ABSTRACT

Amandeep Kaur Randhawa, PLAY IS LEARNING: A PEDAGOGY FOR BUILDING TEACHER CAPACITY INTEGRATING PLAY IN MATH INSTRUCTION (Under the direction of Dr. Matthew Militello). Department of Educational Leadership, December, 2023.

The purpose of this participatory action research (PAR) project was to support teachers to integrate play as a primary pedagogy in the math program. The theory of action was: If teachers develop a mathematical program integrating play pedagogy, then teacher capacity will expand to support the implementation of play in math instruction. I conducted the participatory action research (PAR) study with a small group of three teachers who were in a co-practitioner researcher group. We analyzed the current math instructional program, grade level standards, and designed and implemented play-based learning opportunities that supported classroom instruction. I collected and analyzed data from evidence-based observations in math classes and post-observation conversations to understand the extent to which play can be integrated into the standards-based lessons. Two findings were: (1) With intentional planning and reflection, teachers improve their instructional practices while building their capacity to integrate play-based learning in mathematics instruction; and (2) by integrating instructional practices that involve peer engagement, teachers shift their practice from whole-class instruction to facilitating learning activities and observing students' play-based learning. Finally, we are continuing by sharing with all grade levels at our school and with other schools in the district so other teachers can use play-based learning practices in all elementary grade levels. Play based learning shifts the teacher role in the classroom to a facilitator of learning and supports learning opportunities that aid and broaden students' understanding of mathematical concepts.

PLAY IS LEARNING: A PEDAGOGY FOR BUILDING TEACHER CAPACITY INTEGRATING PLAY IN MATH INSTRUCTION

A Dissertation
Presented to the Faculty of the Department of Educational Leadership
East Carolina University

In Partial Fulfillment of the Requirements for the Degree
Doctor of Education in Educational Leadership

By
Amandeep Kaur Randhawa
December, 2023

Director of Dissertation: Matthew Militello, PhD
Dissertation Committee Members:
Lynda Tredway, MA
Carrie Morris, EdD
Lawrence Hodgkins, EdD
Ken Simon, EdD

DEDICATION

for Laila, Zayden, Mom, and Dad

ACKNOWLEDGEMENTS

There are so many individuals who have supported me through this journey and encouraged me along the way. I would like to begin by thanking the entire Project I^4 staff for recognizing my potential, which I did not realize myself. Dr. Militello, Lynda Tredway, and my amazing coach, Ken Simon, for encouraging and guiding me through the process of accomplishing this degree.

The co-practitioner researchers, Anna Hockman, Ashley Barajas Montano, and Christina Blum for trusting me, sharing their experiences, and diligently working with a mindset of inquiry and a desire to evolve in their instructional practice to improve outcomes for students.

My mom and dad, for their everlasting support, care, and wisdom. Their continuous reminder that education will lead to opportunities taught me to preserver and kept me determined.

My family and friends for believing in me and standing by my side. Knowing you were there to rely on was the greatest source of comfort.

To Laila and Zayden for providing me patience and grace every time Mommy said she had to study. Thank you for allowing me to demonstrate that you can achieve all that you set your mind and heart to. I love you so much!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: NAMING AND FRAMING THE FOCUS OF PRACTICE

Play gives children a chance to practice what they are learning. Mr. Rogers

Chutes and Ladders, Monopoly, tag, and Steal the Bacon are just a few of the games that consumed my childhood and my interaction with other children. As a child, games were a simple opportunity to engage in play. However, now as an educator, I have learned the benefits of how play supports children to leverage their learning and understanding of mathematical concepts. As a student in West Contra Costa Unified School District, the same district where I have served as a teacher and now as an administrator, my experience with mathematical teaching and learning was not positive or successful. Math class consisted of rote memorization of facts and timed tests. The math program did not offer opportunities to demonstrate my knowledge of math concepts beyond paper and pencil tasks. Play, on the other h is research study was to fully incorporate play into the math instructional program.

I have served the community of Olinda Elementary for the past eight years as principal. Olinda Elementary is my neighborhood community school and is located in a residential area of El Sobrante, which is an unincorporated area of Richmond, California. During my time at Olinda, our student population has increased from 302 students to 380. The reputation of Olinda as a rigorous academic school with a diverse student population has consistently made it a popular choice for parents who are looking at various education options. Further, Olinda is an ethnically diverse community-oriented school, and that diversity is our strength: Asian (24%), Latinx (28%), White (19%), Black African American (13%), and Filipino (8%). Olinda's Smarter Balanced Assessment Consortium (SARC) math scores improved somewhat in 2019 after scores from 2017 to 2018 had fallen below standard. However, some subgroups do not exhibit the same gains as others. The impetus for this project was my belief that by integrating

play within the math instructional program, we could better support students' understanding of math concepts and reinforce skills that will assist students in demonstrating their knowledge.

Resources play an important role in the type of math instruction students receive. Olinda uses the district math curriculum— My Math by McGraw Hill—for students in grades Kindergarten to fifth and Houghton Mifflin Harcourt's curriculum—Big Ideas—for our sixth graders. The programs adopted by the district were selected to address Common Core State Standards. However, play-based learning in each program is lacking. The lack of access to play-based learning presents an opportunity gap for most of Olinda's students (Carter &d Welner, 2013). I designed the PAR project to address this gap with an emphasis on this overarching

question: *How do teachers fully incorporate play-based learning into the math curriculum program?* To address the question, I present the rationale and, can offer children engagement opportunities that they can use to strengthen their academic skills by processing and applying learning that meets their unique styles and needs. Nachmanovitch (1990) describes the importance of play: "In play we manifest fresh, interactive ways of relating with people, animals, things, ideas, images, ourselves" (p. 43).

As described in Mr. Rogers' quote, children reinforce their learning through play because play provides practice. Zosh et al. (2017), describe play, whether it is kinesthetic, cognitive, or social, as a universal language for children and an essential part of their development. When teachers incorporate play within learning opportunities all students can participate, fully engage, and apply their learning. Teachers can support academic learning through play by organizing student tasks so they interact with others because peer collaboration assists in processing concepts presented. The Focus of Practice (FoP) for the FoP assets and challenges at the micro,

meso, and macro levels, the participatory action research (PAR) design, and the implications the project and study have for practice, policy, and research.

Rationale

As we implemented Common Core State Standards (CCSS), we recognized that student engagement in play as a foundation of the curriculum had been limited at Olinda. In part, this was due to the school district's selection and adoption of math curricula that support CCSS but have limited incorporation of play. When assessing the developmental appropriateness of math standards, the CCSS points to the importance of play, but play is not specified in the standards. While CCSS welcomes and encourages the implementation of instruction that is play-based, engaging, and cognitively enriching (Common Core Standards Initiative, 2020), schools and districts choose math programs; many do not support play-based learning in mathematics. The two district-selected programs fail to support the integration of play into math instruction.

Embedding games within the math context offers students engagement and enhances their understanding. Nachmanovitch (1990) states that "[w]ithout play, learning, and evolution are impossible" (p. 42). Play-based learning offers students deeper learning opportunities to express their knowledge and understanding of math concepts using various modalities. Hammond (2015) points out that "[g]ames provide a unique opportunity to review and rehearse new knowledge" (p. 137). Play-based learning opportunities provide students with multi-sensory learning experiences that enhance information processing and deepen their learning and understanding.

At the start of the study, the teaching practices at Olinda focused almost solely on external standards and testing. These foci do not serve students working toward independent learning or strengthen their cognitive thinking. Hammond (2015) discusses how "many culturally

and linguistically diverse students become ‘dependent learners’ who don’t get adequate support to facilitate their cognitive growth” (p. 14). Play-based learning can provide the support students need for cognitive growth.

Through the integration of playful learning, students can demonstrate mathematical thinking and reasoning by playing games that align with core content standards, providing time and engagement for students to put their learning into practice (Fisher et al., 2012). Ranz-Smith (2007) in her empirical study of teachers’ perceptions of play discusses how educators recognize the value of play but frequently struggle to incorporate play in planning student learning. She concludes that “with goals and objectives identified through ends-sought test outcomes, there have emerged defined curricula cultivating the practice of direct instruction as the efficient means to achieve the goals, to the neglect of children’s propensity for play-based learning and child-initiated thought” (Ranz-Smith, 2007, p. 272).

As a transitional kindergarten teacher for four years, I experienced first-hand how play-based learning supported students' conceptualization of math by incorporating games to support the development and application of their mathematical relations to real-life situations. Play is engaging and inclusive and offers students a sense of belonging and the opportunity to interact with their peers and apply learning.

Focus of Practice

Thus, the Focus of Practice (FoP) for the participatory action research project and study was to fully incorporate play into the math curriculum program. I worked with a group of teachers who will act as the co-practitioner researcher (CPR) team. They worked with me to plan lessons that aligned with the standards and included play pedagogy. Within the PAR, the CPR co-designed play activities that they implemented in their classrooms. The intent of the PAR

project and study was to make math an engaging learning experience that would lead to deeper learning of concepts. Laski and Siegler (2014) state that engagement will allow students to demonstrate their understanding of math standards through multiple methods and modalities. To accomplish this outcome, teachers engaged in collaborative dialogue to promote shared understanding and consistency of a play-based math teaching and learning program in the school.

The FoP was designed to meet the challenges of integrating play into the math curriculum. One such challenge that teachers face is finding the time for integration of play into an already crowded and fast-paced math program. Because of this challenge, many teachers are reluctant to change their instructional practices. As Rigby and Tredway (2015) note, "We know that shifts in instructional leadership practice necessitate time and expertise to build teacher capacity and see transfer to the classroom, which is often limited at best" (p. 330). I used classroom observations and analysis of play within the current status of the math program in collaboration with the CPR team to design and implement play-based activities to be integrated into the math program. To understand how we can address the FoP through the PAR process, we examined the current assets and challenges.

Assets and Challenges of FoP

To determine the micro, meso, and macro assets and challenges as they pertain to the FoP, a CLE was facilitated with Olinda community members to better understand those assets and challenges (see Figure 1). At the micro-level analysis, I addressed the current status of the school's mathematical program by reviewing the curriculum and specific teacher practices. At the macro level, we addressed the current district-adopted math program. The meso level examined the district-level support offered to sites to strengthen math programs that exist.

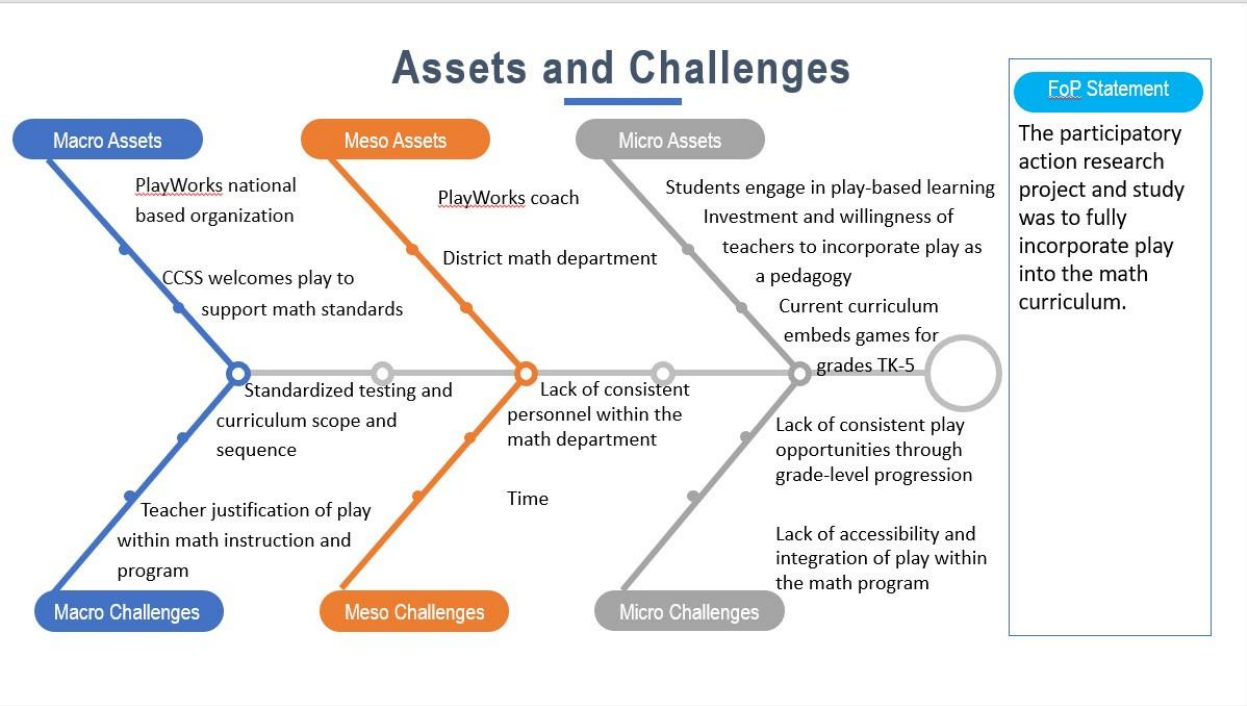


Figure 1. Macro, meso, and micro assets and challenges.

Although a math department exists within the district, the changes and turnover in the department lead to inconsistency.

Micro Assets and Challenges

Teachers were willing and interested in incorporating play into the curricula for math instruction. In addition, because I have a background in this topic and experience in the implementation, I facilitated that learning. The curricula for TK-5 had some games embedded in the lessons, and we built on those. However, resources and time constraints posed challenges for teachers to integrate play into the math curriculum. Although some teachers were willing to incorporate games within their instruction, the current program does not provide high-quality engaging activities or offer materials that are accessible. The district curriculum offers introductory video lessons, read-aloud stories for each unit that connect to real-life situations, and printable games available for units of study. However, to implement these activities fully, teachers have to create their own resources, as materials are not provided or purchased at the district level. Rigid pacing guides, benchmark assessments, and standardized testing requirements place added pressure on teachers to focus on the district curriculum and dismiss any activities that are not directed at improving scores.

Meso Assets and Challenges

For the past two years, the site has had the ability to utilize a Playworks coach who supported Physical Education classes and served as a recess coach. Playworks is a national organization that works with districts and schools to create play environments that support student achievement. The coach interacted with students through active engagement and play.

Due to budget issues, however, Playworks funding was discontinued by the district. To support the continuation of play within our educational program during the 2019-2020 school

year, the site's Parent Teacher Association contributed to the cost of the coaching services. Although the coaching continued, it was not fully funded and access to the coach was limited. However, this experience reinforced the value of schoolwide play, and it introduced a variety of games that could augment the math curriculum.

A further challenge has been district support for a math lead in our building. Previously, the district provided a stipend to sites to pay for a teacher who served as a math lead. The teacher served as a liaison between the site and the district, attended district professional development, and supported site teachers with learning opportunities. The math lead teacher role was a valuable resource because it offered teachers on-site support for collaboration and professional growth. This position has now been eliminated and, therefore, the roles of teachers who will participate in the PAR project and study were critical to continue an emphasis on math.

Macro Assets and Challenges

Several assets supported the FoP at the macro level. First, the CCSS acknowledges the power of play-based learning opportunities within the math program. Secondly, our partnership with Playworks, a national program that supports play-based learning, has been helpful for our teachers as they were able to observe students engaged in play-based learning. The district has a math department that supports sites with professional development opportunities that focus on conceptualization and offer strategies beyond algorithms and multiple methods. However, that training does not support play-based learning. The PAR project and study supported site-based professional development that was authentic and relevant to the work, and teachers received the resources and tools necessary to integrate play into their math lessons. Thus, as the principal, I used these as a rationale for supporting the PAR study.

However, lack of funding has served as a challenge in supporting this work at the site

level. A further challenge is the lack of professional learning for teachers to support the alignment of play within math teaching and learning as they relate to CCSS.

Significance

The FoP was designed to support teachers as they improved their practice in math classrooms with the integration of play-based activities. The FoP was significant to the context because it fostered teacher collaboration and engaged teachers in conversations about how play can support the development of instructional practices that enhance mathematical thinking. Play-based learning can engage students to connect with their home cultures through games and offers opportunities for deeper learning. Next, I discuss how the FoP supports practice, policy, and research. I discuss the importance of applying effective teacher practice to help students grasp math ideas by demonstrating how concepts apply to everyday life. We intended to align the play pedagogy across all grade levels.

Practice

The PAR was significant to practice because teachers incorporated play in instruction with the intent to support an applied learning model. According to Fisher et al. (2012), play provided students with hands-on activities to demonstrate their knowledge, learn new content, evaluate their thinking, solve math tasks through application, and express their understanding. By integrating play into the math program and instruction, teachers created a math program that engaged students to make connections with their real world, solve problems, and give feedback to one another. In turn, teachers developed lessons to support student understanding and ownership of their learning, while teachers facilitated and monitored student engagement (Freire, 2000).

Policy

The work and analysis of the FoP could inform policy at the school and district level related to math instruction, program, and professional development. This PAR project and study offered an opportunity to understand how play and games during math lessons support student mathematical thinking and application, and we can incorporate that into the design of school-level structures and resources. The work aligned with math standards and provided students with various avenues to learn and demonstrate their understanding of standards. The significance of the FoP promoted collaboration with the district's math department and other site administrations to implement a math program that reinforces standards through a play-based framework.

Research

The PAR research can contribute to a growing body of research on how teachers implement play as an instructional practice. While this is a small study, the process of school-level research is critical to teachers and leaders taking an active role in change projects to address equity (Grubb & Tredway, 2010). The integration of play in the math program and instruction supports teachers in justifying play within their classrooms as a means of supporting math content, understanding, and application. McLennan (2014) states that understanding and adapting to students' different social, cultural, and linguistic minorities, and other backgrounds boosts student involvement in specific courses. Increasing professional development for teachers enhances their understanding of incorporating play in their instruction and demonstrates opportunities for teachers to support math standards in an innovative manner that leverages students' understanding. This type of research based on the persons closest to the work determining the direction of math implementation can be replicable in other contexts.

Connection to Equity

What we added to this research was the intentional use of culturally responsive play. Children engaged in play can make a unique connection to the personal lives of students especially if the play is grounded in students' cultures. The Focus of Practice (FoP) is related to issues of equity by incorporating play-based learning opportunities to support and deepen student understanding of mathematical concepts and demonstrating their depth of knowledge. Play offers the opportunity to interact with other students as they build a deeper understanding of math concepts and learn more about themselves. Hammond (2015) notes that "[t]he classroom has to be designed around talk and task structures that allow students to define the people they see themselves becoming" (p. 148). Many teachers at our site recognize the diverse student populations we serve and implement mathematical games that introduce, enhance, enrich, and reinforce students' conceptualization of math through talk.

I focused on supporting the development of teachers' knowledge, skills, and disposition to incorporate play as a learning strategy in math curriculum and instruction. Two equity frames support the Focus of Practice. First, I discuss the socio-political frame, referring to the works of Rigby and Tredway (2015), Gutiérrez (2013), and Labaree (2008). Secondly, I use Eubanks et al. (2013) and Steele (2010) to address the psychological frame.

Socio-Political Frame

School reforms have attempted to address the inequities of marginalized students, and the role of the principal as an organizational actor who frames the equity agenda is a political act at the school level. Rigby and Tredway (2015) believe that:

> as schools in our urban communities face increasingly untenable conditions with the financial and social supports from community agencies and nonprofits, cities, and states

> that were available a decade ago, we must look afresh at what it takes to be effective as an urban leader who has and enacts a commitment to equity. (p. 330)

One way that urban leaders enact their commitment to equity is as instructional leaders supporting teachers to cultivate equity-driven instructional practices. The integration of play within instructional practice assisted those students who do not understand math through traditional practices. Hammond (2015) discusses that in order to progress toward more independent learning, students must learn and internalize cognitive patterns (p. 140). Rigby and Tredway (2015) argue that "[w]ithout a clear and present equity frame, principals can easily get sidetracked by a changing district agenda, neglect the need for school context to be the driver of decisions, and lose touch with his or her principles" (p. 330). The Focus of Practice is related to issues of equity by incorporating implicit learning opportunities of engaging students in play-based learning, to support and deepen their understanding of mathematical concepts and demonstrate their depth of knowledge. I focused on supporting the development of teacher's knowledge, skills, and disposition to incorporate play as a learning strategy in math curriculum and instruction, in order to develop a learning organization, in which play is implemented as an instructional pedagogy.

Secondly, math education is often viewed as an important tool for solving social and economic issues in marginalized communities. Therefore, the teaching of math has become political, and Gutiérrez (2013) states that teachers must be able to do more than only create strong inquiry-based lesson plans and be prepared to form meaningful relationships with their students; they must design lessons that contribute to equitable student knowledge and access. According to Gutiérrez (2013), teachers need to be aware of how oppression in schools operates on a structural as well as an individual level and the conventional conceptions regarding

historically marginalized students are being deconstructed. This understanding will support teachers and inform their practice as they create instructional learning opportunities for students. She introduces the concept of *conocimiento* and states:

> …political *conocimiento* involves: understanding how oppression in schooling operates not only at the individual level but also at the systemic level; deconstructing the deficit discourses about historically underserved and/or marginalized students; negating the world of high-stakes testing and standardization; connecting with and explaining one's discipline to community members and district officials; and buffering oneself, reinventing, or subverting the system in order to be an advocate for one's students. (p. 11)

The equity stance for the FoP aligns with Gutiérrez's (2013) concept of "conocimiento" because it challenges teachers to go beyond the status quo and improve practices that are in the best interest of students. She believes that mathematics teaching is political and mathematics teachers are "identity workers," always contributing to students' identities, not only in school but in society, and always producing what mathematics is and how people might interact with it. Labaree (2008) describes education as "an institution that will pursue our social goals in a way that is in line with the individualism at the heart of the liberal ideal, aiming to solve social problems by seeking to change the hearts, minds, and capacities of individual students" (p. 448). Thus, teachers need to acquire the knowledge, skills, and dispositions to serve as advocates for all students to understand mathematics and form mathematical identities for their students. The FoP supported the collaboration between teachers and principals to implement play within math instruction and reflect on the process, through ongoing observations and intentional professional development opportunities to establish school-wide continuity. This research supported teachers as they acquired the skills to facilitate equitable outcomes for student achievement and, through

play, students became able to transfer and apply their knowledge, changing the way they can learn and communicate.

Psychological Frame

Building relationships with students with a focused understanding of how individual students who enter our classrooms view themselves within the learning environment will support teacher instruction in ensuring equitable learning outcomes. Steele (2010) states "Depending on their group identity, different people would simply have different things to contend with in these places different stereotype threats, different ambiguities about how to interpret their experience, different goals and preoccupations" (p. 60). Hammond (2015) believes that the "…task is to find ways to access their funds of knowledge and understand their home-based ways of learning as starting points for designing more authentic learning experiences" (p. 140). Through the implementation of play, students were able to engage with their peers and establish healthy interactions that supported their socialization and learning. This engagement allowed students to deepen their learning of math concepts and process information in context to their real world. Teachers utilized these learning opportunities by emphasizing community learning that was relevant to their student's learning.

The change in American schooling outcomes has been in play for the past four decades, and the results have only been moderately effective (Eubanks et al., 1997). Designing opportunities for play within math instructional practices allowed teachers to leverage student voices and engage them as active participants in their learning. The integration of play within instruction supported the psychological development of students as learners. Discovering creative ways of working while focusing on relationships as a necessary component of any productive act guided teachers in designing meaningful and engaging learning opportunities.

Through utilizing play in math instruction, teachers provided students with learning experiences that allowed them to express their knowledge and understanding through various modalities. Hirsh-Pasek (2012) states that play offers opportunities for students to engage and learn from one another as well as demonstrate their understanding through implicit learning situations and through problem-posing education, which makes learning relevant and meaningful. Freire (1970) states that "the teacher is no longer merely the one-who-teaches but one who himself is taught in dialogue with the students, who in turn while being taught also teach" (p. 80). This implementation addressed the hegemony of systemic change and offered ongoing learning experiences for students to engage in discourse, which is more critical; through play; by talking and learning from their peers, which will enhance students' processing of information; and applying math skills learned (Vygotsky, 1978).

The participatory action research design and the process for PAR attended to these key equity frames. I designed the research questions and the research design to guide the work of myself and the teachers.

Participatory Action Research Design

As Creswell and Creswell (2018) indicate, "[a] research problem…is an issue or concern that needs to be addressed…" (p. 109). I decided on the FoP based on classroom observations that reflected the lack of opportunities for students to engage in play. I invited three teachers to participate and depended on these three teachers to be Co-Practitioner Researchers (CPR). As a group, the CPR provided feedback on the data that I collected and analyzed so that we could collaboratively plan for improvement. During the research cycles, participants stayed engaged in the project implementation and study (hunter et al., 2013).

Math learning games are limited in many math programs, and this leads to the challenge

teachers face in justifying math games within their instruction and lessons. Hammond (2020) believes that "[a]ll the emerging cognitive neuroscience tells us to do just the opposite: you have to 'water up' instruction to get kids into the learning zone" (p. 6). Teachers must give students cognitive tasks during the day in which they have to stretch themselves. The FoP for this research study was to fully incorporate play into the math program.

With the problem defined, I collaborated with a small group of teachers to implement play-based learning strategies into math instruction. This small team of teachers served as a Co-Practitioner Researcher (CPR) group which operated similarly to a school-based networked improvement community (Bryk et al., 2015). That group consisted of teachers who had a shared understanding of the problem or challenge of integrating play into math instruction. This group included a first-grade teacher, a second-grade teacher, and a fourth-grade teacher, two of whom were familiar with action research in math as they had served as members of the Project I^4 networked improvement community (NIC). This PAR project was an opportunity to look at play and math with fresh eyes and collect evidence on how a small group of teachers integrated play into their instruction. Eubanks et al. (1997) describe play as a process that "makes use of collaboration, shared decision making, and a much wider involvement of people at site-based change" (p. 153).

The PAR project and study sought to enhance and deepen student learning in math by cultivating teacher practice to integrate play-based learning into math instruction. We began the study with a review of core math standards and the vertical alignment of those standards. The CPR reviewed the current math curriculum and aligned math units with play-based activities designed to deepen student understanding of math concepts. During the research study, I conducted classroom observations of CPR members that provided evidence of the integration of

play into teacher practices. To focus on the observations, we co-developed an observation tool that focused on examining play as a meaningful learning strategy.

I further detailed the research questions associated with the PAR and the learning that was demonstrated from the observations of CPR members. I discuss the theory of action that served as the focus of the work. I describe the intent of the PAR as well as the activities that took place to address the FoP.

Purpose and PAR Research Questions

The participatory action research (PAR) aimed to use play to support teaching and learning in the math program. The overarching research question was: *How do teachers fully incorporate play-based learning into the math curriculum program?* These sub-questions guided the research:

1. To what extent do teachers design math lessons that include play pedagogy?
2. To what extent do teachers implement play pedagogy in their instructional practices?
3. How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?

Theory of Action

This theory of action guided this study: *If teachers develop a mathematical program integrating play pedagogy, then teacher capacity will expand to support the implementation of play in math instruction.* The theory of action supports the professional growth of teachers by building teacher capacity in math instruction. Table 1 outlines the major activities for each research cycle. As a result, they shared their learning with other staff, but the focus of this research was building the capacity of a core group of teachers. In the PAR study, we engaged in three action research cycles. The PAR research activities supported the collaboration among

Table 1

Research Activities

Cycle	Major Activities
Pre-Cycle	• Facilitated CPR meetings • Reviewed current math curriculum • Researched play-based math opportunities • Engaged teachers in math activities • Designed play activities for the curriculum • Conducted teacher interview • Co-designed observation tool
PAR Cycle One	• Implemented play activities at three grade levels • Conducted observation and post-observation conversations • Facilitated CPR meetings • Conducted teacher interviews
PAR Cycle Two	• Continued all PAR Cycle One classroom activities • Conducted observation and post-observation conversations • Facilitated CPR meetings • Conducted teacher interviews

three teachers with principal support to implement play with math instruction and reflect on the process. I supported the implementation through ongoing observations and intentional professional development opportunities to establish continuity.

Study Considerations: Limitations, Validity, and Confidentiality and Ethics

The security of the data and the participants' confidentiality were vitally important in the study. I ensured all participants gave informed consent without pressure or obligation. Each participant signed a consent form and was informed that participation is voluntary, and they could request to terminate participation at any time (see Appendix D for the Consent Form). I stored all important papers and data files in a locked file cabinet for three years after the conclusion of the research as well as password-protected all electronic forms of data collected.

The limitations of the qualitative study included the researcher's biases and ability to generalize the findings of the study. As the primary researcher for the PAR project, I brought my ideas to the study. During the PAR cycles of inquiry, I was in an influential role because I was the school-level administrator. There was positional power that came with being a school-level administrator; therefore, I needed to be intentional not to use positional power as I worked through the study not to use positional power.

I took measures to ensure the validity of the study findings. I checked for the accuracy of the findings by employing triangulation using reflective memos and member checks. The member checks are similar to focus groups, which “are a recognized way of exploring the opinions, beliefs, and attitudes of a group of people and of enabling people to respond and interact together" (Birt et al., 2016, p. 1805). Members were asked to comment on the analyzed data to determine if my analysis reflected their experience, and members provided further

comments or insights (Birt et al., 2016). The process of triangulation helped determine the accuracy of the findings (Creswell & Creswell, 2018). Confidence in the truth of the findings will be confirmed by multiple sources and careful and iterative coding of the data (Guba & Lincoln, 1985). I conducted member checks during each PAR cycle of inquiry to ensure collected data was valid.

The intent of this study was not to generalize findings to other settings outside of Olinda (Creswell & Creswell, 2018). However, the study may prove useful to other elementary schools in WCCUSD. The process for collecting and analyzing data could be replicated in other schools within the district. This study provided methodologies that other elementary can use to task theory to action in the service of teachers integrating play into math practice. However, specific outcomes may not be generalized to other contexts.

Chapter Summary

Increasing play within the mathematical program and supporting teachers in the process through professional learning is imperative when establishing a consistent school-based program that emphasizes engagement, discourse, and peer collaboration. Recognizing students' lack of opportunities to engage in play within academic instruction and understanding how play reinforces student learning, led to the development of a program improvement process that provided teachers with intentional learning opportunities to enhance their math practices and support student outcomes. The professional development consisted of learning-by-doing, (Bryk, 2015). By engaging in collaboration with fellow teachers during learning sessions, teachers applied strategies shared, participated in a dialogue with colleagues, and received feedback. During the PAR, reflecting on the process and outcome of the work was ongoing. Reviewing and assessing the PAR during the various project cycles allowed the CPR to assess the work and

make the appropriate adjustments and accommodations. Bryk (2015) says that "teachers, principals, and educational leaders regularly experiment with new approaches seeking to improve outcomes for their students" (p. 10). In the PAR, we addressed the integration of play through research-based practices and encouraged the capacity of teachers to support full implementation.

The PAR addressed the need for play and engaged students with games that leveraged their mathematical understanding of standards taught, supported their knowledge that was transferable as the students progressed through grade levels, and applied their learning to their world. Play served students to be agents of their learning and offered meaningful interactions to sustain their learning through activities that supported high cognitive thinking of mathematical concepts. Play served as a vehicle for students to process and practice information presented in the math program. The study focused on implicitly assisting the integration of these positive learning outcomes for students, by participating in informed decision-making. As Spillane (2013) notes, "We cannot design practice, we can design for practice" (p. 40). Through collaboration, the CPR supported the integration of play, provided students with authentic and innovative learning opportunities to put into practice, and empowered teachers to expand their capacity by creating intentional lessons that integrated play within their mathematical teaching.

In Chapter 2, I present a comprehensive literature review that addresses the research that aligns with the FoP. In Chapter 3, I emphasize the methodologies and the alignment to the PAR. In Chapter 4, I outline the context for the PAR and the results of the PAR Pre-Cycle. In Chapters 5 and 6, I discuss the first and second cycles of the PAR. In Chapter 7, I focus on the discussion of key elements for the PAR and summarize the evidence as it pertains to the full integration of play into the math curriculum

CHAPTER 2: LITERATURE REVIEW

From birth to adulthood, play has an important role in the physical, cognitive, emotional, social, and creative skills growth of young children. Through the alignment of Bruner's work of play serving as invaluable basic training and Piaget's self-discovery approach, researchers and practitioners agree that children's play is beneficial to their cognitive development (First Discoverers, 2020). Through play-based activities, students are engaged in 'active learning opportunities. Play serves as an important mechanism for learning and reflects a natural, child-centered mode of learning (First Discovers, 2020). In the literature review, I share research on how play manifests children's learning as a means of intellectual development and making sense of the world around them; secondly, I describe how play supports ambitious math academic tasks, and finally, I discuss the facilitation of adult learning and professional development that builds teacher's capacity to incorporate play within instructional practices.

Play for Learning

Play has the potential to enhance student learning and growth. Nachmanovitch (1990) states that "[w]ithout play, learning, and evolution are impossible" (p. 42). Play is a matter of context, mindset, and spirit. Play for learning is intrinsically motivating. McLeod (2018) names discovery learning as the theory that children learn best by doing and actively experimenting. Play enhances learning through discovery and exploration. Burghardt (2011) believes that "[p]lay is multifaceted, diverse, and complex. It resists easy definition and engages many disciplines" (p. 11). Weisberg et al. (2016) favor the use of jointly guided and teacher-directed play activities to support academic learning, in which educators take an active role in the play by leading predesigned games, engaging with children, and participating in child-led play to provide learning goals. Their frame for guided play indicates that the balance between the different forms

of play supports teaching at each child's "zone of proximal development," the age when a youngster is most prepared to learn new abilities. Zosh et al. (2017) describe play as a variety of experiences available, ranging from play that allows children to explore and discover with few restrictions to play that is more guided or structured. Regardless of the form of play children are engaged in, they must have agency and be supported rather than directed, which is a key prerequisite (Zosh et al., 2017).

To support play as an integral part of children's learning experience, I describe how play is critical to children's development, indicate the importance of play as joyful and creative, and specifically examine the benefits of play in mathematics.

Play as Critical for Development

Play supports children's academic and social-emotional development in multiple ways. Play supports children to construct and integrate their learning through what Bruner (1960) names as enactive and iconic learning so that later they can translate this to language and symbolic learning. In their research of play and mathematics, Dockett and Perry (2007) describe how play supports students' deeper learning by allowing them to make connections with factual knowledge and their real-world experiences. They see play as a framework in which children can incorporate their experiences and understandings, draw on previous experiences, make connections through experiences, reflect these in various ways, explore possibilities, and build meaning. The essence of a child's play activities will change over time and their abilities will become more nuanced, depending on their age, background, and culture. Play provides an integrating mechanism that allows youngsters to draw on their previous experiences, build connections between them, portray them in different ways, explore possibilities, and create meaning.

Hassinger-Das et al. (2018) identify two different types of play in their research, free play and guided play. They describe free play as child-initiated, in which children control items, interact socially with peers and adults, and narrate activities. Directed play refers to play that maintains the exploratory character of free play, while including developmentally appropriate adult scaffolding including a brief instructional engagement that aids children in mastering a specific learning goal. These researchers highlight how play in learning indicates that whether play activity is more akin to free play, supervised play, or games with a specific learning target, one important criterion is that children have agency and are encouraged rather than directed. This involves seeing children as capable individuals who should be given opportunities to express their thoughts and behavior in a social setting where others have the same rights. They agree with the Weisberg et al. (2016) framing that guided play in a structured play-based learning environment makes academic learning possible and allows students to achieve precise learning targets.

The research of Zosh et al. (2017) found that play activities are not only enjoyable but are critical learning to prepare children for academic and emotional challenges during childhood and adulthood. The fundamental structures of these skills are present from infancy and are assisted and reinforced by high-quality play experiences. They concluded that:

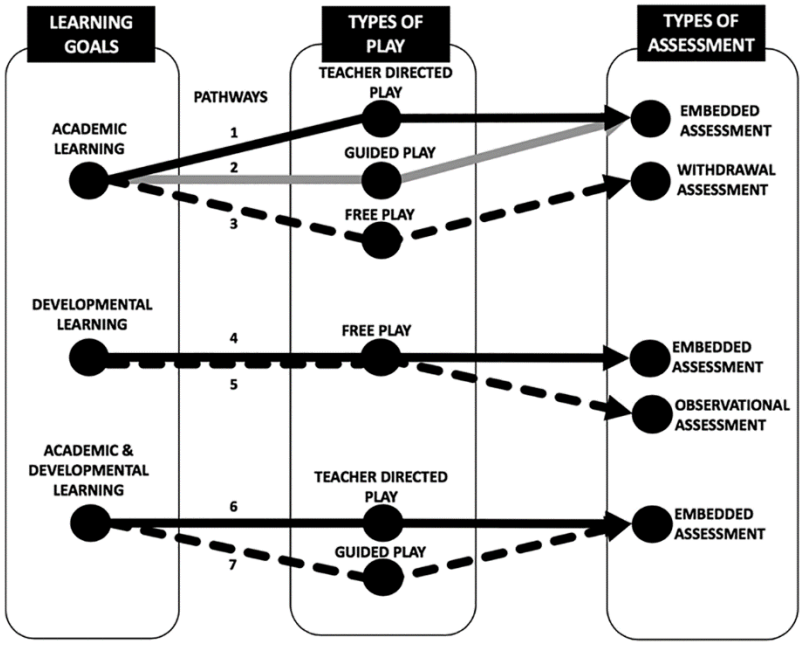
> Learning through play happens when the activity (1) is experienced as joyful, (2) helps children find meaning in what they are doing or learning, (3) involves active, engaged, minds-on thinking, (4) as well as iterative thinking (experimentation, hypothesis testing, etc.), and (5) social interaction. (p. 12)

The researchers explain that at any given time, youngsters use a wide range of talents when playing. “When playing together, children are not just having fun but are building skills of

communication and collaboration" (p. 6). They indicate that playful interactions tend to be a powerful mechanism that helps children not only be happy and safe in their lives today but also build the skills they will need to be the imaginative, committed, lifelong learners of tomorrow.

