MATHE-DRAMATICAL PLAY TASKS KIT:
INTEGRATING SOCIODRAMATIC PLAY AND MATHEMATICAL PROBLEM SOLVING IN THE KINDERGARTEN CURRICULUM

A graduate project submitted in partial fulfillment of the requirements For the Master of Arts Degree in Elementary Education

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Dedication

I dedicate this Master’s project to my new baby girl Quinn. As I brought this project to fruition to connect my kindergarteners’ mathematical learning to the real world, I bring you into this world to learn from all of life’s opportunities both in and out of school and eventually pursue your life’s passion.
Table of Contents

Signature Page ii
Acknowledgements iii
Dedication iv
Abstract vi

Chapter 1: Proposal 1
Chapter 2: Review of the Literature 4
  Does pretend play have a place in academic kindergarten? 4
  What impact does pretend play have in academic content areas? 9
  What is developmentally appropriate for kindergarten mathematics? 12
  Does pretend play have a place in mathematics? 15
    Sociocultural connections 16
    Constructing mathematical knowledge 18
    Problem solving 20
  Conclusion 23
Chapter 3: Explanation of the Math-Dramatical Play Tasks Kit 25
Chapter 4: Math-Dramatical Play Tasks Kit 29
References 66
ABSTRACT

MATHE-DRAMATICAL PLAY TASKS KIT: INTEGRATING SOCIODRAMATIC PLAY AND MATHEMATICAL PROBLEM SOLVING IN THE KINDERGARTEN CURRICULUM

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Master of Arts in Elementary Education

Research findings in early childhood education reveal that children learn while playing. However, dramatic play in academic kindergarten is on the decline. Kindergarten teachers can use dramatic play as a means for constructing conceptual mathematical understanding and application to authentic problem solving tasks. Beginning with a review of the literature, I will synthesize current research on dramatic play in academic kindergarten, dramatic play’s impact on academic content areas, developmentally appropriate math in kindergarten, and dramatic play’s place in mathematics. Based on this research, I will create the Mathe-Dramatical Play Tasks Kit to fill a void in the traditional kindergarten mathematics curricula by fostering problem solving through sociodramatic play scenarios aligned with the Common Core Math Standards for Kindergarten. The kit contains informational teacher task cards about objectives, materials, and assessment questions as well as emergent reader-friendly student task cards to guide students in acting out and resolving real-life mathematical problems.
Chapter 1: Proposal

As a kindergartener in 1988, I can recall painting on the easel, singing songs, building with blocks, and engaging in dramatic play all while learning basic reading skills and math concepts. As a kindergarten teacher in 2012, I cannot help but notice how the push for more academic rigor has created a one-dimensional school day with little time for imaginative endeavors.

Today’s kindergarteners are bombarded with dozens of standards to master in mathematics, but they may not have authentic opportunities to apply these skills to their lives for conceptual understanding. Acquiring an abundance of knowledge is not beneficial unless children form interconnections, a conceptual understanding, and an ability to use it in problem solving situations. With the increase in quantity of procedural-based mathematics standards and tests in schools, even students as young as kindergarteners may view math in school and math in their daily lives as unrelated. Now more than ever, schools must stress students’ conceptual mathematical understanding so they can apply it to solve problems and make decisions in daily life as it pertains to a five-year-old. Early mathematics education must foster problem solving in a context appropriate for and relatable to children: pretend play. (I will be using the phrase “pretend play” to refer to all forms of imaginative play, such as dramatic play, sociodramatic play, and role-play, in which children transform objects and actions symbolically, engage in dialogue, take on roles, and improvise. I will explain the specifics of sociodramatic play in Chapter 3.)

Children play to learn. Early childhood learning takes place while children explore and process new knowledge through acting out imaginative scenarios.
Kindergarten teachers can support students by combining developmentally appropriate mathematics instruction with real-life contexts through pretend play by encouraging students to act out problem solving scenarios. I have managed to maintain the importance of pretend play in my own kindergarten classroom by integrating the puppet theater with academic content areas. Unfortunately, current mathematics curricula lack ways for most teachers to incorporate pretend play. Therefore, this Master’s project proposes an original and creative mathematics curriculum that develops problem solving through pretend play with an immediate application in kindergarten classrooms.

