' experiences thoroughly. The inquirer in a qualitative study intentionally samples the participants and sites to get in-depth information regarding the research problem (Creswell & Poth, 2018).

The present inquiry was conducted in government primary schools in Rangpur. The reason behind choosing the site was familiarity with the context of the schools. I have some acquaintances in this locality who helped me regarding access as well as building rapport with the teachers. These assisted me to get information-rich data.

### **3.5 Sample and Sampling Procedure**

I did purposive sampling for the data collection so that I could get information-rich data. In qualitative inquiry, researchers' effort is to make a comprehensive understanding of the phenomena. In doing so, qualitative researchers select samples where they get thorough information (Merriam & Grenier, 2019).

Government primary school teachers and primary teachers’ training instructors were the participants of this qualitative inquiry. Also, the government primary classes have been observed to explore the scope of play pedagogy. There are two criteria for choosing these pre-primary schools- one is these are government primary schools providing one-year pre-primary education and another one is accessibility. Their perception of play pedagogy has been explored through interviews.

A total of six participants including 4 government primary school teachers and 2 primary teachers’ training instructors have been interviewed in this investigation. Moreover, 4 classrooms were observed twice. Government primary school teachers and instructors are purposefully chosen since they are the best to inform the current practice of classroom teaching and training. Also, play pedagogy experts can provide insightful information on the perception of play pedagogy. Further, classroom observations were required to understand the activities using play pedagogy in teaching mathematics, the scope, and the challenge of employing play pedagogy.

Table 3.1

*Sample and sample size*

<b>Participants</b>	<b>Female</b>	<b>Male</b>	<b>Total</b>
<b>Government primary teachers who take pre-primary classes</b>	2	2	4
<b>Primary teachers’ training instructor</b>	1	1	2
<b>Total</b>	3	3	6

### **3.6 Data Collection Methods**

In data collection, qualitative research relies on multiple data sources to build common themes. Themes derived from data are constantly being checked in inductive reasoning (Creswell & Poth,

2018). The current study also tried to gather data from interviewing teachers and primary teachers' training instructors and observing their classes to explore the teacher's perception, the phenomena of employing play pedagogy in teaching mathematics, and the support and challenges teachers confront in this regard.

### **3.6.1 In-depth interviews with teachers and Primary teachers' training instructors**

One-on-one interviews are conducted over the phone to get data through social interaction. In one-on-one interviews, interviewees unfold their lived experiences. Researchers get participants' viewpoints and uncover the meaning attached to their experiences (Creswell & Ploth, 2018). For this reason, I chose to do one-on-one interviews over the phone. I explored the government teachers' interpretation and their viewpoint of play pedagogy in teaching mathematics based on their classroom practices. I sought how they explain their support and challenges from their classroom experiences through one-on-one interviews. Four government primary teachers participated in the one-on-one interview over the phone whose classrooms were observed as well. In doing so, I developed an interview guide for in-depth interviews. The teachers' interview guide was divided into two parts- Part A includes demographic information about teachers and Part B incorporates open-ended questions regarding teachers' perceptions, classroom practices, opportunities, and challenges. The demographic information consisted of teachers' age, gender, educational qualification, professional training/degree, training on play pedagogy, and teaching experience. In part B, 15 open-ended questions were pre-planned based on three research questions. The interview guide was focused on three areas-

(i) questions about teachers' perceptions of play pedagogy in teaching mathematics. Questions related to perception are like-*What do you mean by 'play pedagogy' in pre-primary class? / What is play pedagogy? How do you view teaching mathematics through play in pre-primary classes?*

(ii) implementation of play pedagogy in the pre-primary classroom. Sample questions are- *What type of play do you use in the classroom to teach mathematics? Please give real examples, what kinds of play do you plan outside of the teacher's guide for teaching early math?*

and (iii) opportunities and challenges related to play pedagogy. Examples of questions regarding opportunities and challenges are- *Do you face any difficulties in classroom management due to play-based learning? How do you solve them? Do you need volunteers/parents to help teach early math through play-based learning?*

Moreover, some probing questions were posed to get detailed information. For example- *Can you give me an example? Can you explain it more?*

I also pre-planned a one-on-one interview protocol for primary teachers' training instructors which had two parts- Part A was about demographic information, e.g., age, gender, educational qualifications, professional degree, and year of experience. Part B was the open-ended questions. This part emphasized opportunities and challenges of employing play pedagogy. Questions regarding opportunities and challenges are- *What types of training are provided to government pre-primary teachers? Does this training include content on play pedagogy? What type of challenges do teachers confront while employing play pedagogy? How do you provide support to mitigate the challenges?*

At the end of the interview, participants were asked if they wanted to add further information and if they had any questions.

### **3.6.2 Classroom observation**

Observation is one of the main instruments for qualitative data collection and is based on research purposes and questions. Through observation, a researcher may seek a physical setting,

participants along with their interactions and conversation (Creswell & Ploth, 2018). In this study, I also did classroom observation to address two of my research questions- How is play pedagogy implemented in teaching mathematics by government pre-primary schoolteachers? What are the support and challenges of teaching mathematics through play pedagogy regarding materials and classroom management? Classroom observation was conducted to find out the procedure of employing play in teaching mathematics by teachers.

Pre-primary classroom activities follow a routine to conduct classes where numeracy occupied a big portion. The allocated time for teaching mathematics is 25 minutes in their daily routine. Mathematics class is held every day except Thursday. On average, the class size was 25. Eight pre-primary classes were observed in four different government primary schools. Each classroom was observed twice. Three topics- elementary numeracy concepts (concepts of big-small & near-far), concepts of numbers & counting, and mathematical operations (addition and subtraction) were taught while observing the classroom activities. I observed the process of employing play pedagogy in teaching mathematics in government pre-primary classrooms. For observational protocol, I prepared an open-ended observation checklist to focus on teaching mathematics through play pedagogy and its opportunities and challenges. For example- Play activities in teaching early mathematics (Description of the play that is implemented in the classroom), Classroom management (Students' attention, any unwanted behavior). I also kept a space for special notes (if any) in the observational protocol.