In a study of kindergarten teachers and students, Danniels and Pyle (2017) observed teachers using play separately from academics and teachers who used play as an intrinsic part of the curriculum; they were concerned about an increasing focus on academic content without play inclusion and developed a continuum of play use from student-initiated to teacher-directed that could inform early childhood use of play. In a study of the developmental and educational benefits of play, Danniels and Pyle (2017) discuss how play-based learning supports children's social and cognitive abilities and academic skills. The ability of children to negotiate and obey rules during play has been linked to the ability of children to negotiate and follow rules.

In addition to the play is so critical for everyday learning in early grades, the Pyle et al. (2020) study of 20 kindergarten classrooms verified how useful play is for assessing academic and social-emotional learning. The researchers conducted a qualitative study and interviewed teachers, observed classrooms, and conducted video analysis. They identified pathways for the assessment of early childhood skills through play pedagogy. The three learning goals for children are academic, development, and a combination of academic and developmental. The types of play that teachers can use are directed play, guided play, and free play, which are the most common. The types of assessments that teachers can use are withdrawal (taking the child out of the group to do independent play), embedded, and observational. From this, they developed seven possible ways to assess children's learning through play. Combining these types of goals, play, and assessments provides multiple ways for the teacher to observe and document student learning (see Figure 2).



Note. Pyle et al. (2020) Figure 2: Common Assessment Pathways, p. 2274

Figure 2. Teachers can use play to achieve learning goals and assess students.

In sum, playful encounters provide a unique framework for helpful and rich learning experiences (Zosh et al., 2017). A variety of play opportunities support children to fully engage - Play-based learning should be an innate part of a student's learning experience, given that children learn better when they are mentally involved and engage with materials in a meaningful way (Danniels & Pyle, 2017). Next, I discuss how play is a joyful and creative experience for children to use their imagination and interact with peers.

Play is Joyful and Creative

Playfulness, like curiosity and creativity, is a state of mind. Young children's play can be highly complex, and children's participation is motivated through relevant and exciting experiences. The play can range from free play to guided play, but the goal is the same: to fully stimulate learners' curiosity and willingness to engage in the task. Dewey (1938) outlines how important continuity or connection from one learning to the next is in learning: "[if] an experience arouses curiosity, strengthens initiative, and sets up desires and purposes that are sufficiently intense to carry a person over the dead place in the future, continuity work in a very different way. Every experience is a moving force" (p. 38).

Thus, continuity – the building blocks of learning – requires that every experience influences the way the learner processes now and the way the learner approaches future tasks. If that experience is joyful and creative, learners gain confidence in their ability to "figure things out" and how to rely on their intuitive selves to learn. Joyful and creative play supports children's motivation and engagement, social relationships, and language development.

The joy of play supports children to make sense of the experiences they encounter and is linked with learning in several ways (Zosh et al., 2017). Play is often associated with interest or motivation. If children can become intensely engaged in play, they can then manage their

learning and "tend to tackle problems that are challenging enough to be engrossing yet not totally beyond their capacities" (Clements & Sarama, 2005, p. 51). Play promotes innovation, risk-taking, and creative problem-solving in which students learn a great deal about themselves, others, and the world in which they exist (Dockett & Perry, 2007).

Zosh et al. (2017) state that "[p]romoting children's drive and motivation to learn, their ability to come up with ideas and imagine alternatives, as well as to connect with others and their surroundings in positive ways, is essential in a 21st-century reality" (p. 7). Play is categorized by the predominant emotions of interest and joy and promotes higher-order skills such as creativity. Clements and Sarama (2005) examined several studies to develop a framework for the kinds of play that children can do at different ages. They support a Bruner (1960) approach in which enactive play with objects can support problem-solving: "[I]f children play with objects before they are asked to solve problems with them, they are more successful and more creative" (p. 56).

In addition, play brings joyful experiences by allowing children to engage in socially interactive opportunities and build relationships. The socialization of playing together is highly engaging and having fun assists children in building skills of communication, collaboration, and learning from one another (Zosh et al., 2017). Dockett and Perry (2007) discuss that the framework for built understandings is provided by the social and cultural circumstances of play. These social interactions during play give children the opportunity to interact meaningfully with people who matter to them, and they foster personal respect by allowing people to offer their own perspectives and be heard.

Finally, according to Dockett and Perry (2007), these collaborative opportunities foster the development of language and a deep desire to communicate and interact with others. Play is described as a setting in which children can demonstrate their learning while assisting in the

scaffolding of others' learning. Many forms of play support inventiveness and creativity. As children play and talk to each other as they play, they test, clarify, and enact their viewpoints and understandings while encountering those of others. Social experiences within play foster shared sense-making and shared sensemaking requires language, termed intersubjectivity by Vygotsky (1978), and interaction, a key criterion of experience for Dewey (1938). Not only does the child interact with the situation or materials and this requires internal interaction, but the child interacts socially with others. According to Zosh et al. (2017) "[p]layful experiences appear to be a powerful mechanism that help children not only to be happy and healthy in their lives today but also develop the skills to be the creative, engaged, lifelong learners of tomorrow" (p. 6).

Play in Math

In considering play for math learning, both free play and guided play are useful. Free play supports the teachers in understanding student choices. By observing children in free play, the teacher can informally assess the strengths and preferences of children, and then design activities that support their learning. Oldridge (2019) defines free play as self-chosen and self-directed, intrinsically motivated by mental norms, imaginative, and generated in an active attentive but stress-free state of mind. Learning opportunities through this learning approach engage students thought process through exploration and curiosity. Another concept of play that will be discussed in this section is guided play, in which teachers facilitate learning by guiding students to engage with big and interesting ideas of mathematics (Oldridge, 2019). Next, I discuss how providing freedom while yet providing direction encourages fruitful play, which helps students better learn difficult mathematical ideas.

Free Play

During free play, which is child-directed, voluntary, internally motivated, and pleasurable, the student can explore a wide variety of mathematics, and the teacher can see how the children are constructing their ideas (Danniels & Pyle, 2017). Free play provides a rich and fascinating space to build mathematical competencies. The basis for later mathematics is laid by these daily interactions. Over time, for example, children can expand on key number sense concepts. Clements and Samara (2005) refer to this process as "mathematization". There is an understanding that children need both these foundational experiences as well as specialized experiences, and then the teacher can design guided play that fosters a sense of free play but targets foundational and conceptual mathematics. For young children, mathematical interactions should be based primarily on their play and the natural connections between learning and life in their everyday activities, desires, and questions. Play provides children with opportunities to engage in a variety of mathematical activities, which are enjoyable and effective for all children.

Children incorporate mathematics into play naturally and without being prompted. Ginsburg and Seo (1999) conducted a study of 90 four and five-year-olds from five different schools and various socio-economic and ethnic groups. In the study, 90 children from different schools were taped for 15 during free play. They observed children's play and focused on mathematical content categorized in different areas. Young children's daily activities were studied in order to learn about their spontaneous mathematical questions and interests. By "using children's spontaneous interests as a starting point and helping them—with what is called 'artful guidance' to learn about patterns and shapes, about numbers and their transformations, about symmetries, and about mathematical relations" (Ginsburg & Seo, 1999, p. 12). Ginsburg and Seo (1999) found that the total number of minutes in which mathematical activity occurred was 42%

(during the 15 minutes each child was observed). The results demonstrated that during play a considerable amount of mathematical activity took place in half of the minutes. Play served as a beneficial learning tool that supported students' understanding of patterns, and shapes, comparing magnitudes, and enumeration.

Hassinger-Das et al. (2018) highlight the empirical study of Ginsburg and Seo (1999) by recognizing the videos of 90 four- and five-year-olds engaged in 15 minutes of everyday play to determine the types of mathematics children engaged in. Hassinger-Das et al. (2018) concluded: "that learning is optimized when children are (1) mentally active in discovering new knowledge; (2) engaged (not distracted); (3) interacting with the material in ways that are meaningful; and (4) socially interactive" (p. 2). Importantly, these four characteristics come together in playful learning. In their study, they reviewed six categories of mathematical content: classification (grouping or sorting by attribute), magnitude (comparing the size of objects, such as a tower built of blocks), enumeration (saying number words, counting, subtilizing, or reading/writing numerals), dynamics (putting things together or taking things apart), patterns and shape (for example, making a necklace out of beads with a pattern), and spatial location (describing a direction or location), spatial learning. Guided play led to the greatest amount of transfer of shape knowledge to atypical shapes. By designing these experiences with specific learning goals, a child's play may be transformed into playful learning.

The study demonstrated that during the child's free play, there was some mathematical practice. Exploration of patterns and spatial forms demonstrated the most frequency during play for students from various ethnicities, socio-economic backgrounds, and genders. The study further demonstrated that during free play, the frequency of complexity levels was a level 1, the activity observed the most, for simple patterns and shapes and saying quantity and number

words, and a level 2, the second most frequently observed activity, for counting. The researchers concluded that gender and income was not a factor for overall mathematical fluency and early childhood educators must first gain a deeper understanding of children's mathematical interests, motives, and competence in order to decide what is developmentally acceptable for early mathematics education. In their play, young children engage in significant mathematical thought and reasoning, especially if they have adequate knowledge of the materials they are using if the task is understandable and encouraging, and if the setting is familiar and relaxed (Clements & Sarama, 2005). The research study of Ginsburg and Seo (1999) concluded that children's mathematics is more advanced and stronger than is commonly recognized, and children from many socioeconomic levels exhibit similar amounts, patterns, and complexities in their mathematical behavior. Drill sheets and workbook pages are insufficient for learning. In the following section, I discuss how students must participate in a variety of mathematical activities that are both interesting and demanding, and how teachers can structure guided play to support that learning.

Guided Play

Guided play activities, with some degree of adult organization and participation, support children to embed or expand learning opportunities within the play itself. Guided play can support children as they explore possibilities, construct meanings, and test these out with people who matter to them. By scripting, modeling, organizing, sequencing, representing, producing, expanding, and socializing, teachers can provide guided play activities that act as scaffolding so that students can review their understandings and experiences; these experiences are particularly important for powerful mathematics learning (Clements & Sarama, 2005; Dockett & Perry, 2017).

Play does not guarantee mathematical growth, but it does provide a wealth of opportunities (Clements & Sarama, 2005). Children's mathematical thinking has been shown to improve through various forms of play (Parks & Wager, 2014). Young children engage in significant mathematical thinking and reasoning while playing, especially if they have a clear understanding of the materials they're using and if the task is understandable. Further, if the environment is familiar with math, it can be effortlessly incorporated into children's daily activities and play. Clements and Sarama (2005) agree that games offer real and tangible problems to support students' learning.

Playing formal games with rules heightens emotion, engagement, and attention for students and allows them to process information in intervals. Games differentiate instruction and allow students at all levels to learn and participate in the task. "The more precisely that physical materials and learning activities are aligned with the desired mental representation, the more likely students are to acquire that representation" (Laski & Siegler, 2014, p. 854). When students have the opportunity to present strategies used to solve the mathematical task, they are able to make connections and apply their new learning. As students engage in the games, teachers are able to assess their learning at different stages of the process and application of skill (Hassinger-Das et al., 2018).

Play is embedded within students' everyday lives. Oldridge (2019) discusses embracing and incorporating play in a culture where mathematical ideas are more than just calculations on a page, but concepts to be debated and reasoned through. Math instruction in play goes beyond rote memorization to a broader grasp of mathematics and the problem-solving process. Play as a learning approach whether through guided play in which teachers respond to their students' thoughts and help them understand concepts or free play, which is self-chosen and self-directed,

creates open spaces for students thinking. In the next section, I discuss the impact play has on students' mathematical understanding and facilitating student engagement through ambitious math academic tasks.

Ambitious Math Academic Tasks

Ambitious math academic tasks combine curiosity, connection-making, challenge, and creativity, and usually involve collaboration. Boaler (2016) refers to these as the 5 Cs of mathematics engagement. The 5 Cs of mathematics engagement, according to Boaler (2016) should be intrinsically interesting and should encourage students to discuss the different ways of seeing problems and solving tasks. Pedaste et al. (2015) describe inquiry-based learning as an educational strategy and process of discovering new causal relations, with the learner formulating a hypothesis and testing them by solving problems through several skills. Oldrige's (2019) study discusses how ambitious math academic tasks are supported through the development of a culture in which mathematical concepts are explored and reasoned through rather than just calculations on a page. Boaler (2016), describes that in classrooms where rich mathematical tasks are evident, students go beyond practicing isolated methods and use them to solve applied problems through a conceptual approach. Traditional math instruction focuses on rote memorization. "When students think their role is not to reproduce a method but to come up with an idea, everything changes" (Boaler 2016, p. 178). According to Boaler (2016), this change impacts students' motivation and understanding, by making mathematics more complex and exciting because students are using their ideas and thoughts. This process supports children working through challenges, by encouraging children to discuss, think, reason, and wonder.

Humans are designed to play. Instilling a feeling of curiosity through this method engages kids in a playful manner. Mathematics can be codified and made true, rigorous, and

genuine by using a playful pedagogy. Math teaching can move away from rote memorization and toward a more expansive comprehension of mathematics by play. As they work through issues, play encourages students to speak, consider, reason, and wonder. Creating a sense of curiosity, even for simple concepts, engages students in a playful way. Simple techniques such as turn-and-talk can foster collaborative and playful learning. Mathematical principles can be made more enjoyable by incorporating prompts into the everyday classroom routine. Mathematical ideas can be presented visually and serve as playful.

A study, conducted by Fisher et al. (2012) demonstrates how play-based learning experiences foster children's interest, motivation, and conceptual math knowledge through 'sense-making' processes. Early learning experiences lay the foundation for future success, later academic achievement, and lifelong success. Fisher et al. (2012) research highlights that a possible reason for Albert Einstein's interest in math and ingenious advances in science was attributed to the playful experiences he had playing games and building puzzles. Fisher et al. (2012) observed rote learning and narrow curricular emphasis contributing to children's increased anxiety at school, as well as their waning interest, motivation, and academic achievement in classrooms across the country in science and math. As a result, more instructional activities in early childhood must foster curiosity and mathematical competencies in ways that will aid later academic achievement and lifelong success. Playing with blocks, solving word problems, constructing houses out of cards, reading books, and conversing are all activities that children enjoy, which support their mathematical knowledge.

Fisher et al. (2012) argue that a playful learning style fosters mathematical thought in the best early learning settings. According to Fisher et al. (2012), playful learning experiences are intrinsically valuable, based on developmental theory and learning sciences studies. Play

motivates children and allows them to improve their conceptual and procedural math knowledge through meaningful participation and 'sense-making' processes. A study conducted by Laski and Siegler (2014) focused on the impact number board games have on students learning to encode. The study researchers emphasized that linear board games improved the knowledge of numerical magnitudes and other numerical skills in preschoolers. The rationale behind this study is that the type of counting used during games affects the encoding of numerical-spatial relationships. Therefore, students are more likely to acquire the ideal mental representation of physical materials and learning experiences are more specifically associated with it.

Pedagogical Play in Math

Direct instruction dominates mathematics teaching and only 27% of U.S. students participate in advanced mathematical thought and reasoning (Fisher et al., 2012). The National Mathematics Advisory Panel (2008) released a systematic report warning that American children are failing to develop the mathematical skills needed to succeed in the twenty-first century. Fisher et al. (2012) suggest that in order to encourage later academic achievement and lifelong progress, further educational activities must foster interest and mathematical competencies in early childhood. “Play, in particular, represents a medium for promoting interest and mathematical thinking in a developmentally appropriate manner” (Fisher et al., 2012, p. 3). Playful learning is a constructivist approach to learning that encourages academic, socio-emotional, and cognitive competencies, and maybe the most effective pedagogy (Fisher et al., 2012). Playful learning goes beyond conventional teaching approaches and encourages mathematical reasoning, procedural fluency, and interest.

A Fisher et al. (2012) study of comparative programs revealed significant conclusions about mastery of material, long-term retention, and academic motivation, playful learning

programs increase mathematical competencies beyond those gained in typical, academically focused programs. A longitudinal study by Marcon (1993) found that children who were exposed to playful, child-centered preschool environments at the age of four had improved academic success in mathematics and other academic subjects, as well as higher intrinsic motivation, than children who were not. Children must participate in individually meaningful experiences that promote the learning process in order to understand mathematics—and to use it in meaningful ways. Play, in particular, represents a developmentally suitable medium for fostering curiosity and mathematical thought (Fisher et al., 2012). They believe that children naturally integrate math concepts such as calculating how many blocks are present during free play or when required to build the world's tallest skyscraper or converting the number on the die to Chutes and Ladders. According to Clements and Sarama (2005) low-income preschoolers who participated in Building Blocks, a play-based learning program, made significantly more year-end advances in math concepts and skills, such as counting, sequencing, and arithmetic; compared to their peers, who had other educational experiences. Students also performed better in computation and geometry.

Play supports multiple elements of mathematical thinking. Fisher et al. (2012) describe the types of play. Free play encompasses a broad range of activities initiated by children, such as object play, pretend and sociodramatic play, sports, and rough-and-tumble play. Guided play is a form of exploration learning that falls somewhere between didactic guidance and free play. During this type of learning opportunity, the instructor facilitates the development and comprehension of mathematical concepts during supervised play while maintaining the child's autonomy and control over the learning process.

Oldridge (2019) discusses how guided play allows students to have flexibility but teachers still provide guidance that allows for constructive play to better understand complex mathematical concepts. Through guided play, students may follow various learning paths in order to achieve the same curricular goal. Further Oldridge (2019) states that driven play is a complex, ever-evolving learning process in which both the teacher and the child actively participate. While directed play is a structured and teacher-facilitated activity, it is also child-centered, allowing the child to make decisions. As students work through directed play choices, decisions, and mistakes offer the ability to participate at their own speed and developmental level. Supervised play helps children build the cognitive skills they need to become independent thinkers and mathematical problem solvers in a secure, social setting. According to the study conducted by Ginsburg et al. (2001) observational studies children spend a significant amount of self-directed, free play time discovering and practicing math concepts. Ginsburg et al. (2001) looked at the frequency of mathematic-related behaviors during the free play time of four- and five-year-old children in daycare. They observed that children participated in a number of activities throughout this period, and it was discovered that mathematical reasoning activities accounted for over half of their playtime: 25% was spent analyzing patterns and forms, 13% on magnitude comparisons, 12% on enumeration, 6% on dynamic change, 5% on spatial relations (e.g., height, distance, and location), and 2% on classifying objects. Free play, according to the findings, provides a rich opportunity for children to practice and develop their foundational math and spatial skills.

Fisher et al. (2012) claim that mathematical thinking evolves over time as a result of the complex interaction of procedural skills, conceptual understanding, and basic cognitive

competencies. Playful pedagogy provides a blueprint for better preparing students to be lifelong learners who will join a world that increasingly values global, socially conscious, and innovative thinkers (Golingkoff & Hirsh-Pasek, 2009).

Math Inquiry

The primary job of the mathematics teacher should be to provide numerous chances for children to reflect on and extend the mathematics that occurs in their daily activities, and conversations, as well as to structure environments that encourage such activities (Clements & Sarama, 2005). An inquiry-based mathematics curriculum can be thought of as an effort to find difficult mathematics in order to improve student knowledge of how to recognize and problematize mathematical patterns and relationships, as well as the intended mathematical generalizations (McLennan, 2014). He states "Preschool classrooms also celebrate curiosity and risk-taking as children engage in inquiry-based exploration at various learning centers and outdoors. Interesting items in the environment encourage children to find answers to their questions and solve problems across all curricular domains" (p. 2).

Fisher et al. (2012) site active, engaging experiences that encourage mathematical 'meaning making' and conceptual understanding to pique children's interest. Further, they believe that teachers can help children make sense of what they're learning by using a variety of socio-cognitive scaffolding techniques, such as commenting on their discoveries, interacting and playing with them, asking open-ended questions about what they're learning, suggesting new ways to explore and play with the materials that they might not have considered, or creating games. One of the cornerstones of play-based learning is the teacher's participation in the game, which includes asking questions and contributing information and perspective.

Education can promote intellectual awareness through child-centered and inquiry-based interactions. This viewpoint assumes that children look for meaning in everything they do and consciously construct their awareness (Fisher et al., 2012). Increases in mathematical knowledge and achievement have been connected to the frequency and difficulty of math-related games. Incorporating math-related resources into a child's early free-play environments has also been shown to encourage math-related behaviors. Through an inquiry-based approach, children should be encouraged to discuss their discoveries and experiences in order to facilitate learning. At group time, teachers might construct a routine in which students share their experiences. Fisher et al. (2012) research has shown that in mastery of knowledge, long-term retention, and academic achievement, playful learning programs inspire and encourage mathematical competencies beyond those attained in conventional, academically based programs.

In Lasik and Siegler's (2014) study they discuss how games such as Chutes and Ladders enable correlations between numerals and the magnitudes they represent to be computed. Furthermore, preschoolers of low-income families benefit from playing a linear number board game by learning the magnitude of the numbers 0-10. The study consisted of 42 kindergartners, 42% were African American, 52% Caucasian, and 7% other. Students attended two different charter schools and were from low to lower-middle-income families. The researchers explored the benefits of playing numerical board games, identifying aspects of the number board game that promote learning, and how changes in numerical knowledge occur while playing board games. The study focused on counting from 1 or counting on. The researchers concluded that counting-on while moving a token in a numerical board game facilitates greater encoding of numerals' spatial positions and, as a result, greater learning about numerical magnitudes. The counting on skill resulted in gains in number line estimation and encoding of the game board's

structure that were approximately twice as high as gains achieved by children who counted from 1 while playing the game (Lasik & Siegler, 2014).

Mathematics can be thought of as a way of thinking rather than a collection of facts and procedures to be memorized leading to a better understanding of the basic cognitive skills that underpin math. McLennan (2014) describes playful learning opportunities, as those that allow children to consciously interact with and explore content, reason for what they see and do, think flexibly, try out new ideas, and symbolize the world around them. Play helps children learn about math in ways that aren't limited to procedural skills and facts. "Inquiry-based learning aspires to engage students in an authentic scientific discovery process" (Pedaste et al., 2015, p. 48). Play as a pedagogy serves as an inquiry-based exploration in which curiosity and risk-taking are celebrated. Through this exploration children see themselves as capable mathematicians (McLennan, 2014).

Culturally and Linguistically Responsive Pedagogy

Hollie (2018) believes that culturally and linguistically responsive teaching and learning consists of fostering student engagement in learning activities. "The authenticity and relevance of the term are steeped in transforming instructional practices to make the difference for improving relationships between students and educators and increasing student achievement" (p. 21). Gellert (2012) discusses that the opportunities perceived by students in their particular social, political, and cultural situations must be addressed in mathematics education. These prepare students from marginalized communities to view the world in a positive light as active participants rather than victims of the social circumstances in which they find themselves (Gellert, 2012). For different cultural and social groups, different types of mathematical knowledge and different mathematical pedagogies may be required to gain personal, social,

political, and other control by acting mathematically and reflecting on the use of mathematics both within and outside the classroom.

Tanase's study (2020) discusses how culturally responsive teaching impacts students' mathematical knowledge. The study focused on twenty-two teachers and their implementation of culturally relevant teaching (CRT) in their middle and high school classrooms. CRT in the area of math and science included the following student-centered strategies: discovery learning, in which students learn hands-on working on real-world problems, center and group work, which facilitates collaborative learning among students, and incorporating games to promote fun and engaging learning. The strategies emphasized are those that are embedded in play-based learning opportunities and further demonstrate how play allows students to be active and engaged participants in their learning.

Hammond (2015) defines culturally responsive teaching as a teacher's ability to understand students' cultural displays of learning and sense-making and react positively and constructively with teaching strategies that use cultural awareness as a scaffold to relate what the student already knows to new concepts and content in order to facilitate successful information processing. Hammond (2015) believes that "the educator understands the importance of being in a relationship and having a social-emotional connection to the student in order to create a safe space for learning" (p. 15). Neri et al. (2019) define culturally relevant education as

> pedagogies that make effective use of the racial, ethnic, linguistic, and cultural assets that students bring to school. Practical pedagogies involve utilizing a constructivist method, which bridges students' cultural references to academic skills, engages students in critical reflection, facilitates cultural competence, in which students learn about their own culture

> and other cultures represented, and pedagogy in which teachers unmask and unmake oppressive systems. (p. 198)

Next, I highlight strategies that incorporate CLRP and align with play-based pedagogy.

Strategies such as talk to learn are embedded in playful learning which engages students and allows them to acquire the mental capacity for processing information. Hammond (2015) states that this practice is culturally responsive in that it is rooted in oral cultural tradition allows students to work collaboratively and recognizes student's voices. Word play is another strategy that is incorporated within playful learning opportunities, which assists students with information processing in relevant and meaningful ways. Hammond (2015) discusses how playing games is beneficial to implement in order to review and rehearse concepts taught. Playing games for this purpose forces the learner to scan their memory for knowledge, the act of playing the game stimulates the brain to strengthen new neural pathways.

Culturally responsive information processing in math should be relevant to student's everyday life. Hammond's (2015) example of a 6th-grade teacher demonstrates the impact games have on learning. The teacher, after researching culturally focused information processing methods, used games based on communication and teamwork in class to help students learn vocabulary for the week's unit and commit it to their long-term memory. Students worked and processed in new ways as a result of the vocabulary games. The teacher found that by the end of the unit, they had a better conceptual understanding of the lesson and that their class discussions were more interesting because they had used the vocabulary more often. From Hammond's (2015) perspective, the goal of educators is to find ways to tap into students' reservoirs of information and to comprehend their home-based learning styles as a springboard for creating more authentic learning experiences.

Next, I discuss how adult learning for math instruction and changes in practices that incorporate play will support the growth of students with mathematical understanding. I discuss how incorporating professional development opportunities assists adults in learning the benefits of pedagogical play and utilizing these instructional practices to enhance professional growth, and promote student engagement and learning within mathematics.

Professional Development

Effective professional development is defined as systematic professional learning that leads to changes in teacher practices and student learning outcomes (Darling-Hammond et al., 2017). The authors believe that "teacher professional learning is of increasing interest as a critical way to support the increasingly complex skills students need to learn in order to succeed in the 21st century" (p. v). Creating conditions for effective professional development and learning opportunities for adults is key and includes these key criteria -- is content-centered, uses adult learning theory to incorporate constructive learning, supports collaboration, models' good practice, offers coaching and consultation with experts, provides feedback and reflection of concepts learned, and is long-term in nature. The professional learning opportunities offered during the PAR incorporated these conditions for teachers to reflect upon their practice, collaborate with their colleagues, and highlight strengths while building teachers' capacity to view play pedagogy as a valuable learning method. Professional learning allowed teachers to observe play pedagogy in practice and partake in learning activities that developed and supported their understanding.

Next, I examine effective professional learning processes, including the essential role of relational trust in working with teachers to collectively understand how to improve classroom

practice to enhance student outcomes in classrooms. I discuss how to cultivate adult learning opportunities in which teachers learn with and from each other to improve practice.

Relational Trust

Ford (2010) discusses that an adequate foundation of trust can provide a fertile ground for collaboration among colleagues who have previously been isolated from one another, as well as facilitate conversations and critical dialogue about instructional reform that allow teachers to push each other to make significant improvements in their practice. These processes can help create trust in peer relationships. Bryk et al. (2015) explore how to use networked improvement communities (NIC) to impact adult learning and identify four essential characteristics of a NIC in their research: a shared goal; a deep understanding of why the problem exists, the systems that produce it, and educational theory to support change; and systematically developing, testing, and refining interventions and sharing results with the school and educational community. Physical comfort, mutual trust and respect, reciprocal helpfulness, freedom of expression, and acceptance of differences define the learning environment (Knowles, 1980). For purposes of the PAR teachers served as co- practitioner researchers to support the FoP. The PAR study expanded the capacity of teachers as leaders as they created learning and collaboration opportunities for their colleagues, based on actions put in place.

Guajardo et al. (2016) state that relationships are key in establishing trust which in return builds a community. The Community Learning Exchange (CLE) theory of change emphasizes that trust leads to action (Guajardo et al., 2016). According to Guajardo et al. (2016), creating a gracious space establishes an environment that encourages deeper listening and understanding and expands the connection beyond the realms of investment and trust. From the development of the PAR study and throughout establishing, building, and monitoring relational trust was a key

factor. This work included the participation of storytelling in which members had the opportunity to share their assets and align their beliefs and values with the FoP which in return led to action to improve teacher practice. Safir (2017) discusses that an ethical leader and transformative agent who slows down and listens to others' experiences as they share their vulnerabilities regarding issues that concern them—and then continues to create trust by making an honest attempt to genuinely grasp the challenges.

Adult Learning

Drago-Severson (2011) states that designing learning environments takes careful consideration to support growth, which consists of intrapersonal, interpersonal, cognitive, emotional, or affective. This work is established by creating learning conditions, in which participants learn about the content, learn through interacting with one another, and learn from the learning process itself. PD that engages teachers in learning activities that are supportive, job-embedded, instructionally oriented, collaborative, and continuing is considered successful professional development (Hunzicker, 2011). Creating these adult learning conditions increases the likelihood of teacher learning and improved teaching practice.

Collaboration is an important component of well-designed PD because it supports schoolwide continuity of practices and allows teachers opportunities to learn from professionals beyond the school (Darling-Hammond, 2017). These learning opportunities were part of the PAR study by creating situations in which teachers shared the impact play pedagogy had on student achievement and how play spiraled through the grades, which allowed teachers to problem-solve and learn together. Another component implemented during PD was modeling play pedagogy strategies such as demonstrating lessons that align with curriculum materials and standards. Teachers analyzed student work samples and written cases of teaching and observations. As

learners interact with and teach each other, teachers can promote high-quality peer learning (The National Academy of Science Engineering Medicine, 2018).

In order to support adults' understanding and intent to change instructional practices, professional development should consist of opportunities for teachers to reflect on their practices, collaborate with colleagues share ideas, and organize classroom environments and activities that promote student interaction and engagement. Teachers need time and space to analyze and deconstruct lesson plans and intentionally create lessons based on the analysis that will target specific learning goals. Bryk et al. (2015) state that adult learning focuses on what is aimed to be achieved, the changes made, and the reasons and evidence that will show that a change is indeed a good thing. Making explicit hypotheses about change, testing these hypotheses against data, updating change ideas based on what is learned from such tests, and testing again are all part of this process. Improvement necessitates going through this process several times. The PAR study provided teachers with the time and capacity to analyze techniques implemented to support play pedagogy and adjust through an ongoing process. PD created for staff included intentional activities for teachers to reflect upon their own learning styles and learning experiences by engaging in creating journey lines and establishing an intent for their professional growth.

Drago-Severson (2011) states that a learning model should encompass "developmental intentionality," which takes learners' needs and input into consideration. Adults with varied ways of understanding their experiences might grow and learn through reframing activities. The PD offered during the PAR study, varied in learning opportunities, and highlighted the relevance of play in teacher practice, by allowing CPR to share their FOP work while building their leadership capacity. PD consisted of CPR and other teachers to learn together, from one other,

and for each other. Stipek (2017) states when reviewing adult learning for instruction, teachers need to be given more opportunities to collaborate with colleagues to create their own activities based on learning trajectories and expectations. The idea that learning is an internal process has a significant relevance for adult education practice: approaches and procedures that engage the individual most profoundly in self-directed inquiry will create the most learning (Knowles, 1970). Adult educators must first and foremost be aware of the existential issues of the people and organizations they serve and be able to provide learning experiences that address these concerns (Knowles, 1970). Bryk (2017) describes improvement in instruction as consisting of teachers working towards solving a shared problem. Through the PDs provided during the PAR research teachers were presented with new approaches that were integrated into instruction to increase student outcomes. Teachers' expertise, values, and experience are the most important indicators of their professional growth (Zehetmeier, 2012). People value learning gained through experience more than learning acquired passively (Knowles, 1970). The National Academies of Sciences Engineering Medicine (2018) that "learning is supported by an array of cognitive processes that must be coordinated for successful learning to occur" (p. 69).

Adult learning and effective teacher professional development are instrumental in supporting student competencies. Hammond et al. (2017) state that teachers need to learn and refine pedagogies for improvements in student learning outcomes. Through establishing relational trust, adult learning should consist of a focused area of study, incorporate engagement and active learning, support collaboration, and use models of effective practice that teachers can apply in their instructional practices, provide coaching, and support reflection and feedback. Creating conditions that enhance professional growth supports teacher investment in the work by relating it to their understanding and knowledge. Professional development needs to include a

safe space in which teachers are supported in meaning-making systems that encourage teachers to develop co-construction of knowledge through ongoing collaboration and practice.

Conclusion

In this chapter, I shared how play-based learning, embedded within the instructional program, provides children with learning opportunities in which intelligence is gained through action and children are able to learn by doing. During play, children assimilate new situations by figuring out how any new knowledge fits with what is already understood and is grounded in the child's cultural background (First Discoverers, 2020). Teacher's instructional practice should include engaging students to participate as active learners that construct their own knowledge and facilitate learning in which a child's problem-solving and thinking skills can subsequently be applied to a variety of scenarios (McLeod, 2019). Teacher professional development should include building teacher capacity to create learning situations for students that incorporate appropriate instruction together with practice or experience. In Chapter 3, I provide a detailed overview of the PAR study and research design.

CHAPTER 3: RESEARCH DESIGN

In the participatory action research (PAR) study, I concentrated on this Focus of Practice (FoP): the integration of play in math curriculum and instruction. The theory of action is: *If teachers develop a mathematical program integrating play pedagogy, then teacher capacity will expand to support the implementation of play in math instruction*. Our long-term goal is schoolwide use of play in mathematics; however, we began with a small group of three teachers and, by the conclusion of the study, were ready to share our learning with the full staff. We analyzed the current math instructional program and designed play opportunities that supported classroom instruction at their grade levels. I collected and analyzed data, including observations in math classes, to understand the extent to which play is integrated into the lessons. Finally, we intend to share our processes with other teachers in the school so the play-based learning can be replicated in other grade levels and the practices we developed could be used in the entire school.

The PAR took place at Olinda Elementary in the West Contra Costa Unified School District in El Sobrante California. Olinda is an ethnically diverse community-oriented school of 24% Asian, 28% Hispanic/Latinx, 19% White, 13% Black/African American, and 8% Filipino; 36% of our students qualify for the free and reduced lunch program. The reputation of Olinda as a rigorous academic school with a diverse student population has consistently made it a popular choice for parents who are concerned with education options. In the past six years, our enrollment has grown from 302 students to 380 students.

In this chapter, I discuss the research methodology for the PAR study. First, I describe the qualitative research process for the study, the cycles of action research, and the research questions for the study. Then I explain the data collection and analysis and conclude with the study limitations, validity, confidentiality, and ethics.

Qualitative Research Design

Qualitative research is an approach to exploring and understanding the meaning that individuals or groups ascribe to a social or human problem (Creswell &Creswell 2018). In this PAR study, I sought to understand how teachers can consistently integrate play into math instruction as a means of creating more equitable access for students**.** I designed the PAR project and study to foster teacher collaboration and engage teachers in conversations about how play can support the development of instructional practices that enhance students' mathematical thinking. Next, I describe action research and the role that activist action research plays in this study. Then, I explain how the use of improvement science processes of iterative cycles of inquiry supported our work and how community learning exchange processes will enhance our ability to learn together.

Participatory Action Research

Creswell and Guetterman (2019) define participatory action research (PAR) as a focus on investigating a practical issue of the participants with the goal of developing an action plan toward a solution. Participatory action research is a collaborative and reflective approach centered on a specific action or cycle of actions that members of an organization or community have taken, are taking, or wish to take to address a specific problem solution (Anderson & Herr, 2014). PAR studies make use of inquiry through research cycles to collect and analyze data, reflect on practice, and continue with the action while observing the impact of the study (Anderson & Herr, 2014). Participants in PAR studies will include those who are closest to the issue to engage in learning by doing (Bruner, 1960; hunter, et al., 2013). Initially, I invited three teachers to participate, and they were directly involved in the process as a means to improvement; I depended on these three teachers to participate as a co-practitioner researchers

(CPR) group, and they provided feedback on the data that I collected and analyzed so that we could collaboratively plan for improvement. During the research cycles, participants engaged in the project implementation and study (hunter et al., 2013). This ongoing engagement and monitoring of the study supported reflection opportunities and appropriate adjustments as needed moving forward.