My rationale for creating the Mathe-Dramatical Play Tasks Kit includes debunking the myth that pretend play has no place in academic kindergarten. Incorporating high-quality pretend play in the classroom has numerous social and academic benefits for students, which will be synthesized in the literature review in Chapter 2. Teachers should not be inhibited to bring imagination and exploration back into kindergarten while upholding academic rigor. In addition, everyday discussions I have with primary teachers about pretend play focus on teachers’ uncertainty with how to structure a pretend play center to enhance academics. When teachers use my kit they will receive specific standards-based scenarios, suggested materials, tasks for students, and oral assessment questions to successfully and confidently implement in their classroom.

My Mathe-Dramatical Play Tasks Kit is a ready-to-use collection of problem solving math tasks set in real-life contexts in which students explore open-ended solutions through pretend play. It is intended to supplement kindergarten teachers’ traditional mathematics instruction to provide opportunities for students to engage in mathematical problem solving, higher-level thinking, and connections to everyday life.
that traditional textbooks lack. These tasks directly align with the Common Core Standards for Mathematics; therefore, the kindergarten teachers in 44 states across the nation who have adopted these high-quality standards may utilize my tasks kit (Common Core State Standards Initiative, 2011).

My Master’s project will consist of a literature review, explanation of the Mathe-Dramatical Play Tasks Kit, and a collection of ready-to-use task cards for teachers and students. The purpose of the literature review is to synthesize current research in the areas of pretend play and developmentally appropriate mathematics in early childhood education. The benefits of pretend play as documented in the literature support my integration of pretend play and open-ended problem solving scenarios. After reviewing the literature, I will thoroughly explain the elements of the Mathe-Dramatical Play Tasks Kit and make suggestions for using these elements in a kindergarten classroom. Lastly, I will include the teacher and student task cards for all kindergarten Common Core State Standards for Mathematics. Each task card in the kit contains information for the teacher and students on a problem solving scenario in which students take on the role of a character, imagine a familiar setting, and cooperatively engage in pretend play to develop solutions. The kit can be seamlessly integrated into an existing curriculum by using the task cards that align with the current unit of study to reinforce skills and to most importantly foster problem solving in scenarios familiar and engaging to young students.

Ultimately, as a kindergarten teacher myself, my goals in creating the Mathe-Dramatical Play Tasks Kit are to teach to the whole child, invest other kindergarten teachers in integrating pretend play with mathematics, and gain administrative and policymaker support in pretend play’s place in the academic classroom.
Chapter 2: Review of the Literature

By examining the benefits and successful elements of pretend play and early childhood mathematics, I hope to appease administrative and policymakers’ concerns about maintaining an academic kindergarten as well as inspire kindergarten teachers to return to educating the whole child knowing the full value of pretend play. First, I will conduct a review of the literature. The purpose of this literature review is to synthesize the current research on pretend play and developmentally appropriate mathematics pedagogy in early childhood education is to support the need for pretend play in kindergarten and validate it as a vehicle for exploring mathematical knowledge. The questions that guided the focus of this review are:

1. Does pretend play have a place in academic kindergarten?
2. What impact does pretend play have in academic content areas?
3. What is developmentally appropriate for kindergarten mathematics?
4. Does pretend play have a place in mathematics?

Does Pretend Play Have a Place in Academic Kindergarten?

It is often said that “play is the beginning of knowledge,” and this is supported by early childhood research (US Play Coalition, 2011). It is well established in scholarly research that children learn through exploring their world in play, yet there has been a drastic decline of pretend play in kindergarten. It may initially appear that the creative and open-ended aspects of pretend play conflicts with academic kindergarten. However, without pretend play opportunities, students lack a means of digesting and further exploring academic and social experiences in school as it relates to them. The nation’s No Child Left Behind Policy has placed an emphasis on schools’ standardized test scores
to the extent that textbook publishers include standardized test preparation worksheets for kindergarten! What is left behind are the important facets of early childhood development in the academic kindergarten classroom. Pretend playtime in kindergarten is nearly extinct. In the few classrooms where it still survives, it has been reduced to low-quality free choice time or unstructured play at recess.

Kindergarten teachers, early childhood education specialists, and other proponents of pretend play in school are challenged with informing school administration and policymakers on why the benefits of pretend play are paramount to academic readiness. The Common Core Standards for Mathematics can support teachers in this endeavor because the standards require strong representational skills, divergent problem solving abilities, and social-linguistic complexity, all of which are exercised in pretend play.

There is a growing body of evidence supporting connections between cognitive competence and high-quality pretend play. Pretend play is receiving renewed research-based support from the National Association for the Education of Young Children (NAEYC), National Council of Teachers of Mathematics (NCTM), Alliance for Childhood, and American Academy of Pediatrics. In order to advocate for the return of pretend play in kindergarten, specifically as a medium for building mathematical knowledge, one must understand its place in today’s academic kindergarten. The studies below have found that purposeful and productive pretend play is positively related to higher-level cognition, such as self-regulation, socio-emotional development, symbolic thinking, and academic skill development.