### **3.7 Data Collection Procedure**

To investigate the research problem, I interviewed government primary school teachers who take pre-primary classes over the phone. The telephone interview is one of the approaches in qualitative research to elicit participants' views and opinions (Creswell & Creswell, 2018). Apart

from this, it provides researcher access and flexibility (Block & Erskine, 2012). As a full-time professional, it was hard for me to take in-person interviews while maintaining participants' schedules. Hence, I found telephone interviews feasible for my data collection. Since teachers gave me their time for the interview, I had the flexibility to maintain their schedule because of the telephone interview. Before calling the teachers for the interview, I pre-scheduled the interview time and gave them the consent letters with the help of a research assistant and I also sent them through email. I called the interviewee and explained the interview procedure and my research purpose. I asked about their overall well-being, e.g., *How are you? And your family?* for ice breaking. Then I started the interview by asking about their demographic information. After that, I asked questions about play pedagogy following the interview guide. However, while asking the questions, I asked them in a less formal way to make the interview natural and more conversational. For example- I asked, *'What do you understand by learning through play?'* instead of *'What do you mean by 'play pedagogy' in pre-primary class?'* The duration of each interview was 45 minutes on average. The same procedure was followed for interviewing primary teachers' training instructors. I interviewed two primary teachers' training instructors whose duration was nearly 30 minutes respectively. Interviews were conducted through phone calls which were recorded with participants' consent. Consent letters were sent through email to the primary teachers' training instructors. Also, I recorded their interviews with their permission. After their in-depth interviews, the respective teachers' classes were observed as well focused on mathematics teaching. In doing so, I also sent them a written consent letter. Two university graduates assisted me by doing the classroom observation following the observational protocol. Before going for the observation, I explained my research purpose, questions, and observational

protocol to the observers. For notetaking, I provided the observation checklist through email which was printed by the observers.

### 3.8 Data Analysis

Often data analysis is synonymous with the approach of text and image analysis in a qualitative study. However, Data analysis is more than that. It involves preparing and organizing data, theme development through coding, and finally representation (Creswell & Poth, 2018).

I did a thematic analysis to find relevant themes in the data. I followed the steps to derive themes by Braun and Clarke (2006).

1. Familiarize with the data: First, I thoroughly read and re-read the transcriptions to give a deep dive into the data. Moreover, I listened to the recording repeatedly to grasp the underpinning message and made necessary notes.
2. Generate initial codes: I systematically organized data in this phase. I coded with colors the small chunks of information from the transcript to link to my research questions. In doing so, I used color coding on the hard copies of the transcripts and gathered them under specific codes. For example-

Table 3.2

*Generate initial codes*

Interview extract	Codes
'They are very young, 5 to 6 years old kids. They get very happy when I teach numbers with rhyme. There is a rhyme in our pre-primary Teachers' guide. Last class, I teach them the number 7 with the rhyme. Kids are clapping and reciting the rhyme after me.' (T1)	Cheerful Cherished activity Active engagement Increase attendance Increase attention Easy to learn Separate space



<p>'We have 4 corners named sand and water corner, book and art corner, imagination corner, and block corner. Students engage in play at these corners.' (T1)</p> <p>'Students become very attentive when I use toys and other materials. They become enthusiastic about mathematics and their brain easily accepts the lesson.' (T2)</p> <p>'They just want to play. I have 17 children in my class. On average, 14 children regularly attend school. My students do not miss the class because they can play with the elephant, horse, swing, and slipper in school.' (T3)</p>	Resources
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3. Search for sub-themes: I separated the codes into broader sub-themes. I scrutinized the codes and put them according to the specific sub-themes. For example-

Table 3.3

*Search for sub-themes*

Codes	Sub-themes
<ul style="list-style-type: none"> <li>• Cheerful</li> <li>• Cherished activity</li> </ul>	Play pedagogy is regarded as a Joyful activity
<ul style="list-style-type: none"> <li>• Active engagement</li> <li>• Increase attendance</li> </ul>	Play pedagogy is regarded as an active participation strategy
<ul style="list-style-type: none"> <li>• Increase attention</li> <li>• Easy to learn</li> </ul>	Play pedagogy is regarded as an effective method for teaching mathematics
<ul style="list-style-type: none"> <li>• Separate corner</li> <li>• Resources</li> </ul>	Availability of resources

4. Review the sub-themes: I jotted down all the data associated with specific sub-themes to make sure the data represented the sub-themes accurately. Then I combined them into the themes. In doing so, I rechecked all the sub-themes to categorize them under the themes which were aligned with the research questions. For Example-

Table 3.4

*Review the sub-themes*

<b>Codes</b>	<b>Sub-themes</b>	<b>Themes</b>
<ul style="list-style-type: none"> <li>• Cheerful</li> <li>• Cherished activity</li> </ul>	Play pedagogy is regarded as a joyful activity	Teachers' perception

5. Define themes: I refined themes to check it is expressing the exact meaning. For example- I checked the theme: teachers' perceptions. The theme does not articulate perception of what? Hence, I refined the theme like so- teachers' perceptions of play pedagogy in teaching mathematics. Next, I explained what the theme means and rechecked the alignment of the sub-themes, play pedagogy is regarded as joyful activity.
6. Write-up: Finally, I wrote the themes in the result and analysis sections of the report.

### **3.9 Ethical Issues and Concerns**

Before every interview, I made an initial phone call to seek their verbal consent and preferred time. I also informed the participants that they will get a written consent form through email, and I collected their email addresses. Then I sent them consent letters through email. During the call, first I articulated the objectives and purpose of my study in Bangla and asked if participants had any queries. I also assured the participants that they could discontinue at any moment of the interview if they want. I informed them that consent letters incorporated all the information related to the study in an easily understandable way. Also, I sent the interview recordings to the participants for member checking. And participants did not inform any objection regarding the recording. For classroom observations, I followed the same procedure. I took consent from class teachers and classroom observations were shown to them to check the accuracy. After collecting

data, I ensure the confidentiality of the information by giving a code to the respective participant (e.g., T1, T2). I was also mindful of not imposing my own belief and bias. While taking the interview, I tried to be an active listener and did not influence participants' thoughts by asking any guided questions. Moreover, I used all the data from interviews and observations for the study purpose only.

### **3.10 Trustworthiness and Rigor**

Qualitative research findings become trustworthy when it has reliability and validity and is conducted in an ethical manner. The Trustworthiness of a qualitative study is established by triangulation, member checks, peer review, researcher's position or reflexivity, adequate engagement in data collection, maximum variation, audit trail, and rich, thick description (Merriam & Grennier, 2019). In my study, I established trustworthiness through data triangulation, peer review, member checking, and audit trial.

*Triangulation-* I used multiple sources of data and data collection methods. I collected data from government primary teachers who take pre-primary classes, primary teachers' training instructors, and classrooms. I employed two types of data collection methods; one-on-one in-depth interviews and classroom observations to explore the teachers' perception of play pedagogy in teaching mathematics and the phenomena of employing play pedagogy.

*Peer review-* I discussed the research process with one of my colleagues who works as a staff researcher. I also engaged in a discourse regarding the alignment of the data collection methods with the research questions and the tentative interpretation of the findings in the discussion. Moreover, the study was supervised and reviewed by my supervisor.

*Member checking*- I sent the interview recordings and the classroom observations to the respective teachers to verify if the study reflected their voice and intended meaning.

*Audit trail*- Before starting the thesis, I did a literature review to find a search gap that I could work on. In doing so, I reviewed several articles, books, and documents. I generated the idea of data collection methods e.g., interviews for teachers' perceptions and classroom observation for teachers' practice; by reading several articles related to play pedagogy. The literature review also helped me to develop the tools. After developing the tool, I did a pilot interview with participants and made the necessary changes to my tools. After collecting data, I thoroughly go through them to generate themes and sub-themes. Finally, I wrote the discussion chapter where I presented the alignment/contrast of my findings with other studies. I also discuss the possible reason for the alignment or contrast of my findings considering the previous study.