As described in the literature review, play-based learning should be an integral part of student learning experiences, given that children learn better when they are mentally involved and engaged with materials in a meaningful way (Danniels & Pyle, 2016). I collaborated with teachers to design learning experiences that integrated play as pedagogy into the math curriculum. Teachers, who are closest to the issue, brought insights and expertise to this research. Further, the study supported the cultivation of my skills as an instructional leader as I worked with teachers to develop a math program that more fully integrated play. I intended to support the integration of play into the curriculum by coaching teachers and facilitating professional development. By the final cycle of inquiry, I projected that the teachers in the CPR group could support other teachers in the building.

In addition, I designed this as an activist participatory action research project that focused on actions for social change (hunter et al., 2013). Through the integration of play as pedagogy in math instruction, the social change that took place was a transformation of how math is taught with the intention that the learning experiences in classrooms are equitable for all learners (NCTM, 2012). The qualitative study focused on improvement by assisting teachers in developing their knowledge, skills, and attitudes in using play as a learning approach in math curriculum and instruction. This design of math instruction was for students to use play as a way to provide access and rigor in math instruction (Boykin & Noguera, 2011). The PAR study

focused on equity by adding implicit learning possibilities such as engaging students in play-based learning to assist and expand their comprehension of mathematical concepts and demonstrate their depth of knowledge.

Improvement Science

In the PAR study, I addressed instructional practices and supported teachers to incorporate play as a pedagogy. First, we used improvement science processes to address play within the instructional math program. We focused on the positive impact play-based learning has in supporting students' mathematical acquisition, skills, and conceptual understanding. We used the Bryk et al. (2015) PDSA (Plan-Do-Study-Act) cycles of inquiry to iteratively examine how to improve instructional practices in the math program. According to Bryk (2015) "the Plan-Do-Study-Act (PDSA) cycle-is an inquiry process in improvement research that guides rapid learning" (p. 121). The teachers and I engaged in three cycles of inquiry. These opportunities allowed me to monitor and reflect upon the ongoing work of the PAR implementation. The ongoing discussions encompassed analyzing and addressing the lack of play opportunities students have within the teaching and learning of the math program.

Community Learning Exchange (CLE)

Building community through a philosophy of relationship building, change, and action underlies the CLE work and foreshadows a community-building approach that moves away from deficit thinking (Guajardo et al., 2016). I used the CLE methodology for this PAR study to engage community members to participate in deep learning and openly discuss common concerns in order to effect change. First, I used the CLE processes at the small meetings with the three teachers who are in the CPR group. These five CLE axioms support our approach to the work of action and activist research: (1) learning and leading are dynamic social processes (2)

conversations are critical and central pedagogical processes (3) the people closest to the issues are best situated to discover answers to local concerns (4) crossing boundaries enriches the development and educational processes (5) hope and change are built on the assets and dreams of locals and their communities (Guajardo et al., 2016, pp. 24-27).

At the CPR meetings, participants shared personal narratives and engaged in circle meetings to establish relational trust and share experiences. I captured the dialogue and discussion and used the analysis of the field notes to guide the context of the study. Participants engaged in inquiry to present perspectives and reflected on the implementation, suggested next steps, and made informed decisions about improvement based on reflecting on the evidence I collected and analyzed. The engagement in dialogue of participants was consistent with the work of Freire (2010). "In this meeting, they explain the reason for the investigation, how it is to be carried out, and to what use it will be put; they further explain that the investigation will be impossible without a relation of mutual understanding and trust" (p. 110).

The improvement science and community learning exchange processes augmented the participatory action and activist research design. Through a focused use of these processes over time, we expected to iteratively use evidence to inform the next steps that helped me answer the research questions.

Role of Praxis

The CPR group and other participants used reflection to drive their actions. The process of reflection allowed for deep conversations designed to lead to action that transforms teacher practices. According to Freire (1970), this process of praxis is a deeper reflection that depends on the generative dialogue of the persons who are engaged in the change. Specifically, praxis is the process of reflecting and acting to enact social change. This systematic form of praxis allows

participants to work together to make a difference and supports activist action research processes (hunter et al., 2013). During the PAR, participants thoroughly examine their education practices and carefully address the focus of practice (Anderson & Herr, 2015). Reflections were documented with artifacts produced through active pedagogy, memos, observation notes, and reflections.

Research Questions

Throughout the action research cycles, teachers incorporated play within instruction. As a result, the teachers supported students in play engagement to bolster their engagement and understanding of math concepts. The overarching research question was: *How do teachers fully incorporate play-based learning into the math curriculum program?* These sub-questions guided the research:

1. To what extent do teachers design math lessons that include play pedagogy?
2. To what extent do teachers implement play pedagogy in their instructional practices?
3. How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?

Through three cycles of inquiry, I used data to support the responses to the questions.

Action Research Cycles

The PAR occurred in three iterative action research cycles (Bryk et al., 2015). Pedaste et al. (2015) define inquiry-based learning as the process of learning new causal relationships; the learner creates hypotheses and puts them to the test through experiments and/or observations. "Inquiry-based learning emphasizes active participation and learner's responsibility for discovering knowledge that is new to the learner" (p. 48). I collected and analyzed data within

each PAR cycle and emphasized how we build knowledge and skills over time to experiment with play in the math curriculum (see Table 2).

In the Bryk et al. (2015) framing, a cycle begins with someone posing a question about the work in relation to the school's vision of teaching and learning and then identifying possible sources of information that could assist in answering it. The next step is to collect and analyze pertinent data, reflect, and then choose the next steps that are based on evidence. Finally, that analysis leads to new action, which leads to more research into the findings, and the cycle. repeats again.

As part of the PAR process, I took inventory of what our current math program offered, assessing the strengths and areas of growth. Upon completion of the review, I shared the analysis and worked with teachers to design play activities that align and support grade-level standards during the Pre-Cycle. The next step during PAR Cycle One focused on the implementation process; teachers engaged students in play during math instruction. During this inquiry cycle, I supported the integration of play and collected evidence through classroom observations that included reflection and post-observation conversations to plan the next steps. As the CPR teachers reflected on the work, we adjusted and accommodated accordingly, which assisted in the co-design of professional development learning. We determined, based on the process of the PAR cycles, when it would be best and possible to engage other teachers.

Participants, Data Collection, and Analysis

Next, I discuss the CPR participants who engaged in the PAR study. During the PAR cycles, I collected and analyzed data, and then shared that analysis with the CPR teachers. Then, I discuss the data I collected and analyzed related to the PAR research questions.

Table 2

PAR Research Cycles

Research Cycle	Major Activities
PAR Pre-Cycle and Context October- November 15, 2021	Analyze current math curriculum Engage teachers in math activities Design play activities for the curriculum Interview teachers Use CLE practices for CPR meetings
PAR Cycle One November 16-April 15, 2022	Implement the play activities at two grade levels Co-design observation tool incorporating play elements Conduct Classroom Observations Interview teachers Use CLE practices for CPR meetings
PAR Cycle Two April 16, 2022- October 15, 2022	Continue PAR Cycle Two activities for CPR Develop professional development opportunities that will support the integration of play within the school-wide math program Facilitate CLE for school staff

Participants

The participants who engaged in the research study were three teachers who served as the co-practitioner researcher (CPR) group (n=3). Participants provided evidence in cycles of inquiry to determine the extent to which teachers design and implement play in the math curriculum. All participants signed informed consent forms and knew they could opt out of the study at any time (see Appendix D).

Co-Practitioner Researcher Group

A co-practitioner researcher (CPR) group operates similarly to a school-based networked improvement community in the improvement science structure (Bryk et al., 2015). That group consists of participants who have a shared understanding of a problem or challenge they are attempting to address. "As these conversations begin, it is natural for participants to see current operations through the lens of their own particular work and to interpret events based on personal experiences and belief" (Bryk et al., 2015, p. 66). The major criterion for inviting members of the co-practitioner researcher (CPR) group was that they shared a willingness and were interested in learning to incorporate play into the math curriculum and instruction. Through inquiry, the CPR group engaged in shared experiences and a collaborative effort with me, as the lead researcher, to integrate play pedagogy in math instruction. After the collaborative work of the CPR in the Pre-Cycle and PAR Cycle One, we expected to support site-based professional learning in a community learning exchange that would provide other teachers with models for integrating play into math learning experiences.

I selected CPR participants based on purposeful sampling. Patton (1990) states that "the logic and power of purposeful sampling lies in selecting information-rich cases for in-depth study" (p. 199). The participants I selected for the CPR were teachers who demonstrated an

interest in and willingness to incorporate play as a pedagogy within their math programs and had served as lead teachers in some capacity. They provided information and in-depth detail over time so that we could understand deeply how to integrate play into the math curriculum.

I expected that the first responsibility of the proposed CPR group would be to build our expertise in integrating play into math instruction and programs. As a result, the CPR members and I co-designed lessons that incorporated play pedagogy in inquiry-based math instruction and implemented those lessons. Then, I facilitated collaborative conversations to assist with grade-level alignment and supported how the teachers could start to incorporate play into the math curriculum. As we shared ideas and perspectives on play integration among teachers, the collaboration offered opportunities for participants to learn from one another and develop their instructional practices. "Participants in an improvement network form a colleagueship of expertise – academic, technical, and clinical – deliberately assembled to address specific problems" (Bryk et al., 2015, p. 9). I expected that teachers would then be a source of evidence to see if transfer was occurring within classroom instruction. The goal of the study was for teachers at the school to collaborate to bring more play into mathematical instruction. The core group experimented with the processes and supported their colleagues to use the practices.

Data Collection

Emerging questions and processes are part of the research process as are the data acquired in the participants' environment. I collected and analyzed data to understand how teachers integrated play into the math curriculum. I collected and analyzed evidence from CLE artifacts (CPR meetings), interviews with teachers in the CPR, documentation from meeting notes and agendas, observations, and reflective memos that I wrote regularly. I worked with the teachers to identify play opportunities that could be embedded into math instruction and support

the math standards. The CPR group focused on the alignment of math units with particular games that support play as instruction and guide students' mathematical thinking. Then, the CPR group designed lessons and engaged in conversations that included play. To deepen and strengthen the observations, the CPR co-developed an observation tool that acknowledged fully integrated play as a meaningful learning strategy. By using the observation tool, teachers engaged in dialogue with the principal about the patterns that were evident in instructional practices and had conversations based on data from observation sessions. Later, I anticipated that the work of the PAR would be transferred to professional development opportunities in which other teachers would collaborate with one another and share play-based learning strategies across grade levels.

Data Analysis

Data analysis builds inductively from specifics to broad themes as the researcher iteratively codes, analyzes, and interprets data (Creswell & Creswell, 2018; Saldaña, 2016). I applied a five-step process to analyze data collected during the PAR (Creswell & Creswell, 2018): (a) organizing and preparing the data, (b) reviewing all the data presented, (c) coding the data, (d) generating descriptions and themes, and (e) making assertions or claims based the data. In this case, I relied on Saldaña's coding and analysis process for the initial data I coded in the Pre-Cycle; in that cycle of inquiry, for step three, I developed categories and designed a codebook based on those categories. I did not make assertions or claims until the final PAR cycle. In PAR Cycle One, I continued to collect and analyze data and used the codes I had developed and any new codes that emerged to analyze the data for emergent themes. Finally, in PAR Cycle Two, I repeated this process and expected to determine findings from the PAR study. Saldaña (2016) discusses that coding is based on prior knowledge and strong coding strategies

can remove subjectivities from the process. As I collected data and established categories and subcategories, I engaged in iterative analysis to develop categories, emergent themes, and finally, assertions or findings. I believed this process would culminate in redefining the theory OF action to a theory IN action. In Table 3, I present the data sources and triangulation associated with the PAR research questions.

A key part of the data analysis is member checks. Member checking served as a quality control tool that allowed the researcher to improve the study's accuracy, credibility, and validity. Conn and Gerdes (2001) describe member checking "as opportunities for participants to clarify their comments and checking for understanding" (p. 187). To determine the accuracy of the obtained data, the researcher shares the analysis with CPR members to determine the accuracy which consists of a means of participant certification.

CLE Artifacts

As part of the PAR process, I utilized community learning exchange (CLE) practices and protocols. CLE produces deep, meaningful relationships that foster growth through lived experiences (Guajardo et al., 2016). I utilized CLE protocols to develop deeper relationships among staff as they considered cultivating their math instructional practices to include play-based learning experiences. The CLE aligned well with the goals of the FoP, seeking to include teacher voice as we adopted new practices in math instruction. To promote authentic engagement in the CLE, I used dynamic pedagogies to support analysis and reflection, including circle conversations, appreciative listening, and journey lines (Guajardo et al., 2016). These artifacts helped me to collect data from the CPR team as we moved through the cycles of inquiry.

Table 3

Research Questions and Data Sources

Overarching Question: *How do teachers fully incorporate play-based learning into the math curriculum program?*

Research Questions	Data Sources	Triangulated With…
To what extent do teachers design math lessons that include play pedagogy?	CLE artifacts Interviews Documents	Reflective memos Member Checks
To what extent do teachers implement play pedagogy in their instructional practices?	Observations Conversation Protocol Documents CLE Artifacts Interviews	Reflective memos Member Checks
How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?	Documents CLE Artifacts Reflective memos	Interviews Member Checks

Reflective Memos

Reflective memos serve as data and make connections between my work and the social world I am learning about (Kolb, 1984; Saldaña, 2016). I utilized reflective memos to document my feelings, thoughts, and interpretations throughout the PAR study. Memos provided data points that justified changes and adjustments that needed to be made for the PAR study. The reflective memos aligned with the qualitative data supporting the evidence for the PAR study and were a source of triangulation for research questions 1-3 and a primary source of data for research question 4 about my leadership growth.

Classroom Observations

In qualitative research, observations are a common method of gathering data. Classroom observations provide a firsthand account of the scenario under investigation and enable a comprehensive analysis of the phenomenon under investigation (Merriam, 1998). Observations will demonstrate how teachers incorporate play into classroom practice. Based on using selective verbatim for collecting data for classroom observations, I will then code the observations (Acheson & Gall, 2003). "Coding is not just labeling, it is linking: It leads you from data to the idea and from the idea to all the data pertaining to that idea" (Saldana, 2016, p. 9). I used a format to conduct initial classroom observations collected data and worked with teachers to co-co-develop codes that reflected the research on play in math (see Appendix E).

Documents

Documents included meeting notes, field notes, and agendas. CPR members reviewed the current curriculum and standards to address how play could be incorporated into instructional practices. Evidence of meeting agendas and notes and field notes provided documentation of the ongoing work and process the CPR ensued and captured the discussions that took place.

Study Considerations: Limitations, Validity, and Confidentiality and Ethics

Qualitative research is concerned with expanding one's understanding of a topic rather than numerical representation (Queirós et al., 2017). I constructed the qualitative research study to address how we could implement play in the teaching and learning program. I developed an interest in the study from the ideas and teaching experience of my years as a Transitional Kindergarten teacher and the potential of incorporating play as a pedagogy to enhance a student's mathematical mindset. As a CPR team, we first investigated play in the classrooms of three teachers; then we planned and implemented a CLE for additional staff. The iterative cycles of inquiry added to the validity of the PAR study. The limitations of the PAR study were internal and external as this was a small study in one school.

Limitations

The internal limitations of the study had to do with my role as the leader and the size of the study. My role as an instructional leader in the elementary school setting is to guide, support, and facilitate teaching and learning. The bias related to my role as an instructional leader in the PAR study attributed to my experience as a TK teacher and now my point of view as a researcher. The implementation of play within the instructional program of my TK class contributed to the bias for the PAR study because I have incorporated play and have ideas about how to do this.

A second limitation was the size of the study and the experience of the teachers; because it was a small study, it may not generalize to other contexts. However, the research process we undertook—iterative PDSA cycles in a school context—is usable by others. “The qualitative methodology intends to understand a complex reality and the meaning of actions in a given context” (Quierós et al., 2017, p. 369). Finally, since the CPR members are teachers who are

within the first few years of their teaching careers, that could have been a limitation of the study. Therefore, it was imperative to support their understanding and acquisition of the work by connecting with them one-on-one and engaging in reflective dialogue so that they were prepared to share what they learned effectively with staff.

Internal Validity

I addressed internal validity in three ways: triangulating data through member checks and multiple sources; trustworthiness; and usefulness to participants as a criterion for validity. Being intentional about ongoing collaborative conversations that involve data collection and analysis supported internal validity as I engaged the CPR teachers in member checks at the conclusion of each cycle of inquiry (Creswell & Creswell, 2018; Creswell & Guetterman, 2018). Using member checks at key points in the data analysis supported triangulation of data sources, which allowed the CPR members to address different perspectives, and interpretations, and check the accuracy of the data. The triangulation of the data source during the PAR study offered validity to ensure that there is coherent justification and accuracy of the findings, (Creswell & Creswell, 2018). Field notes from observations served as authentic feedback within the setting of the PAR study which supported the validity of the findings and offered insight on the process of the study.

Secondly, Guba and Lincoln (1985) state that the methods employed to establish the research credibility must support trustworthiness: "Do the findings represent 'truth' as it occurred for the participants and their context?" (p. 187). To guide the trustworthiness of the PAR study, I ensured the credibility of findings through the triangulation of data sources and alignment with the research questions. Through the collection and analysis of data, transferability, and dependability were established.

Third, a key criterion of validity for participatory action and activist research is

usefulness to participants (Hale, 2008). I determined how useful the evidence from this PAR project and study was to the CPR group and other staff in the school through interviews and analysis of CLE artifacts. The internal validity of the qualitative study rests on the depth and breadth of the data collection and analysis; over fourteen months and three cycles of inquiry, I gathered and collected sufficient evidence to understand how to implement play as an integral part of math classroom instruction.

External Validity

The PAR study occurred at Olinda Elementary, a TK-6th grade school within the West Contra Costa Unified School District. The application of this study may be transferable in other elementary school settings because play serves as a universal language for children and is an important element of their development, whether it is kinesthetic, cognitive, or social. Because this was a small study, we cannot generalize the findings to other contexts. However, the process we used for inquiry is transferable. This threat to the external validity of the PAR study is described by Creswell and Creswell (2018) as the characteristics of the environment of participants in an experiment cannot be generalized to individuals in other contexts, the interaction of setting and treatment is important**.**

Confidentiality and Ethical Considerations

For the PAR study, I requested that participants provide consent to participate without any coercion or sense of obligation. Their participation in the study could have been withdrawn at any time. A formal request to conduct the study was approved by my direct supervisor (see Appendix C). To adhere to the ethical requirements governing human research, I completed the Institutional Review Board Collaborative Institutional Training Initiative (IRB CITI – see Appendix B), and IRB approved the study in December 2023 (see Appendix A).

Participants in the study were site-based practitioners who were interested in learning more about how play can improve their teaching practices as related to their math instruction. I selected participants based on their prior participation in a school-based team to investigate math instruction and the relational trust established during that work. I invited each potential participant to attend a one-on-one meeting with me to discuss the relevance of this study to their work and was informed that their participation is completely voluntary. As stated, CPR members signed consent forms approved by East Carolina University's Institutional Review Board prior to undergoing the study. The data aligned with the study, and we used the data to review components of the study and modify implementation as needed. The confidentiality of the participants and the security of the data obtained were paramount in this study. Confidentiality was maintained by adhering to this set of guidelines (Creswell & Creswell, 2018).

1. Transparency and accuracy of data will be communicated with CPR members to support improvement and reflection.
2. Data collection, important and important files will be stored in a protected file.
3. Pseudonyms will be used to protect the privacy of participants.
4. All data will be stored for three years and then destroyed.

Summary

This chapter provides the research design and methodology for the PAR project and study that I implemented to address the research question: How do teachers fully incorporate play-based learning into the math curriculum program and subsequently provide professional development to staff? Using the PAR methodology, I engaged the CPR team in three iterative inquiry cycles to participate during the Pre-Cycle using the CLE processes and then supported them in making connections with their experiences and the study data analysis. During two

subsequent cycles—PAR Cycle One and PAR Cycle Two—I collected and analyzed data to inform the PAR study and decide on the next steps. I described procedures for data collection and analysis in this chapter, re-stated the purpose of the study, and addressed the study considerations. In Chapter 4, I present the context of the study the study participants, and the results of the Pre-Cycle.

CHAPTER 4: CONTEXT AND PRE-CYCLE

Play as an instructional practice has been an important focus of my professional growth as a teacher and instructional leader. I have frequently observed the positive impact that play has on students, which initiated my drive to engage in a PAR project study to improve the capacity of teachers to integrate play as a pedagogy to support math instruction. Using my previous experience with play as a pedagogical tool, I developed a focus of practice for the study: To fully incorporate play into the math curriculum program. Within the context of the FoP, I collaborated with a group of teachers as co-practitioner-researchers (CPR) to design a math program that integrated play within their instructional practices to offer students more meaningful learning opportunities.

I engaged the CPR members in the Pre-Cycle and two cycles of inquiry to implement play as a pedagogical tool to support learning in math. Fortunately, the teachers had backgrounds in play pedagogy and, as a group, we made progress toward the project goals in our thinking and implementation in the Pre-Cycle. In this chapter, I share the context of the study, introduce the CPR team, and discuss the Pre-Cycle results and the emergent categories (Saldaña, 2016). I then reflect and offer the next steps.

PAR Context

The participatory action research (PAR) study took place at Olinda Elementary, which is a school in the neighborhood where I also live. The TK-6 school is located in a residential area of El Sobrante, an unincorporated area of Richmond, California. Olinda was built in 1957 and stands today as it was built 64 years ago. We are surrounded by the natural hills of El Sobrante and the vast open spaces of the local water district and Kennedy Grove Regional Park. Our students reside in the Sherwood Forest, Carriage Hills, and other neighboring communities.

Olinda Elementary is part of the West Contra Costa Unified School District, an urban school district that serves 31,027 students and encompasses 11 cities (see Figure 3).

Olinda Elementary School

As of the 2022-2023 school year, Olinda's student population had increased from 302 students to 380. Olinda is an ethnically diverse community-oriented school, and that diversity is our strength: Asian (24%), Latinx (28%), White (19%), Black African American (13%), and Filipino (8%). Olinda's teaching team consists of fourteen classroom teachers and one Resource Specialist who serves 7.5% of our students with Individual Educational Plans (IEP). Olinda's student population consists of 34.5% socioeconomically disadvantaged students and 13.5% English Learners (EL). The reputation of Olinda as a rigorous academic school with a diverse student population has consistently made it a popular choice for parents who are assessing education options.

The California School Dashboard, a state accountability system, helps parents and educators identify strengths and areas for improvement within schools and districts and make decisions about learning goals for children. According to 2019 data compiled from the California School Dashboard, students at Olinda Elementary were within the yellow or middle-performance level for English Language Arts, which is .6 points below the standard. The data from 2019 for math demonstrated a performance level of 12.4 below standard. Based on the Smarter Balanced Assessment Consortium (SBAC), 51.4% of our English Learners are making progress toward English language proficiency. The suspension rate and chronic absenteeism as measured by the California Dashboard reflect a performance level in yellow, with 0.8% of students being suspended at least once and 7.4% of students being chronically absent (see Figure 4).

Figure 3. Olinda Elementary.

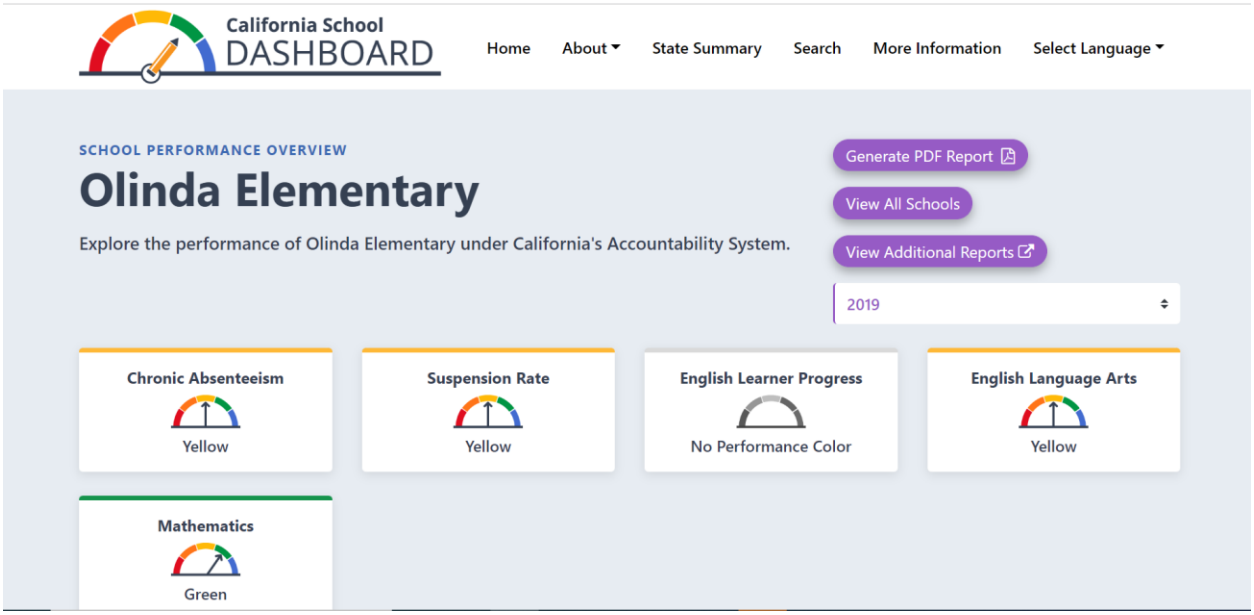


Figure 4. Olinda Elementary California School dashboard data.

Co-Practitioner Researcher Team

The co-practitioner research team (CPR) included three classroom teachers: Ashley Barajas Montano teaches 1st grade, Christina Blum teaches 2nd grade, and Anna Hockman teaches 3rd grade. The teachers offered a range of experience from novice (under five years) to experienced (over 10 years). For the PAR study, CPR members served as contributing members working within the context of a professional learning community. The teachers demonstrated a willingness and interest in learning how to incorporate play more fully into the math curriculum and instruction and have taken leadership roles that support school culture. Through inquiry in the Pre-Cycle, the CPR group engaged in shared experiences and collaboration to integrate play pedagogy in math instruction, and to align play pedagogy across grade levels.

AH, in her third year of teaching, has taught third grade at Olinda since 2019. Before teaching at Olinda, AH taught English as a foreign language to children and adults in South Korea and San Francisco. AH has pursued leadership roles at our site by serving on the Instructional Leadership Team (ILT) and the Culture and Climate Committee and, in the school year 2021-2022, she was the lead teacher at our site for facilitating teacher professional development on race and equity. AH views play as an essential tool in both language and math, allowing students to make connections for context and to feel the importance of what they are learning. AH feels that play provides students with a filter of protection with the expectation of performing in a classroom setting. CPR member AH shared the following reflection during the initial discussion of play: “Play is a more natural way for children to engage with classmates and learn from each other through their interests and not just standards.” AH shared her excitement about the PAR project and study as a means to continue to explore play and learning and hoped that, through the PAR, we could collectively put into practice and share our experiences as a

whole school. AH stated that she welcomed a chance to work with colleagues across grade levels to help support students throughout their experience at Olinda.

AB, a first-grade teacher at Olinda, is in her first year as part of our community. AB was entering her third year of teaching at the start of this cycle and had taught kindergarten during her first two years at another elementary school in the school district. She had substantial experience that supported our CPR group, including a Master's degree from UC Berkeley, a background in science, and experience as a public education specialist at Lawrence Hall of Science specializing in early childhood education. She developed and coached a community college course at Atlas Madonna's College with funding from the National Science Foundation which promoted early learning in science and mathematics. The program philosophy was constructivist, with hands-on learning that was heavily rooted in play and exploration. In addition, AB worked on an international project that partnered with Saudi Aramco, a Saudi Arabian public petroleum and natural gas company, to help in the development of constructivist-based science courses for high school students. During her time there, she conducted professional development courses domestically and in the Kingdom of Saudi Arabia, part of a larger movement to transition to more hands-on, exploration-based learning pedagogy in that country. AB has made several conference presentations on early STEM learning, including for the California Kindergarten Conference Steam Colloquium a national professional development conference, and the Association of Children's Museums Conference. AB's philosophy on education is rooted in constructivist pedagogy and experiential learning. She believes that play is a time for students to participate in child-directed exploration, where students are constructing knowledge. AB states that play often supports the whole child's language development, cognitive growth, fine and gross motor development, problem-solving skills, and social interaction. She

views learning through play as an opportunity for more meaningful learning and fun experiences for children. She is interested in the participatory action research project and study because she sees it as an opportunity to collaborate with her peers, gain valuable insights, and continue to grow by dedicating her time to reflecting on her practice and implementing more play-based learning experiences for her students.

Our site's second-grade teacher, CB, has been at Olinda for three years and in the teaching profession for ten years. CB served as the literacy lead teacher for our site. Her past roles include supporting curriculum writing in multiple districts and serving in various mentorship roles. She piloted a purposeful play program during her four years as a kindergarten teacher. Through the course of the program, CB participated in training that emphasized the science behind purposeful play and constructive play linked to academics. CB stated that she observed how students engaged and flourished in play-based learning experiences. She carried that experience with her when she taught fourth grade, although she realized that play does not look the same in upper grades. She observed that play was enriching for her students' learning, especially in math. Her experiences and interest in incorporating math games within instruction contributed to her decision to participate in the PAR study. She integrated games into her mathematical practice involving reviewing and practicing mathematical concepts. As a second-grade teacher, she placed students in different groups to engage in games. Those games were leveled differently and offered students a review of concepts. According to CB, play better supports differentiation and the students find the process more engaging and enjoyable. CB views play as a way to enhance students' learning; for those reasons, she was interested in the PAR project and study. CB is excited to bring additional play into her second-grade math program.

The CPR members bring a wealth of understanding and direct application to the project and study how play should be embedded within instructional practices and integrated into math programs. All CPR members have prior knowledge of incorporating play learning opportunities in math instruction, exposing students to relevant and meaningful engagement with math concepts. CPR members' experiences of learning through play support their understanding of the integration of play in the classroom. They understand how play allows students to connect with their world and apply and transfer those skills to their everyday lives. Through these experiences, CPR members share the drive to collaborate and learn from one another to strengthen their practices and further enhance students' learning of math through play-based learning opportunities.

PAR Pre-Cycle Process

During the PAR Pre-Cycle, CPR members learned about one another and the experiences we each bring to the research. By engaging in CLE protocols during the Pre-Cycle, CPR members developed relational trust and respect for one another. The Pre-Cycle process was collaborative and deepened our understanding of what play consists of in instructional practice and the impact it can have on their math programs to support and enhance student learning. See Table 4 for an explanation of the activities that CPR members participated in during the PAR Pre-Cycle.

I initiated the PAR Pre-Cycle with CPR members sharing their autobiographies on FlipGrid, which provided an opportunity for members to view each other's autobiographies and comment on their similarities and differences. In their autobiographies, CPR members shared teaching experiences, their experiences at Olinda Elementary with teacher leadership roles and professional development, their interest in the PAR, and their thoughts about play and learning.

Table 4

Activities PAR Pre-Cycle

Activity	Dec. 8, 2021	Jan. 31, 2022	Mar. 30, 2022
Flipgrid CPR autobiographies & responses(n=3)	●		
Meetings with CPR (n=3)		●	●
CPR Journey Lines		●	
Photovoice Protocol			●
Reflective Memos	●	●	●

The first activity was a valuable introduction to understanding the different experiences that each member brought to the work and offered a process for CPR members to learn more about one another. CPR members demonstrated an understanding of play in instructional practices and had experiences supporting adult learning. The common interest among CPR members was the intent to further teachers' instructional practices, integrate play within their classroom programs, and have collaborative learning opportunities with colleagues.

I facilitated two CPR meetings using CLE pedagogies and protocols during the PAR Pre-Cycle. I reviewed meeting norms in each CPR meeting and began with dynamic mindfulness. During the January 31, 2022, CPR meeting, CPR members received information about the PAR, the study's context, and the research question that guided the research; they discussed the Flip Grid autobiographies. We engaged in these activities:

- Creating personal journey lines of how we learned through play
- Analyzing quotes from research about play
- Co-developing a paragraph on how research on play could be applied in the classroom
- Discussing the level of accessibility that play offers

During the second CPR meeting, CPR members participated in a photovoice protocol in which participants provided captions to photos they took that symbolized play and learning. CPR members shared photos in a gallery walk and responded to the pictures by making connections with the pictures they observed. The CPR team's discussion from the gallery walk centered on the various ways students experience play in the classroom and the learning opportunities for students. CPR members discussed how the photovoice protocol reflected the members' expertise in terms of play and learning and how to use photovoice in the classroom.

In the meeting, CPR members developed a cohesive and collective definition of play grounded in the notion of play in learning, which will support the PAR study. The co-constructed definition is as follows: "Play is a joyful learning experience that is engaging, hands-on, and supports creativity" (CPR meeting, March 30, 2022). The CPR team developed this definition from their personal experiences and evidence of the implementation of play in learning that they have observed in their classrooms. In support of the research and study, the definition encompasses CPR members' reflections. Joyful refers to the fun and engagement students are involved in during play, as they continue to learn concepts, but through a method that brings enjoyment. When teachers use play, they actively engage students through hands-on exploration, enhancing their imagination and creativity as they work through problem-solving skills. This definition guided CPR members in the PAR project and study.

The qualitative data that I examined during the Pre-Cycle of the research came from the CPR meetings, protocols, and my reflective memos of the process. I then coded the data through observations of repeated patterns that emerged, as it related to the context of the overarching question of the PAR study: *How do teachers fully incorporate play-based learning into the math curriculum program?* The sub-questions are:

1. To what extent do teachers design math lessons that include play pedagogy?
2. To what extent do teachers implement play pedagogy in their instructional practices?
3. How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?

The questions served as a guide, and I used the questions to code and analyze to determine categories. The process for coding included a holistic coding approach, which Saldaña (2016) describes as an approach to coding for beginning researchers which focuses on data for

categories being reviewed as a whole (p. 167). The analysis of the data included CPR (n=3) members, their experiences of learning through play, their teaching and work experiences with play integration, their thoughts on play as a pedagogy, and their participation in the PAR study. Table 5 demonstrates the categories that emerged from the protocol's CPR members' engaged in, which reflects both their perspectives of play within a learning context and my reflective memos of the protocols. In the following section, I will share the three emergent categories that emerged from the data collected and their relevance to the PAR study.

Emergent Categories

In this section, I discuss how I analyzed the data and determined emergent categories. Three categories emerged from my analysis of the data: play serves as hands-on exploration; play is collaborative and cooperative; and play offers real-world connections. I analyzed multiple sources of data from the PAR Pre-Cycle. Those sources included CPR member biographies, journey lines, photovoice, and memos. In each of the three emergent categories, CPR members highlighted that play in mathematical instruction offers hands-on exploration, is collaborative and cooperative, and supports students in making real-world connections. The importance of play was observed during classroom visits, in which students developed and strengthened their conceptual understanding as they progressed through concepts during play-based activities. I analyzed and coded the data and, from those codes, I identified three emergent categories. Further, I examined the data in alignment with the research questions to gain insight into CPR members' understanding of how play, as an instructional practice, supports student learning.

Hands-On Exploration

Hands-on exploration learning is learning by doing, and play is the hands-on action of engaging by moving, building, and touching through the process. CPR members' understanding

Table 5

Emergent Categories and Codes from PAR Pre-Cycle

Emergent Category	Codes	Frequency of Code
Play serves as experiential learning	Actively involved and engaged Kinesthetic Modality of Learning Experiential learning and discovery	74
Play is collaborative and cooperative	Interactive and learning from peers Social-emotional development by building relationships	67
Play offers real -world connections	Deeper understanding by making connections to prior knowledge	19

of interactive learning opportunities focuses on how students take math concepts and apply them through games and activities that are child-focused and independent. As I reviewed and analyzed data from CPR member's autobiographies, journey lines, and photovoice protocol, the data reflected (a) hands-on learning through play in which students are actively involved and engaged, (b) the kinesthetic modality supports learning, and (c) play provides exploration and discovery learning.

Hands-on Learning through Play: Active Engagement

In CPR members' autobiographies and play-based learning experiences, a common category was pretend and imaginative play that they had as learners and then transferred to their teaching practices. CPR members' personal childhood play experiences of active engagement involved creating pretend restaurants or lemonade stands, which enhanced their learning of math concepts such as money, adding, and subtracting. CPR members referred to hands-on exploration learning opportunities that they had experienced that they then transferred to engaging students in self-directed experiences as they constructed knowledge. Students were active participants during a learning process in which the teachers provided students with experiences of learning and activities that were interactive and assisted students' understanding of mathematical concepts.

CPR member CB shared the various ways she has integrated math and play into her classroom by implementing purposeful play; students utilized building blocks to create a castle structure. Through this play-based approach, students engaged in a learning process that supported their creativity and understanding of how to apply math skills. Students had the freedom to express their knowledge in a manner that was student-focused and in which they were actively building and constructing. CB created conditions in the classroom that fostered

students' participation beyond the pencil-to-paper understanding. This meaningful learning opportunity allowed students to problem-solve by implementing engineering skills.