In kindergarten, acquiring self-regulatory skills is essential for all aspects of learning and peer relations. Self-regulation is the ability to control one’s emotions,
regulate behavior, and resist impulses. It is not surprising that kindergarten teachers rank self-regulation as the characteristic most necessary for school readiness, especially when more than half of their students lack effective self-regulatory skills (Rimm-Kaufman & Pianta, 2000). Scholarly research reports on the benefits of possessing self-regulatory skills and the strategies that teachers employ to foster them. Children who regulate their emotions positively do better in school and have an easier time getting along with peers (Ponitz, et al., 2008; Bronson, 2000). Children tend to develop stronger self-regulation skills when they are in adult-supported, rather than adult-directed, play situations. Supporting their behavior is what gives children the best chance to develop their own regulatory skills (Berk, Mann, & Ogan, 2006).

Russian psychologist Lev Vygotsky theorized that children use private speech during pretend play to regulate their behavior, eventually using internal thought to self-regulate (1978). Newer research continues to build on Vygotsky’s work. Krafft and Berk (1998) found that more private speech occurs in the pretend play settings than in traditional settings in preschools. Also, reducing pretend playtime and increasing teacher-directed involvement accounted for less private speech and thus less self-regulation. Even more so, complex pretend play is linked to the development of self-regulatory competence and may be particularly beneficial for children who are impulsive or less advanced in self-regulation (Elias & Berk, 2002). This means that for early childhood education settings, pretend play is vital for developing self-regulation in childhood. Because kindergarten builds students’ school readiness academically and socially, it behooves teachers of all grades to develop students’ self-regulation in kindergarten.
Engaging in pretend play also facilitates social and emotional learning opportunities. In pretend play, “a child’s capacities to reflect before acting, sense the perspective and emotional experiences of others, and self-regulate emotional experiences are enhanced” (Ashiabi, 2007, p. 203). Vygotsky is noted for his work on the significance of children’s social interactions to children’s learning. In his theory, thought and language are intertwined. He believed that children need to talk about their problems in order to solve them, and need to talk about concepts in order to understand and apply them (Vygotsky, 1978). Thus, the actions and communication among children in pretend play are a vital part of childhood for acquiring socio-emotional competence. Like Vygotsky, psychologist Erik Erikson studied the social aspects of human development. “Eight Ages of Man” is his psychosocial theory that includes stages that build upon one another from birth through old age (Erikson, 1994). During ages 3-6, which covers the preschool and kindergarten age groups, children are challenged by the conflict between initiative and guilt. Children develop initiative by positively responding to challenges, taking on responsibilities, enjoying accomplishments, and becoming purposeful. Yet guilt can set in when adults belittle children’s work. Erikson supported pretend play as a way for children to apply new social skills and explore their social world.

Two decades ago, kindergarten classrooms were alive with pretend play, exploratory activities, peer collaboration, and opportunities for initiative. The Alliance for Childhood (2009) released a revealing report on the crisis facing kindergarten since then. It reported on the use of kindergarten classroom time on a typical day in New York and Los Angeles. In both cities, teachers reported allotting at least 60 minutes for literacy instruction, 30-60 minutes for math instruction, and 30 minutes for test
preparation. Whereas New York teachers designate up to 30 minutes for free play, which includes pretend play, a staggering one-fourth of Los Angeles teachers find zero minutes in the day for free play. The American Academy of Pediatrics (Ginsburg, 2007) warns of possible implications for children’s social and emotional development with declining time for pretend play in school. There is concern for the rising trend of increased emphasis on enhancing children’s academic learning at the expense of socio-emotional growth. Because pretend play has been shown to help children adjust to the school setting, socio-emotional learning is best integrated with academic learning. Pretend play needs to remain an important component of children’s socio-emotional learning especially in school.

In addition to socio-emotional learning, an important yet overlooked aspect of child development is symbolic representation. Thinking symbolically and interacting with symbols are cognitive skills needed for academic learning, such as reading comprehension and understanding mathematical symbols. Pretend play is a major facilitator of symbolic thinking because children engaged in pretend play transform reality and use symbolic representations of their world. Research supports the positive correlation between pretend play and symbolic representation in young children’s academic abilities. Symbolic substitution—the concrete or abstract nature of children’s props—observed in preschoolers’ pretend play is the most powerful predictor of academic abilities (Hanline, Milton, & Phelps, 2008). After testing students’ concepts and skills in early math and reading abilities, the results show the level of symbolic thinking in preschool relates positively to math and reading abilities, as both academic areas involve abstract thinking and the use of symbols. Therefore, for children’s proper
cognitive development and future academic success, pretend play needs to have a place in academic kindergarten to develop students’ symbolic thinking. Overall, pretend play has a place in academic kindergarten because it fosters self-regulation, socio-emotional skills, and symbolic representation.