### **3.11 Limitations of the Study**

An in-person interview and classroom observation done by me could be more effective for getting in-depth information. As a full-time professional, it was difficult to manage taking in-person (face-to-face) interviews and doing classroom observation on working days. Hence, I had to take telephone interviews and classroom observations were done by two university students.

## Chapter 4

### Results

#### 4.1 Overview

The purpose of this chapter is to present findings from the analysis of data. This begins with the thematic analysis of classroom observations, teachers, and primary teacher trainers' interviews. I organize this chapter into three sections. The first section reports findings of the teachers' perception of play pedagogy from teachers' interviews. Classroom practice in teaching mathematics through play pedagogy is reflected in the second section. This chapter also focuses on findings of the scope of employing play pedagogy in teaching mathematics concerning classroom management and materials. I triangulate data from interviews and classroom observation and present them thematically. The data received from the participants is divided into four themes followed by several sub-themes.

Table 4.1

#### *Themes and Sub-themes*

<b>Theme 1- Teachers' perceptions of play pedagogy in teaching mathematics</b>	<b>Theme 2- Classroom practice in teaching mathematics through play pedagogy</b>	<b>Theme 3- Support while employing play pedagogy in teaching mathematics</b>	<b>Theme 4- Challenges of employing play pedagogy in teaching mathematics</b>
<ul style="list-style-type: none"><li>• Play pedagogy is regarded as a joyful activity.</li><li>• Play pedagogy is regarded as an active</li></ul>	<ul style="list-style-type: none"><li>• Use of play and materials</li><li>• Gender-stereotyping while distributing play materials/toys</li></ul>	<ul style="list-style-type: none"><li>• Availability of resources</li><li>• Support from the others</li><li>• Training support</li></ul>	<ul style="list-style-type: none"><li>• Scarcity of separate classrooms for pre-primary</li><li>• Challenges regarding classroom management</li></ul>

- 
- participation strategy.
  - Play pedagogy is regarded as an effective method for teaching mathematics.
  - Play pedagogy is regarded as the main activity in children mathematics learning.
- Lack of follow-up after the training
- 

## 4.2 Teachers' Perceptions of Play Pedagogy in Teaching Mathematics

This theme discusses the teachers' understanding or interpretation of play pedagogy in teaching mathematics. All of the participating teachers have 15-days of training in the pre-primary teaching-learning method. Teachers' viewpoints of play pedagogy in teaching mathematics are quite diverse and positive. They perceived play pedagogy as joyful activity, effective pedagogy, participatory strategy, and main activity. Based on their understanding, I organized the four sub-themes as *Play pedagogy is regarded as a joyful activity*, *Play pedagogy is regarded as an active participation strategy*, *Play pedagogy is regarded as an effective method for teaching mathematics*, and *Play pedagogy is regarded as the main activity in children mathematics learning*.

### 4.2.1 Play pedagogy is regarded as a joyful activity

All participants regard play pedagogy as a joyful activity in teaching mathematics. They mentioned phrases like, 'playful activity by students', 'rhyme for learning numbers', 'singing',

and ‘childhood play’ while referring to play pedagogy in teaching mathematics. One of the teachers shared her experience with play pedagogy while teaching mathematics,

*‘They are very young, 5 to 6 years old kids. They get very happy when I teach numbers with rhyme. There is a rhyme in our pre-primary Teachers’ guide. Last class, I teach them the number 7 with the rhyme. Kids are clapping and reciting the rhyme after me.’ (T1)*

Another teacher said,

*‘My students play open-ti-bioscope. It is a childhood play. We all played this in our childhood. My students have fun while they play open-ti-bioscope. But I have other intentions. I teach them subtraction. They do not realize this. They think I am playing with them.’ (T4)*

#### **4.2.2 Play pedagogy is regarded as an active participation**

Teachers who attended Interview perceived play pedagogy as an engaging approach where students actively participated in the learning activity. Employing play pedagogy increased the school attendance of children. It provokes students to participate and inspires them to understand mathematics. A participant remarked,

*‘They just want to play. I have 17 children in my class. On average, 14 children regularly attend school. My students do not miss the class because they can play with the elephant, horse, swing, and slipper in school.’ (T3)*

Another participant said,

*‘When I keep toys in front of them, their interest in learning increases. They become inspired to learn. Then they try to learn the mathematics, try to understand it, and try to internalize it.’ (T2)*

### **4.2.3 Play pedagogy is regarded as an effective method for teaching mathematics**

All participating teachers unanimously deemed play pedagogy as the most suitable strategy for teaching mathematics. Children easily remember mathematical content through play. Hence, they can understand mathematical concepts effortlessly. One of the teachers added-

*‘Students become very attentive when I use toys and other materials. They become enthusiastic about mathematics and their brains easily accept the lesson.’ (T2)*

Furthermore, the participating government teachers considered that students become enthusiastic and attentive because of play materials. Teachers considered that toys and materials were an integral part of teaching mathematics through play pedagogy. While they were talking about play pedagogy in teaching mathematics, they emphasized using toys and materials in free play.

Children learn to count numbers while they are playing in their free play time. Teachers also used materials like number cards to teach counting while playing. According to a participant teacher,

*‘We have 4 corners named sand and water corner, book and art corner, imagination corner, and block corner. Students engage in play at these corners. Male students play with helicopters and cars. I asked them how many toy cars you have. They try to count the cars. Girls also play with plastic utensils. They can count their plates and glasses while playing.’ (T1)*

Another interviewee said,

*‘I teach one number a day. I use number cards and pictures and ask my students how many apples are there.’ (T2)*



#### **4.2.4 Play pedagogy is regarded as the main activity in children learning**

Interviewee teachers mentioned play is the main activity of all children. They never get bored while playing. Therefore, the pre-primary curriculum also emphasized play pedagogy. According to a participant teacher, students did not want to learn mathematics. Their leading activity is playing. This is the reason play pedagogy is emphasized in pre-primary mathematics teaching. An interview said-

*‘They like only to play. They do not get tired of playing. They love all kinds of play. Hence, our teacher’s guide includes a lot of play to teach mathematics..... Students of pre-primary are 5+. Children of this age do not like to learn much. They like playing more than anything..... I teach them mathematics through play in a joyful environment.’ (T1)*

#### **4.3 Classroom Practice in Teaching Mathematics Through Play Pedagogy**

Through classroom observation, the process of using play pedagogy in teaching mathematics were explored. While observing, the focused areas were teaching- elementary mathematical concepts, concepts of numbers, and mathematical operations through play pedagogy. Under this theme, I scrutinized how teachers employ play and use materials while teaching mathematics. In doing so, I presented the activities used by teachers while teaching counting numbers, basic mathematical concepts, and mathematical operations in classrooms. Moreover, I also explored gender stereotyping fostered by teachers. Hence, I organized the data into 2 sub-themes- Use of play and materials, Gender-stereotyping while distributing play materials.