During the first CLE, the CPR explored the meaning of hands-on play through an examination of a Clements and Samara (2005) research study which stated: "The primary job of the mathematics teacher should be to provide numerous chances for children to reflect on and extend the mathematics that occurs in their daily activities and conversations, as well as to structure environments that encourage such activities" (p. 51). Through the discussion, CPR members identified their understanding of how teachers serve as facilitators of hands-on play opportunities and set up classroom structures in which students doing the work are engaged in a productive struggle. They agreed that the teacher's role is to integrate experiences and observe different ways students are naturally using math and the various ways and times students are making connections and applying math outside of the classroom setting.

Through these observations of student play and dialogue, teachers can then provide feedback to each other on where and how math presents itself naturally for students. As a result, teachers can then plan hands-on experiences for students at the student's level of accessibility and interest. CPR member ABM applied the photovoice data in her first-grade class to engage students in a teacher-developed structured play activity in which students build a conceptual understanding of regrouping through a hands-on game with a partner. As is evident from this photo, students are actively engaged in their learning and demonstrating their knowledge interactively. These data emphasize kinesthetic learning.

Kinesthetic Modality in Learning

CPR members expanded the definition and practice of play by offering students opportunities for physical movement, which supports tactile sensory learning and strengthens

fine and gross motor skills. The frequency of codes for this category (n=28 instances) indicated that CPR members referred to kinesthetic learning as those experiences in which students can touch and manipulate materials to express knowledge and understanding. This type of play offers students an engaging opportunity within their zone of proximal development that is kinesthetic (Vygotsky, 1978).

While CPR members' discussion about play as a hands-on exploration included multiple modalities, the kinesthetic modality presented the strongest evidence. Through hands-on play, students were able to build and manipulate materials and put their understanding into practice while simultaneously improving their coordination. Creating learning experiences for students to use hands-on manipulatives and construct their learning through movement reinforces their understanding and creates conditions for open-ended learning. Using photovoice for collecting evidence, we have an example of students applying engineering design principles and having the opportunity to move and manipulate materials to problem solve. CPR member AH refers to this play and hands-on learning opportunity as a way for her third-grade students to tap into a deeper understanding of math concepts by making connections to prior knowledge through construction. This hands-on experience allows students to learn and create through physical modalities.

CPR members' responses to biographies indicated that CPR members believe the integration of play is a valuable and enriching learning tool. CPR members have all demonstrated some shared knowledge about the benefits of play and these experiences are rooted in their own experiences. Through the reflection of sharing their biographies, CPR members observed a common trend in the recollections of their interaction with play and the effects it had on their learning. CPR member CB's journey line offers her early recollections of play and learning. The majority of her experiences focus on kinesthetic and active play geared toward

imaginative and creative participation (see Figure 5). CPR discussion about early play experiences of pretend and imaginary play highlights how kinesthetic play was an opportunity for CPR members to process new information and learn. CB's journey line also provides evidence of how her experiences of utilizing play to learn are transferred and applied to her instructional practices and classroom. As evidenced by her journey line and data collected from photos shared during the photovoice protocol, she incorporates play to aid students' review of concepts, enrich student learning with choice, and support social-emotional development. In the next section, I will discuss how hands-on play encompasses exploration and discovery through the learning process.

Play Provides Exploration and Discovery

Play serves as a hands-on method to initiate learning through exploration and discovery by engaging students in experiential and differentiated activities. CPR members understand that learning through exploration and discovery actively involves students who thereby learn through their curiosity and independence. The exploration process of hands-on learning supports students in understanding themselves and investigating mathematical topics, scenarios, and objects that interest them. Exploration and discovery of play through hands-on learning allow students to dive deeper into their understanding of what is taught and apply knowledge that is outside standard learning expectations.

The discussion among CPR members highlighted that learning through play is hands-on and enhances students' learning experiences. CPR member AB states in her autobiography, "I believe that play is a time for students to participate in child-directed exploration, where they're constructing their knowledge" (ABM, CPR member, January 31, 2022). CPR members participated in creating journey lines and, upon analysis during the CLE meeting and discussion,

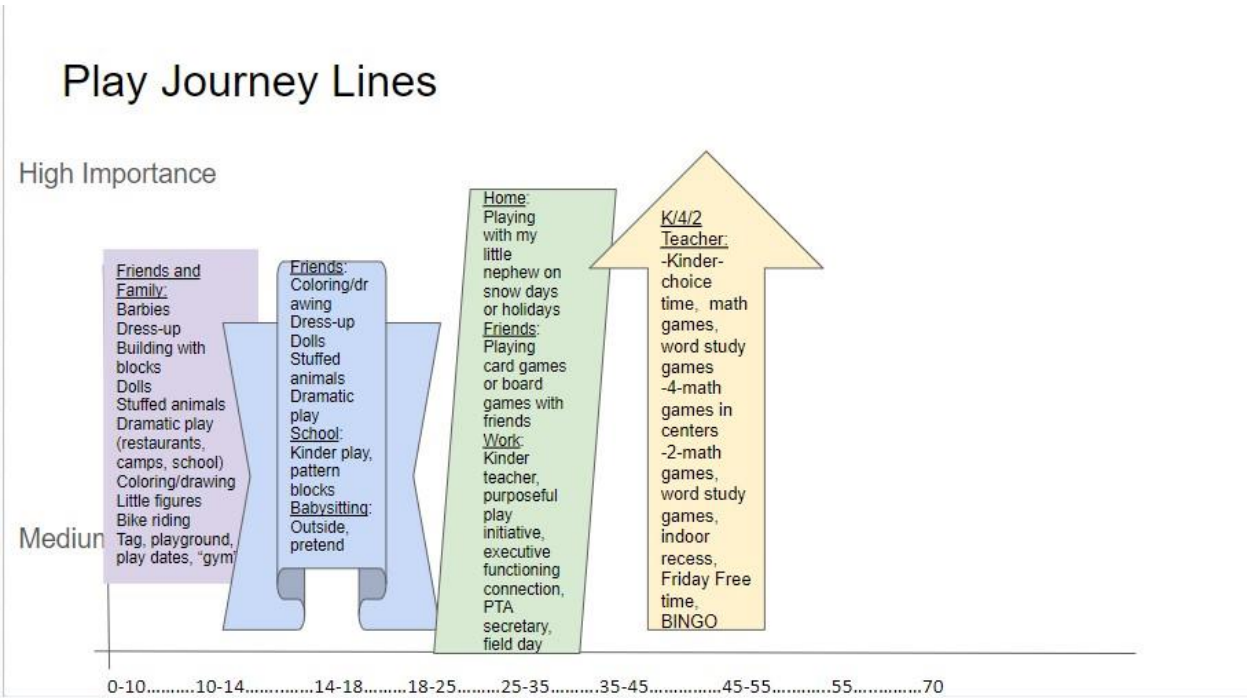


Figure 5. CPR member CB's play journey line.

determined that imaginary and pretend play was the root of their play experiences. Artifacts were part of the photovoice protocol CPR members participated in during our March CLE meeting. First graders in a CPR member's class engaged in "unstructured, open-ended play: two students created a store during choice time, using the cash register and pretend money to purchase toys. Skills practiced: counting, adding, subtracting, cooperation, turn-taking, problem-solving, creativity." This artifact referenced CPR members' early experiences of imaginative play and pretend play within a classroom context of dramatic play. Through this play opportunity, students are engaged and many math skills are enriched. This artifact aligns with the codes by showing how the activity offers both an exploration of concepts taught as well as students' initiative in participating in a hands-on experience. When students are able to manipulate learning situations, their understanding of the taught concepts is reinforced.

CPR member, a second-grade teacher, shared the following in her autobiography, "You can differentiate and the kids have fun. They don't think or feel like they're learning; they are just having fun and it's an engaging way to enhance their learning" (CB, CPR member, January 31, 2022). From CLE discussions, the evidence observed from the photovoice protocol indicates that hands-on play, in which students utilize various modalities of learning and move through learning, allows students to apply their understanding and knowledge of learning tasks and transfer that understanding through exploration as they work and engage in problem-solving. Play as a hands-on learning experience is a practical and natural method of learning through action and active participation. The hands-on approach of play provides students the developmentally appropriate stimulation to promote learning. Next, I provide information from the data that demonstrates how play is a collaborative and cooperative learning opportunity.

Play is Collaborative and Cooperative

Play is relational and fosters building relationships and friendships. Through a collaborative process in play, students can tap into a deeper understanding of their learning, while making connections with others. CPR members agree that play is multifaceted, and an important element of play is student collaboration and cooperation. This concept of play allows students not only to support their social skills but also to learn from their peers and review concepts from different perspectives. In this section, I provide evidence from the Pre-Cycle of how play guides students' social and academic skills through collaborative and cooperative learning experiences.

Play is Interactive and Supports Peer Learning

Play offers a time for students to interact with peers and engage in experiences that support their development. Play also provides valuable opportunities for students to engage in learning activities that allow them to learn cooperatively from peers and practice their understanding of concepts together in an inclusive and interactive way. "Play is natural for children; as they engage with their classmates, they're learning from each other within a context of something." (AH, FlipGrid response, December 8, 2021)

The codes that emerged for play as a learning pedagogy that is collaborative and cooperative were evident in the visual representation of the photovoice protocol. As was demonstrated in the data, students participated in cooperative learning while practicing their academic skills. The caption for the photo described how the students were engaged in unstructured open-ended play, in which they created a store and used the cash register and pretend money to purchase toys. AH, CPR member and third-grade teacher, said in her autobiography, "Play offers opportunities to learn from each other around their interests." During

the CPR meeting discussion on January 31, 2022, CPR member ABM shared her play experiences as a child and how, through her interaction with peers, her social development was supported through cooperative exploration with friends. The engagement of play observed in the codes through the photovoice all show students working with one another in collaborative settings.

Through discussion during the CLE meeting, members discussed how, through collaborative play, students can learn from their peers by watching and observing each other and providing initiative to try something new, which leads to feeling important and successful and builds confidence. The cooperative learning that play offers supports students with team building and teamwork. Collaboration among students is vital for achieving a common objective. Such partnerships empower all students to gain knowledge by solving problems and developing a deep understanding of concepts. Collaboration among students is vital for achieving a common objective. Such partnerships empower all students to gain knowledge by solving problems and developing a deep understanding of concepts. Other photos from the photovoice provided evidence of students engaged in math games with partners. In her FlipGrid autobiography, CPR member CB discusses how creating an interactive play-based learning environment allowed her to create different groups and engage students in play based on their different levels. Group work could consist of a review of concepts or practice of skills just learned, allowing her to differentiate learning and allow the students to have fun while enhancing their learning. The interaction between students creates different opportunities for play as well as equitable participation. Equitable participation consists of all students being involved in the learning process through active participation and engagement in the activity. CPR members' notes for the photovoice artifact also stated that students were building and fostering relationships through this

collaborative learning opportunity, which supported not only students' academic skills but also their social skills. In the next section, I expand on how play supports students' social-emotional development through building relationships.

Play Fosters Students' Social-Emotional Development by Building Relationships

Play has an important role in students' social-emotional development, especially as they develop relationships with their peers. There was a frequency of 34 codes that were presented in the Pre-Cycle for this theme. Students engaging in partnerships during play-based learning assist their growth in socialization as they develop skills that promote friendships. Engaging with peers guides students' social-emotional learning as they learn and strengthen skills such as sharing, turn-taking, patience, and communication. Through this cooperative play-based learning, students are exposed to social interactions that allow them to learn from and with one another.

Group efforts provide supportive learning opportunities as students are actively engaged and involved. The evidence of the photovoice protocol aligns with CPR members' own learning experiences as is demonstrated in CPR member CB's journey line artifact. CB categorized her play and learning experiences as involving family and friends. She recalls how her play experiences included playing board games with family; and dress-up, dolls, and dramatic play with friends. Reflecting upon these experiences supports her understanding of the value play integration in the classroom has on students' learning. CPR members' discussion for this category addressed how learning in a play-based setting is supportive and nurturing. Students develop self-expression and regulation as they are guided to interact with one another constructively and cooperatively. This observation initiated a shift in my thinking and mindset toward math learning. I shared my experience as a transitional kindergarten teacher and observed how my students engaged and had fun with math as they played and interacted with one another.

In one example, four students were sitting in the dramatic play area at a table dividing a pizza among themselves. This type of interaction helps establish self-expression as students work with one another toward a common learning goal. Students learn to help one another and, through the process, strengthen their social-emotional development. As demonstrated in the data of the photovoice, student partnerships are fluid, and the students interact with many different classmates during learning activities. During this process, they navigate through various personalities to establish and build relationships. Data from photos provided evidence of students creating an imaginary store and through this activity, students were putting social and academic skills into practice. Play in learning offers an ongoing reciprocal opportunity for students in which they learn about themselves and others.

Play as a collaborative and cooperative learning process is an essential component of a student's social and emotional development and is an inclusive practice. Peer learning through play reinforces students' understanding, provides different perspectives, and fosters relational trust. During play in a collaborative setting, students can make connections with one another and their personal lives. In the next section, I will share how play offers real-world connections.

Play Offers Real World Connections

A reoccurring point that was evident during CLE meeting discussions was that play helps students make connections to their real world. These connections in turn enhance and enrich student learning. In their research on play and mathematics, Dockett and Perry (2007) describe how play supports students' deeper learning by allowing them to make connections with factual knowledge and their real-world experiences. They see play as a framework in which children can incorporate their experiences and understandings, draw on previous experiences, make connections through those experiences, reflect on these in various ways, explore possibilities,

and build meaning. In this section, I will provide evidence on how play provides students with meaningful learning that is relevant to the world around them and supports deeper understanding as students make connections to prior knowledge.

Play Provides Meaningful Learning That is Relevant to the World Around Them

Tapping into students' prior knowledge, making connections, and transferring that knowledge into the real world leads to meaningful learning opportunities, in which students can connect content with their understanding and how it applies to their everyday lives. Students are able to make connections to the concepts taught when they apply prior knowledge and implement it through play. Structured play activities support students' conceptual understanding and provide freedom of expression. These skills, which are enhanced by play experiences, tap into students' prior knowledge that is then transferred into their everyday lives. Giving students the chance to construct and create using things from the actual world provides them with more context in which to play. Teachers who are alert to the context of play give students opportunities to create and build using real-world materials.

CPR members discussed Dockett and Perry's (2007) research on how play can be applied to the classroom. CPR members understand that when educators integrate play into the classroom, they can serve as facilitators and set up structures for students to engage in open-ended play that develops context to real-world skills. photovoice data was an example of how students' engagement in creating a store and using pretend money to purchase toys aligned with their understanding of the world around them. Students transferred their understanding in a situation that was meaningful to them by practicing the concepts that they had learned through play-based learning.

As teachers observe students at play, they can then differentiate student learning and give students choices, a variety of learning modalities, and flexible approaches to accomplish a learning target. In another photo that was displayed during the CPR meeting and CLE photovoice protocol (March 10, 2022). CPR member ABM shared a photo of first-graders engaged in a structured open-ended play in which students worked in teams to build something using one hundred cups. This activity engaged the students in problem-solving skills by implementing engineering skills and creating something by using links to their environments and what they have observed. Play supports students' self-expression at their level. Teachers who provide different opportunities for play embedded in the classroom and through their instructional practices promote equitable participation and student voice. Play in the classroom is adaptable and all students at all grade levels can participate and engage as it relates to their everyday lives. CPR member AB shared in her autobiography that "Play often supports the whole child's language development, cognitive growth, fine and gross motor development, problem-solving skills, and social interaction. Learning through play can lead to more meaningful learning experiences for children, and it's fun" (CB, Artifact, May 30, 2022).

Play provides students with an understanding of how math relates to the real world and initiates the application of that knowledge into their everyday lives. Play is relevant for students because play gives students context and meaning. Teachers design play-based learning opportunities to support students in seeing the relationship between math lessons in the classroom and how those math skills can transfer to the outside world.

Play Promotes Deeper Understanding by Making Connections to Prior Knowledge

Play-based learning allows students to access prior knowledge to address and manipulate new situations and materials; as a result, they make meaning and have a deeper understanding of

their learning. CPR members reflected on their current instructional practices that integrate play and further discussed how they observe the implementation of play during math outside of the classroom such as during recess or in the cafeteria. CPR members shared that play is a natural way for students to construct knowledge and enhance the learning experience.

As demonstrated in data from the photovoice data, students created inventions that related to their prior knowledge and understanding, using prior knowledge that may be long-term or recent. In this case, teachers exposed students to skills of design that they could apply to measurement. CLE discussion provides evidence that CPR members believe that when presented through play, new conceptual information can be linked to a student's prior knowledge, and "students tap into areas of deeper understanding by making connections to prior knowledge." The activity in the photo, illustrated students' understanding of measurement through engineering design principles and problem-solving. However, depending on individual students' developing schema and familiarity with the prior knowledge and skills needed, students construct meaning at different rates.

For example, in a second-grade classroom, CPR member students participated in building a helicopter using Legos. The activity followed a lesson about the development and evolution of aircraft. Students engaged in a discussion and reviewed facts learned about flying vehicles. Students then followed step-by-step directions to build a fully functional Lego helicopter. Students followed directions, engaged in problem-solving, found and matched materials to directions, and worked together. The artifact demonstrated how, through play, students were engaged in a goal-oriented activity that referred back to the knowledge they gained about helicopters and applied new conceptual information in an accessible way, a process that deepens and strengthens their problem-solving skills. Through this activity, students met several different

standards including mathematics, science, and literacy. Play encompasses many content areas and encourages students to develop real-world skills that are applicable as they continue their educational journeys.

The benefits of play that is guided by what students have learned and been exposed to offer students the opportunity to develop a deeper understanding of their learning. Play-based learning allows students to review concepts and learned skills and enriches their growth as they apply those skills that build on their understanding. In the final section of this chapter, based on the evidence and codes that emerged, I will describe the reflection and planning of the Pre-Cycle and how this will inform the next cycle of the PAR.

Reflection and Planning

The final activity during the CLE meeting was developing a cohesive definition among CPR members of play as a learning pedagogy. From the protocols and discussions, we collectively decided that play is a joyful learning experience that is engaging, hands-on, and supports creativity. This definition, coupled with the PAR research questions, served as a guide for the work that CPR members engaged in during the PAR study. Next, I discuss my reflective process for the Pre-Cycle and how this analysis informed the planning for PAR Cycle One.

As I reflected on the Pre-Cycle and shared the PAR questions with CPR members, I concluded that CPR members entered this project with a wealth of knowledge and experience that demonstrated their capabilities of play integration into instructional practices. As is evident through the CLE meetings, autobiographies, reflective memos, and photovoice protocol, CPR members understand play in the classroom and its benefits to learning. CPR members have demonstrated how play can be incorporated and integrated during learning opportunities. My facilitation during the PAR Pre-Cycle promoted CPR members' reflection on their experiences

and how those experiences guided their contextual understanding. Providing CPR members with a voice that contributes to the work offered them value and respect, which strengthened relational trust and created a collaborative setting in which CPR members freely shared perspectives, thoughts, and ideas. As I built the leadership capacity of CPR members and engaged them in protocols that highlighted their experiences, I reflected with them on what is currently taking place in their classrooms and how their work aligned with the PAR research study.

In particular, the photovoice protocol provided the visual context for students to enhance their learning of skills and concepts through play. CPR members' autobiographies and journey lines provided the context of CPR members' personal experiences of play and how those experiences impact their understanding and implementation of play in their teaching practices and learning opportunities for their students. Teachers are the people closest to the issue, and thus bring insights and expertise to the research. During the PAR project and study, we continued to provide extensive play opportunities to enhance and enrich students' knowledge of concepts, apply their understanding, and transfer knowledge into real-world situations. As we observed and assessed those opportunities, we developed methods to support play-based learning in more classrooms.

Children need to be engaged in play to strengthen their academic learning by processing and applying their learning through their unique styles and needs. The long-term goal of the PAR is to transfer learning from professional development to teacher practice. Increasing play within the mathematical program and supporting teachers in the process through professional development is imperative when establishing a consistent school-based program that emphasizes engagement, discourse, and peer collaboration. The implications for leadership included an I

increased ability to promote teacher collaboration and engage teachers in discussions about how play can support the development of instructional practices that enhance students' mathematical thinking. I did this through the use of CLE protocols to build relational trust.

During PAR Cycle One, the CPR took an inventory of what our current math program offers, assessing the strengths and areas of potential growth. We shared and discussed the analysis and worked collaboratively to design play activities that align and support grade-level standards. As the CPR teachers reflected on the work, we adjusted and accommodated accordingly, which will assist in the co-design of professional development learning sessions that we will share with other teachers on site. By the final cycle of inquiry, I projected that the teachers in the CPR group would be ready to support other teachers in the building.

Conclusion

The Pre-Cycle provided data that guides the PAR study progression by providing valuable information about the expertise and experiences CPR members are bringing to the study. As was observed during the photovoice protocol, CPR members have already developed learning opportunities that integrate play within their instructional practices. We reviewed these activities and further enhanced these play-based learning opportunities by aligning them with grade-level standards and reviewing how these can integrated between the grades. Building teacher capacity to structure play within the learning program and providing professional development to other teachers can lead to a cohesive school-wide play-based learning program. Play can serve as an essential tool for students to process and practice information in the math program. Through a collaborative effort, the CPR supported the integration of play, providing students with authentic and innovative learning opportunities to put into practice, and

empowering teachers to expand their capacity by creating intentional lessons that will integrate play within their teaching

CHAPTER 5: PAR CYCLE ONE

In PAR Cycle One, the CPR team and I built on the data that emerged from the PAR Pre-Cycle. We developed a deeper understanding of how play as a pedagogy—providing hands-on, collaborative, and cooperative exploration that offers students real-world connections— is integrated within teaching practices and the math program. During PAR Cycle One, the CPR team collaboratively assessed the current math program, integrated play activities within the instructional practices, and aligned practices with grade-level standards. CPR members sustained relational trust and monitored their progress and growth toward improving instructional practices through the collaborative process that included open dialogue and reflective practices.

In the PAR process, CPR members implemented play-based learning to guide students' conceptual understanding of math. As demonstrated through the activities during PAR Cycle One, CPR members created engaging experiences in which students incorporated learning from peers while establishing meaning and relevance to their world. During PAR Cycle One, I engaged CPR members through a reflective process of community building. Members reviewed the assets, their work, and collaboration toward collective efficacy, and developed lessons that integrated play within CPR members' instructional math practices.

During CPR meetings (n=3), I gathered and examined data; after coding these data, three themes emerged. This chapter describes the data sources: CPR meeting artifacts, classroom observations, and post-observation discussions. I analyzed data to determine these emerging themes: developing instructional practices that incorporate play; conceptual understanding of math through play-based opportunities; and ensuring equity and accessibility through play. Finally, I consider how completing PAR Cycle One has improved my leadership and research skills as a practitioner, and I describe how PAR Cycle One evidence influenced PAR Cycle Two.

PAR Cycle One Process

PAR Cycle One (August–October 2022) included a collection of artifacts from CPR meetings and the Pillar Protocol and Visual Mapping CLE protocols. Other artifacts that informed the work during PAR Cycle One focused on selective verbatim classroom observations, post-observation conversations, personal narratives, and reflective memos. Through the implementation of carefully chosen protocols, I provided CPR members opportunities to collaborate, review, and reflect upon instructional practices that will inform their progress to plan the next steps towards further incorporation of play to enhance students' mathematical thinking and learning. In PAR Cycle One, I was able to gather meaningful data by following particular protocols. The artifacts provided a variety of data sources that I processed and arranged according to categories and then into emergent themes. The next section provides a comprehensive explanation of the activities that were included in PAR Cycle One.

Key Activities

During PAR Cycle One, CPR members participated in various protocols that allowed them to reflect upon their math program, teaching practices, and how to enhance their conceptual understanding of math by engaging students in the play. The key activities are referenced in Table 6 and focused on three CPR meetings that included CLE protocols for data collection, two rounds of selective- verbatim classroom observations, followed by post-observation conversations, CPR members' personal narratives, and my reflective memos. The following section provides activities from the CPR meetings and the CLE protocols implemented to collect data.

CPR Meetings

The first activity CPR members participated in during the August CPR meeting was the CLE Pillar Protocol. During this meeting, CPR members engaged in an open discussion of the data findings from the PAR Pre-Cycle, how the work from that cycle reflects on what they already know about play pedagogy, and some new developments. This discussion led to CPR members observing the pillar tower image, listing their observations based on the image, and naming the tower based on their accomplishments from the PAR Pre-Cycle. CPR members then engaged in planning a lesson within the context of instructional practices that incorporate play within the current curriculum and are aligned with grade-level standards. This preparation led to the first round of selective verbatim classroom observations.

PAR Cycle One included two additional CPR meetings with CLE protocols and engaged CPR members in writing personal narratives that reflected on building their leadership capacity and confidence while addressing inequities they observed. In their personal narratives, CPR members discussed how the work during the PAR study supported their professional growth by understanding each other's instructional practices and how sharing resources and ideas with one another assisted in developing instructional practices that were targeted toward student engagement and participation within the learning context. During the final CPR meeting held on October 19, 2022, members created a visual map demonstrating the equitable needs that are being addressed by play integration into math instructional practices and the impact it has on the learning culture. CPR members discussed how integrating play within teacher practices through the variety of modalities embedded in the learning program allowed students to create shared meaning and understanding from peers and transfer their understanding through play all while having fun.

Classroom Observations and Post-Observation Conversations

The purpose of the classroom observations was to observe how play, when incorporated into instructional practices, created innovative learning situations that CPR members could assess, then adjust and make improvements as needed to monitor student progress and growth in math. CPR members completed lesson planning guides for the first observations, focusing on grade level standards, lesson objectives, and goals, play integration in instruction, the transfer of play with student learning, and the expected lesson outcomes. The lesson planning form served as a guide for intentional teaching practices that target play as a means of learning for students. Utilizing a lesson planning guide provided me with context for the teaching and learning that is currently taking place in CPR members' classes and how play will be implemented based on the intended outcome. After the plans were provided, I conducted the first round of observations, completed the selective verbatim observation form, and invited CPR members to a post-observation conversation. The post-observation discussions included a reflective process, allowing CPR members to recognize how play supported student learning, what if any challenges were encountered, and what the next steps will be for integrating play.

In addition to the three CPR meetings during PAR Cycle One, CPR members completed a second round of classroom observations and engaged in dialogue during a second post-observation meeting. As CPR members entered the second round of post-observation discussions, they felt more confident in their play teaching practices and better understood how to adjust instruction to create positive learning outcomes for students. Throughout the process, I reflected on the work of the CPR members and I wrote reflective memos to capture the work and my understanding of the PAR study as I developed as an instructional leader. I provide a guide to the activities and the timeframes in which these activities took place (see Table 6).

Table 6

PAR Cycle One Activities

	Aug. 24, 2022	Sept. 8, 2022	Oct. 24, 2022
Pillar Protocol	•		
Meetings with CPR (n=3)	•	•	•
Classroom Observations		•	•
Post-Observations Meetings		•	•
Personal Narratives			•
Visual Mapping			•
Reflective Memos	•	•	•

Data Collection and Analysis Process

Data collection and analysis entailed examining information that was gathered, coded, and then categorized using established codes derived from a codebook. The codes that were evident lent themselves to emerging themes that focused on answering the study's overarching question: *How do teachers fully incorporate play-based learning into the math curriculum program?*

The activities that CPR members engaged in during PAR Cycle One produced evidence of play integration in the math program and instructional practices that support conceptualizing math understanding. Further, when teachers expand their instructional practices with play, math concepts become more accessible to students who struggle with traditional math classroom activities. During the process in which CPR members aligned teaching practices to lesson objectives, data emerged that demonstrated students' enhanced understanding of mathematical concepts. Throughout the data analysis process, CPR members discussed their understanding of play within their math programs and collaborated to develop lessons that integrated play-based activities to engage students. Throughout the discussions, CPR members referred to previous categories that emerged: play serves hands-on exploration; play is collaborative and cooperative; and play provides real-world connections.

The codes observed during PAR Cycle One demonstrate the connection to the categories that emerged during the Pre-Cycle and further developed. The data across the Pre-Cycle resulted in emergent codes of play as experiential learning, collaborative, and foster connections. These codes continued as a common trend during PAR Cycle One and further developed into emergent themes. The emergent themes that evolved during PAR Cycle One were evident from the codes collected from the data that play supports conceptual math understanding, incorporating play

within math programs develops teachers' instructional practices, and play offers students equity and accessibility to learning.

Next, I discuss the emergent themes derived from the initial codes observed during the data analysis process that support the assertions from the relevant codes.

Emergent Themes

After analyzing the data, I identified three emergent themes that aligned with categories and codes. The data analysis continued to demonstrate that play is a relevant and useful pedagogy for math instruction. The following emergent themes support play as a pedagogy:

- Developing instructional practices that incorporate play
- Conceptual understanding of math through play-based opportunities
- Ensuring equity and accessibility through play

At this stage of the PAR study, play-based learning opportunities encouraged students to develop academic vocabulary, transfer their learning, and make connections to their learning. As teachers continue to integrate play-based learning within their math programs, the evidence I collected showcased how teachers utilized play as a means of informal observations, fostering the implementation of math strategies, and using the data to reflect and improve instructional practices. In Table 7, I capture the emergent themes during PAR Cycle One, along with the categories and the frequency of codes.

Developing Instructional Practices that Incorporate Play

During the classroom observations, I noted that teacher planning of play-based pedagogy was evident. Incorporating play within CPR members' math programs supported CPR members to use play-based learning as a means of informal observations of students, in an effort to better support students' mathematical conceptual understanding. Next, I analyze the codes I developed

Table 7

Emergent Themes and Categories

Emerging Themes	Categories	Frequency/% of Categories
Developing instructional practices that incorporate play (n=38)	• Serves as informal observation	10/26%
	• Teaching practices that support conceptual understanding of math strategies through play	10/26%
	• Offers reflective process on play integration	18/69%
Conceptual understanding of math through play-based opportunities (n=59)	• Develops academic math vocabulary	15/25%
	• Transfers understanding	20/33%
	• Leads to connections in learning	24/40%

that emerged and their contribution to the category of instructional practices developed that incorporate play (see Figure 6).

Play Serves as an Informal Observation for Teachers

During the observations conducted in PAR Cycle One, I noted a common trend -- when students are engaged in play, teachers have the flexibility to monitor students as they work through the activities. As mentioned in ABM's first post-observation conversation during PAR Cycle One, the play incorporated in her lesson on grouping served as an extension of the lesson and allowed her to move through the room and check students' understanding as they engaged in the play activity. This was further documented by the exit ticket students provided at the conclusion of the lesson. The frequency of codes that emerged for this theme equated to 26% and included CPR members having the time and space to monitor the progress of students' application of math processes as well as their conceptual understanding of concepts during play-based activities. All CPR members utilized the play-based time to check in with students in small groups or partnerships to guide their conceptual understanding and process.

During her first post-observation meeting, CPR member ABM stated, "Play provided an intimate setting in which I was able to check in with students as they worked through the process of taking numbers apart and problem-solving together" (ABM, post-observation conversation, September 23, 2022). This valuable time allows teachers to observe which students may still be struggling and individualize their teaching to meet those students' needs or revisit instructional practices that further support students' understanding. As teachers engage with students during their play-based learning, teachers use this time as an informal assessment and check for understanding to observe if common errors are being made. This engagement allows teachers to inform their instruction and make the appropriate changes that foster conceptual understanding.

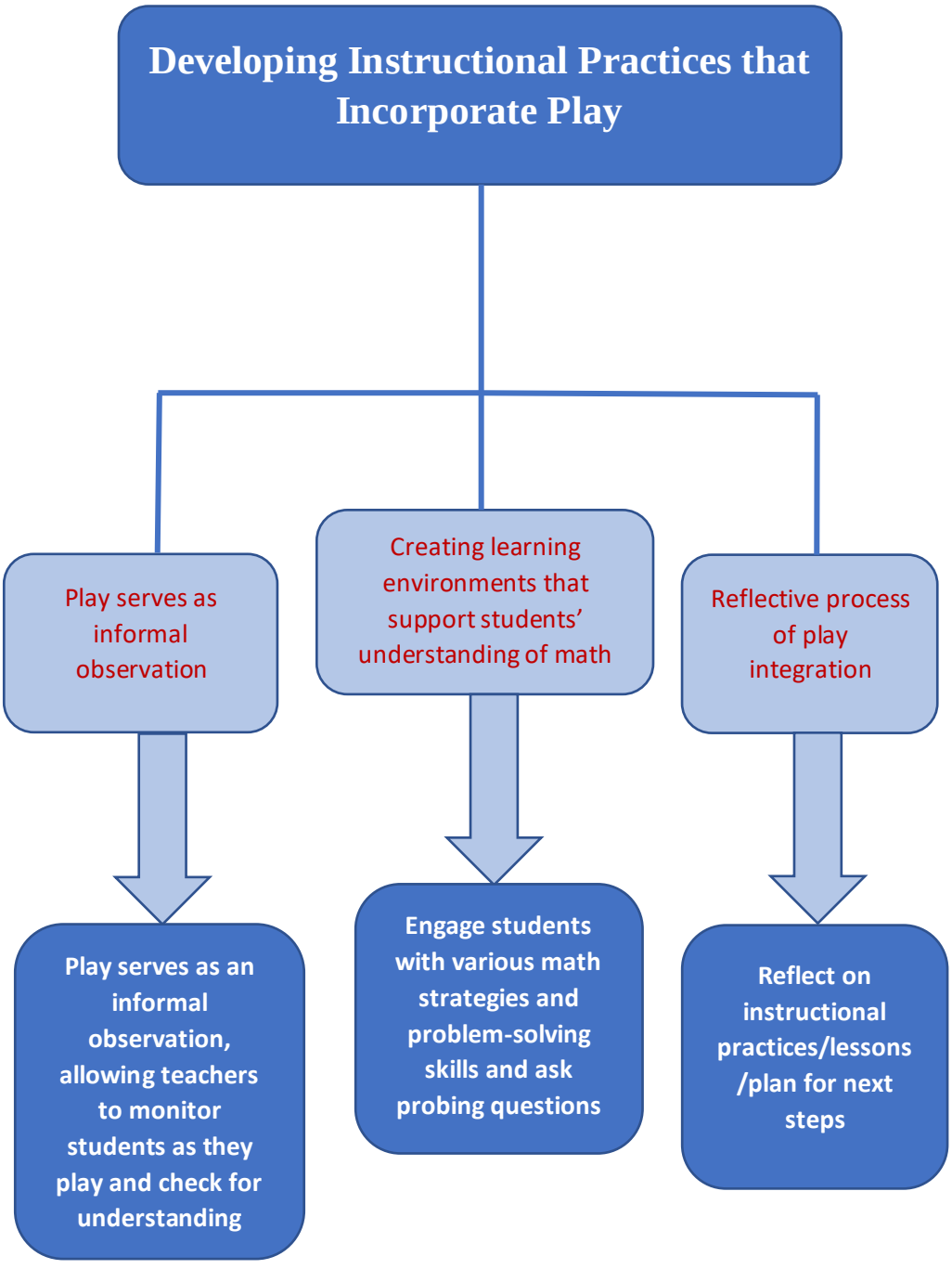


Figure 6. Categories for instructional practices.

During our post-observation meetings, CPR members reflected on what went well in the play-integrated lessons and what modifications would be made for future lessons. CPR member ABM stated, "The play-based learning activities allowed me to move around the classroom and check for understanding and incorporate a math exit ticket that students then took home for families to reinforce the skills taught for the day" (ABM, post-observation conversation, September 23, 2022). She also recognized that the play-based learning engagement offered experiential learning with kinesthetic learning through movement. Her objective in future lessons is to integrate the benefits of play learning more frequently by engaging students in mini-lessons, hands-on play-based learning that allows students to construct their knowledge and exit ticket protocols that capture students' knowledge and support communication at home. In our first post-observation meeting on September 22, 2022, CPR member AH discussed how intentionally creating peer partnerships for a lesson using a specific card game promoted participation and engagement because students were paired with materials at their level and, as she monitored students' play, she noticed that students continued to problem solve and strategize with one another.

During her first post-observation meeting, CPR member CB reflected on the challenges that were encountered during the fact family lesson. "I feel the lesson was lengthy with a lot of discussions and there were two or more concepts that were taught" (CB, post-observation conversation, October 15, 2022). She further discussed how perhaps breaking up the lesson into two parts may support students' understanding even further and make connections between addition and subtraction facts. CB also expressed challenges with time and transitions between the second-grade center rotations. CB was pleased with the lesson emphasizing flexible thinking

and how engaging students in number talks allowed them to develop a better understanding of how we all solve problems differently.

The integration of play-based activities in the mathematical program offers informal observation for teachers to assess students' understanding of the concepts taught and how students can apply those in an engaged collaborative manner. This form of observation provides teachers time to actively participate alongside students to check for conceptual understanding and guide students through the learning process by assessing their readiness, modifying instructional practice for specific students, and reteaching concepts as needed based on those interactions and observations. The informal observations lead to the next section of play—providing teachers with the tools they need to develop teaching practices that enhance students' problem-solving skills through probing questions.