**What Impact Does Pretend Play Have in Academic Content Areas?**

The skills developed in pretend play are beneficial to academic readiness in all content areas. Children who engage in high levels of pretend play in preschool performed better later in school than those whose preschool play was less mature (Smilansky & Shefatya, 1990). Results of educational research show the benefits of pretend play in academic skill development in literacy, social studies, science, and, most recently researched, mathematics.

In literacy, pretend play positively impacts student reading comprehension. Recent findings generate implications for teachers to help students, especially English Learners (ELs), access and negotiate their understanding of narrative elements. Research indicates that literacy is a social process by which students negotiate the meaning of stories (Vygotsky, 1978; Wong Fillmore, 1991). Therefore, students socially engaging in pretend play use verbal and nonverbal interactions with peers as comprehensible input to negotiate their understanding of narratives. ELs then display their understanding of narrative elements through pretend play as comprehensible output. In a study of 4- and 5-year-old children, Kim (1999) explored their comprehension after enacting stories through pretend play. Results showed that children involved in pretend play used more elaborative narratives, had higher levels of narrative structure, and scored higher in narrative recall. These results are further supported by the overwhelming research
indicating pretend play’s positive impact on enhancing the value of emergent readers’ meaning-making experiences with narratives (Adomat, 2009; Hoyt, 1992; Konishi, 2007; Korat, Bahar, & Snapir, 2002; Phillips, Gorton, Pinciotti, & Sachdev, 2010; Rieg & Paquett, 2009; Stone & Christie, 1996; Varelas et al., 2009). Pretend play fosters a wider oral vocabulary to reenact narratives, deepens reading comprehension, and enhances a student’s breadth of engagement with all forms of literacy.

Social studies is another core content area with which pretend play and informal forms of drama connect well. In one study, researchers assessed the impact of a second-grade social studies program based on pretend play during a unit on community. Students constructed a community out of blocks throughout the classroom and chose their role as a community member. It initially began with only two houses, a store, and a post office. Each pretend play session led the class to analyze the community’s needs and add more services and workers. Results concluded that the pretend play group was on task more often, displayed more cooperative behavior, and scored higher on social studies tests of factual knowledge than the control group (McKinney & Golden, 1973). Another study with second-graders investigated the impact of using shadow puppetry, a form of drama, as a medium for social studies instruction. For a national symbols unit, small groups of students researched a symbol, wrote a script, created puppets, and performed an informative shadow puppet show. Key results included gains in comprehension, social studies achievement, and cooperation (Peck & Virkler, 2006). Rosler (2008) studied fifth-grade students as they engaged in a process drama while learning social studies. Results revealed these students learned to combine texts to understand and create new texts, they collaborated with their peers, and they were more engaged in the subject
matter. Additionally, integrating the dramatic arts with social studies has a positive correlation with historical knowledge and learning enjoyment (Otten, Stigler, Woodward, & Stanley, 2004). Students performing a musical drama about a historical period reported higher scores on history assessments and greater enjoyment of history than those in the control group. The level of enjoyment of history predicted later scholastic achievement in history.

Whereas pretend play inherently contains narrative components that align well with literacy and social studies, educational research has found that pretend play e.g., informal forms of drama, such as simulation, role-play, improvisation, and dramatic play) aligns especially well with science. Pretend play in combination with science instruction reveals higher science achievement, enhanced cognitive skills, and positive social interactions. Studies have shown that basic comprehension of science facts improved and students had a higher rate of long-term recall after participating in a dramatic form (Boggs, Michel, & Holtom, 2007; Cokadar & Yılmaz, 2010; Hommerding, 2007; Kerby, Cantory, Weiland, Babiarz, & Kerby, 2010). The studies documented the improvement of students’ conceptual understanding as witnessed in student work and teacher reports. In one study, students creating their own drama embedded the causes, processes, and consequences of global warming after learning scientific facts (Pongsophon, Yutakom, & Boujaoude, 2010). Teachers also reported having a greater scope for teaching abstract science concepts, and students stated dramatic simulations helped to clarify difficult concepts (Dorion, 2009). During science units in which students used simulation or role-playing, students displayed enhanced cognitive skills. Some examples include students hypothesizing about alternative situations, considering multiple perspectives, and using
higher-order thinking (Boggs et al., 2007; Cokadar & Yilmaz, 2010; Dorion, 2009; Ponsophon et al., 2010; Varels et al., 2010). Further, positive social interactions such as communication were promoted through collaborative discussions with peers (Bogg et al., 2007 & Dorian, 2009).