##### **4.3.1 Use of play and materials**

Participated teachers employed different play which are suggested by the pre-primary curriculum of Bangladesh. Participating teachers used ‘rhyme’ and ‘playing with number cards’ for counting numbers. Besides, teachers gave play materials in free play time where children count how many

toys they have. For basic mathematical concepts like far and near, teachers played a game ‘Did you see what I see’. Apart from these, role-play which is an imaginary train was employed to teach mathematical operations by participating teachers.

*Counting Numbers-* In pre-primary classes, only one number is taught in one day. The teacher used rhyme and number cards for teaching concepts of numbers. The teacher recited the rhyme with clapping first-

*‘Eker pore dui, ar dui er pore tin (Two after one, three after two)*

*Moner sukhe gunbo mora (We will count happily)*

*Nachobo ta dhin dhin (We will dance)*

*Tiner pore char, ar char er pore paach (Four after three, five after four)*

*Emni kore gunte pari (We can count)*

*Phul, Pakhi ar gaach (Flowers, birds, and trees like this)*

*Paach er pore choi, ar choi er pore saat (six after five, seven after six)*

*Gunbo aat, gumbo noi (We will count eight, we will count nine)*

*Dhore haat a haat. (Hold our hands in hands)*

*The teacher remarked, ‘Students like this rhyme very much. And they remember numbers through this rhyme easily.’ (T3)*

Students repeat after the teacher and clapped their hands as well. After the rhyme. the teacher demonstrated a number card showing the 7 apples and then the teacher asked,

*Teacher: How many apples are there?*

*Children: 7 (some of the children did not answer)*

In another classroom, the teacher gave students 10 small sticks and some seeds to count up to 7 by themselves without forming any group. Then the teacher kept some toys, small sticks, and seeds separately and asked them to count. The teacher asked them to count the same type of things and he kept track of the students who did it correctly. Students who finished the counting successfully were appreciated by clapping. The teacher also encourages the children who did not count correctly by saying,

*‘You need to play with the toy and gradually you will learn to count the number’.* (T1)

However, one of the participating teachers just wrote numbers- 5, 6, and 7 on the board and asked students to draw 5, 6, and 7 lines on their copies.

*Basic mathematical concepts-* The participating teacher identified some landmarks and said, ‘Did you see what I see?’- tube well, toilet, road beside the school, and slipper in the schools to teach the concept of far and near. The teacher asked,

*Teacher- where is the tube well?*

*Students- Over there (oi dike- pointing their fingers)*

*Teacher- Is it near your classroom?*

*Students- Yes (All together)*

*Teacher- Which one is nearer to you tube well or the slipper? Who can tell me first?*

Another teacher taught the concept of being tall and short with pencils and crayons and asked them to find out which one was short. After that, the teacher asked students to draw and color a short tree and a tall tree.

*Mathematical operations-* To teach addition and subtraction, the teacher made an imaginary train with the students. Students were asked to get off the train at their favorite stations. Whenever a student left the train, the teacher asked the rest students, ‘How many of you are left?’

#### **4.3.2 Gender-stereotyping while distributing play materials/ toys**

All the participating teachers claimed that they do not make any difference between girls and boys while teaching mathematics. According to the interviewees, the government emphasized girls’ education, hence they take special care of girls. They looked after them so that male students could not beat them or snatch their toys while teaching mathematics. However, while I asked to describe a play activity they use in the classroom for teaching mathematics, teachers shared how they separated play materials for boys and girls according to their gender to teach counting. A participated teacher was teaching counting the numbers using toys. The teacher kept different toys and asked students to count them. The teacher said-

*‘I gave toys to the students. I gave balls to the boys and asked them- how many balls do you have? And I give dolls and utensils to the girls and asked them- how many dolls do you have? how many utensils do you have?’ (T3)*

#### **4.4 Teachers Having the Support While Employing Play Pedagogy**

In this theme, I presented the support, teachers have while implementing play pedagogy in the classroom. I will present the result in regard to the availability of resources, Support from others, and Training support.

##### **4.4.1 Availability of resources**

Three pre-primary classrooms had sufficient play materials. Four corners had different types of toys to play with. In the book and art corner- color pencils, crayons, color books were found. The

imagination corner was organized with a doctor set, plastic utensils, a cooking set, different animals, and hand-made dolls. There were blocks, blocks with numbers, pictures, puzzles, and an alphabet in the block corner. Students could play with water, sand, funnel, measuring cups, bowls, and spoons in the sand and water corner. These materials were used to teach counting numbers and basic concepts like big-small. In classroom practice, one of the participating teachers used crayons and color pencil through which children draw a small tree and a short tree. One of the teachers mentioned-

*'We have lots of toys for children. They do not need to share their toys with other students while counting numbers.'* (T2)

Apart from these toys and materials, the classrooms were painted with numbers (1-10) in both Bangla and English. There were also number cards for playing with number cards game through which student learn numbers.

In addition, teachers were greatly dependent on the teachers' guide provided by NCTB while teaching mathematics. They mostly followed the teacher's guide while teaching mathematics.

One of the teachers said-

*'Teachers' guide has all the play with the learning outcome for math. We take preparation based on the teachers' guide so that the learning outcome for mathematics and the play remain aligned.'* (T4)

#### **4.4.2 Support from the others**

Teachers did not get any kind of resistance from the community and parents. According to the interviewee teacher, parents thought play is a leisure time before but now their perspective has

changed. Often, they got help from class students of classes 4 and 5. One of the teachers mentioned-

*'Parents positively take play pedagogy now. Though, they did not consider play as a way of learning once. Their viewpoint is changed....When we have two shifts in our school, I asked students from classes 4 and 5 to help me. As class 5 students are a bit mature, they can help me. They help my students to sit in their place and look after them so that students do not get hurt.'*

(T2)

In addition, teachers got some assistance from 2 or 3 parents to manage the class as well. Though they do not have any training on managing young students.

#### **4.4.3 Training support**

Participants received 15 days of training for pre-primary teaching where some of the parts were on play pedagogy. During the training teachers trained on the procedure of teaching all the subjects by using play and toys. Teachers also took practice classes including mathematics classes. One participant shared,

*'We learn about play pedagogy in 15 days of training. This training helped us a lot to implement play pedagogy in the classroom. We took demo classes in that training as well before our Sir. There are many plays for teaching mathematics aligned with learning outcomes in teachers' guide. We prepare based on the guide so that play and the learning outcome of mathematics remain aligned.'* (T4)

#### **4.5 Challenges of Employing Play Pedagogy in Teaching Mathematics**

The challenges of implementing play pedagogy in teaching mathematics includes space, classroom management, and follow-up training in this study. Under this theme, I brought three

sub-themes- scarcity of separate classrooms for pre-primary, challenges regarding classroom management, and lack of follow-up training.