Creating a Learning Environment that Engages Play-Based Math Understanding

By developing an environment that incorporates play-based activities, teachers allow students to apply their understanding of concepts taught through engaging activities that demonstrate their learning processes. CPR members implemented instructional practice and created play-based opportunities that allowed students to work through their conceptual understanding of math skills. As reflected through classroom observations, teachers' instructional practices created opportunities that enhanced students' learning and offered an avenue for them to explain their understanding and demonstrate it to their peers while teachers monitored the students' thinking and the progress of the process.

During the second observation of CPR member and second-grade teacher CB's classroom on October 27, 2022, the lesson focused on adding two-digit numbers. CB's instruction included guiding students through strategies that involved breaking up two-digit

numbers. CB led students to write number sentences focusing on place value techniques. CB's instruction implemented base-ten block manipulatives and embedded flexible thinking, play-based activities for students to utilize strategies they were most comfortable with. The independent practice served as a transition to board games, in which students demonstrated the strategies they utilized to work through two-digit addition. During the post-observation discussion, CB reflected upon the lesson, indicating that the variety of play-based activities highlighted students' understanding. "The play-based activities that students engaged in after the lesson incorporated hands-on engagement, demonstrating student's math thinking, within practice based on playing a game of their choice" (CB, post-observation conversation, November 8, 2022). Through student choice, students were able to explain their understanding to their peers because they worked within heterogeneous groups, which supported higher students helping lower students. Students were offered board games appropriate to their level of understanding; students needing intervention played basic one to ten facts and students already demonstrating an understanding extended their learning with appropriately levelled games. Applying strategies during game time developed students' conceptual understanding of addition facts.

CPR member ABM designed a play-based first-grade lesson to teach addition facts. ABM's, second observation on October 26, 2022, led to codes of instructional practices that integrated a kinesthetic learning activity to engage and support students' understanding of how to add numbers. The whole group lesson allowed ABM to guide students with the addition strategy of counting-on. She facilitated learning by having students identify the bigger number of the equation and asked students to jump as they counted to get the sum. The whole group lesson was followed by a game that would reinforce their understanding of the counting-on strategy taught. Students engaged in a partnership game of creating addition number sentences by rolling a die

and writing a number sentence on whiteboards, circling the bigger number, and counting as they jumped to find the sum of the problem. The teacher continuously monitored students as they worked, checking for understanding, and recognizing where additional support may be needed. "The lesson was an extension from the lesson of the previous day and was an introduction to the counting on strategy in a playful kinesthetic manner to reinforce the strategy and for students to practice freely on their own" (ABM, post-observation conversation, November 7, 2022). The game portion of the lesson emphasized using math facts to practice the counting-on strategy specifically and access more meaning for the addition process. ABM. shared that this skill would now be transferred to future addition lessons by connecting it to other strategies such as utilizing a number line, doubles, and near doubles. During the post-observation meeting, ABM. discussed how this lesson would be connected to future math lessons and informed her instruction to develop more meaningful lessons to engage and support students' math learning process with grade-level standards. In the next section, I will discuss the personal narratives CPR members engaged in as a reflective process of play integration in instructional practices.

Reflect on Instructional Practices, Lessons, and Next Steps

During the CPR meeting held on October 24, 2022, CPR members participated in writing a personal narrative that provided them time and opportunity to reflect on building their leadership capacity and confidence, while addressing inequities that they observed. The data of the personal narrative reflects that CPR members found that collaborating with colleagues supported their professional growth and instructional practices because the time provided them to learn from one another and understand educational practices in more depth. With a frequency of codes measuring 22.9% for developing instructional practices that embed play, CPR members

agreed that collaboration with colleagues allows for reflection, learning, growth, and improving instructional practices. CB shared,

> When we meet in our CPR meetings we have had time to share strategies, activities, and ideas to best help our students access learning. We have discussed ideas around what play is and ways to incorporate play into our daily learning. Sharing these ideas across grade levels has given me the confidence to incorporate play into my classroom and with my grade-level team members. (CB, personal narrative, October 24, 2022)

The site-based collaboration provides familiarity and experience through continued education together rather than in isolation. CPR members valued the reflective process, particularly because the sharing of ideas, resources, and activities best supported student learning and accessibility.

The discussions held during CPR meetings demonstrated members having collaborative conversations about incorporating play into daily learning and the classroom amongst cross-grade level members. The commitment to the work during the PAR cycle promoted a shared voice, built CPR members' confidence, and further connected members to one another through relational trust. "The PAR study validated the importance of play and the need to integrate it more into the learning environment" (ABM, personal narrative, October 14, 2022). CPR members found reflecting on teaching practices with colleagues as an inspirational experience due to the relevance of the work and the objective, which focused on common and similar pedagogies. In one reflective memo, CPR member ABM further stated that the CPR meetings offered a space for her to share her voice and perspective with new colleagues. As a contributing member of the CPR group, she was able to connect with like-minded educators with similar goals with hopes of implementing certain play-based practices and pedagogies in their

classrooms. AH reflected on how participation in the PAR study built a positive work environment, and learning how other teachers were being creative with play integration and thoughtful practices expanded her own instructional practices. “Through this reflection lens I am able to plan the next steps [for]students who are below grade level, struggling with math concepts, as well as students who benefit from showing their confidence and . . . shine in math” (AH, personal narrative, October 24, 2022). CPR members further discussed the impact and value of play within their instructional practices and math programs.

The data that focused on the reflection of instructional practices based on the value of play was further evident during CPR members’ personal narratives and discussions during the pillar protocol. “During math warm-ups and games, I see students sharing their ideas and participating as opposed to some of the hesitation and lack of confidence I see during math ‘work’ time” (AH, personal narrative, October 24, 2022). Collaboration with colleagues during PAR Cycle One allowed CPR members to have conversations with one another to discuss integrating play to support students’ learning styles. CPR member, ABM. shared that these collaborative discussions provided her confidence in her experience and she developed a willingness to speak up because of the validation she received by recognizing she had a voice that is valuable to share. During the pillar protocol, which was conducted during the August 14, 2022, CPR meeting, CPR members discussed how learning from one another based on their different perspectives and experiences helps build and strengthen instructional practices. In her personal narrative, ABM also recognized her reflection of play being an equitable and accessible form of learning. “Play in the classroom helps to create an equitable learning environment and a strong classroom culture and community rooted in peer support and a love and enjoyment for

learning" (ABM personal narrative, October 24, 2022). Next, I discuss the final emergent theme that was evident from the data of PAR Cycle One.

Conceptual Understanding of Math Through Play-Based Opportunities

Aligning play-based activities that promote the understanding of math concepts supported students to demonstrate their knowledge. By integrating play-based opportunities either through activities before the lesson, such as a warm-up, or games upon the conclusion of a lesson, CPR members were able to offer students a conceptual understanding of math by developing academic language, transferring learning, and making connections to learning. In Figure 7, I present a summary of categories and key codes for this theme. The graphic figure reflects that instructional practices embedded within play present mathematical conceptual understanding by making connections to learning and developing academic math vocabulary, which transfers students' understanding through play-based learning activities. Some of the evidence that emerged from the PAR study included teachers' instructional practices and the implicit teaching of academic vocabulary, students' understanding was reinforced through play-based learning experiences that activated students' prior knowledge.

Develop Academic Math Vocabulary

Each CPR member participated in two classroom observations, and I collected evidence that I coded using the selective-verbatim method. In each observation, I observed CPR members introducing academic language that aligned with math vocabulary. They integrated academic language vocabulary to assist students' processing of math concepts and used appropriate math language to develop strategies for students to utilize as they work through mathematical understanding.

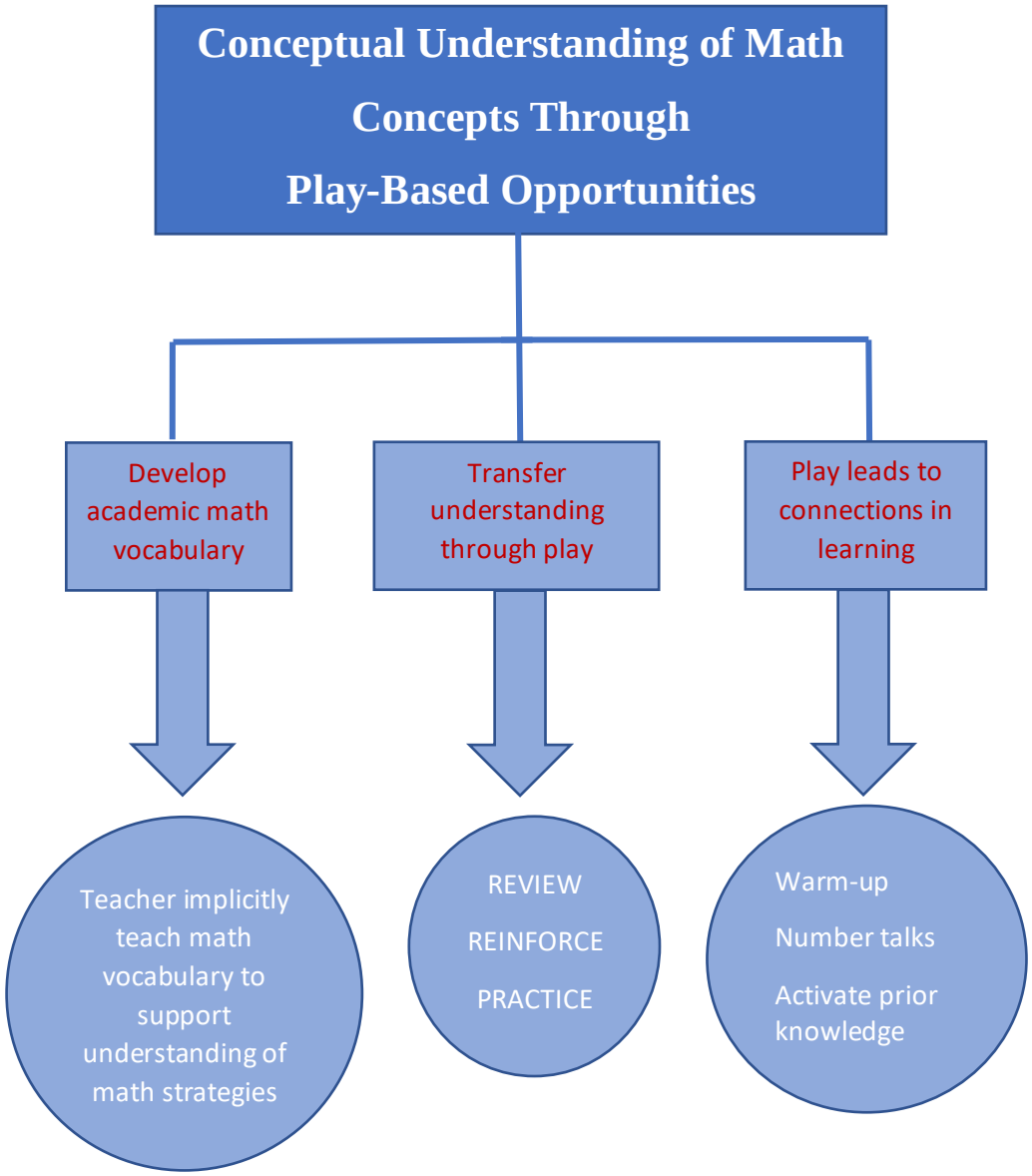


Figure 7. Categories for supporting math concepts.

During the first observation on September 22, 2022, CPR member AH explained subtraction vocabulary to students so they had a better understanding of the subtraction process. During the lesson, AH probed students by asking them, “If we are subtracting two numbers, how do I decide which one goes up top?” (AH, observation, September 22, 2022). To support students’ understanding of subtraction, AH first prepared students to think by creating situations that engage them in visualizing place value concepts. In the game for the subtraction lesson, students made connections to prior concepts and skills; they used a deck of cards to visualize the subtraction process. Throughout student play participation, CPR member AH monitored students’ engagement and processing skills and encouraged students to share their strategies.

During the post-observation meeting held on September 22, 2022, CPR member AH reflected on the lesson and shared that the integration of play within her instructional practices supported students’ processing of subtraction in a fun, engaging, and collaborative manner. AH intentionally incorporated a game that assisted students’ knowledge of place value and its role in subtraction. Since students played a similar addition game, they could make connections to prior knowledge. Using a subtraction card game, students processed while strategizing and problem-solving. AH indicated that the game provided equitable engagement and participation because she created leveled partnerships to meet students at their levels of understanding; she differentiated by creating decks of cards that included additional support for students at the intervention level and those who needed more challenge. AH’s final reflection on the observation reiterated that through the engagement of play, students understood the context of math language, and thus math vocabulary is normalized.

Classroom observations of CPR members' math instruction demonstrated that members incorporated math vocabulary as a means of understanding math strategies. Play integration in

instructional practices leads to students making connections to learning and then transferring that understanding into practice. As is reflected in the frequency of 33% for the codes of transference, including more game time in which students have the time and space to apply the strategies taught to strengthen conceptual understanding. In the following section, I will provide evidence of how play-based learning experiences transfer understanding of math skills into practice.

Transfer Understanding Through Play

By providing students with intentional opportunities to engage in play-based activities that ignite their interest, students apply their knowledge of skills and put their understanding into practice. The data and codes in this section provide evidence of how instructional practices that integrate play foster students implementing strategies such as creating a number line, counting on, engaging in subtraction facts that included regrouping, and through song and ten frames practice math facts. Through the use of these strategies and connections to play, students not only activate their understanding but also build upon the knowledge they have obtained.

Students are provided opportunities to transfer their understanding of concepts taught which demonstrates their knowledge while they engage with their peers in play-based learning experiences which further enhances their learning. The codes from this category focused on students applying strategies while making connections to math concepts and noticing the practice in play-based activities. The frequency of codes for this category resulted in a frequency of 33% and highlighted instructional practices that integrate the process of mathematical understanding and application through play.

ABM's first-grade lesson on September 23, 2022, focused on a subtraction chapter which provided data on how the transition of subtraction understanding is demonstrated through play engagement. The lesson was conducted by engaging students in a warm-up question based on

students' interest in Pokemon cards. Students constructed meaning and were directed to share their understanding of solving the number sentence. Students were then encouraged to turn and talk with a partner and shout out their answers when directed to do so, allowing for equitable participation in which all students access learning. With the guidance of the teacher, students worked out the problem using a ten frame and recognized the information needed to solve the problem accordingly having students assist in writing the number sentence. Through pre-arranged student partnerships, ABM then referred students to a play-based activity as a follow-up of the lesson to reinforce their learning. The activity allowed students to transfer their understanding of subtraction facts and apply it to the game.

The play-based activity that supported students' transfer of subtraction knowledge, involved students playing a math game in which they were provided game boards and dinosaur moving pieces, a ten-frame chart, and a whiteboard to capture their thoughts. ABM explains expectations for the game and refers to students' sportsmanship skills by reminding them to "Ro Sham Bo," should a disagreement occur. I observed students working with partners in taking turns to roll the dice, move their game piece to a number sentence, and solve by placing markers on the ten-frame chart, working through the subtraction by taking away the number of markers for the smaller number, writing the number sentence on the whiteboard, and circling the bigger number. Students work through the game board until they reach the end.

In my observations, I noted students engaged in practicing the skills that were learned by utilizing the ten-frame to foster their understanding of how subtraction takes place and recognizing the bigger number being written first in the number sentence. In their partnerships, students supported and assisted each other and engaged in ongoing dialogue on how to best solve the problem. As students worked, the teacher monitored students' understanding and progress,

checking in with all partner groups to guide them through the process. This play-based activity provided students with an engaging activity that allowed them to transfer their knowledge of subtraction in a fun and effective way. They developed a deeper understanding of how to subtract and how to utilize the ten frames as a method and strategy, which then was transferred into writing the number sentence. These observations led to a discussion of how CPR members incorporated play into their instructional practices to make meaningful experiences for students.

I observed these meaningful experiences during classroom visits as students moved through the play-based activities. Student conversations during play time indicated that they utilized academic language to practice and participate in the activity with intentionality and support each other's learning, assisting the learning process. In the following section, I will present evidence of how CPR members developed and created play-based learning opportunities to enrich curriculum-based lessons.

Teachers' Practices Integrating Play Seeks to Create Connections in Learning

As students learn and build their mathematical understanding, providing opportunities that allow students to make connections to their learning is imperative to strengthen that growth. Play is an avenue that, when integrated into a math program, activates prior knowledge. Activating prior knowledge activates students' thinking as it relates to what they already know and makes connections to previous understanding as it aligns with learning new concepts.

Activation of prior knowledge through play integration was observed in CPR member CB's introductory subtraction lesson in her second-grade class, held on September 15, 2022. The subtraction lesson began with a number talk warm-up with CB followed by a game that used dots for students to observe and represent their thinking to assist with conceptual understanding. CB recognized with students that their interpretations of subitizing demonstrate the different ways to

think about math and numbers. Students engaged in the process and CB integrated play as she drew and connected the game to their thinking. The data from this observation reflected that the teacher circled students' answers and provided a visual conceptual understanding and equity and accessibility by incorporating visual representations with a frequency of 69% codes. The lesson transitioned into an addition and subtraction fact family lesson. By transitioning students into the new lesson, CB activated their prior knowledge by referring to a related lesson taught earlier in the week. The evidence of this data reflects the emergent theme of supporting student understanding of math through play-based opportunities, specifically focusing on the category of play that leads to connections in learning, with a frequency of 24%. CB refers to different strategies that students may utilize to solve equations that align with the codes for flexible thinking and had a frequency of 31%. Many of the strategies included counting back on a number line, solving by doubles and near doubles, and making a number ten when adding and subtracting. CB guides students in thinking about many ways to add numbers using math language. Upon conclusion of the lesson which included direct and guided instruction, she led students to independent practice before the math centers rotation which all incorporated various games of math facts.

CB's instructional practices integrated students' transfer of learning through math centers where students worked in small groups playing various math games, either board games or online software such as Zearn. These math centers offered students the opportunity to connect their prior knowledge of concepts taught to those in the current lesson engage in play activities that reinforced and reviewed, and practice concepts with their peers to learn from each other and participate and demonstrate their learning. Students worked in a play-based center for twenty minutes and then were rotated to a new center.

CPR member CB worked at the back table as one center in the rotation with one group at a time. The teacher-guided center included students rolling dice and creating addends to create addition equations to work through and solve on their whiteboards. They then shared with their group the different ways they created equations to represent the dots on their die, which is specific to the codes of flexible thinking. Observations of the other centers demonstrated students talking through the various strategies they have learned to solve and process their understanding of equations. Students were observed using and discussing strategies to solve problems. The data included CB asking students probing questions and students drawing triangle diagrams to support their understanding of number placement. These data represented conceptual understanding with a code frequency of 40% for equity and a code frequency for accessibility of 31%. Students were not only able to make connections to their learning but also transferred their knowledge through play-based activities. In the next section, I further discuss the transfer of knowledge that was observed in the play-based activities of CPR member ABM's first-grade class.

Ensuring Equity and Accessibility Through Play

Observations and data collected from PAR Cycle One provided evidence that demonstrated how play addresses equity and accessibility. The focus of practice is related to issues of equity by incorporating play-based learning opportunities to support and deepen student understanding of mathematical concepts and demonstrating their depth of knowledge. As CPR members engaged in play integration, they observed how play incorporation focused on equity by allowing them to develop learning opportunities that were developmentally appropriate practice, focusing on where students are and the accessibility of play included students participating in the practice and process of learning (see Figure 8).

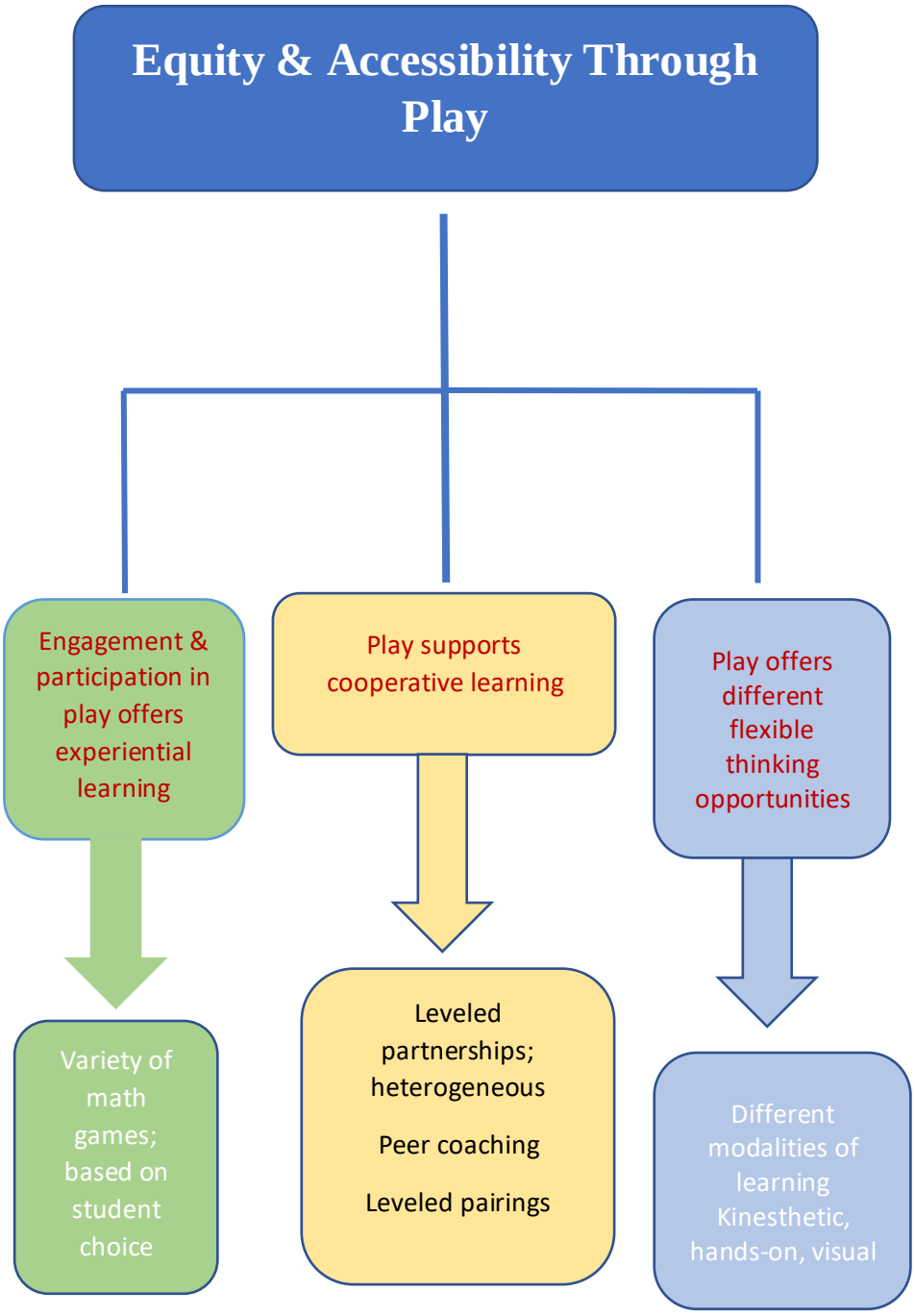


Figure 8. Categories for equity and accessibility.

Hammond (2015) offers that the goal of educators is to find ways to tap into students' reservoirs of information and to comprehend their home-based learning styles as a springboard for creating more authentic learning experiences. CPR members incorporated play integration in their math practices, with the acknowledgment that students' learning and skills vary. To support equitable practices and reach all students, CPR members incorporated play-based instruction and opened pathways for students to participate in the learning experience and demonstrate their knowledge through avenues that were appropriate to their levels of understanding. When reviewing how equity and accessibility are demonstrated through play, the categories that support this emergent theme include: engagement and participation in play offer experiential learning, support cooperative learning, and differentiate thinking opportunities.

Engagement and Participation in Play Offers Access to Learning

During the two rounds of classroom observations, all CPR members integrated games within their math lesson that involved students working with peers either in partnership or group settings. Observations provided evidence that students showed a willingness to engage in learning when it was play-based because they felt comfortable and the play opportunity allowed them to demonstrate their play experience while learning new skills. “Inequities that I see in the classroom are addressed through play by allowing students to engage in review, repetition, supported learning, and explore their personal understanding of the math skills” (AH, personal narrative, October 24, 2022).

I observed play engagement by all students as they worked through the process of math concepts taught and applied their understanding of strategies to the play-based experiences teachers incorporated. Through the methods students used to solve math equations via play it highlighted their understanding and assisted sense-making using different modalities of learning.

Number talks included in lessons allowed students to reflect upon their math processing and taught students that flexible thinking is valuable to understanding math because it demonstrates the many possibilities of solving and learning math. Each student was able to participate and share the value of their knowledge.

CPR member and second-grade teacher CB discussed how offering students a variety of play-based math activities at the end of a lesson adds to the accessibility of learning because it offers students a choice to demonstrate growth and progress toward math learning objectives. CPR members discussed the equity and accessibility of learning via play by acknowledging that partnerships and groupings were intentionally established so students were able to access and participate in their learning based on their needs and levels. Discussion during the visual mapping protocol included CPR members acknowledging that equity and accessibility of play fostered students' learning from others' thinking, developing shared meaning and understanding, and strengthening problem-solving skills. Peer collaboration is another category that supports the emergent theme of equity and accessibility through play, which will be presented in the following section.

Play Supports Cooperative Learning

Play during PAR Cycle One presented play as an interesting and welcoming engagement, giving students the chance to interact with peers and have a sense of belonging. During a CPR meeting, CPR members discussed how the pillar protocol was an example of the type of collaboration that offers and develops thought partners amongst students when working and solving math equations.

During the two rounds of observations of the three CPR members, cooperative learning among students was evident. Play creates positive memories because it gives students the chance

to interact socially and form bonds with others. Playing with others is a meaningful way for children to socialize, fostering their ability to communicate, work together, and share knowledge (Zosh et al., 2017). As was observed during the PAR Cycle One observation, students were interacting with one another in a positive manner solving math equations together. At a CPR meeting, CPR member AH reflected that participation during play-based learning is high due to partner pairing, friendly competition, and working together to play or solve a puzzle. Aside from math skills, students have a chance to focus on social skills or leadership by acting as a student coach (AH, personal narrative, October 24, 2022). "Children who play together develop their communication and teamwork abilities in addition to having fun" (Zosh et al., 2017, p. 6). The collaborative nature of play-based learning is further supported through leveled partnerships, heterogeneous groupings, and peer coaching. In the following section, I will share insight from the data from observations and discussions during PAR Cycle One and relevant research that aligns with the claim.

In their study on the developmental and educational benefits of play, Pyle and Danniels (2018) describe how play-based learning promotes children's social and cognitive capacities as well as their academic capabilities. Children can exhibit their learning through play while also helping to scaffold the learning of others, according to this definition. Play comes in many forms, and it fosters imagination and creativity. Children test, clarify, and act out their opinions and understandings while engaging with those of others as they play and converse with one another. During the visual mapping protocol, CPR members discussed that play-engaged activities in the classroom created a supportive learning environment in which peer learning is differentiated based on students' levels and needs. During this process, students learn from others' thinking and strengthen their problem-solving skills. The data included collaboration with partners during

play, and the location in the classroom where students chose to work out problems together and share their perspectives of understanding with each other. The code frequency for this theme was 35.5%. During CPR member AH's first classroom observation conducted on September 22, 2022, students engaged in conversations explaining the regrouping strategy as they practiced math facts through a partnership card game. Students implemented AH's instruction by focusing on a regrouping strategy and discussing how to solve problems with their partners. According to Dockett and Perry (2007), the social and cultural contexts of play give the basis for developed understandings, Children have the chance to communicate meaningfully during play with individuals who matter to them, and this encourages personal respect by allowing people to express their own opinions and be heard. During her first post-observation conversation on September 22, 2022, CPR member A.H. shared that she intentionally created leveled partnerships during students' play-based subtraction card games, created equitable engagement and participation by meeting students at their level of understanding, and allowed the students to practice those skills accordingly. As students processed in leveled pairings, the transition from subtraction understanding to play became clearer. Creating a classroom culture based on collaborative and cooperative learning creates an environment that promotes the various ways students learn, understand, process, and think about math. Next, I discuss the data represented during PAR Cycle One that reflects how play creates a learning environment in which flexible thinking around math is encouraged.

Play Promotes Different and Flexible Thinking Opportunities

With the Common Core standards and the study of math based on multiple methods, it has become even more important to provide students with opportunities in which they are able to exhibit their learning style and approach to solving math equations. Play provides students with

opportunities to work with peers at various levels, and students' flexible thinking is showcased which supports students learning different use of strategies. Children are given multisensory learning chances through play, improving information processing, learning, and understanding. Through inquiry and discovery, play improves learning. According to Burghardt (2011), "[p]lay is varied, diverse, and complex. It defies simple definitions and crosses numerous disciplines (p. 11). From the data analyzed during PAR Cycle One, the learning opportunities created by CPR members offered students opportunities to participate in play-based learning that incorporated different modalities of learning and integrated learning through play that was kinesthetic, hands-on, and visual. Utilizing various modalities of experiential learning deepens students' understanding of math concepts.

During PAR Cycle One observation, students constructed and worked with materials as they put their information into practice through hands-on play. Students' learning and understanding were reinforced. During PAR Cycle One, I conducted observations of CPR members integrating learning pathways that included opportunities for students to use hands-on manipulatives and construct their learning through movement. In her post-observation conversation on October 27, 2022, CPR member ABM discussed the intentional lesson planning she constructed to ensure that her subtraction lesson engaged students through body movements and kinesthetic learning.

Analysis of data from classroom observations utilizing the selective verbatim tool reflected that play as a hands-on learning activity is a useful and organic way to learn through doing and actively participating. Codes that emerged to support the theme of equity and accessibility represented a frequency of 31% and included: when students are given the developmentally appropriate stimulation to partake in learning opportunities through the hands-

on style of play, they develop a deeper understanding of problem-solving skills. In CPR member ABM's second observation on October 26, 2022, I observed that she implemented a variety of learning modes to support differentiated instruction. For example, she guided students to jump as they counted during an addition lesson. Students continued this interaction during a play-based game, in which ABM integrated an addition game rolling dice, writing number sentences, and adding two digits as they applied the counting on strategy by jumping. The CPR members discussed prospects for hands-on exploratory learning where students engage in self-directed experiences from which they develop knowledge. The findings showed that students actively participated in a learning process when teachers gave them hands-on learning opportunities and interactive exercises to help them understand mathematical ideas. "Learning through play addresses inequalities by offering students to use their own thinking and words to explain the process of problem-solving" (CB, personal narrative, October 24, 2022).

The CPR members discussed prospects for hands-on exploratory learning where students engage in self-directed experiences from which they develop knowledge. ABM's second classroom observation which took place on October 26, 2022, provided evidence of how the My Math lesson from the previous day was reinforced through the introduction of a counting-on game that was kinesthetically playful and collaborative. Through student-to-student interaction, students interacted with partners to freely practice the strategy. Data showed that by integrating a play-based learning program, teachers gave students hands-on learning opportunities and interactive exercises to help students understand mathematical ideas while students actively participated in a learning process.

The CPR members discussed prospects for hands-on exploratory learning where students engage in self-directed experiences from which they develop knowledge. CPR member AH's

second post-observation discussion facilitated a conversation of her reflecting upon the multiplication war game she embedded using a deck of cards as a warm-up activity in her multiplication lesson. AH shared, "Students developed a sense of success by watching others" (AH, post-observation conversation, October 26, 2022). The findings showed that students actively participated in a learning process in which teachers gave them hands-on learning opportunities and interactive exercises to help them understand mathematical ideas. Data observed and analyzed during PAR Cycle One indicated that CPR members created and integrated play into math lessons that involved students in immersive and differentiated activities, play that serves as a hands-on experience starts learning via exploration and discovery.

CPR members have learned through research and discovery that this form of learning involves students who are active participants and learn through their independence and curiosity. As was reflected in the Visual Mapping Protocol, CPR members stated that play-based learning fosters different modes of learning in which students' thinking and problem-solving are valued and respected, developing a shared meaning. During CPR member ABM's first observation, she engaged students by writing numbers in the air and singing a song for each number to guide their understanding of number recognition prior to a subtraction lesson and game. AH, in her personal narrative on October 24, 2022, explained that play addresses a learning approach in which students explore their personal understanding of math skills. AH stated that "Students can delve deeper into their grasp of what is taught and apply their knowledge that goes beyond conventional learning objectives through exploration and discovery of play through hands-on learning" (AH, personal narrative, October 24, 2022).

The research conducted in PAR Cycle One, built upon the codes and categories that emerged from the PAR Pre-Cycle of play offering real-world connections and focused further on

how equity and accessibility in math instruction can be established through play-based activities. Equitable participation entails each student actively participating in the activity engaging in the learning process and being given the means to do so. Structured play activities support students' conceptual understanding and provide freedom of expression. These skills, which are enhanced by play experiences, tap into students' prior knowledge that is then transferred into their everyday lives. When students are given opportunities in which they are creating and building by using real-world materials, they are further experiencing play-based learning. CPR members developed instructional practices that integrated play, thereby creating learning situations for students to make choices and share perspectives of thinking. Based on the data analysis and completion of PAR Cycle One, I reflected on how the themes that emerged from the research study relate to the overarching research question: *How do teachers fully incorporate play-based learning into the math curriculum program?* This question, along with the sub-questions that guide the research, will be discussed in the next section.

Research Questions Emerging Themes of PAR Cycle One

The overarching research question for the PAR research study is: *How do teachers fully incorporate play-based learning into the math curriculum program?* These sub-questions will guide the research:

1. To what extent do teachers design math lessons that include play pedagogy?
2. To what extent do teachers implement play pedagogy in their instructional practices?
3. How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?

Upon reflection on the work of PAR Cycle One and the data I collected and analyzed, evidence demonstrates that CPR members developed and created intentional learning opportunities for

students that integrated play as a mechanism to support students' mathematical conceptual learning. The lesson plan template that CPR members created and shared prior to the observations included the objective of the lesson, play integration in instruction, the transfer of play in student learning, and the expected outcome for the lesson. The template captured the intentional planning process of CPR members.

Through collaboration with colleagues, CPR members discussed the focus of grade level standards and how best to support the lesson through the appropriate use of play. As is reflected in the lesson template, CPR members made connections to the learning objectives and how that will transfer into play to demonstrate students' understanding. During her second observation math lesson template completed on October 26, 2022, CPR member ABM wrote the following expected outcome for her lesson on addition strategies:

- Students will understand how to use 'counting on' as one strategy to support addition.
- Students will gain valuable practice with this strategy and receive peer support if needed.
- Students will have the opportunity to make mistakes in a low-risk setting, learn from those mistakes, and develop a positive mindset toward math.
- Students will identify as mathematicians and build confidence in their understanding of math practices.

CPR members analyzed lessons and strategically developed play opportunities to enhance student learning and address the PAR study sub-questions. Evidence from PAR Cycle One indicated that CPR members integrated some form of play-based learning in their math programs, whether it was included as a warm-up prior to the lesson or inserted as an opportunity to reinforce concepts at the conclusion of the lesson. The play-based learning supports either a

a new concept introduced or provides students time to practice, review, and reinforce skills taught previously.

As CPR members evolved through the planning stages of the PAR Cycle One, the evidence demonstrated that members took the time to plan and collaborate with one another during CPR meetings and discussions as well as with grade-level teachers during weekly planning to create learning opportunities for students that integrated a play-based learning concept within their math programs.

Next, I reflect on my leadership at this stage of the PAR research study, the action steps that led to PAR Cycle Two, and the data I chose to collect to answer the PAR research study sub-question. We determined how teachers co-designed and co-facilitated useful professional learning processes for other teachers with a focus on using play in math curriculum and instruction.

Leadership Reflection and Action Steps for PAR Cycle Two

The PAR research study has impacted my leadership in a meaningful way and has served as a positive growth in my work as an instructional leader. The most valuable experience in my professional growth consisted of developing the leadership capacity of teachers at my site who have served as CPR members. In my first reflective memo (October 9, 2022), I recall how impressed I was with the CPR members who chose to participate in the PAR research study and how much I valued the amount of experience they already had with play-based learning.

The interactions I shared with CPR members strengthened relational trust because, during PAR Cycle One, relationships were enriched through our collaborative efforts toward the research and the sharing of ideas, thoughts, and resources. I encouraged CPR members to facilitate discussions, which built their teacher leadership capacity and led to a shift in my

leadership. As the sole leader at my site for the past seven years, I had the sense that I needed to focus my efforts on instruction, management, and daily school-based operations. Much of my work in the past has been in isolation. However, through the work of the PAR research study, I have shared many tasks and relied on the expertise of CPR members to guide the research.

The main shift in my leadership growth was learning to create a collaborative professional team and relying on teacher leaders to assist with the research. Through this process, CPR members' ideas and efforts are valued and respected. As ABM remarked:

> I personally also have an innate tendency towards shyness and assume that others have more experience or knowledge. In the past, this has sometimes led to me staying silent or not speaking out, and unsure of how to speak out in situations where I disagreed. This work particularly, and working with these colleagues, has built my confidence around my own experiences and knowledge base and helped me to see that I have a voice to bring to the table. I feel like I am now more likely to share an opinion, reach out to a colleague, or offer support. I feel connected to my school, my colleagues, and to my practice (personal narrative, October 24, 2022).

My PAR study research and the work concluded during the PAR Pre-Cycle and PAR Cycle One demonstrate that the focus of play as a pedagogy for math learning is valuable in building teachers' instructional practices in their math programs to develop meaningful learning experiences for students. The codes that emerged during the PAR Pre-Cycle aligned and continued with the codes and emergent themes that developed during PAR Cycle One. The data was evident that CPR members were able to appropriately design math lessons and develop instructional practices that integrate play as a means of learning. The main area of focus that has been repetitive during the PAR Pre-Cycle and PAR Cycle One is that play as a pedagogy is a

collaborative form of learning for students and provides students an opportunity to demonstrate their understanding through various accessible modalities of learning, which are hands-on and kinesthetic.

These connections were further expanded during PAR Cycle One by creating situations in which play was integrated within CPR members' instructional practices and math programs. CPR members were able to reflect on their teaching practices and develop math programs in their classrooms that supported students' conceptual understanding through the use of academic math vocabulary, transferring learning, and informal observations of play. Based on the evidence collected during PAR Cycle One, the action steps included for PAR Cycle Two will consist of continuing the research and having CPR members co-design and co-facilitate a useful professional learning process for other teachers with a focus on using play. During PAR Cycle Two and the final data collection cycle, this is an area I am most eager to learn, as a goal of the PAR research study is to develop school-wide continuity and consistency in our site's math programs that will expand the math curriculum, support innovative teaching practices, and enhance student conceptual math learning and understanding. The PAR research projects will help teachers and principals work together to integrate play into math instruction and evaluate the results. Through regular observations and deliberate professional development opportunities to ensure school-wide continuity, I will support the implementation.

Conclusion

When creating a consistent school-based program that prioritizes engagement, dialogue, and peer cooperation, it is crucial to increase play within the mathematical program and assist teachers in the process through professional development. Learning opportunities for teachers to improve their math practices and support student outcomes through the development of a

program improvement process, which is based on the understanding that play reinforces student learning, and that additional opportunities to play during academic instruction benefit students' learning.

During the final cycle of the PAR research study, CPR members and I continued to hold CPR meetings with CLE protocols to discuss the relevance of play within the instructional math program, understand how to further integrate play as a pedagogy in teaching practices, and extend the research by co-creating professional learning opportunities to offer other teachers at the site to expand this type of instructional practice school-wide. Learning by doing is the cornerstone of our professional development (Bryk, 2015).

Evidence from the PAR Pre-Cycle along with the emergent themes that were present during PAR Cycle One indicates the PAR study is demonstrating success toward the goals of the FoP. In the second PAR cycle, the CPR members encourage play integration through a cooperative effort, giving students real-world, cutting-edge learning experiences to put into practice, and allowing instructors to develop their skills by planning lessons that incorporate play into their math instruction.

CHAPTER 6: PAR CYCLE TWO AND FINDINGS

Play is often talked about as if it were a relief from serious learning. But for children, play is serious learning. Play is really the work of childhood. Fred Rogers

In the PAR study, I collaborated with three classroom teachers to integrate play into mathematical teaching practices as a foundational practice of students' conceptual understanding through exploration. In Chapter 5, I discussed the data from PAR Cycle One that led to these emergent themes: developing instructional practices that incorporate play; conceptual understanding of math through play-based activities, and ensuring equity and accessibility through play. During the first level of the PAR research, teachers developed strategies; in PAR Cycles One and Two, I observed that teachers implemented play-based learning activities to support academic vocabulary development, transfer to students' learning, and connections. In particular, the evidence I documented demonstrated how teachers used the time children were engaged in play activities as a means of informal observation and used data from observations to reflect and improve instructional practices. Teachers continued integrating play-based learning within their math programs as the PAR study evolved during PAR Cycle Two.

In this chapter, I focus on the data from PAR Cycle Two and the themes that emerged from the data analysis. The PAR Cycle involved CPR members participating in community learning exchange data protocols, group discussions, and further developing and incorporating play activities that matched grade-level criteria into their instructional practices. CPR members used play-based learning to direct students' conceptual grasp of math and deepen their understanding. CPR members continued to create engaging learning settings that enabled students to participate in learning opportunities. In addition, through the activities presented during PAR Cycle Two, CPR members took part in reflective processes, continued to build capacity in current teaching practices, and pursued their professional growth as they fully

incorporated play into the math curriculum program. I describe the processes and activities of PAR Cycle Two and analyze the data (see Table 8).

PAR Cycle Two Process

In PAR Cycle Two, CPR members continued to engage in community-building processes. They reflected on their work as aligned with the research questions, collaborated to increase their collective efficacy, and created lessons incorporating play into math teaching strategies. CPR members planned their next steps in further integrating play to improve children's mathematical thinking and learning during the first post-observation conversations. As a result of CPR member C.B.'s involvement in the PAR process, she received funding for a play-based project titled: STEM Learning Through Lego Play. She attributed her participation in the PAR project and the benefits from the PAR research study as the motivation impetus for extending student learning in the classroom with play-based STEM activities.

During PAR Cycle Two, CPR members engaged in two CPR meetings including the data-collecting process of a kiva protocol, in which members collaboratively discussed the research questions and planned for the next steps and chalk talk. During meetings, CPR members reflected on the process of the PAR project and study and revisited the initial overarching question and sub-questions based on the state of the data collection from PAR Cycle One. I observed classrooms to highlight the integration and implementation of play pedagogy in mathematical instruction and facilitated reflective post-observation conversations in which CPR members further reflected on their instructional practices.

At the initial CPR meeting held on January 23, 2023, CPR members reflected on the progress of the data collection from PAR Cycle One and the implementation of play-based instructional practices. During the January CPR meeting, CPR members used the Kiva protocol

Table 8

Activities PAR Cycle Two

Activity	January 23	January 27	February 15	March 10	March 14
CPR meetings (n=2)	•				•
Classroom Observations		• •	• •	• •	
Post Observation Conversations		• •	• •	• •	
Reflective Memos	•		•		•

Note. January-March, 2023.

to review and assess the data and the emergent themes from PAR Cycle One data and supporting evidence that emerged during PAR Cycle One of play-based learning, CPR members shifted their thinking to focus on this question: To what extent do teacher instructional practices support peer learning? Other activities during PAR Cycle Two included two rounds of observations using selective verbatim, followed by post-observation conversations in which CPR members reviewed evidence from lesson observations and discussed the areas of strength and need. While the study was focused on teacher actions to implement strategies, those strategies are closely tied to student responses. Therefore, I recorded responses and other teachers' actions supporting student learning.

I concluded PAR Cycle Two with a final CPR meeting using a chalk talk protocol focused on reflective questions pertaining to what participants learned, including the effectiveness of teacher implementation of play integration, the PAR experience for CPR members' professional growth, new information or ideas developed from the PAR project, next steps to advance play integration as normal teaching practice in math instruction, and feedback on my school leadership in the process. I prepared reflective memos to document both the work that the CPR members and I completed as well as my knowledge of how the PAR study benefited my development and progress as an instructional leader.

As CPR members participated in the PAR study during PAR Cycle Two, I observed additional evidence to fortify the initial emergent themes. CPR members reviewed the data presented reflected on the discussion from the kiva protocol and applied that information to adapt a research question: To what extent does play pedagogy in math instruction transfer to practices that support peer learning? This development aligned with the data for the emergent category from the PAR Pre-Cycle that focused on play serving as a collaborative and cooperative process.

From the implementation of play in math instructional practices during the PAR Pre-Cycle and PAR Cycle One, CPR members developed their skills; by following a reflective process, they developed a better understanding of play practices in math instruction and the resources needed to successfully integrate play in their instructional practices. An additional data point emerged through this process: through planning and implementation of play-based learning, teachers shifted to become facilitators of individual student learning while monitoring progress. Next, I provide evidence from the previous two PAR Cycles and the relation to the emergent themes of the final PAR research cycle.

PAR Cycle Two: Emerging Themes

As a result of the PAR Cycle Two, CPR members implemented, planned, and integrated play pedagogy into their instructional practices to create learning experiences for students that were equitable and accessible. The teaching practices focused on designing activities for peer learning. The PAR Cycle Two data were consistent with the categories (Pre-Cycle) and emergent themes (PAR Cycle One); when teachers intentionally planned play-based strategies, the students engaged in peer learning and actively co-constructed meaning. During PAR Cycle Two, I focused on how CPR members developed instructional practices that incorporated play, including how often they integrated play within mathematical teaching practices, what they needed to sustain a play-based mathematical pedagogy within math programs, and how play offered teachers the freedom to informally assess students' thinking to inform instruction. In addition, I observed what students did as a result of teachers' implementation of play, which indicated that students were actively talking to each other in play pairs or small groups.

Teachers' increased levels of planning and implementation resulted in data that supported the emergent themes of PAR Cycle One, which corresponded to the data from PAR Cycle Two.

As the PAR research study progressed from the emergent themes of PAR Cycle One, PAR Cycle Two emerging themes were:

- Planning for Instruction
- Instruction to Support Student Play-based Learning
- Equity and Accessibility through Play

I reviewed the data that emerged during PAR Cycle Two and confirmed that the data connected to previous categories and supported further development of the emergent theme of conceptual understanding of math through play-based opportunities. I focused on the newly developed sub-question of how play transferred to support practices that fostered peer learning, as well as the emergent theme of developing instructional practices that incorporate play. I emphasized the frequency, resources, and purpose of play serves as an informal assessment for monitoring students' progress and learning. The data from PAR Cycle Two provided connections from the categories of the PAR Pre-Cycle and emergent themes of PAR Cycle One to develop themes in PAR Cycle Two (see Table 9).

Planning for Instruction

In PAR Cycle Two, teachers planned play activities to fully engage students, particularly in peer learning, representing 34% of the data for the cycle of inquiry. In planning, the data demonstrated increased play activities as teachers identified additional resources. In addition, the purpose of play became clearer to teachers. When teachers plan for interactive instruction, they have the opportunity to observe how students are processing information and can target students individually. The informal form of observation and assessment created intentional situations in which teachers addressed and accommodated students' specific learning needs and development in real-time as they modified instruction based on those encounters.

Table 9

PAR Cycle Two Emergent Themes with Categories and Codes

Emerging Themes	Categories	Codes
Planning for Instruction (n=76 or 34%)	• Play Implementation • Resource Identification • Purpose of play	• Backwards planning (n=19) • Materials (n=15) • Plans for curriculum and instruction (n=22) • Frequency of play (n=10) • Lesson objective (n=20)
Instruction to Support Student Play-based Learning (n=101 or 45%)	• Academic math vocabulary • Transfer understanding • Connection to learning (teacher actions)	• Making connections (n=19) • Deeper understanding (n=21) • Facilitation/progress monitoring (n=36) • Conceptual understanding (n=25)
Equitable Accessibility through Play (n=44 or 20%)	• Experiential learning opportunities • Cooperative learning • Differentiated and flexible thinking opportunities	• Modalities of learning (n=7) • Exploration (n=9) • Practice/review/reinforce (n=13) • Peer collaboration (n=15)

Frequency and Resources

During discussions in PAR Cycle Two, CPR members reflected on their instructional practices to understand the extent of play implementation more fully—specifically, how often and what is needed in order to secure the success of play integrated within instructional practices. Through intentional backward planning from lesson goals to choosing play activities that would foster those goals, CPR members created an initial bank of games. They then continued their research and added to the repertoire by creating games that would support the unit of study, taking into consideration students' level of understanding, small group work, and partnerships. CPR members integrated play within mathematical instruction at least three times a week through daily math warm-ups, number talks, and a review of math concepts prior to a chapter test with online resources such as Kahoot, either daily after students completed math assignments or on designated days such as Math Monday or Fun Friday. With attention to the lesson objectives, the teachers reported that they were strategically choosing play activities.

CPR members' classrooms included accessible games readily available to students. CPR members established the expectations and protocol of play-based learning in the math program. Teachers assessed the frequency and knowledge students acquired through the use of the games and strengthened their instructional practices by conferring with students as they engaged in the tasks, connecting with them, and offering support as needed. By incorporating new games weekly and offering a variety of games, CPR members created an effective method to monitor student's progress toward learning and understanding math concepts. CPR members integrated play within instructional practices as a transition from one math chapter to the next, building upon and front-loading students' growing knowledge. During the CPR meeting on January 23, 2023, CPR members discussed the benefits they gained from taking the learning cycle approach

of play integration; they improved their planning process by analyzing when play-based learning would be appropriate and beneficial to support meaning-making. That consideration involved reviewing the math curriculum, aligning with grade-level standards, and integrating play instructional practices within the introduction to a lesson, during exploration, or during the debrief.

Purpose of Play

As CPR members entered the final cycle of the PAR study, they had more experience in reflecting on the purpose of play and the rationale for including play in the math curriculum. The reflective process allowed CPR members to articulate why play is integrated within their instructional practices and what is needed to support play within their math teaching practices and programs. During this crucial period, teachers observed how students encountered difficulties and tailored their lessons to students' requirements. In post-observation conversations, teachers shared that analyzing instructional practices became central to their process. They applied their analyses to create teaching situations that benefited students integrating a platform for students to communicate and display their understanding to their peers with a method for teachers to monitor students' development and thought processes.

When CPR members participated in the CLE protocol chalk talk, they developed a different perspective on standards-based instruction. First, members could see that the use of play supported student learning, and they discussed how their goals of student academic talk during play led to more student dialogue. Teachers realized that intentionally planning for play meant that they had more opportunities to observe student learning, conduct informal assessments, and adjust learning—especially through questioning and guided inquiry. They could respond to individual learning needs because students were engaged in play and making

sense of math concepts with peers as they played. Teachers continued to plan and implement concurrently, and their instructional practices began to support student learning more systematically.

Instruction to Support Student Play-Based Learning

During PAR Cycle Two classroom observations, the evidence demonstrated that students had more conversations with one another. Teachers used instructional practices to support language-rich conversations using academic math vocabulary by modeling the use of math vocabulary and urging students to make connections to their understanding. The learning transferred and connected to math as students played, talked, and made meaning. Teachers initiated instructional practices guided by what students comprehended about the lesson and what teachers wanted them to learn more about.

Teachers who are most familiar with the work contributed knowledge and insight to the study. We continued to offer significant play opportunities throughout the PAR project and research in order to further and expand students' conceptual understanding, apply what they have learned, and apply what they have learned in real-world contexts. As we came to understand play opportunities, we encouraged and advocated for play-based learning. The research benefited from the perspectives and experiences of the teachers who have the best understanding of the problem. We continued to offer many play opportunities to students throughout the PAR project and study to deepen and broaden their comprehension of topics, put learning into practice, and apply what they had learned. As we came to understand the skills taught, our intent was to encourage more teachers to use play-based learning.

Academic Math Vocabulary

Play-based activities motivated students to explain their answers and translate their knowledge to build upon new learning. When participating in play activities, students focus chiefly on defining the math ideas' appearance and meaning. ABM purposefully designed a regrouping math game to help students better understand what regrouping is and how to conduct the process. ABM observed how students utilized the math vocabulary to help them with their explanations. For example, in ABM's first classroom observation, I observed that students demonstrated their understanding of the task verbally as they worked through a play-based activity. Students explained what regrouping means by demonstrating it on a ten-frame and explaining the process to a peer.

In her final analysis of the observation, AH noted that, by using play, children better understood the context of math language and normalized math terminology. I observed CPR members using intentional math language to support students' comprehension of math concepts by engaging the students in more complex conversations about the concepts taught. During a regrouping lesson, ABM integrated visual teaching strategies into a partnership game titled "Race to Fifty," which guided students to engage in a dialogue about how ten ones create a group of ten and apply their understanding through the use of a ten-frame. "I noticed as students moved through the game, their conversations included recognizing that once they completed placing markers on the ten frames, they made the connection of regrouping and used the appropriate terminology when bundling a group of ten" (ABM post-observation conversation, February 7, 2023). Teachers create learning opportunities for students when they incorporate academic vocabulary into their lessons; academic vocabulary aids students in processing mathematical ideas with math language.

Transfer and Connections to Learning

As teachers integrated play, they developed their problem-solving abilities. In addition, teachers were eager to gain knowledge from the ideas of others during this process. We observed that adding play to lessons seemed to improve time for information processing, learning, and understanding by providing children with opportunities for multimodal learning and providing an avenue for demonstrating their understanding through a creative outlet. Play-based instruction enhanced the learning of students and, through this process, the students gained deeper conceptual comprehension. In AH's second classroom observation, I observed that children were making meaning by practicing a fraction game. AH asked them to share how they knew which fraction did not belong to the group. In this activity, Students used problem-solving strategies and critical thinking skills to expand their understanding and create a visual representation. AH transferred this understanding with a follow-up lesson in which students practiced simplifying and adding fractions. The first post-observation conversation with CB included a discussion of how play assisted students' fluency computation with math facts, which then fostered connections to previous learning in addition to transferring that understanding to upcoming lessons. The chalk talk protocol revealed to CPR members that play-based engagement created a positive association with learning and engendered success in conceptual understanding.

In PAR Cycle Two, the data reflected that the majority of play implemented in teaching practices included peer collaboration, working partnerships, or small group instruction. The integration of play as a pedagogy in math instructional practices exhibited how CPR members designed learning spaces in which students participated in learning through peer engagement; the students demonstrated their understanding and learned from one another. CPR members supported peer collaboration by exposing students to various math strategies that offered a

choice in partnerships. CPR member AH, during her March post-observation discussion, reflected that partner work provided a learning environment of ease and comfort that helped students focus on math. “I intentionally created table groups so that there were a variety of levels, but students chose their partner within their table group. Offering partnership choice led to peer modeling and students supporting each other through the activity” (AH, post-observation conversation, March 8, 2023). Observation data from PAR Cycle Two included turns and talks, with students engaging in dialogue and building ideas and inspiration from each other. Through these working partnerships, CPR members facilitated learning opportunities of peer modeling with students at different levels interacting to assist learning. In the analysis of data, I observed the transfer of learning through play by addressing students’ needs either through review or more complex learning readiness. CPR member CB related in her post-observation reflection (March 10, 2023) that she intentionally grouped students according to their level and students selected their partners within that group. “The groupings focused on students helping and challenging each other. In peer learning and partnerships during play, students began to explain their thinking in their terms to each other, help each other, and offer positive competition while extending their understanding” (CB, post-observation conversation, March 10, 2023). CPR members agreed that peer collaboration during play fostered student learning of math concepts. “When students hear from each other through a different voice, concepts click and they understand it more. Actual peer conversation facilitates understanding in a different way” (ABM, post-observation conversation, March 13, 2023). Next, I analyze how this data informed the emergent theme of equity and accessibility through play.

Equitable Accessibility through Play

In Chapter 5, the emergent theme of equitable accessibility through play demonstrated how play creates equitable opportunities for student participation (access) and thinking (rigor). In the PAR Cycle One data, teachers chose instructional strategies in which students applied play-based learning experiences to their math knowledge. Students worked positively together to solve math problems, expressed their mathematical understanding, and supported the learning of others. Based on PAR Cycle Two classroom observations and discussion during the CPR meeting in January, I identified how teachers utilized play to support student interaction as students tested out ideas, clarified, and acted out their ideas and understanding. Play-based activities in the classroom offered experiential learning opportunities, supported cooperative learning, and promoted differential and flexible thinking, all of which created an opportunity for equitable access and increased rigor.

Experiential Learning Opportunities

Teachers directed learning via investigation and discovery by involving kids in immersive and diverse activities during play. CPR members discovered that this form of learning engages students in their learning, and they then learn through their curiosity and independence through inquiry. During play-based experiences, students improved and enhanced their conceptual knowledge as they developed responses through self-directed learning experiences. At the initial CPR meeting in PAR Cycle Two, CPR members reviewed data from the PAR study's previous cycles and discussed play-based activities that promoted students debating, comparing and contrasting, and challenging themselves. "By incorporating student choice in play activities, students were observed to be empowered while exploring concepts through play-based tasks that they could lead and do independently" (AH, CPR meeting, January 23, 2023). Students

actively participated in a learning process in which teachers designed hands-on learning opportunities and interactive exercises to help the students comprehend mathematical topics.

According to Clements and Samara (2005), teachers should provide numerous opportunities for students to extend math learning into their everyday lives. Teachers may then give feedback on how math presents itself naturally for students and, from that information, they can observe students at play and in conversation. As a result, teachers design practical learning opportunities for students that are accessible and engaging. However, access and engagement are only the first steps to active learning. Through play, students kinesthetically articulate what is taught and apply their knowledge, which supports conventional learning objectives through exploration and discovery of play through hands-on learning. Bruner (1960) suggests that children enhance their learning in multiple ways—enactive (active), iconic (image), and symbolic (linguistic). Further, learning occurs through active experimentation and intersubjectivity of peer learning and interactions (Vygotsky, 1978).

Cooperative Learning

During the PAR Pre-cycle, one emergent category was collaboration, which was evident in students' cooperative learning activities. Students process and understand the content better while forming connections through a collaborative play approach. In the PAR Pre-Cycle, CPR members concurred that cooperative activity among students is a key component of play. In a learning environment centered on play, students strengthened their social skills while simultaneously learning from peers and reviewing ideas from many perspectives. Play that serves as a collaborative and cooperative process offers interactive peer learning that supports social-emotional and relationship development. The evidence highlighted how cooperative play supported peer learning; students observed one another as well as taking the initiative to attempt

something new, and practice concepts taught, which resulted in a sense of success and confidence building. Play helps children learn to work together and establish a strong sense of collaboration through cooperative learning experiences. Peer interactions support students' social-emotional development through sharing, taking turns, developing patience, and engaging in communication. Students engage in social interactions as they learn from and with one another through interactive play-based learning.

In addition, because play is a collaborative and cooperative process, students learn to communicate with friends during play, a skill that supports their overall growth and development. The play-based learning employed in this study offered students multiple chances to participate in activities in which they exercised conceptual understanding collaboratively with peers in a welcoming and dynamic environment. As teachers implemented instructional practices in which students were instructed to communicate with one another in a positive and cooperative way, students exhibited self-expression and self-regulation. “Intentional pairings at mixed levels provided students to learn from one another and discuss their solving techniques as they applied the concepts taught” (CB, post-observation conversation, February 6, 2023). Students expressed themselves through this interaction as they collaborated to achieve a common learning objective.

Play as a collaborative and cooperative learning process is an inclusive activity crucial to students' social and emotional development. Peer learning through play helps children understand concepts, exposes them to various viewpoints, and develops relational trust. ABM’s first classroom observations included evidence of students interacting in turn and talking. This strategy offered opportunities for students to converse with different groups and share their understanding, strengthen their meaning-making, and learn from different perspectives. During the Kiva protocol, ABM shared, “Students working in partnership allowed for social interactions

and was a fantastic opportunity for peer coaching" (CPR meeting, January 23, 2023). In order to accomplish a shared goal, student collaboration is essential. Through problem-solving and conceptual comprehension, these collaborations enable all students to learn.

Differential and Flexible Thinking

The PAR study provided evidence that play-based instruction fosters a meaningful learning experience that promotes student differential and flexible thinking. As students shared knowledge that centered on them, they were actively creating and growing. Data validated that the teacher's responsibility during play-based learning is to acknowledge the occasions when students recognize connections and apply math outside of the classroom, and then use those examples as re-teaching tools to illustrate that students are naturally utilizing math strategies. "I observed how students developed a comfort level with a repertoire of games and were drawn to similar repetitive games which they could navigate through with ease and apply math strategies taught and challenge themselves to apply new strategies learned" (AH, CPR meeting, January 23, 2023). As students constructed and worked with materials and practiced via hands-on play, they improved their fine motor and eye-to-hand coordination. As they observed the students utilizing hands-on manipulatives and constructing meaning via movement, teachers could assess levels of learning and ask probing questions, redirect students, and offer ideas about how to think about their constructions.

Students made and worked with materials while putting their knowledge into practice via hands-on play during PAR Cycle observations. During play-based activity focused on three-digit regrouping addition, students made connections to previous games of double-digit addition and built upon those concepts (CBM, classroom observation, January 27, 2023). Teachers constructed a play process with limitless, open-ended learning, and students' comprehension and

learning were strengthened. Play was observed as a natural method of learning in which students are doing and actively taking part in the work. During AH's classroom observation on February 10, 2023, she described how she expanded students' knowledge of equivalent fractions by providing a challenge to a previous play-based game focused on prime and composite numbers. As she monitored students' engagement, AH probed students' understanding by asking how they determined if the number was a prime number. This observation demonstrated how the teacher was building the capacity of students' understanding of the math concept by asking them to apply and explain their thinking. Incorporating activities that encompass structured play based on the connection between topics taught and information students already possess provided students freedom of expression while supporting their conceptual grasp.

As reflected by PAR Cycle Two data, the research study evolved, strengthening and expanding the emergent themes from the previous two cycles. PAR Cycle Two offered insight into how play-based teaching practices supported teachers to develop skills that were beyond conventional instructional practices. These changes in practice and shifts in teacher's thinking led to a more consistent implementation of play-based learning experiences. The three emerging themes provided information from which this study's conclusions are derived. In the section that follows, I discuss how teachers built their capacity to integrate play into mathematics instruction. Secondly, I describe how teachers who integrated instructional practices that involve peer engagement shifted their practices to observing children's work and facilitating learning activities.

Findings

As a result of this participatory action research (PAR) study, teachers developed their instructional practices to promote learning experiences that increased student access,

involvement, and outcomes. During this process, as the instructional leader, I was purposeful in facilitating meetings that cultivated relational trust and maintained collaboration among teachers so they could transform and adapt their teaching methods. In addition, data from evidence-based observations and post-observation discussions supported teachers' efforts as they applied techniques to further develop their disposition of teaching practices. Based on the analysis of the PAR data from three cycles of inquiry, I determined two findings:

1. With intentional planning and reflection, teachers improve their instructional practices while building their capacity to integrate play-based learning in mathematics instruction.
2. By integrating instructional practices that involve peer engagement, teachers shift their practice from whole-class instruction to facilitating learning activities and observing students' play-based learning.

I reached these findings based on evidence from CPR meetings incorporating community learning exchange protocols, observations, and post-observation conversations. In Table 10, I display data from the PAR project that supports the findings. Teachers engaged in collaborative community learning exchanges and observations, followed by a reflective process, and were thereby more inclined and willing to modify practice.

The categories from the three cycles of inquiry supported the emergent themes and were consistent during the study but evolved and expanded throughout the research based on the experiences, implementation, and reflections of the teachers (see Table 10). When teachers consistently integrated play-based learning, their planning was more intentional, their practices became stronger, and their motivation increased. As the data indicates, as we proceeded, we continued to focus on the why (purpose) and the how (planning and implementation). However, I

Table 10

Findings: Three Cycles of Inquiry Data

	Pre-Cycle	PAR Cycle One	PAR Cycle Two	TOTAL/%
With intentional planning and reflection, teachers improve their instructional practices while building their capacity to integrate play-based learning into mathematics instruction.				
Purpose of Play and Resources	38*	54	76	168/27%
Play Integration	38*	35	74	147/24%
By integrating instructional practices that involve peer engagement, teachers shift their practice from whole-class instruction to facilitating learning activities and observing students' play-based learning.				
Collaborative Learning	67	49	44	160/26%
Teacher Shifts	19	28	92	139/23%
TOTAL				614/100%

Note. In the Pre-Cycle, I did not code the difference between the purpose of play and integrating play. I divided the evidence for the purpose of representing both categories in the final data.

observed an increase in teacher shifts by the conclusion of PAR Cycle Two once we had the why and how in place. Next, I discuss the first finding on the intentionality of planning and implementation plus reflection that supported teachers to integrate play-based learning.

Intentional Planning, Implementation, and Reflection: Increasing Teacher Capacity

Professional growth within teaching requires teachers to examine teaching through a reflective lens, and to process their teaching practices to inform instruction and create learning situations that serve all students; 51% of the total data represents teachers' planning, implementation, and reflection. Additionally, principals must construct opportunities for teachers to collaborate and learn from one another through reflection on practice and focus on planning. Evidence from the PAR Pre-Cycle suggested that bringing teachers together within a space of relational trust, to share experiences, collaborate, and learn together, contributes toward a common objective of enhancing teaching practices toward student achievement. Facilitating a community of practice with teachers raises teachers' voices and builds confidence in order to share practices and strengthen instruction. Evidence from PAR Cycle Two revealed that time and space were crucial for instructors to reflect on practice with colleagues, guide planning sessions that informed instruction, and develop the next steps. When focusing on the development of instructional practices that incorporate play, CPR members discussed the need to have appropriate planning time and collaboration with other teachers to share ideas, resources, and materials (see Figure 9).

As we continued the PAR study and emphasized our common goal of improving outcomes for students, teachers exhibited stronger commitments to the change process. I formed the team by presenting a play-based learning pedagogy and utilizing the experiences of team members to lead the work and initiate change in instructional practices. Throughout the study, as

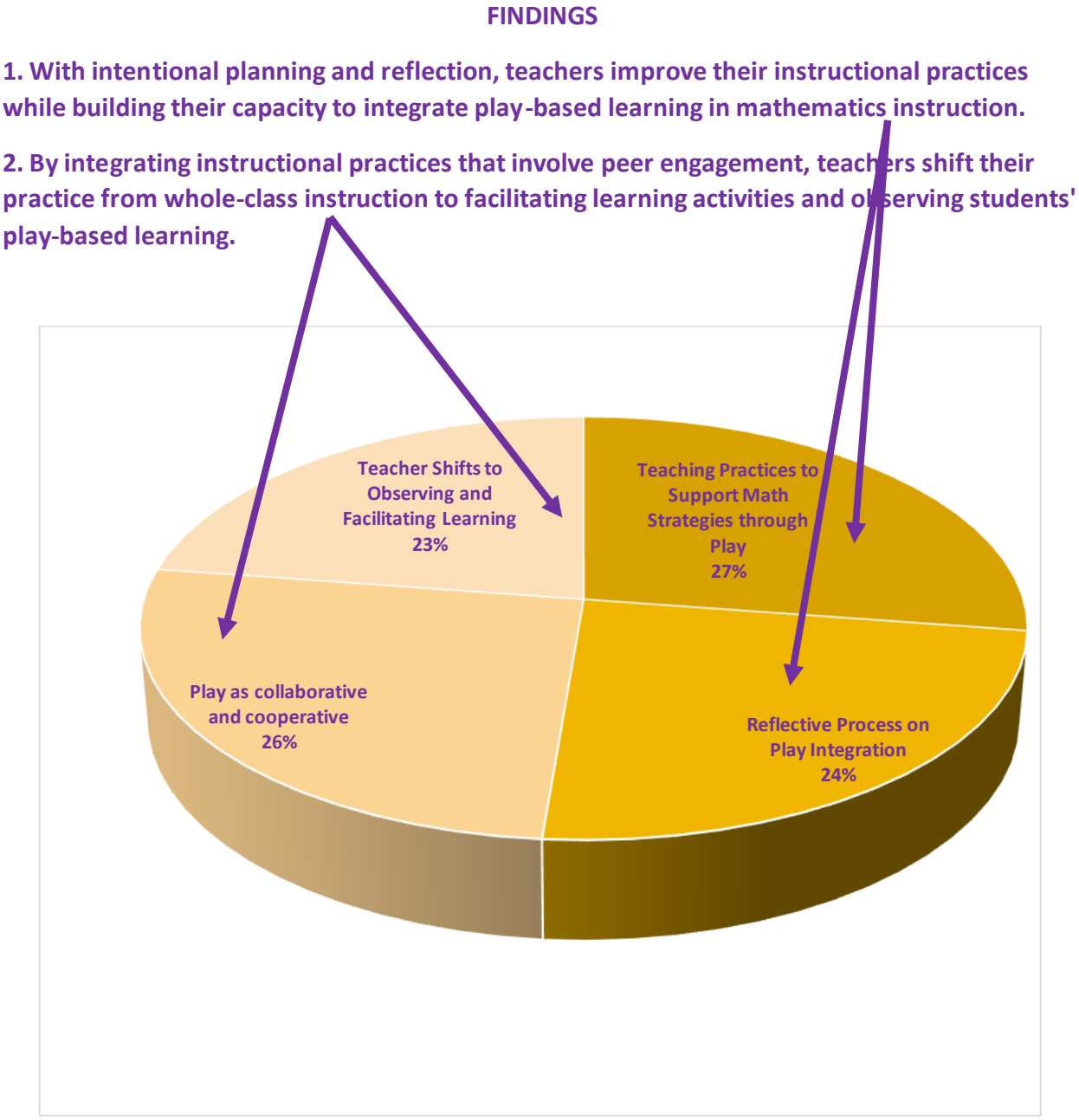


Figure 9. Findings of the PAR data from three cycles of inquiry.

team members met together, they created a learning space that involved ongoing dialogue and sharing of ideas and resources to intentionally plan lessons and units of study to improve the quality of instruction. CLE protocols such as Photovoice provided insight into the process in team members' classrooms and the impact of incorporating play as a pedagogy. As CPR members observed students' learning patterns and success, they were able to focus on sophisticated planning that included a conceptual understanding of math.

Through the PAR study, teachers created and enhanced their knowledge of play-based learning within mathematical instruction members viewed this experience as an opportunity to collaborate with each other and empower one another to create learning environments that were joyful. The observation toolkit data and transcripts of student conversations motivated CPR members to keep exploring innovative and engaging methods to help students access content, ignite interest, and add to student learning; and elicited a commitment from CPR members to regularly incorporate play. During the chalk talk protocol, CPR members shared post-observation conversations, and the debrief invited CPR members to reflect on math practices.

As CPR members entered the final cycle of the PAR study, they had spent a year implementing play instructional practices in their math programs and had evidence that supported the need to have play-based activities accessible within their math programs. However, as noted in the data, the teachers successfully increased their role as facilitators of learning, which increased 3.3 times from PAR Cycle One to PAR Cycle Two. In order to further support play-based instruction, the teachers developed specific game-specific materials to assist with the implementation and provide effective time management. The teachers could then utilize instructional minutes to explain how to play the game and then shift to monitoring student participation and intervening to scaffold as necessary during play partnerships. Observations

demonstrated that pre-made materials provided valuable resources for student reference, including benchmark charts, visuals, and tactile/hands-on materials. Teachers developed materials that were not overly complicated or difficult to prepare. Teachers designed and developed resources together as an efficient means to continue the incorporation of play as they planned for the upcoming school year. CPR member CB shared, "Depending on the lesson and where we are going, there is a lot of backward planning that takes place, reviewing games already created, and looking for something new" (CPR, CLE meeting, January 23, 2023). In particular, the teachers continued to focus on practices that supported math.

Teaching Practices to Support Math Strategies Through Play

As we began the PAR study, teachers had previous knowledge and experiences related to play-based learning. This knowledge and experience served as the foundation for the work we embarked on in this study. According to observations in the classroom, teachers' instructional strategies produced learning opportunities that benefited students by providing a platform for them to explain and display their understanding to their peers while their development and thought processes were being monitored by the teachers. The observations provided teachers with the context of how they were integrating play within their math programs and creating learning environments that supported their development of effective instructional practices.

I observed and provided evidence to the teachers of how they embedded play pedagogy within instruction, which inspired CPR members to develop and create more play-based learning experiences. During a classroom observation, I observed that CB purposefully integrated a play-based game that combined practice opportunities for a new concept taught with a review and adding on of a previous concept. Through the PAR study, AH explained how intentionally forming peer partnerships using a particular deck of cards encouraged participation and

engagement. As she observed students' play, she observed that they did not falter but instead continued to problem-solve and strategize with one another. With these data, she planned to further expand her play pedagogy and she was more purposeful in planning her next steps.

ABM shared an example in a post-observation conversation, "The lesson was an extension of the lesson from the previous day and was an introduction to the counting-on strategy in a playful kinesthetic manner to reinforce the strategy and for students to practice freely on their own" (ABM, post-observation conversation, November 7, 2022). Using math facts to practice the counting-on approach and access extra meaning for the addition process were stressed throughout the game section of the session. During the post-observation meeting, ABM related the evidence to subsequent math lessons and shaped her instruction in order to create more engaging lessons to assist students' achievement of grade-level standards. As teachers observed the data, they built the capacity to create more play-based instruction to guide students' conceptual understanding. Reflection served as an important component in changing teaching practices toward play-based pedagogy.