#### **4.5.1 Scarcity of separate classrooms for pre-primary**

All the observed pre-primary classrooms were part of government primary schools. These classrooms had quite a spacious playground. One of the teachers informed me that there were different kinds of activities for pre-primary students, such as- playing football; those were played in the playground. However, the teacher said that there was no need to go outside to teach mathematics. They employed play pedagogy while teaching mathematics in the classroom. Though they have a shortage of classrooms. They had to share the pre-primary classroom with class 5. Teachers did not have enough room to organize the toys. Moreover, children do not have enough space to move. Students of pre-primary learn count numbers while playing. Also in classroom practice, teachers did role-play like imaginary train and played open-ti-bioscope for teaching mathematics through play in the classroom which requires space. One interviewee commented-

*‘Pre-primary classroom is shared with class 5. But pre-primary classroom has toys.... They have 4 play corners with lots of toys. Because of benches and desk for class 5, it is difficult to organize the toys... I often use play materials to teach counting while they are playing.’ (T3)*

Another teacher added,

*‘I play imaginary train with them through which they learn numbers and subtraction. Four corners are their stations. They roam around the station and get off to their favorite one.....I keep the benches at one side of the classroom which is why space shrinks a bit. They cannot move easily.’ (T4)*

#### **4.5.2 Challenges regarding classroom management**

According to the classroom observation, it is found that teachers confronted some challenges in teaching mathematics through play concerning classroom management. Students often got restless when they got any toys or materials. According to a teacher, sometimes they do not want to follow rules and become inattentive and without attention, children cannot learn mathematics. In classroom observation, it is found that often they were talking to each other.

*‘They are very young and sometimes do not follow rules. At times they get inattentive.....They cannot learn without attention.’ (T2)*

In another classroom, students asked questions altogether that the teacher could not manage. Teacher informed it is hard to manage the children sometimes. They make noise and get excited at time. It is difficult to calm down, especially while writing numbers through play. One of the teachers commented,

*‘They (children) become noisy and run across the room sometimes with toys. It is difficult to calm them down. Because of their restlessness, it is hard to teach them to write numbers through play.’ (T3)*

#### **4.5.3 Lack of follow-up after training**

After the training teachers did not get any follow-up activity. Moreover, class monitoring has also been done by assistant upazila education officers (AUEO) who are not involved in that training. Hence, the feedback given by the AUEO is not aligned with the training content.

Eventually, teachers do not understand their improvement areas after employing play pedagogy. One of the primary teachers’ training instructors mentioned,



*‘15 days of training in pre-primary teaching is not sufficient. Also, they do not have any follow-up where they can share their issues concerning employing play pedagogy. And their class has been monitored by assistant upazila education officers. So, teachers receive training from one place and take feedback from another. This gap makes the training ineffective.’ (Primary teachers’ training instructor 2)*

## **4.6 Summary**

This chapter has presented the teachers’ perception of play pedagogy in teaching mathematics, classroom practice, support, and challenges. Teachers deemed that play pedagogy was an effective, participatory, and joyful approach to teaching mathematics. They employed play pedagogy following the teachers’ guide. Moreover, teachers get training on play pedagogy in teaching mathematics. Though they had sufficient toys and other play materials, they did not have enough place, particularly, a dedicated classroom for pre-primary. Pre-primary classrooms are shared with other classes which have different sitting arrangement with benches. This sitting arrangement shrink pre-primary students play space. Also, teachers confronted challenges regarding classroom management including students become restless and inattentive which impede learning to write numbers through play. Other than these, lack of after training follow-up also hinder the understanding of teachers about their pedagogical strengths and weaknesses.

## **Chapter 5**

### **Discussion and Conclusion**

#### **5.1 Introduction**

The purpose of this chapter is to discuss the findings of the research questions. This chapter includes a discussion of teachers' perceptions along with classroom practice. Furthermore, the scope of teaching mathematics through play pedagogy is presented. Finally, I suggest some recommendations for further study.

#### **5.2 Discussion**

This section explains my findings and discusses them under the three research questions. The study found from the interviews and classroom observations that there is a gap between teachers' perceptions and practice in the classroom. Moreover, scope and challenges are also discussed and scrutinized for underpinning reasons. The discussion developed by searching the alignment or contrast between the findings and other research results as well as the reason behind the alignment or contrast.

##### **5.2.1 What is government pre-primary teachers' perception of play pedagogy in teaching mathematics?**

All the participating teachers perceive teaching mathematics through pedagogy positively. Teachers identify play pedagogy as joyful activity and a strategy of active participation. A study by Rashid & Jahan (2021) has similar findings where teachers had a very positive view towards play pedagogy, and they perceived play as joyful mathematics learning. In addition, this finding aligns with the characteristics of play pedagogy postulated by the Lego Foundation. According to the Lego Foundation learning through play includes a joyful and an actively engaging experience for children (The Lego Foundation, 2017).

In addition, teachers considered teaching mathematics through play the most effective pedagogy. According to early learning and development standards (2020) of Bangladesh, play is considered an instructional strategy for teaching mathematical concepts. This result is also aligned with the educators' viewpoint of play as a useful pedagogical tool for teaching early grades mathematical content (Meaney et al., 2014). According to prominent educators like Froebel and Margaret Mcmillan, play pedagogy is very effective for learning since it's a children's work and play creates a joyful learning environment (Chin & Zakaria, 2015). Other than these, teachers also use toys or materials for teaching mathematics effectively. Extent research showed that toys are the tools through which children perform their play and learning activities (Dag et al, 2021).

Teachers' perception regarding play pedagogy is the main activity in children learning. Vygotsky (1966) addressed play as the leading activity of children. This is the predominant activity of young children. Hence, while formalizing early childhood education, play is considered as the principal teaching and learning approach (Fleer, 2018).

Teachers' perceptions of play pedagogy are widely influenced by society and culture. For example- in Japan and Taiwan play is viewed as a development and learning tool for children. Yet, they believed that children should enjoy playing for the sake of playing (Izumi-Taylor et al., 2014). The goal of one-year pre-primary education is to school readiness and create a joyful learning environment for children (NCTB, 2011). Aligning with this goal, teachers were found to employ different play in the classroom. In this study, teachers' perception is quite positive toward play pedagogy which influences their classroom practice. A reviewed article by Rasid & Akkari (2020) found that Bangladeshi parents perceive play as merely spending leisure while teachers take play as an effective method for the development of children and school preparedness. This positive perception of play might be developed because the policy and curriculum emphasize

play pedagogy since society and culture influence teachers' values and beliefs regarding play (Izumi & Taylor et al., 2014). According to the pre-primary curriculum (2011) & Working draft of the National Curriculum (2020), play is one of the key teachings and learning strategies for pre-primary classroom teaching.