Reflective Process on Play Integration

According to personal narratives, CPR members found working with colleagues improved their professional development and teaching strategies; they shared knowledge and gained deeper understanding of strategies. They concurred that working with colleagues enabled reflection, learning, growth, and the improvement of instructional practices. CB stated,

> When we meet in our CPR meetings, we have time to share strategies, activities, and ideas to best help our students access learning. We have discussed ideas around what play is and ways to incorporate play into our daily learning. Sharing these ideas across grade

> levels has given me the confidence to incorporate play into my classroom and with my grade-level team members. (CB, personal narrative, October 24, 2022)

Site-based cooperation, focused on continuing education together rather than separately, offered familiarity and experience. CPR members reflected on the evidence that our collaboration promoted student learning and accessibility, and they emphasized their belief that the sharing of concepts, materials, and activities throughout the reflective process was a benefit of the PAR project and study.

Team members valued evidence that focused on strengths and areas for improvement. Members discussed how to modify lessons to improve students' learning results. CPR member AH shared that the feedback provided from the data assisted her reflection on classroom teaching by guiding her next steps to reach the needs of students; she felt that she could assist struggling students who were below grade level as well as confident students who benefit from displaying their skills in math.

The discussions that took place at CPR meetings showed that members from different grade levels were working together to consider how to include play in daily learning and the classroom. In the initial meeting of the final cycle of the PAR study, teachers discussed the importance of assessing information that is already available when focusing on planning and based on that information, creating plans and curriculum instruction for review.

Based on the unit of study in the curriculum where we are in a lesson and where we are going requires backward planning. Taking into consideration that there are a lot of games already created led teachers to look for something new that supports grouping size or partners at mixed levels or abilities, that can be incorporated in weekly new games, or a special game with an introduction to the lesson that can be added to the basket, intentionally thinking of small groups

collaborative effort in which CPR members learned with and from one another. CPR members (CB, CPR meeting, October 23, 2023). The reflective process throughout the PAR study was a addressed how learning from one another based on their various views and experiences helps establish and enhance instructional methods.

The conversations that took place at CPR meetings showed that members from different grade levels could work together to consider how to include play in daily learning and the classroom. The collective dedication encouraged a collective voice, increased the members' self-assurance, and strengthened their relationship and trust with one another. When teachers visualized the data during individual conversations and in CPR meetings, they could observe how they were engaging students in learning and what modifications needed to be made when reflecting on the next steps. "Transcripts of student conversations and debrief questions prompted reflections on my practice because through the data I was able to review how my students learned and adjust my lessons accordingly" (AH, CPR meeting, March 14, 2023). Due to the relevance of the work and the purpose, which concentrated on shared and comparable pedagogies, CPR members found discussing teaching approaches with colleagues to be an encouraging experience, and as they designed more opportunities for peers to work together, they experienced an accelerated shift in their practices.

Peer Instruction: A Pivotal Moment for Teacher Shifts

By integrating instructional practices that involve peer engagement, teachers shifted their practice from instructing the whole group to observing students' work and facilitating learning activities. As teachers developed instructional practices that supported flexible thinking and equitable access for students, they became more aware of their roles as facilitators of learning.

The shift to play-based learning in mathematics provided a pivotal moment for teachers to reimagine their roles.

When teachers designed collaborative learning experiences for students in working together to solve problems through play, teachers have the opportunity to reimagine their roles in the classroom. CPR members included activities in their math lessons that required students to collaborate with classmates in teams or partnerships. According to observations, students were more inclined to participate in learning when the experiences involved play and appreciated the chance to play while learning new abilities. CPR members acknowledged throughout the visual mapping process (CPR meeting, October 24, 2023) that they could provide more equitable access, which encouraged students to learn from one another's perspectives, establish common meaning and understanding, and sharpen their problem-solving abilities. They discussed that when they were more intentional about partnership learning with play-based strategies, they could shift their roles and observe student learning. They then observed that the shift in their roles created more opportunities for flexible thinking and equitable access for students.

Teacher Shifts to Observing and Facilitating Learning

I observed a recurring pattern in the observations made throughout the PAR study—while students were engaged in play-based learning, teachers had more freedom to observe students as they completed the tasks. With greater frequency (from 28 instances in PAR Cycle One to 92 in PAR Cycle Two), teachers spent instructional time with individuals and groups, probing them with questions to explain and reinforce their thinking. Through this process, student-to-student dialogue provided teachers with a coaching stance and gave feedback on differentiating instruction for deeper learning as the students practiced the academic task.

CPR members reflected that this practice served as an ongoing formative assessment and targeted students but lacked the tools to implement the intervention. Integrating instructional practices through play-based engagement assisted teachers in taking the learning cycle approach of exploration and allowed them to debrief student learning based on curriculum lessons, extensions, and standards alignment (CLE artifact, January 23, 2023). ABM shared during the CPR meeting that the game component of the lesson is crucial because it provides insight into students' learning patterns, perspectives, and application of math concepts and processes because they are doing the work in real time. Through this inquiry of teaching and learning, teachers can create targeted small-group instruction for students with similar thinking. Instruction is specifically designed to address student needs and respond to the data collected during play-based activities; as a result, teachers adapted or modified practices to keep students as active participants and supported students in setting individual learning goals and profiles. Monitoring students' progress through play leads to meaningful interactions.

Student engagement in play-based activities through peer learning created situations in which teachers facilitated learning by monitoring student progress and growth as their thinking unfolded in peer conversation. As a result, teachers could assist students by asking clarifying or probing questions to reach the learning objectives. Teachers designed play activities more intentionally so that students interacted with one another to construct meaning; therefore, teachers had more opportunities to observe students' learning and monitor progress with on-the-spot informal assessments. The observations provided teachers with information about a student's readiness by probing for understanding and scaffolding as needed. Planning for play-based instructional practices engaged students with the cognitive work; therefore, teachers could observe student learning. This in turn informed instruction by reviewing students' levels and

adjusting practices. During my observations in the classroom, I observed that when teachers planned play-based pedagogy, they could better assist students' conceptual grasp of mathematics. In particular, I could observe and teachers concurred that students had flexible thinking and equitable access.

Flexible Thinking

Leveled partnerships, varied groups, and peer coaching further reinforce the collaborative character of play-based learning which supports flexible thinking. I observed students engaged in conversations about regrouping while practicing math facts with a partnership card game during CPR member AH's first classroom observation (September 22, 2022). Students practiced AH's lesson by concentrating on a regrouping method and talking with their companions about how to problem-solve. Establishing a collaborative and cooperative learning culture in the classroom fosters an atmosphere that supports the diverse ways that students learn, comprehend, process, and think about arithmetic. During a Flipgrid reflective response, ABM shared that children naturally play, and, while they interact with their peers, they are each learning something from the other (December 21, 2021). By creating situations in which students are able to socialize with their peers and participate in play-based learning activities, teachers are giving students opportunities to practice and share their ideas in a welcoming and dynamic environment. “Partnerships of peer learning provide students beneficial chances to explain their thinking and help each other, valuing the thought process by allowing students to say it in their terms” (CB, post-observation conversation, March 14, 2022).

In addition, teachers observed that play nor only encouraged flexible thinking but promoted friendships and connections. Thus, students simultaneously constructed knowledge and developed social-emotional competence. The CPR members concurred that play has many

facets and that cooperation and cooperation among students is a key component of play. Students may strengthen their social skills while simultaneously learning from their peers and considering various perspectives through this application of play. This promoted equitable access to learning.

Equitable Access Through Play

Ensuring that all students are accessing curriculum and instruction appropriately and equitably is a priority in teaching practices. CPR members used the play-based time to check in with students in small groups or pairs and help them develop conceptual knowledge. During this crucial period, teachers identified students who may still be having difficulty and could tailor lessons to the student's requirements. They revisited teaching strategies that helped students comprehend concepts. Teachers utilized this time as an informal assessment to check for understanding and spot frequent mistakes. Through this interaction, teachers improved their lessons and could make the necessary adjustments during the lesson to encourage conceptual understanding. “Supporting students through a variety of approachable games presented students’ needs during play, especially games that review the same skills” (AH, CPR meeting, January 23, 2023).

Play-based learning activities provide a variety of learning modalities, including kinesthetic learning through movement and experience learning through making connections to prior knowledge. Teachers strengthened their instructional practices and incorporated the advantages of play learning more frequently by giving students mini-lessons and engaging them in play-based tasks that let them build their knowledge, while the teachers monitored the students’ progress and comprehension.

In addition, the role of the teacher as facilitator/monitor encouraged communication at home because these informal assessments gave teachers meaningful notes and data to share with families on how their child learns best. During her post-observation conversation, AH shared that facilitating students' learning during game time helped her develop meaningful questions to solicit data on how students were demonstrating their knowledge (February 13, 2023). CB's second-grade class demonstrated how a teacher can help students understand that everyone approaches problems differently by creating lessons with an emphasis on flexible thinking and engaging students in number chats (CB, classroom observation, September 22, 2022). Teachers who design lessons with flexible thinking and student engagement have the opportunity to assess student levels of comprehension, adapt instruction for particular students, and reteach concepts appropriately. Observing students as they work and process information gives teachers the opportunity to actively participate alongside students to check for conceptual understanding and guide students through the learning process. As a result, the inclusion of play-based activities in the math curriculum enabled teachers to make informal observations on their students' knowledge of the ideas being taught and their ability to apply those concepts in a motivated, cooperative way.

In conclusion, teachers used cooperative play-based instruction to foster student thinking and problem-solving skills. The methodology supported teachers as observers of students who assess in real time how well students are processing information and constructing meaning. Based on this information, teachers appropriately revisited curriculum and instruction to intervene and address learner variability. In post-observation conversations, CPR members shared that play-based instruction motivated them to review and adjust instruction, be more intentional about planning prior to the lesson, and search for resources that will enhance learning

and elicit student thinking. During the second post-observation conversation, CPR member CB stated that play engagement within her instruction forced her to be more mindful of referencing materials such as anchor charts to guide students' executive functioning skills and offer multiple options for accessing the curriculum.

Teachers used play-based observations to motivate their inquiry of exploring new and engaging methods to help students learn. During the chalk talk protocol, CPR member ABM shared that play-based instruction challenged her to try new things and think about teaching standards differently through the use of the curriculum or other resources and materials. By recognizing student levels of comprehension, adapting instruction for particular students, and reteaching concepts in light of feedback from student engagement based on those interactions and observations.

I encouraged CPR members to think about their experiences and reflect on how those experiences shaped their contextual understanding throughout the PAR study through the lens of my facilitation. Giving CPR members a voice enhanced our relational trust and facilitated the open exchange of viewpoints, thoughts, and ideas among CPR members. We discussed what was happening in their classrooms at the moment and how our work complemented the PAR research project by enhancing the leadership skills of CPR members and including them in protocols that emphasized their experiences.

Based on this process, teachers began to view their instructional practices through a different lens, and they were eager to take on leadership roles to share with other teachers. The findings concluded that when teachers have the opportunity to reflect on their practice and analyze the data presented, they can then make informed decisions and change practices to support student learning. In addition, incorporating play-based learning situations in which

students engage with one another created instructional practices in which students became active participants in their learning; as a result, teachers pivoted from instructing the whole class in teacher-directed lessons to serving as facilitators of learning and monitoring each student's progress toward learning with the intention of developing instructional practices that target students' specific learning styles, needs, and levels. This model is the heart of inquiry-teaching and learning in which the students generate knowledge and questions and teachers shift their roles to supporting learning.

Conclusion

In PAR Cycle Two, CPR members developed and improved instructional practices by incorporating intentional learning opportunities embedded in play. During PAR Cycle Two, CPR members' teaching practices and knowledge of play pedagogy led to shifts in their teaching practices. The three CPR members had previous play-based learning experiences, but as they navigated, researched, and moved through the PAR study, their confidence in their teaching practices grew and they became more motivated to build their capacity as teacher leaders. As previously mentioned, CPR member CB took her professional learning from the PAR Study, applied for, and was funded for a Donors Choose project, "STEM Learning Through Lego Play." CPR member CB. designed a project that supports hands-on learning through the use of Legos to enhance STEM learning. She shared that her students love learning through practice and that this project supported students' equitable access to their learning while building and creating their own ideas, and through Lego play, students engage in problem-solving group work. CPR members reflected on their teaching practices and reviewed how they could expand play pedagogy. CPR member CB's intentional project request exemplifies the commitment CPR members have as it pertains to integrating play within instructional practices.

The findings in PAR Cycle Two revealed CPR members' commitment to the work and intentional lesson planning and design to ensure that they fully integrated play-based learning in math. Through the collaborative process of the PAR study, CPR members addressed the extent of time play should be embedded and established a bank of games; they were eager to continue their research in adding to the repertory by inventing games that would support the math lesson while considering students' level of knowledge.

The collaborative effort observed, particularly during PAR Cycle Two, encouraged play integration by providing students with real-world, innovative learning experiences to put theory into practice. As a result, CPR members continued to develop their skills by planning lessons that incorporated play into their math instruction. The evidence from the observations in PAR Cycle Two demonstrated that students engaged in play, and teachers accommodated and modified learning conditions for students. In chapter seven of the PAR research project, I provide evidence as to the final sub-question for the study: *How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?*

CHAPTER 7: DISCUSSION AND IMPLICATIONS

The questions are the important things. Each time they get asked there's a different meaning because you've grown so much from the last time you've asked it. Betty Reid Soskin

In our district, we look to Betty Reid Soskin, who retired at 95 years of age from her position as a National Park Service ranger at the Rosie the Riveter Historical Site in Richmond, California, after many years and experiences, which she details in a memoir, *Sign My Name to Freedom.* As a woman of much experience with questions, she calls on us to keep a fresh eye, ear, and heart to those we teach. Their questions are the essence of learning; the epigraph describes the process in which we engaged during the participatory action research (PAR) study. In the PAR study, our work developed from a series of questions about play as a pedagogy and how we could integrate play-based learning with math instructional practices. As co-practitioner researchers in an eighteen-month journey of inquiry, we embarked on the path of researching and implementing play as learning. Our experiences and the experiences we designed for students led us to explore different pathways. As a result, we developed renewed perspectives about play as learning, which supported our growth and furthered our understanding of how play impacts teaching and creates meaningful opportunities for student learning.

In the PAR study, I examined how three elementary teachers implemented play-based instructional practices and integrated them into their mathematical instruction. As a result of participation in the study, teachers constructed play-based learning programs through intentional lesson planning that engaged students to strengthen conceptual understanding while the teachers facilitated students' progress. The theory of action for the PAR study states: *If teachers develop a mathematical program integrating play pedagogy, then teacher capacity will expand to support the implementation of play in math instruction.* We largely succeeded in achieving our goals by consistently fostering relational trust, creating a shared understanding of play-based

pedagogical practices for enhancing conceptual math understanding, observing instructional practices using evidence-based protocols, and conversing with other teachers on staff who were not CPR members. The CPR team used Community Learning Exchange (CLE) protocols and methods to achieve these aims, and doing so has significantly altered how I think about my work and leadership as a school administrator.

The setting for the PAR study and project was Olinda Elementary, a school in the neighborhood in which I live. The TK-6 school is located in a residential area of El Sobrante, an unincorporated area of Richmond, California. By supporting teacher practice to include play-based learning in math education, the PAR project research goal was to change teachers' instructional practice to deepen learning in math. The CPR team demonstrated desire and interest in learning how to better integrate play into the math curriculum, participated together to incorporate play-based learning in their instruction, and took on leadership responsibilities that promoted school culture and staff learning. To support play pedagogy across grade levels, the CPR group engaged in shared experiences and a collaborative effort to incorporate play pedagogy in math education via an inquiry process. Participants' experiences in CPR meetings encouraged genuine introspection and transformation throughout the research. The teachers found that the evidence from the observations and the post-observation conversations were helpful in changing their methods to improve classroom instruction for their students. "The data and transcript from the lesson prompted reflection of what worked well and what did not" (AH, CLE artifact, March14, 2023). As an instructional leader, I focused on enhancing teacher assets and teacher conversations by providing opportunities for reflection.

In three iterative cycles of inquiry PAR over the 18-month action research project and study, we engaged in activities that helped our individual and group capacities to execute

techniques of play-based pedagogy (see Table 11). To fulfill that purpose, I guided CPR members' participation in collaborative meetings utilizing CLE protocols that helped us examine their understanding of play pedagogy and reflect on instructional practices; our collaborative inquiry and discussions were useful in expanding members' knowledge and abilities. I conducted classroom observations focusing on how play-based instruction is implemented in math programs. I followed the observation with post-observation conversations in which I used coaching questions and reflection that reinforced our learning and guided the next steps for play-based integration. In reviewing the PAR results, I related the findings to the extant literature and responded to the research questions. As a result of the study findings, I created a framework for changing teaching practices. I conclude the chapter by discussing implications for practice, policy, and research and reflecting on my leadership growth throughout the PAR project.

Discussion

After analyzing the data from the original literature review and additional readings during the PAR study, I synthesized what transpired in the research process and its relation to the PAR research questions. The findings of the PAR are:

1. With intentional planning and reflection, teachers improve their instructional practices while building their capacity to integrate play-based learning in mathematics instruction.
2. By integrating instructional practices that involve peer engagement, teachers shift their practice from whole-class instruction to facilitating learning activities and observing students' play-based learning.

I explain how the results relate to the extant literature before presenting a framework for change.

Table 11

Key Activities: Three PAR Cycles of Inquiry

Activities	PAR Pre-Cycle Spring 2022 (Jan-May 2022)	PAR Cycle One Fall 2022 (Aug-Dec 2022)	PAR Cycle Two Spring 2023 (Jan-Mar 2023)
Meeting with CPR members (n=8)	***	***	**
Classroom Observations (n=18)	******	******	******
Coaching Conversations with CPR members (n=18)	******	******	******
Conversations with ECU Professors (n=12)	****	****	****

Integrating Play-Based Learning

Over the course of three inquiry cycles, CPR members engaged in discussion and reflection of instructional practices that supported their planning and implementation of conceptual understandings in math. Focusing on the creation of play-based pedagogy, CPR members discussed the necessity for adequate preparation time and collaboration with peers to exchange materials, ideas, and resources. I examined the structure for the meeting, the intentional planning, and the classroom implementation results.

Meeting Structure

For teachers to reflect on their practice and concentrate on planning, principals must create situations for them to work together and learn from one another. Evidence from the PAR study revealed that gathering teachers with the intent of establishing relational trust, in a meeting structure designed for sharing experiences, proved to be an effective opportunity for teachers to work together and learn from one another. In their study on how to use networked improvement communities (NIC) to affect adult learning, Bryk et al. (2015) found three key characteristics of a NIC: a shared goal; a thorough comprehension of the root causes of the issue, the systems that contribute to it, and educational theory to support change; and the systematic development, testing, and improvement of interventions before sharing the findings with the school and educational community. As the study progressed, team members gathered regularly to create a learning environment that encouraged conversation and the exchange of information and resources in order to purposefully construct lessons and units of study to raise the caliber of instruction.

The possibility of teacher learning and improved teaching practice is increased by creating collaborative adult learning environments. According to Drago-Severson (2012), adult

learning environments need to be places in which teachers feel held and nurtured. I designed and facilitated meetings to include personal narratives and self-care, and focused collaborative discussions in which teachers expressed themselves and learned in public. In other words, the elements of gracious space (Hughes and Grace, 2010) are critical in offering a spirit and a setting that supports the teachers to invite strangers, or new learning, and learn together in public.

According to Stipek (2017), teachers should have more opportunities to work with colleagues to develop original activities based on learning trajectories and expectations when assessing adult learning for instruction. By creating situations where teachers talk about the impact play pedagogy has on student achievement and how play can be spiraled through the grades, teacher's perspectives evolve. These learning opportunities were a continuous part of the PAR research and allowed teachers to collaborate and problem-solve together.

For example, during the chalk talk process we used to discuss play-based learning CPR member ABM said she wanted to try new things and rethink how she taught standards by utilizing the curriculum or other tools and resources. In addition, as CPR members reflected in meetings on data from classroom observations, they reviewed grade-level standards and practices to plan meaningful learning that deepened student understanding of mathematical concepts. This led to intentional lesson planning of play pedagogy, in which teachers helped students learn by encouraging them to interact with complex mathematical concepts (Oldridge, 2019).

Lesson Planning

Planning lessons is a crucial part of teaching and is even more important in inquiry-based instruction so that the teacher ensures activities and questions that support student thinking and independence (Simon, 2019). Prior to classroom observations, CPR members completed lesson planning templates that focused on lesson objectives, alignment of standards based on the

curriculum, and play pedagogy within the lesson. Their planning provided a guide for teachers to refer to as they focused on their role in supporting the cognitive development of each student. By receiving feedback from post-observation conversations and engaging in discussions during CPR meetings, teachers grasped how to include play into their lessons and foster creativity and innovation to engage students. This focus supported teachers' instructional practices which directly influenced how and how often teachers implemented math play-based practices. CPR members viewed the PAR research as a chance to work together and empower one another to create engaging learning environments by developing and increasing their expertise in play-based instruction within mathematics education. Teachers need time and space to examine and dissect lesson plans, and then purposefully design classes that will focus on certain learning objectives in light of the analysis. According to Bryk et al. (2015), adult learning focuses on goals, justifications, and supporting data that demonstrate whether a change is, in fact, beneficial, and then provides evidence of the change. The plan-do-study-act (PDSA) cycle helped teachers use pragmatic evidence from observation and post-observation conversations to iterate and improve practices (Russell et al., 2017; Cobb et al., 2018). Teachers who work in teacher advice networks are better situated to solve their own problems of practice (Coburn et al., 2006).

Modeling play pedagogical techniques, such as presenting lessons that align with curricular materials and standards, was another element we used during CPR meetings that incorporated CLE protocols. Teachers need time and space to examine and dissect lesson plans, and then purposefully design future lessons to focus on certain learning objectives in light of the analysis. The most significant predictors of teachers' professional development are their knowledge, values, and experience (Zehetmeier, 2012). For example, during meeting discussions of observations and conversations, CPR members exchanged ideas, which motivated them to

examine and modify their lesson plans, be more deliberate in their pre-lesson planning, and look for materials that would improve learning and encourage students to think. Through these processes, they were primed to learn new ways to work and learn with each other in the CPR space.

Early in the PAR study as the teachers and I began collaborating as a team, I recognized that CPR members came to the study with a wealth of knowledge and experience in relation to play as an instructional practice. As the instructional leader, I depended on their expertise to develop the pathway for the PAR study and ensure that meetings were consistently collaborative. I provided the circumstances for teachers to reflect on their practice, work together with their colleagues, and emphasize strengths. Further, I included the professional learning opportunities throughout the PAR, which increased teachers' capacity to see play pedagogy as an effective teaching strategy. By connecting the work to the teachers' understanding and prior knowledge, I created circumstances that fostered professional growth and increased teacher engagement. Whitford and Wood (2010) recommend these conditions for effective teacher learning in professional communities: an inquiry stance, acknowledging current knowledge and building on individual knowledge to collectively learn, making worries public, and tightly focusing on teaching and learning.

In time, teachers understood that preparing for play-based learning gave them additional opportunities to assess informal learning from each other and students, observe student progress, and modify instruction, particularly through guided inquiry and questioning. Planning naturally overlaps with implementation, and teachers’ instructional strategies promote student learning opportunities.

Shifting Practices to Facilitation and Observation

As the teachers implemented play-based learning, they recognized that they had more time to facilitate student learning and to observe and assess student progress. As I observed teacher practice, I also observed how students responded. The students' positive reactions led me to conclude that the three teachers should accelerate their shift from whole-group instruction to becoming teachers of inquiry in which student-generated learning is possible (see Figure 10).

Principal Observations and Conversations

During my observations in the classroom, I observed that the teachers had planned for their use of play-based pedagogy. When CPR members used innovative play-based learning strategies to engage the students, they received positive responses from students, which furthered their commitment to include play on a regular basis. In addition, post-observation conversations that are coaching conversations between the principal and the teacher are more effective in teacher decision-making (Tredway et al., 2021; Tredway & Militello, 2023). This scenario, in which the conversation is a dialogue, replicates the student experiences we strive for in the classroom. The principal is providing a parallel experience for teachers that can transfer to classrooms (Machado, 2021).

In addition, the use of common tools for observation mediates the learning experience for teachers (Gomell, 2020) and provides scaffolding for teacher learning. Thus, I used selective verbatim and coded the observations for evidence that provided data for teachers to use to make decisions about their planning and instructional moves. Ahn et al. (2021) discuss the usefulness of building trust in teachers through learning analytics—tools that offer both social and material-mediated learning. In addition, we used Photo Voice as an observation tool, and team members gained insight into what was happening in their classrooms and the effects of using play as a

TEACHERS PROMOTING PLAY-BASED LEARNING

PARTICIPANT STANCE → / PEDAGOGICAL FOCUS ↓	Teacher Generated	Teacher-Facilitated	Student Generated
ACADEMIC DISCOURSE	Teacher control of classroom dialogue	Teacher facilitates questioning and instruction for collaboration	Teacher and students co-facilitate learning
INQUIRY TEACHING AND LEARNING	Whole group instruction	Primarily whole group with using equity protocols to engage more students	Teachers authorize peer interactions and informally assess and adapt to student learning

Note. Adapted from Framework of Classroom Learning and Practice (Tredway et al., 2019).

Figure 10. Teachers promoting play-based learning.

pedagogy. By having a focus on play-based pedagogical practices, teachers are able to focus on sophisticated planning centered on ideas that incorporated those play-based activities and allowed CPR members to concentrate on student learning patterns and achievement. Teachers were able to observe students learning with cognitive tasks and in turn, used those observations as a tool for more sophisticated and nuanced planning. The data from the observation tools encouraged CPR members to continue looking for innovative and engaging methods to support students' learning, pique their interest, and enhance student learning.

As a result of the post-observation conversations, CPR members improved lessons to enhance and target student learning. Teachers provided guided play activities that served as scaffolding and students reviewed their understandings and experiences; these experiences are particularly crucial for powerful mathematics learning (Clements & Samara, 2005; Dockett & Perry, 2017). Teachers did this by scripting, modeling, organizing, sequencing, representing, producing, expanding, and socializing. As I indicated in the literature review, only 27% of students in the United States engage in advanced mathematical thought and reasoning, and direct instruction is the predominant method of teaching mathematics (Fisher et al., 2012). Data from the PAR study demonstrated that collaborating with teachers and supporting their instructional practices created playful learning experiences that enhanced students' mathematical thinking, procedural fluency, and engagement.

Classroom observations provided concrete data that revealed how the research CPR members applied and transferred to learning situations in the classroom, and by doing something made a tangible difference in improving student engagement. Observing the teaching and learning that integrated play as a pedagogy provided meaningful revelations of how students are capable of learning and how instructional practices can be used to support that process. Next, I

discuss how play-engaging opportunities affect student learning and inform instructional practices.

Facilitating Student Play and Discourse

Teachers facilitated play-based learning opportunities for pairs or small groups of students that allowed students to retain autonomy and control over the learning process. During these opportunities for supervised play, the teachers facilitated the growth and comprehension of mathematical ideas. According to Fisher et al. (2012), active, engaging experiences that foster mathematical meaning-making and conceptual understanding pique children's interest. An inquiry-based mathematics curriculum can be viewed as an effort to find challenging mathematics to improve student knowledge on how to recognize and problematize mathematical patterns and relationships, as well as the intended mathematical generalizations. Teachers can aid students in learning by employing a variety of socio-cognitive scaffolding techniques—commenting on their findings, engaging in play with students, engaging in conversation about learning, posing open-ended questions, suggesting fresh approaches to exploring and playing with materials or developing games (McLennan, 2014). Resnick (2015) describes this type of learning as shared cognition, which works for teachers as well as students. During her second post-observation conversation, C.B. addressed those instructional observations during play activities and discussed how putting children in play-based learning contexts helps them comprehend. According to C.B., observation data assisted her in forming heterogeneous learning groups enabling students of all skill levels to assist others. This led teachers to provide more specialized small-group education for students who share similar thinking. Through this investigation of teaching and learning, teachers discovered more opportunities to informally assess students.

Informal Assessment of Student Learning

When teachers develop agility in play-based learning, they use their time in a student-generated classroom differently. They can informally assess the growth of students' critical thinking and cooperative problem-solving abilities. Teachers learn more about how pupils interpret material and make sense of it using this practice. As observed through play-based activities, teachers can create activities that promote the students' learning by informally assessing the strengths and preferences of the students while they are engaged in play. According to Pyle et al. (2020), teachers have proven methods for evaluating play-based learning, including observational, embedding, and withdrawal evaluations, which might include moving the student out of the group to engage in autonomous play. By combining various objectives, games, and evaluations, teachers may monitor and record students' development in a variety of ways. As a result, teachers effectively intervene and handle student variability based on this daily real-time information.

Teachers were inspired to look for novel and engaging methods to support students' learning via play-based observations. They realized that learning continued to occur as students played and discussed arithmetic ideas with their friends. As teachers shifted toward a practice of observing learning and scaffolding as necessary with individual students or collaborative pairs, teachers viewed planning differently and changed their roles to facilitators of student-generated learning.

Framework for Change

I adapted the learning instructional triangle developed by Cohen et al. (2003) and refined by Little (2006) to illustrate teacher reform and the adoption of play pedagogy within instructional practices. The instructional triangle emphasizes the critical interactions and

dynamic interrelationships among the teacher, student, and content (see Figure 11). In the original triangle, the teacher is at the top of the triangle, and while the teacher still is the expert learner in the classroom, I place the student at the pinnacle of the revised triangle to demonstrate that student-generated questions and meaning-making are the most important factor in the classroom. The teacher structures the content and pedagogy to ensure student learning. As a result of this process, the students and the teacher are in a reciprocal relationship of sensemaking and sense-giving (Norris, 2022). While Norris discusses how this happens between school leaders and teachers, a parallel relationship occurs between teachers and students.

The focus of the PAR study was to develop the integration of play into math teaching practices. To accomplish this goal, I supported teachers through ongoing collaboration that involved establishing relational trust that allowed CPR members to authentically engage in conversations and learn from each other's practice. As the instructional leader, I provided teachers with opportunities to build their teaching capacity and establish play-based learning programs by creating time and space for collaboration and implementing protocols for reflection. According to Rigby and Tredway (2015), "We know that shifts in instructional leadership practice necessitate time and expertise to build teacher capacity and see transfer to the classroom, which is often limited at best" (p. 330).

Together, as a CPR team, we created and implemented play-based learning activities in the math program using observations from the classroom and an analysis of play within the existing state of the math program. Utilizing observational data, teachers improved access and rigor by incorporating play-based activities to achieve equitable access to learning math. Teachers were encouraged to purposefully plan and support students' development by co-creating a definition of play for learning. Furthermore, improving transfer to classroom practice

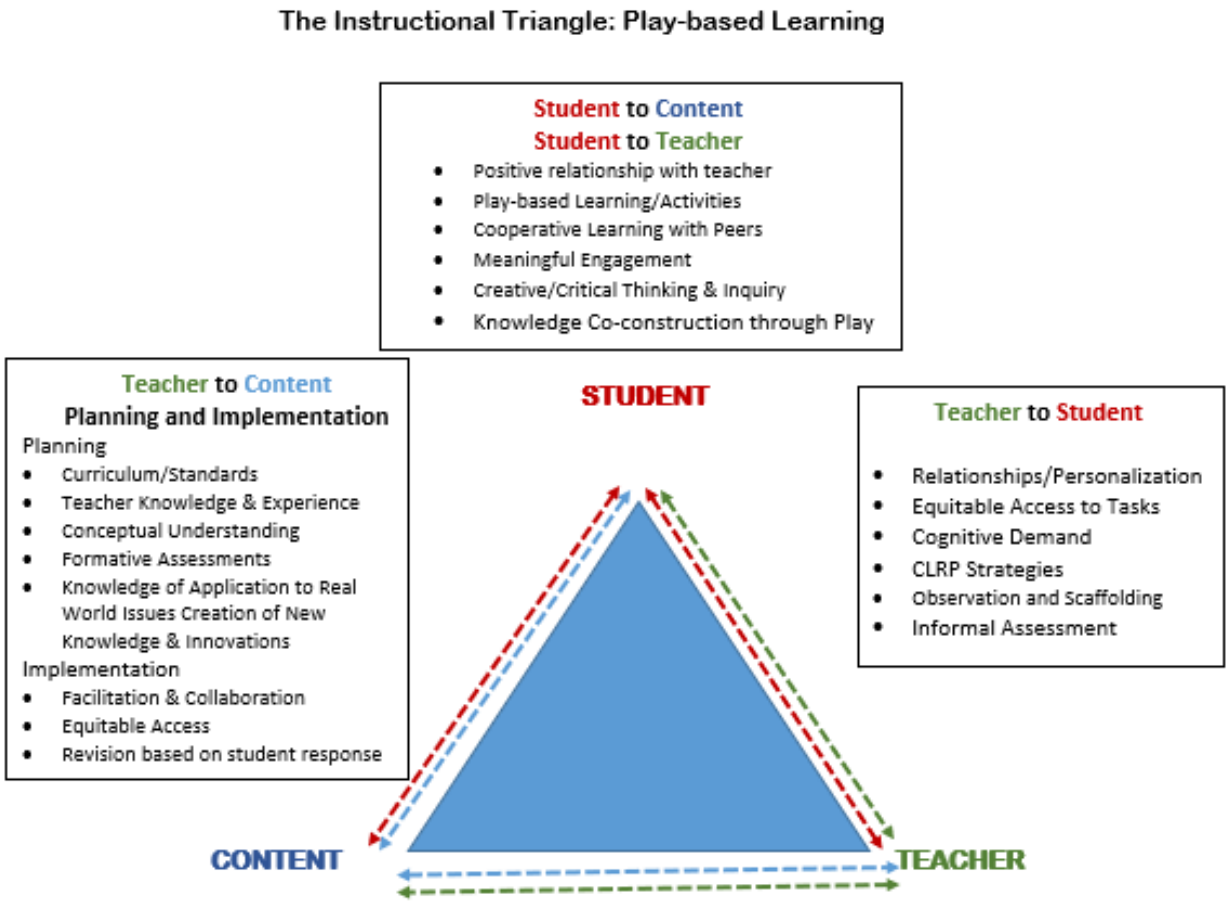


Figure 11. Framework for changing instructional practice to promote play-based pedagogy.

required observation dialogues and post-observation conversations. As I provided teachers more autonomy in decision-making and we practiced the reciprocal relationships of sensemaking and sense-giving, teachers provided more autonomy for student learning. Thus, teachers could observe students and make immediate adjustments to enhance student learning.

Re-examining Research Questions

The overarching research question: *How do teachers fully incorporate play-based learning into the math curriculum program?* These sub-questions guided the research:

1. To what extent do teachers design math lessons that include play pedagogy?
2. To what extent do teachers implement play pedagogy in their instructional practices?
3. How do I grow and develop as a leader by working with teachers in the school to support a math program and instructional process focused on play pedagogy?

Throughout the PAR study, CPR members gathered with continuity and participated in group learning. During this PAR research, the teachers' group depended on one another to support and enhance play-based learning opportunities by altering instructional strategies to foster equitable access toward mathematical conceptual understanding. As was established during the PAR Pre-Cycle, CPR members brought previous knowledge as well as play-based experiences to the work; however, the integration of play-based practices required refinement, and building teachers' capacity to change instructional practice became an important component of the study.

Teachers collaboratively created a unified concept of play as a learning technique. They collaboratively defined play as a joyful learning experience that is engaging, hands-on, and supports creativity. The definition served as a guide for the work that CPR members performed during the PAR project, together with the PAR research questions. Through a reflective process,

members reviewed learning lessons and adjusted and modified instruction to incorporate more play-based learning. Teachers' reflections from the observations of the study included that in play-based learning, students have more opportunities to communicate what they know and understand about math through a variety of modalities. According to Hammond (2015), "[g]ames provide a unique opportunity to review and rehearse new knowledge" (p. 137). Students are given multisensory learning chances through play, which improves information processing and deepens learning and understanding.

I conducted frequent CPR sessions centered on creating relational trust, building connections, and reflecting on teaching to modify practice, in order to support CPR members' development. Teachers' professional growth was evident through their intentional planning of play-based learning activities that promoted students to be active participants in the math program. As the PAR study progressed and evolved, evidence from the data demonstrated that teachers relied on both the collaboration process in which they strategized together and the informal assessment play-based learning offered from student observations, to create lessons that targeted students' levels and more effectively monitored their progress. The progress made to change teacher practice aligned with the research study of Ranz-Smith's (2007) empirical study in which she concluded, "With goals and objectives identified through ends-sought test outcomes, there have emerged defined curricula cultivating the practice of direct instruction as the efficient means to achieve the goals, to the neglect of children's propensity for play-based learning and child-initiated thought" (p. 272). Teachers worked together to create a common understanding and consistency of a play-based math instruction and learning program within their classrooms.

The examinations of the PAR questions during this study included how to expand these experiences into a cohesive school-wide program that incorporates play into instructional practices. Through the PAR study process, a small group of teachers were able to build their practice and are now ready to lead others, thereby changing math instruction across the school. As is evident through the notes from the CLE meetings, autobiographies, and photovoice protocol, CPR members understood play in the classroom and its benefits with learning. CPR members demonstrated how play can be incorporated and integrated during learning opportunities. The photovoice protocol provided a visual context of students enhancing their learning of skills and concepts through play. Autobiographies and journey lines provided a context of CPR members' personal experiences of play and how those experiences impact their understanding and implementation of play in their teaching practices and learning opportunities in classrooms with students. Teachers, who are closest to the issue, brought insights and expertise to this research. In alignment with the research questions, the PAR study concluded that providing students with extensive play opportunities will enhance and enrich their knowledge of concepts, apply their understanding, and transfer knowledge into real-world situations.