### **5.2.2 How is play pedagogy implemented in teaching mathematics by government primary school teachers?**

Teachers employ teachers' guide suggested play for teaching mathematics and all are guided play. Child-directed plays are scarce in teaching mathematics. Moreover, the lack of playfulness is noticed in the classroom which leads to the play activity monotonous for children. In turn, the attentiveness and active participation of students are severely impeded. After the play activity, teachers mostly engaged in the 'asking and answering' activity to help students to memorize the numbers. This finding is contradictory to the children learning. According to Froebel, and Reggio Emilia, children learn through active participation and interaction with the world around them (Samuelsson, 2008). Furthermore, these guided plays often decrease the scope of constructing knowledge on their own since students get inattentive. Researchers argue that mathematical skills are best developed through play and experience in daily life. Teachers need to follow students' interests while they are playing and discern the mathematical activity in children's daily life. In a teacher-directed approach, they plan the situation and observe students closely to decide when to deliver their play to teach mathematics (Meaney et al., 2014). In the current practice, teachers followed the contents and prescribed play pedagogy explained in the teachers' guide. They did not consider the students' individual interests when teaching mathematics content. The reason behind this could be the centralized education system of Bangladesh. In a centralized system, decisions and instructions are disseminated in a top-down

approach. This leads to ceasing the teachers' freedom to employ play pedagogy according to the student's interests and the situation. Teachers become highly dependent on NCTB-provided materials and reluctant to use other resources (Chowdhury & Sarkar, 2018). Eventually, this prescribed play pedagogy can impede students' creativity and mathematical concept development (Meaney et al., 2014). Moreover, a study by Rashid and Jahan (2021) also found that teachers have ambiguous perceptions of play pedagogy which might limit the practice of child-directed play. Also, the goal of pre-primary education in Bangladesh is school readiness which is why classroom activities in line with guided play are emphasized more than free and spontaneous play (NCTB, 2011).

Despite these issues, a study found that guided play expands children's mathematical skills (Bobbies et al., 2005). Furthermore, guided play employed by teachers is quite aligned with Jean Piaget's theory and Fleer's conceptual play world described in the literature review. Children learn mathematical concepts better when they find the activity interesting (Piaget, 1962).

Teachers used seeds, sticks, blocks, and toys to teach counting which is based on constructive play. This play is goal-directed, and teachers used play materials. Also, functional play is found when they recited rhymes to teach counting. Students clapped and stood in a circle while reciting the rhyme. This play involves bodily movement and no rules. While teaching addition and subtraction, the teacher created an imaginary situation where students imagined riding up a train. The teacher created an imaginary situation where students meet and solve their mathematical problems.

According to early childhood researchers, children's social skills, and foundational arithmetic capabilities are developed through symbolic/fantasy play (Leong & Bodrova, 2012). Teaching mathematics through play like building blocks and rhymes improves students' problem-solving

skills, mathematical concepts, understanding, and manipulating models (Rosli & Lin, 2018). Moreover, imaginary situations in play improve students' literacy and numeracy skills through students' active engagement and motivation for problem-solving. Early grades children learn addition and subtraction through imaginative play (e.g., selling and buying shoes) as it creates a condition of meaningful mathematical learning (Ma et al., 2023).

Gender biases are another aspect when choosing to play or play materials. A gap is found between the perception and the practice. All the participating teachers said in the interview that they do not have such prejudice, however, teachers do show biases in distributing materials and toys in classroom practice. This finding is quite aligned with the report on gender inequality in pre-primary schools by Unicef. Educators have often fostered gender stereotyping through their interaction, choosing separate games and learning materials for boys and girls. Moreover, teachers in Asia are found to be more caring towards boys as they believe boys have the natural ability to excel in academic subjects (Unicef, 2022).

Children start recognizing gender roles at the age of six. Biological orientation has an impact on gender roles which is why boys like to play active, rough, and noisy play. Other than biological orientation, interactions with family, peers, teachers, toys, and culture influence gender roles. Even in toy stores, play materials are offered according to the societal gender role (Woolfolk, Misra & Jha, 2015). In preschool, educators often stereotype children by saying, "Bears are for boys" and "Butterflies are for girls" (Berk, 2013). These societal beliefs about gender roles influence the classroom practice of teachers (Santos & Santos, 2020).

### **5.2.3 What are the support and challenges of teaching mathematics through play pedagogy regarding materials and classroom management?**

The study found teachers have some in terms of resource availability and training. Pre-primary classrooms of this study have all the resources for teaching mathematics which is quite aligned with the finding of Rashid & Jahan (2021). The pre-primary curriculum (2011) of Bangladesh also emphasizes the teaching aid and toys for the successful implementation of the curriculum. Play with objects increase children's mathematical thinking. According to Bruner, teachers can scaffold with play materials e.g., blocks and interactions where children learn geometry (Meaney et al., 2016). Play experiences with substantial objects help develop the mathematical understanding of pre-primary students. Play materials like origami increase young students' thinking skills and improve their spatial skills which are very important for geometry. Constructive play with blocks instills problem-solving skills, constructing skills, mathematical concepts, and concepts of balance (Rosli & Lin, 2018).

The study found that teachers get 15 days training which helps them to employ play pedagogy in the classroom. The study of Nath et al (2014), also emphasized the importance of teachers' training on play to boost their confidence.

This study found that there is a scarcity of classrooms for pre-primary and their classrooms have been used for conducting other classes, e.g., five. Also, classrooms have to accommodate benches and desks for students from other classes. A similar result is found by Yasmin, Rumi, & Robert (2020) where insufficient classroom and age-appropriate furniture (e.g., small chairs) were scarce. This finding directly contradicts the pre-primary curriculum (2011) where the learning environment is specifically mentioned for pre-primary children. According to the curriculum, pre-primary classrooms should have a home-like ambience. These classrooms should

be informal, warm, and safe where students can play spontaneously, move freely, and imagine. Also, classroom walls should be vivid, and artworks by students should be displayed there to develop classroom ownership among the students (Pre-primary curriculum, 2011). The reason behind this challenge could be the lack of adequate planning for infrastructure to start pre-primary classes. Pre-primary education was provided by government primary schools in 2012 in Bangladesh. This initiative was taken without allotting any specific classrooms (Nath, 2014).

Concerning the support from the community, teachers did not get any resistance from the community and parents. Moreover, parents and students from classes 4 and 5 assist them to manage their classes. Though, none of them have any kind of training in pre-primary classroom management which directly contradicts the teachers' guide. According to the teachers' guide, the teacher-student ratio in the pre-primary classroom should be 1:30. Teachers can have support from 2-3 parents for classroom management, however, they need to be trained (NCTB, 2022). Pre-primary students are very young; hence their caregivers need to be well-trained so that caregivers can give support to their holistic development.