Implications

The PAR study focuses on equity by adding implicit learning possibilities derived from engaging students in play-based learning to assist and expand their comprehension of mathematical concepts and demonstrate their depth of knowledge. Many teachers at our site recognize the diverse student populations we serve and implement mathematical games that introduce, enhance, enrich, and reinforce a student's conceptualization of math. However, there is a lack of school-wide continuity of incorporating play within the math instructional program

and teacher practice which limits the process of vertical progression between grade levels. Incorporating play and games provides students with opportunities to demonstrate and apply their knowledge of mathematical concepts and reinforces their depth of understanding. If teachers incorporate games within their instructional practices, they can expect to create equitable situations for students to participate in math discussions that reinforce their learning. I focused on supporting the development of teachers' knowledge, skills, and dispositions to incorporate play as a learning strategy in math curriculum and instruction.

The purpose of the participatory action research (PAR) was to address the use of play to support teaching and learning in the math program and to discern how I could support teachers' integration of play through coaching feedback which will extend to professional development. The CPR and I are prepared to offer professional learning sessions to teaching staff to build their capacity in instruction that incorporates play. Strengthening teachers' practice and knowledge will instill school-wide continuity by providing students with engagement in play that will support their mathematical success. Thus, in our findings, I propose implications to practice, policy, and research.

Practice

The conclusion of the PAR study demonstrated beneficial implications for leaders, teachers, and the instructional math program. Through their involvement in the PAR study, CPR members improved their knowledge of play as a pedagogy in instructional practices in the classroom. The framework for change focuses on the relationship between teacher and content through reflective instructional practices and the transfer of that relationship to teacher and student and student to content.

Other schools and possibly other districts could institute stronger practice-based professional learning related to play-based instruction. While the study was small and implications were local, the processes we used for the PAR study are generalizable and useful to other practice-based inquiry projects. Discussions and data observations can lead to improvements in practice if participants engage in frequent meetings where all members have the same emphasis.

The framework encourages the consideration of teachers' knowledge and experiences and supports how teachers view instruction; applying that knowledge as they reflect on their practice leads to a shift in instructional practices. Through evidence-based observations and post-observation conversations, other teacher groups could learn to reflect on data to examine their practice in a different light and develop practices that focus on particular objectives and goals. The CPR process using CLE protocols was vital to our change efforts and other school-based educators could use the same protocols to construct their internal professional learning. Grissom et al. (2021), in a meta-study on effective instructional leadership, recommend that school leaders promote student learning by "Engaging in instructional focused interactions with teachers [and by] facilitating productive collaboration and professional learning communities" (p. xiv). The processes we use are replicable in other contexts and can provide a beacon for the school leader and teachers who take responsibility for successful school change (Grubb & Tredway, 2010).

Policy

The work and analysis of the PAR study provide a direction for school and district policy pertaining to math teaching, programs, and professional development. Specifically, the PAR study offers a chance to understand how play and games during math sessions enhance students'

mathematical thinking and application. Math standards were aligned through this work and, as teachers shifted their teaching practices, students had access to a variety of learning and assessment opportunities. The PAR research can be implemented and utilized as a means of collaboration with other site administrators and the district's math department to design a math curriculum that reinforces standards using a play-based framework.

On a broader level, leaders offer a pathway to learning by creating situations in which teachers have opportunities at the site level to engage in collaborative conversations with the school leader and other teachers. At the micro level, we need policies for establishing time and space for intentional planning that can support the continuity of teaching practices and equitable access to learning. At the meso level of the district, we need to migrate away from typical professional learning processes that offer little direction on how to make changes at the classroom level. Frameworks that schools and districts put in place that facilitate teacher learning and cooperation can support teachers to make deliberate changes to their practices, but only if the teachers have concrete experiences in their professional learning that mirror student learning. The district needs to include experiential education for teachers as they must have experiences in precisely the kinds of pedagogy we want in classrooms before they are confident enough to shift their practices (Britt, 2023; James, 2023). At the macro level, in order to guide teaching techniques that are developmentally appropriate for student learning, the state must provide districts with information, tools, and professional development related to instructional pedagogies. Through the provision of appropriate frameworks, bolstered by useful professional learning, districts and schools may assist teachers' efforts to alter their instructional practice and shift thinking about instruction and how to teach math through a new equitable lens.

Research

The PAR study adds to the expanding body of knowledge about how instructors use play as a teaching strategy. Despite the modest size of this study, it aligns with Grubb and Tredway's (2010) finding that teachers and leaders who want to actively participate in change initiatives to address equality must do school-level research. Teachers must defend the integration of play within the mathematical program and instruction in their classrooms as a technique for promoting math content, knowledge, and application. The PAR project was considered as a result of observing few worthwhile opportunities for students to link arithmetic ideas. According to McLennan (2014), recognizing and accommodating students' various social, cultural, language, and other backgrounds will increase their engagement in certain courses or even after compulsory education. By receiving more targeted professional development, teachers will be better able to grasp how to include play in their lessons and see how they may use creativity and innovation to engage students and achieve math requirements. This kind of study, in which the people doing the job directly influence how math is implemented, may be replicated in various settings.

The school-level research helps us understand the "black box" of teaching and learning in which teachers may change for a short time but revert to the grammar of schooling once the project or initiative ends (Tyack & Cuban, 1995). Cuban (2012) terms this dynamic conservatism—we change, but too quickly return to engrained practices. Many schools and districts enact project after project that does not result in a substantial change in teacher practice. In this research, through teacher learning and agency, the team co-developed practices that they can teach to the entire school. Therefore, more research on exactly how teachers make those complex shifts is needed so that we are not continually revisiting reform (Cuban, 1990).

Limitations

Based on the relatively small sample of the study and my leadership position, there were inherent limits to the study. I am the school leader and have responsibility for teacher evaluation. As the instructional leader, I encourage and promote teaching and learning in the primary school context. My background as a TK teacher and my point of view as a researcher may have produced bias in my capacity as an instructional leader in the PAR project. Because I have introduced play and have suggestions for how to accomplish this, the inclusion of play in the curriculum for my TK class may have influenced the results of the PAR research. To mitigate this potential bias, I developed collegial and non-hierarchical relationships with the CPR team members. Because they had former knowledge and expertise, I listened closely and carefully to them, just as I expected them to listen to students' thoughts and responses.

Time contributed to the limitations of the PAR study. Although three improvement cycles covered a period of eighteen months, more time would have been required to fully assess the impact of observation dialogues on practice. Therefore, transferring the experiences and learning from the PAR study to professional development with other site teachers did not fully occur. We plan to continue the work and will incorporate more classroom observations and discussions to further develop and change instructional practices by integrating more play-based learning opportunities. The CPR members' engagement and participation in the study will lead to school-wide implementation and professional development because CPR members are ready to successfully communicate what they learned to staff.

The small size of the sample is a further limitation, as it does not represent the perspectives multiple participants would provide; nevertheless, the depth and breadth of the qualitative data have validity. As Hale (2008) contends, the most important validity factor in

action research is the usefulness to the participants, and the participants found the research useful to them as teachers and their involvement bolstered their confidence as teacher leaders. As indicated in the implications section, the processes we used are useful to other groups, and the small size permitted us to form a close relationship.

Leadership Development

From my participation in the PAR research study and by engaging in this learning process, I developed as a practitioner-researcher and as a school leader. The CLE work is grounded on a philosophy of relationship development, change, and action, which foreshadows a community-building strategy that rejects deficit thinking (Guajardo et al., 2016) and focuses on the assets of the community members. In order to bring about change, I employed the CLE axiom for this PAR project: involve community members who are closest to the work in deep learning and open discussion of shared problems. In our meeting, I utilized the CLE methods. The five CLE axioms underpinned how we developed the action and activist research: (1) learning and leading are dynamic social processes (2) conversations are critical and central pedagogical processes (3) the people closest to the issues are best situated to discover answers to local concerns (4) crossing boundaries enriches the development and educational processes (5) hope and change is built on the assets and dreams of locals and their communities (Guajardo et al., 2016, pp. 24-27). As I started the PAR study, the CLE axioms served as a framework for my leadership work. I became increasingly familiar with the axioms as I used them throughout the PAR and realized how deeply ingrained they were, and they became my values towards my work.

As I reflect on my leadership during the PAR study, I realize shifting instructional practices involves a collaborative process stemming from relational trust. Establishing trust was

a key element for the CPR group to drive their actions. The process of reflection allowed for deep conversations designed to lead to action that transformed teacher practices. Further, reflection provided me with insight into how the work cannot be conducted in isolation. As the sole administrator at the site, I had previously felt obligated to address the needs of teaching and learning alone. The PAR study taught me that working more closely with teachers leads to better student outcomes. Very early in the PAR research study, I realized that CPR members brought a wealth of knowledge and experiences to the FoP. Their knowledge set the tone for the work and established the foundation to build upon. In addition, the bond that was established through the research process fostered relationships that allowed each member to be vulnerable and, through the supportive nature of collaboration, guided us to work together towards a common goal and learning experience.

The PAR research study increased teachers' potential as leaders as they worked with their colleagues to learn and collaborate on actions taken. The CLE axioms embedded within the PAR study provided teachers with a voice and engaged them in intentional conversations around the teaching and learning that was taking place in their classrooms. Empowering teachers to share their perspectives and valuing their thinking, created opportunities for the team to continue their development of professional growth and capacity of instructional practices. I used feedback and reflection from interviews, CPR meetings, and CLEs throughout the PAR experience to direct the group's learning and make the learning relevant to the CPR members. To make intelligent and appropriate instructional adjustments in the classroom, participants and I needed time to analyze and comprehend precisely what the study implied while reflecting on existing practice.

My process of classroom observations shifted during the PAR study; rather than solely focusing on what students were doing, I focused on the teacher's practices with more intentionality and how those instructional practices transferred to student learning. Following the classroom observations with post-observation conversations fostered different and more useful conversations with each CPR member as we reflected on and processed the data together. This engagement strengthened the connection I had with each CPR member; I became a facilitator of the learning by asking open-ended questions and guiding CPR members' thinking. The genuine conversations that took place during the post-observation meetings were inspirational because there was motivation and drive to move forward with change by collaboratively generating ideas. These conversations initiated the next steps toward action and planning to support a change in how we teach.

Real inspiration means to inspire people to live more abundantly, to learn to begin with life as they find it and make it better (Woodson, 1990). One of the main areas of development I benefited from during the PAR study was growth in my ability to inspire teachers to look within and initiate change. By empowering CPR members and recognizing their abilities, knowledge, and leadership, we collectively made incremental progress and personal growth in the work and our profession. Teachers were fully ready to be advocates and leaders of change in the school after observing the shifts in teachers' instructional practices and enthusiasm toward their practices; once we as leaders authorize others to lead and make decisions, we grant them a renewal of their sense of agency (Grubb & Tredway, 2010). As I reflect on the Project I^4 process, I am astounded by the personal and professional development I have witnessed as a result of taking on the task of the PAR study. First, I have noticed changes in myself professionally front in two particular areas: time and connections. Second, I have become better at making selective

verbatim observations and conversing with teachers regarding classroom instruction in an authentic and intentional manner.

My leadership development focused on the professional development of teachers and encouraging them to share their depth of knowledge through a process of being seen, heard, and valued. Reflection during the PAR allowed for in-depth discussions that resulted in actions that changed the teacher's practice. Inviting teachers into the work and taking their lead presented a shift in my thinking away from assuming myself to be the sole initiator of change and improvement. Relying on CPR members created situations in which we could accomplish bigger things together. My progress and development will continue to include a leadership commitment to participate in the inquiry, present differing viewpoints, and reflect on implementation while offering suggestions for improvement for future actions.

Conclusion

The PAR study provided data and valuable information about the expertise and experiences CPR members brought to the study. As I observed during the photovoice protocol, CPR members had already developed some learning opportunities that integrated play within their instructional practices. Based on the expertise of the CPR members, the team further enhanced play-based learning opportunities by aligning them with grade-level standards and exploring how to effectively spiral them between the grades. Building teacher capacity to structure play within the learning program and providing professional development to other teachers will lead to a school-wide cohesive play-based learning program. Through each cycle of the PAR study process, we continued the work by consistently reviewing our current program, including curriculum and practices, and developing intentional plans of where and how play would be embedded into our math programs. Implementing the observation toolkit provided

evidence of play elements in instructional practices. These observations provided CPR members with opportunities to reflect upon their programs, teaching practices, and student engagement. The data collected guided CPR members to adjust and modify activities that supported the PAR study's progress.

Upon completion of this PAR study, our goal is for CPR members to facilitate professional development for other teachers. We will be focusing on supporting site-based professional development that provides teachers with a better understanding of play integration within their math lessons and units of study. The PAR study addressed the need for play and engagement with students through games that help leverage mathematical understanding, support students' knowledge as they progress through grade levels, and apply their learning to their world. Play served as a mediator of student learning and offered meaningful interactions to sustain and support their learning through high cognitive thinking of mathematical concepts. Play served as a vehicle for students to process and practice information presented in the math program. The CPR team intentionally assisted in the integration of these positive learning outcomes for students by participating in informed decision-making. Through a collaborative effort, the CPR team supported the integration of play by providing students with authentic and innovative learning opportunities, and by empowering teachers to expand their capacity by creating intentional lessons that integrate play within their mathematical teaching. In sum, playful encounters provide a unique framework for helpful and rich learning experiences (Zosh et al., 2017).

REFERENCES

Acheson, K. A., & Gall, M. D. (2003). *Clinical supervision and teacher development preservice and in-service applications.* John Wiley & Sons.

Ahn, J., Campos, F., Nguyen, H., Hays, M., & Morrison, J. (2021). Co-designing for privacy, transparency, and trust in K-12 learning analytics. *LAK21,* 55-65.

Anderson, G.L. & Herr, K., (2014). *The action research dissertation: A guide for students and faculty* (2nd ed.). Sage.

Birt, L, Scott S., Cavers, D., Campbell, C., & Walter F. (2016). Member checking: A tool to enhance trustworthiness or merely a nod to validation? *Qualitative Health Research, 26*(13), 1802-1811.

Boaler, J. (2016). *Mathematical mindsets: Unleashing students' potential through creative math, inspiring messages and innovative teaching.* Jossey-Bass.

Borges, I., & Cesar, M. (2012). The way we work: Contributions of collaborative work to mathematics learning. *Quaderni di Ricerca in Didattica Mathematics, 22,* 221-224.

Boykin, A. W., Noguera, P. (2011). *Creating the opportunity to learn: Moving from research to practice to close the achievement gap.* ASCD.

Britt, L. B. (April 2023). *Creating a home: Promoting equitable academic discourse by establishing teacher agency and co-design* (Doctoral Dissertation, East Carolina University). Retrieved from the Scholarship. (http://hdl.handle.net/10342/12819.) Display/Hide MLA, Chicago and APA citation formats.

Bruner, J. S. (1966). *Toward a theory of instruction*. Belknap Press.

Burghardt, G. (2012). Defining and recognizing play. In P. Nathan & A. Pelligrini (Eds.), *The Oxford handbook of the development of play* (pp. 9-18). Oxford University Press.

Bryk, A. S., Gomez, L. M., Grunow, A., LeMahieu, P. G. (2015). *Learning to improve: How America's schools can get better at getting better.* Harvard Education Press.

Carter, P. L., & Welner, K. G. (Eds.). (2013). *Closing the opportunity gap: What America must do to give every child and even chance.* Oxford University Press.

Chronaki, A., & Mountzouri, G. (2012). Playing with numbers in cultures: Beginning to trouble essentialist views of mathematical knowledge re-production. *Quaderni di Ricerca in Didattica Mathematics, 22,* 90-94.

Clark, L. M., DePiper, J. N., Frank, T.J ., Nishio, M., Campbell, P. F., Smith, T. M., Griffin, M. J., Rust, A. H., Conant, D. L., & Choi, Y. (2014). Teacher characteristics associated with mathematics teachers' beliefs and awareness of their students' mathematical dispositions. *Journal for Research in Mathematics Education, 45*(2), 246-284.

Cobb, P., Jackson, K., Henrick, E., Smith, T.M. and the MIST Team. (2018) *Systems for instructional improvement: Creating coherence from the classroom to the district office*. Harvard Education Press.

Coburn, C. E., Russell, J. L., Kaufman, J. H., and Stein, M. K. (2012). Teachers' advice networks teacher sustainability and ambitious reform. *American Journal of Education, 119* (1), 137-182.

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis*, *25*(2), 119-142.

Conn, J. H., & Gerdes, D. A., (2001). A user-friendly look at qualitative research methods. *Physical Educator, 58*(4), 183-190.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage.

Creswell, J. W., & Guetterman, T. C. (2019). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (6th ed.). Pearson.

Cuban, L. (1990). Reforming again, again, and again. *Educational Researcher, 19*(1), 3-13.

Cuban, L. (2012, August 9). Dynamic conservatism and stability in teaching. https://larrycuban.wordpress.com/2012/08/09/dynamic-conservatism-and-stability-in-teaching/

Danniels, E., & Pyle, A., (2017). A continuum of play-based learning: The role of the teacher in play-based pedagogy and the fear of hijacking play. *Early Education and Development, 28(3)*, 274-289.

Darling-Hammond, L., Hyler, M., Gardener, M., & Espinoza, D. (2017). *Effective teacher professional development.* Learning Policy Institute.

Dewey, J. (1938). *Experience & education.* Touchstone.

Dockett, S, & Perry, B., (2007). What makes mathematics play? *Shaping the future of mathematics education: Proceedings of the 33rd annual conference of the Mathematics Education Research Group of Australia*. MERGA.

Drago-Severson, E. (2011). How adults learn: Forms the foundation of the learning designs standard. *The Learning Professional, (32)*5, 10-12.

Eubanks, E., Parish, R., & Smith, D. (1997). Changing the discourse in schools. In P. M. Hall (Ed.), *Race, ethnicity and multiculturalism policy and practice* (pp. 151-167). Garland Publishing.

First Discoverers (2017, May 26). *Child development: Cognitive development.* Firstdiscoverers.co.uk.

Fisher, K. R., Golinkoff, R. M., & Hirsh-Pasek, K. (2012). Fostering mathematical thinking through playful learning. In S. Suggate & E. Reese (Eds.), *Contemporary debates in childhood education and development* (pp. 81-92). Routledge.

Ford, D. (2010). Underrepresentation of culturally different students in gifted education: Reflections about current problems and recommendations for the future. *Gifted Child Today, 33*(3), 31-35.

Freire, P. (2000). *Pedagogy of the oppressed.* Continuum.

Gellert, U., FitzSimons, G., Gimenez, J., Hitt, F., Kafoussi, S., Poirier, L., Romero, S., Theis, L., Di Paola, B., & Diez-Palomar, J. (2011). Facilitating access and participation: mathematical practices inside and outside the classroom, editorial and discussion paper. *Quaderni di Ricerca in Didattica Mathematics, 22,* 6-13.

Ginsburg, H, & Seo, K. (1999). What is developmentally appropriate in early childhood mathematics education? Lessons from new research. In D. Clements & J. Sarama (Eds.), *Engaging young children in mathematics: Standards for early childhood mathematics education* (pp. 91-104). Lawrence Erlbaum Associates.

Golinkoff, R. M., &Hirsh-Pasek, K., (2011). The great balancing act: Optimizing core curricula through playful pedagogy. In E. Zigler, S. Barnett, & W. Gilliam (Eds.), *The preschool education debates* (pp. 2-26). Paul H. Brookes Publishing Co.

Grissom, J. A., Egalite, A. J., & Lindsay, C. A. (2021). *How principals affect students and schools: A systematic synthesis of two decades of research*. The Wallace Foundation. http://www.wallacefoundationorg/principalsynthesis

Grubb, W. N., & Tredway, L. (2010). *Leading from the inside out: Expanding roles for teachers in equitable schools.* Routledge.

Guajardo, M., Guajardo, F., Janson, C., & Militello, M. (2016). *Reframing community partnerships in education: Uniting the power of place and wisdom of people.* Routledge.

Guba, E. G., & Lincoln, Y. S., (1985). *Naturalistic inquiry.* Sage.

Gutiérrez, R. (2013). Why (urban) mathematics teachers need political knowledge. *Journal of urban mathematics education, 6*(2), 7-19.

Hale, C. R. (2008). *Engaging contradictions: Theory, politics, and methods of activist scholarship.* University of California Press.

Hammond, Z. (2015). *Culturally responsive teaching & the brain: Promoting authentic engagement and rigor among culturally and linguistically diverse students.* Corwin.

Hammond, Z. (2020, January 22). A conversation about instructional equity with Zaretta Hammond. *Collaborative Classroom Blog.*

Hassinger-Das, B., Zosh, J. M., Hirsh-Pasek, K., & Golinkoff, R. M. (2018). Playing to learn mathematics. *Encyclopedia on Early Childhood Development* (pp. 1-5). https://www.child-encyclopedia.com/play-based-learning/according-experts/playing-learn-mathematics

Hunzicker, J. (2011) Effective professional development for teachers: a checklist. *Professional Development in Education, 3*7(2), 177-179.

Hollie, S. (2018). *Culturally and linguistically responsive teaching and learning: classroom practices for student success.* Shell Education.

Hughes, P., & Grace, B. (2010). *Gracious space: A practical guide to working together* (2nd ed.). Center for Ethical Leadership.

hunter, l., emerald, e., & Martin, G. (2013). *Participatory activist research in the globalized world*. Springer.

James, J. L. (April 2023). *Leave this place better than you found it: Facilitating inquiry-based learning experiences that support student agency* (Doctoral Dissertation, East Carolina University). Retrieved from the Scholarship. (http://hdl.handle.net/10342/12808.)

Kersaint, G. (2015, September 29). *Talking math: How to engage students in mathematical discourse*. Gettingsmart.com.

Knowles, M. S. (1988). *The modern practice of adult education: From pedagogy to andragogy*. Cambridge Adult Education.

Kolb, D. A. (1984). *Experiential learning: Experience as the source for learning and development.* Prentice-Hall.

Labaree, D. F. (2008). The winning ways of a losing strategy: Educationalizing social problems in the United States. *Educational Theory 58(4),* 447-460.

Laski, E.V., & Siegler, R.S. (2014). Learning from number board games: You learn what you encode. *Developmental Psychology 50*(3), 853-863.

Little, J. W. (2006). *Professional development and professional community in the learner-centered school.* National Education Association.

Lobo da Costa, N., Prado, M., Pietropaolo, R., & Campos, T., (2012). Mathematics teacher education as a freedom practice: An approach of practical reflection. *Quaderni di Ricerca in Didattica Mathematics, 22,* 288-292.

Machado, M. (May 2021). *Family stories matter: Critical pedagogy of storytelling in fifth grade classrooms* (Doctoral Dissertation, East Carolina University). Retrieved from the Scholarship. (http://hdl.handle.net/10342/9084.)

Marcon, R. (1993). Socioemotional versus academic emphasis: impact on kindergartners' development and achievement. *Early Child Development and Care*, *96*(1), 81-91.

McLeod, S. A. (2019, July 11). Bruner - learning theory in education. *Simply Psychology*. www.simplypsychology.org/bruner.html

McLeod, S. A. (2018, June 6). Jean Piaget's theory of cognitive development. *Simply Psychology*. www.simplypsychology.org/piaget.html

McLennan, D. P. (2014). Making math meaningful for young children. *Teaching Young Children 8*(1). NAEYC. https://www.naeyc.org/resources/pubs/tyc/oct2014/making-math-meaningful.

Merriam, S. B. (1998). *Qualitative research and case study applications in education*. Jossey-Bass.

Nachmanovitch, S. (1990). *Free play: Improvisation in life and art*. Jeremy P. Tarcher/Putnam.

National Academies of Sciences, Engineering, and Medicine. (2018). *How people learn II: Learners, contexts, and cultures.* The National Academies Press.

Neri, R. C., Lozano, M., & Gomez, L. M. (2019). (Re)framing resistance to culturally relevant education as a multilevel learning problem. *Review of Research in Education, 43*(1), 197-226.

Norris, J. (2022). *School leaders' sensemaking and sensegiving*. Brill.

Oldridge, M. (2019). *The playful approach to math*. Edutopia.org.

Osorio, V., Moll, V., Gimenez, J., Diaz, A., & Casales, B. (2012). Teaching practices research as a source to develop training programs for mathematics teachers. *Quaderni di Ricerca in Didattica Mathematics, 22,* 284-287.

Paez, D., & Guzman, J. (2012). The mathematics teacher learning through his practice: the influence of his didactic and mathematical knowledge. *Quaderni di Ricerca in Didattica Mathematics 22,* 302-305.

Patton, M. Q. (2018). *Principles-focused evaluation: The guide*. The Guilford Press.

Pedaste, M., Maeots, M., Siman, L. M., de Jong, T., van Riesen, S. A. N., Kamp, E. T., Manoli, C.C., Zacharia, Z. C., & Tsourlidaki, E. (2015). Phases of inquiry-based learning: definitions and the inquiry cycle. *Educational Research Review, 14,* 47-61.

Playworld (2019, April 12). How schools can incorporate play-based: learning into playtime. https://playworld.com/blog/schools-can-incorporate-play-based-learning-playtime/

Pyle, A., Pyle, M., Prioletta, J., & Alaca, B. (2020). Portrayals of play-based learning: misalignments among public discourse, classroom realities, and research. *American Journal of Play*, *13*(1), 53-86.

Quierós, A., Faria, D, & Almeida F. (2017). Strengths and limitations of qualitative and quantitative research methods. *European Journal of Education, 3*(9), 369-387.

Ranz-Smith, D.J. (2007). Teacher perception of play: In leaving no child behind are teachers leaving children behind?*Early Education and Development*,*18*(2), 271-303.

Resnick, L. B., Asterhand, C. S. C., & Clarke, S. N. (Eds.). (2015). *Socializing intelligence through academic talk and dialogue.* American Education Research Association.

Rigby, J. G., & Tredway, L. (2015). Actions matter: How school leaders enact equity principles. In M. Khalifa, N.W. Arnold, A. Osanloo & C.M. Grant (Eds.), *Handbook on urban educational leadership* (pp. 329-346). Rowman & Littlefield.

Rimbey, K. (2019). *Discourse during math games*. KP Mathematics.

Russell, J. L., Bryk, A. S., Dolle, J. R., Gomez, L. M., LeMahieu, P. G., & Grumow, A. (2017). A framework for the initiation of networked improvement communities. *Teachers College Record*, *119*(5), 1-36.

Sarama J., & Clements, D. (2005). Math play: How young children approach math. *Early Childhood Today*, *19*(4), 50–57.

Safir, S. (2017). *Listening leader*. John Wiley & Sons.

Saldaña, J. (2016). *The coding manual for qualitative researchers.* Sage.

Simon, K. (2019) *Inquiry: A pedagogy for personal empowerment, collaboration, and democracy*. (Doctoral Dissertation, East Carolina University). Retrieved from the Scholarship. (http://hdl.handle.net/10342/7610.)

Spillane, J. P. (2013). Diagnosing and designing for schoolhouse practice educational administration and instructional improvement. In H. J. Malone (Ed.), *Leading educational change: global issues, challenges, and lessons on whole system reform* (pp. 37-41). Teachers College Press.

Steele, C. M. (2010). *Whistling Vivaldi: How stereotypes affect us and what we can do.* W.W Norton & Company.

Stipek, D. (2017). *Playful math instruction in the context of standards and accountability*. National Association of the Education of Young Children.

Tanase, M. (2020). Is good teaching culturally responsive? *Journal of Pedagogical Research, 4(3)*, 187-202.

Todd, J. (2021, August 5). *How to improve mathematical discourse in the classroom.* Sadlier.com.

Tredway, L., Militello, M., & Simon, K. (2021). Making classroom observations matter. *Educational Leadership, 78*(7), 56-62.

Tredway, L., & Militello, M. (2023). Supervision redux: Leaders with teachers activate culturally responsive practices. In I. Mette, D. R. Cormier, & Y. O. Ortiz (Eds.), *Culturally responsive instructional supervision: Instructional leadership for equitable and emancipatory outcomes.* Teachers College Press.

Tsai, K., (2012). Play, imagination, and creativity: A brief review. *Journal of Education and Learning, 1*(2), 15-20.

Tyack, D. & Cuban, L. (1995). *Tinkering toward utopia*. Harvard University Press.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Harvard University Press.

Wager, A. A., & Parks, A. N. (2014). Learning mathematics through play. In L. Brooker, M. Blaise, & S. Edwards (Eds.), *The Sage handbook of play and learning in early childhood* (pp. 216-227).

Weisberg, D. S., Hirsh-Pasek, K., Golinkoff, R. M., Kittredge, A. K., & Klahr, D. (2016). Guided play: principles and practices. *Current Directions in Psychological Science, 25*(3), 177-182.

Whitford, B. L., & Wood, D. R. (2010). *Teachers learning in community: Realities and possibilities.* SUNY Press.

Wilkerson, I. (2020). *Caste: the origins of our discontents.* Penguin Random House.

Woodson, C. G. (1990). *The miseducation of the negro.* Africa World Press.

Zehetmeier, S., (2012). As time goes by: What remains from teachers' professional development? *Quaderni di Ricerca in Didattica Mathematics, 22,* 313-316.

Zosh, J. M., Hopkins, E. J., Jensen, H., Liu, C., Neale, D., Hirsh-Pasek, K., Solis, S. L., & Whitebread, D. (2017). *Learning through play: A review of the evidence*. The Lego Foundation.

APPENDIX A: INSTITUTIONAL REVIEW BOARD APPROVAL

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board
4N-64 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office **252-744-2914** · Fax **252-744-2284** · **rede.ecu.edu/umcirb/**

Notification of Exempt Certification

From: Social/Behavioral IRB
To: Amandeep Randhawa
CC: Matthew Militello
Date: 12/15/2021
Re: UMCIRB 21-002461
Play IS Learning: A pedagogy for building teacher capacity with integrating play in math instruction

I am pleased to inform you that your research submission has been certified as exempt on 12/15/2021. This study is eligible for Exempt Certification under category # 1 & 2ab.

It is your responsibility to ensure that this research is conducted in the manner reported in your application and/or protocol, as well as being consistent with the ethical principles of the Belmont Report and your profession.

This research study does not require any additional interaction with the UMCIRB unless there are proposed changes to this study. Any change, prior to implementing that change, must be submitted to the UMCIRB for review and approval. The UMCIRB will determine if the change impacts the eligibility of the research for exempt status. If more substantive review is required, you will be notified within five business days.

Document	Description
CALL Survey(0.01)	Surveys and Questionnaires
CLE Protocols(0.01)	Additional Items
Consent Form(0.01)	Consent Forms
Interview Protocols(0.01)	Interview/Focus Group Scripts/Questions
Invitation Email Script(0.01)	Recruitment Documents/Scripts
Play IS Learning: A pedagogy for building teacher capacity with integrating play in math instruction(0.01)	Study Protocol or Grant Application
Post-Observation Protocol(0.01)	Additional Items

For research studies where a waiver or alteration of HIPAA Authorization has been approved, the IRB states that each of the waiver criteria in 45 CFR 164.512(i)(1)(i)(A) and (2)(i) through (v) have been met. Additionally, the elements of PHI to be collected as described in items 1 and 2 of the Application for Waiver of Authorization have been determined to be the minimal necessary for the specified research. The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B: CITI CERTIFICATION

CITI PROGRAM

Completion Date 26-Dec-2020
Expiration Date 26-Dec-2023
Record ID 40091486

This is to certify that:

Amandeep Randhawa

Has completed the following CITI Program course:

Not valid for renewal of certification through CME.

Human Research
(Curriculum Group)
Group 2.Social / Behavioral Research Investigators and Key Personnel
(Course Learner Group)
2 - Refresher Course
(Stage)

Under requirements set by:

East Carolina University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wb2db10e0-d725-441e-b560-d203ba29e449-40091486

APPENDIX C: STUDY APPROVAL LETTER

WEST CONTRA COSTA UNIFIED SCHOOL DISTRICT
1108 Bissell Avenue | Richmond, CA 94801-3135
Office: (510) 231-1101 | Fax: (510) 236-6784
www.wccusd.net
Kenneth C. Sr., Ed.D.
Superintendent

July 20, 2021

To Whom It May Concern:

West Contra Costa Unified School District recognizes the benefits of participating in relevant, well-designed research studies proposed by qualified individuals. Approval for conducting such studies is based primarily on the extent to which substantial benefits can be shown for WCCUSD Schools and its mission of educating students. The purpose of this letter is to notify you of the **approval** to use conduct your dissertation study titled, Play IS Learning: A pedagogy for building teacher capacity with integrating play in math instruction with participants in our schools. We also give permission to utilize the following spaces at district offices and schools to collect data and conduct interviews for his dissertation project: Play IS Learning: A pedagogy for building teacher capacity with integrating play in math instruction.

The project meets all of our school/district guidelines, procedures, and safeguards for conducting research on our campus. Moreover, there is ample space for Amandeep Randhawa to conduct his study and his project will not interfere with any functions of WCCUSD. Finally, the following conditions must be met, as agreed upon by the researchers and WCCUSD:

- Participant data only includes information captured from the state data collection strategies.
- Participation is voluntary.
- Participants can choose to leave the study without penalty at any time.
- Any issues with participation in the study are reported to the school administration in a timely manner.
- An executive summary of your findings is shared with the school administration once the study is complete.

In addition to these conditions, the study must follow all of the East Carolina University IRB guidelines.

We are excited to support this important work.

Respectfully,

Kenneth C. Hurst Sr., Ed.D.
Superintendent

APPENDIX D: ADULT CONSENT FORM

Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Play IS Learning: A pedagogy for building teacher capacity with integrating play in math instruction

Principal Investigator: Amandeep Kaur Randhawa
Institution, Department or Division: East Carolina University, Department of Educational Leadership
Address: 5855 Olinda Road, El Sobrante CA 94803
Telephone #: 510-231-1452
Study Coordinator: Dr. Matthew Militello
Telephone #: 252-328-6131

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why am I being invited to take part in this research?

The purpose of this participatory action research (PAR) project is to inform how teachers integrate play as a primary pedagogy into a mathematical program and provide opportunities for professional growth to build teacher capacity and foster schoolwide use of play in math instruction. You are being invited to take part in this research because you have expressed an interest in this work. The decision to take part in this research is yours to make. By doing this research, we hope to learn how teachers fully incorporate play into the math curriculum program and provide professional development to staff.

Are there reasons I should not take part in this research?

There are no known reasons for why you should not participate in this research study.

What other choices do I have if I do not take part in this research?

You can choose not to participate

Where is the research going to take place and how long will it last?

The research will be conducted at Olinda Elementary School. The total amount of time you will be asked to volunteer for this study is approximately twenty hours over the next fourteen months.

What will I be asked to do?
If you agree to participate in this study, you may be asked to participate in an interview, classroom observations, post observation interviews, engage in Community Learning Exchanges with other teachers, complete the CALL survey of distributive leadership (responses will be anonymous), design and facilitate professional development for other teachers. The interviews or observation may be video recorded in addition to handwritten notes by the research team members. All of the interview questions will focus on your experience integrating play as a pedagogy within your math program and instruction and reflecting on professional development conducted.

What might I experience if I take part in the research?
To the best of our knowledge, there are no known risks (the chance of harm) associated with this research. Any risks that may occur with this research are no more than what you would experience in everyday life. I do not know if you will benefit from taking part in this study. There may not be any personal benefit to you, but the information gained by doing this research may help others in the future.

Will I be paid for taking part in this research?
We will not be able to pay you for the time you volunteer while being in this study

Will it cost me to take part in this research?
It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?
ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), the North Carolina Department of Health, and the Office for Human Research Protections.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

How will you keep the information you collect about me secure? How long will you keep it?
The information in the study will be kept confidential to the full extent allowed by law. Confidentiality will be maintained throughout the data collection and data analysis process. Consent forms and data from surveys, interviews, and focus groups will be maintained in a secure, locked location and will be stored for a minimum of three years after completion of the study. No reference will be made in oral or written reports that could link you to the study.

What if I decide I don't want to continue in this research?
You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

Who should I contact if I have questions?
The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator at phone number 510-231-1452 (weekdays, 8:00 am – 4:00 pm) or email arandhawa@wccusd.net
If you have questions about your rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2941 (days, 8:00 am – 5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the ORIC at 252-744-1971.

I have decided I want to take part in this research. What should I do now?
The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT) **Signature** **Date**

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above and answered all of the person's questions about the research.

Person Obtaining Consent (PRINT) **Signature** **Date**

APPENDIX E: CLASSROOM OBSERVATION FORM

Utilize the chart to take selective verbatim notes. It is important to note the time of all notes. After the observation, analyze the selective verbatim notes and create initial codes.

Teacher:_____ Observer:_____ Date:_____

Duration of Observation: _____ to_____

Time Stamp	Selective Verbatim Evidence from Observation	Code