The study also found that teachers confronted challenges of classroom management while teaching mathematics through play. Students often get restless and inattentive. A similar result has been found in Rashid & Akkari (2020) where pre-primary classroom management evolved as a big challenge. Classroom management is a significant factor in implementing play in teaching mathematics. It helps students to retain their attention and increases students' engagement (Harrington, 2019). And students' engagement in the context of play helps young learners develop their mathematical concepts (Björklund et al., 2020)

Another finding regarding the challenge is teachers did not get any follow-up after they received 15 days of pre-primary training. However, they get feedback from education officers who are not



involved in this training process. This finding is quite aligned with the study of Chin & Zakaria (2015) where Malaysian teachers were found to be confronted with problems while implementing play pedagogy due to a lack of knowledge and skills. Proper supervision and feedback prepare teachers to deliver quality education. Teachers can understand the difference between teaching pre-primary and primary level through supervision and feedback. In turn, it improves their teaching strategy and makes it child-friendly (Nath et al., 2005).

### **5.3 Conclusion**

I investigated the government pre-primary teachers' perception of play pedagogy in teaching mathematics, classroom practice, and challenges through this study. In doing so, I interviewed government primary teachers along with their classroom observation and primary teachers' training instructors. Play pedagogy in teaching mathematics is one of the effective pedagogies for pre-primary students (Vogt, Hauser, Stebler, Rechsteiner, & Urech, 2018). In this study, all the participating teachers perceived play pedagogy positively. All the pre-primary teachers got training in pre-primary teaching where they also learn about play pedagogy. The Teachers' guide suggested guided plays are the most used play for teaching mathematics. However, there are some challenges regarding separate classrooms, classroom management, and precise feedback which impede children's free movement and learning mathematics and teachers' understanding of their strengths and weakness. This study has implications for teachers' training which may help to improve teaching mathematics through play pedagogy in pre-primary classrooms by informing recent practices, support, and challenges.

### **5.4 Recommendations**

Based on this study, the following are the recommendations for teachers, policymakers, and further research on play pedagogy in mathematics teaching.

- Though teachers get a 15-day long training, a proper follow-up is needed. Also, this could be a potential exploration area for further research.
- Training and feedback after classroom observation should be given by the same entity so that teachers can work on their improvement areas.
- All the stakeholders need to be involved in resolving the issue regarding the scarcity of separate pre-primary classrooms and classroom management.
- Some volunteer parents can be trained to assist pre-primary teachers to manage the classes.

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# Appendices

## A. Permission Letter

Permission Letter for School Authority

To

The Headteacher

.....

Subject: Request for providing support for Master's thesis

Dear Sir/Madam,

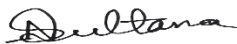
Greetings! Under the Brac Institute of Educational Development (Brac IED), Brac University, I am doing my thesis on 'Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study'. The study intends to explore the teachers' perceptions of play pedagogy in teaching mathematics and the implementation of play pedagogy in the pre-primary classrooms.

To collect data, an in-depth phone interview will be conducted and recorded first by the researcher. After interviewing, two pre-primary classes of the interviewee will be observed by the researcher/ a research assistant. As a researcher only I have access to interview recordings and transcriptions. Participation in this research will be voluntary. Participant's identities will be kept confidential, and information will be used only for this research. Participated teachers can withdraw their consent at any time.

Therefore, I would like to seek your permission to allow me to conduct this research in your school. I hope you and your colleagues will provide all sorts of support in this regard. If you have any queries regarding this research, please call or email me.

Thank you for giving your valuable time.

Sincerely,



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Nazmin Sultana

Master's Student

Student ID- 18357033

Email- [nazmin.sultana@bracu.ac.bd](mailto:nazmin.sultana@bracu.ac.bd)

Brac Institute of Educational Development, Brac University

## **B. Consent Form for Government Primary Teachers**

### **TEACHERS' INFORMED CONSENT FORM FOR RESEARCH**

**This form is valid from September 01, 2022 to April 30, 2023**

#### **Teaching Mathematics Through Play Pedagogy in Government Pre-primary: An Exploratory Study**

**Nazmin Sultana, Master's Student**

**Brac Institute of Educational Development, Brac University**

I have read the information provided thoroughly and understand it. After careful reading, I have decided to participate in the project titled, "Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study".

The study intends to explore the teachers' perceptions of play pedagogy in teaching mathematics along with the implementation of play pedagogy in pre-primary classrooms.

I agree to the conditions listed below with the understanding that I may withdraw my participation from the project at any time, and I may choose not to answer any questions that I do not want to answer.

#### **DESCRIPTION OF RESPONSIBILITY**

- I will participate in an over-phone interview with the researcher.
- My class will also be observed by the researcher/ a research assistant.

#### **RISKS**

- There should be no risks to me or my students and the classroom practice from this research.
- No information will be recorded that may be embarrassing or uncomfortable to me.
- My consent is optional and voluntary.

#### **BENEFITS**

- I understand that I may benefit from participation by self-reflecting-
- My understanding of play pedagogy in teaching mathematics.
- The support and challenges I have while teaching mathematics through play pedagogy.

#### **CONFIDENTIALITY**

I understand that the information in the study records will be kept strictly confidential. Data will be stored securely in the laptop that is password protected. Data will not reveal subjects' identities.

Audio recordings of the interview will be retained confidential and conceal the participants' identities. No reference will be made in oral or written reports, which reveal my name. All the data will be used by the researcher to explore my perception of play pedagogy in teaching mathematics and how I employ play pedagogy while teaching mathematics in pre-primary classrooms. Also, reports using the recordings may be shared with the research community at conferences as well as in research papers.

## CONTACT

If you have questions at any time about the study or the procedures, you may contact the researcher through email. Also, if you later decide to withdraw your consent for participation in the study, you should contact the researcher. You may discontinue participation at any time.

Nazmin Sultana

Email- [nazmin.sultana@bracu.ac.bd](mailto:nazmin.sultana@bracu.ac.bd)

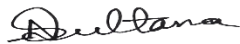
If I decide to participate, I am free to discontinue participation at any time without prejudice. If I withdraw from participation, my information will be removed from the thesis results.

If I participate in the research project, I can get information about the research project and copies of my interview and classroom observation data.

Teacher Name: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher Name: Nazmin Sultana



Signature: \_\_\_\_\_ Date: March 01, 2023

\*\*The Teacher should keep a copy of this form for his/her records.

## **C. Consent Form for PTI Instructors**

### **PTI INSTRUCTORS' INFORMED CONSENT FORM FOR RESEARCH**

**This form is valid from September 01, 2022 to April 30, 2023**

#### **Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study**

**Nazmin Sultana, Master's Student**

**Brac Institute of Educational Development, Brac University**

I have read the information provided thoroughly and understand it. After careful reading, I have decided to participate in the project titled, "Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study".

The study intends to explore the teachers' perceptions of play pedagogy in teaching mathematics along with the implementation of play pedagogy in pre-primary classrooms.

I agree to the conditions listed below with the understanding that I may withdraw my participation from the project at any time, and I may choose not to answer any questions that I do not want to answer.

#### **DESCRIPTION OF RESPONSIBILITY**

- I will participate in an over-phone interview with the researcher.

#### **RISKS**

- There should be no risks to me, teachers, and students from this research.
- No information will be recorded that may be embarrassing or uncomfortable to me.
- My consent is optional and voluntary.

#### **BENEFITS**

- I understand that I may benefit from participation by analyzing the classroom situation regarding the support and challenges of teachers while teaching mathematics through play pedagogy in pre-primary classrooms. This may add new insight to my knowledge and practice.

#### **CONFIDENTIALITY**

I understand that the information in the study records will be kept strictly confidential. Data will be stored securely in the laptop that is password protected. Data will not reveal subjects' identities. Audio recordings of the interview will be retained confidential and conceal the participants' identities. No reference will be made in oral or written reports, which reveal my name. All the data

will be used by the researcher to explore my perception of play pedagogy in teaching mathematics and how I employ play pedagogy while teaching mathematics in pre-primary classrooms. Also, reports using the recordings may be shared with the research community at conferences as well as in research papers.

## CONTACT

If you have questions at any time about the study or the procedures, you may contact the researcher through email. Also, if you later decide to withdraw your consent for participation in the study, you should contact the researcher. You may discontinue participation at any time.

Nazmin Sultana

Email- [nazmin.sultana@bracu.ac.bd](mailto:nazmin.sultana@bracu.ac.bd)

If I decide to participate, I am free to discontinue participation at any time without prejudice. If I withdraw from participation, my information will be removed from the thesis results.

If I participate in the research project, I can get information about the research project and copies of my interview.

Instructor's Name: \_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Researcher Name: Nazmin Sultana



Signature: \_\_\_\_\_ Date: March 01, 2023

\*\*The participant should keep a copy of this form for his/her records.

## **D. Interview Guide for Government Primary Teachers**

**Interview: Government primary teachers**

### **Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study**

#### **Part 1- Demographic information**

Please fill in the blanks or put a tick (✓) next to the word or phrase that best matches your response.

1. Name-
2. Email-
3. Phone number-
4. Age-
5. Year of teaching experience in pre-primary class-
6. Education qualification-
7. Professional degree-
8. Do you get any training on 'play-based learning'? (I) Yes      (II) No
9. If your answer is 'YES', please write the name of the training-

\_\_\_\_\_

#### **Part 2- Interview questions**

(This asks for your views on “play-based learning”, the use of games in the classroom, and the reality of pre-primary classrooms. Please detail your personal experience, and examples. Because, I value your opinion.)

1. What do you mean by 'play-based learning' in pre-primary class? / What is play-based learning?
2. What is your viewpoint on teaching mathematics through play in pre-primary classes?
3. Do you think it is possible to achieve early math learning outcomes through play-based learning alone?
4. How effective is 'play-based learning' in teaching mathematics?
5. What play do you use in the classroom to teach mathematics through play pedagogy? Please give real examples.
6. What kinds of play do you plan outside of the teacher's aid for teaching early math?
7. What kind of development does play-based learning promote? Give an example.
8. What kind of play do students like most in teaching early math? Describe the lesson you conducted through the last game. (e.g., content, learning materials, activities etc.)
9. How do you choose games to teach beginning math to students with special needs? Give examples.



10. Do you face any difficulties in classroom management due to play-based learning? (Eg – chaos, shouting, running around). How do you solve them?
11. Do you need volunteers/parents to help teach early math through play-based learning?  
\*If help what kind of help do they provide? \*Do they have any training?
12. Does your school have toys/equipment (in the classroom and on the field) that support play-based learning? Are they adequate in proportion to the students?
13. How do your colleagues/SMC members/parents support play-based learning in teaching early mathematics in your school? (Or how to stop it?)
14. Was there any play-based learning component in your training? If so, what did you learn about play-based learning in that part?

\*\* Do you want to add any more information?

\*Do you have any questions about this study?

## **E. Interview: Guide for PTI Instructors**

### **Interview: PTI Instructor**

#### **Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study**

##### **Part 1- Demographic information**

Please fill in the blanks or put a tick (✓) next to the word or phrase that best matches your response.

10. Name-
11. Email-
12. Phone number-
13. Age-
14. Year of teaching experience-
15. Education qualification-
16. Professional degree-
17. Do you get any training on 'play-based learning'? (I) Yes      (II) No
18. If your answer is 'YES', please write the name of the training-

\_\_\_\_\_

##### **Part 2- Interview questions**

(This asks for your views on “play-based learning”, the use of games in the classroom, and the reality of pre-primary classrooms. Please detail your personal experience, and examples. Because, I value your opinion.)

1. What is your viewpoint of teaching mathematics through play in pre-primary classes?
2. Do you think it is possible to achieve early math learning outcomes through play pedagogy?
3. How effective is 'play-based learning' in teaching mathematics?
4. What play do teachers use in the classroom to teach mathematics through 'play-based learning'? Please give real examples.
5. What kinds of teachers do you plan outside of the teacher's aid for teaching early math?
6. What kind of development does play-based learning promote?
7. How do you choose play to teach beginning math to students with special needs? Give examples?

8. Do you face any difficulties in classroom management due to play-based learning? (Eg – chaos, shouting, running around). How do you solve them?
9. What kind of difficulties can teachers face due to play-based learning? How can the teacher solve them?
10. What kind of support do teachers receive in play-based learning?
11. Was there any play-based learning component in your training? If so, what did you learn about play-based learning in that part?

\*\* Do you want to add any more information?

\*\*Do you have any questions about this study?

## F. Classroom Observation Protocol

### Teaching Mathematics Through Play Pedagogy in Government Pre-primary Classrooms: An Exploratory Study

**School's name:**

**Time (duration of observation):**

**Date:**

**Number of classroom observation:**

<b>Teacher's name:</b>	
<b>Gender:</b>	<b>Number of students:</b>
<b>Subject:</b> Elementary mathematics	<b>Content name:</b>
<b>Learning outcome:</b>	

<b>Teaching-learning process</b>	
Use of play related to lessons (name of play)	
Game-based learning activities in teaching early mathematics (Description of the game being played in the class)	
Kinds of support in play-based learning for children with special needs. (If applicable)	
What did the teacher do to ensure the participation of all types of students in the game? (Calling names, saying words of encouragement, answering all sorts of student questions)	
What materials did the teacher use in game-based learning?	
Classroom management	Student's attention -(listens attentively / follows directions / to a friend next door / asks questions / does not follow directions)
	*Write what the students were doing- Unwanted behavior- (talks too much to others/disrupts group work/willfully throws or breaks things)
	*Write what the students were doing-
	Student Participation- (Student participated on his/her own interest/participated after

	being told by the teacher/did not participate even after being told by the teacher) *Write what the students were doing-
What did teacher do for class management?	
Classroom size, pictures and toys	
Special note (if any)	