When academic areas such as literacy, social studies, and science are integrated with pretend play and other forms of dramatic arts, student benefits include higher achievement, greater enjoyment, and higher-level thinking. Before reviewing the research on pretend play and mathematics, it is necessary to discuss the developmentally appropriate practices for kindergarten mathematics.

What is Developmentally Appropriate for Kindergarten Mathematics?

Because students’ formal mathematics education begins in kindergarten, it is vital that their mathematics foundation be built upon developmentally appropriate principles. Revised in 2010, the NAEYC/NCTM Joint Position Statement: Early Childhood Mathematics: Promoting Good Beginnings lists recommendations for curriculum and teaching practices in programs for 3- to 6-year-olds. The National Association for the Education of Young Children encourages excellence in early childhood education, and the National Council of Teachers of Mathematics promotes high-quality mathematics learning. This combined effort between NAEYC and NCTM suggests an equal value placed on both early childhood development and the mathematics learning spectrum especially at the beginning of students’ formal mathematics education.

Strengthening problem solving and supporting play as a context for exploring mathematical ideas are the two recommendations at the core of the Mathe-Dramatical Play Tasks Kit. Three other recommendations from the joint position statement support
the foundation of developmentally appropriate mathematics for kindergarteners: building on children’s experiences and knowledge, interacting deeply with mathematical ideas, and basing teaching on children’s development. These are vital to the creation of a kindergarten curriculum that is mathematically appropriate for this age group.

First, building on children’s experience and knowledge promotes developmentally appropriate mathematics because it values students’ informal mathematical knowledge that they bring from home into the classroom. Informal mathematical knowledge is accrued from everyday activities like the grocery store, home life, or park. These informal experiences form the foundation for understanding formal mathematics in school. Informal math experiences tend to be aligned with big mathematical ideas or concepts, and an understanding of these big ideas helps students adapt the procedures to novel tasks. When applying inquiry-based tasks in informal math learning, students construct conceptual understanding, develop and use computation, and think strategically (Baroody, Lai, & Mix, 2006). In fact, children's informal experiences at home with numbers are predictive of their performance on a standardized test of early mathematical ability (Bleins-Knabe & Musun-Miller, 1996). Math learning can be difficult if formal instruction is unconnected to students’ informal mathematical knowledge. However, if students lack informal mathematical knowledge this can prevent them from inventing informal problem solving strategies. If these gaps are not filled, then instruction may not make sense and make learning difficult (Ginsburg, 2006). Therefore, pretend play and mathematics connect the teacher’s formal math instruction with students’ informal knowledge. The characters and setting of pretend play scenarios are based upon the
people and places from real-life that provide an opportunity for students to build informal knowledge.

Secondly, developmentally appropriate mathematics for kindergarteners should foster deep interaction with mathematical ideas in order to develop conceptual understanding. The Mathematical Task Analysis Guide (Smith & Stein, 1998) defines the highest level of cognitive demand as mathematical tasks that require an exploration of math concepts, application of knowledge and experiences, and nonalgorithmic thinking. High cognitively demanding tasks are indeed appropriate for kindergarteners because students are capable of exploring math ideas in open-ended scenarios, applying knowledge, and thinking conceptually. Open-ended mathematical experiences naturally encourage application of knowledge and conceptual thinking. Students who follow a traditional approach develop a procedural knowledge that is of limited use to them in unfamiliar situations. Students who learn mathematics in an open-ended and project-based environment develop a conceptual understanding that is advantageous in a range of assessments and situations (Boaler, 1998).

The third element of developmentally appropriate kindergarten mathematics is using child development as a foundation for teaching. The NAEYC’s position statement (2009) on developmentally appropriate practice in early childhood programs requires all developmental domains to be considered during learning. Students’ physical, social, emotional, and cognitive domains are interrelated and all are essential to the learning process. Therefore, educators need to plan how students will physically manipulate, socially interact, express themselves, and mentally interpret ideas within math lessons. For instance, as children progress from the sensory response to the symbolic knowledge
stage in their development, the math curriculum needs to reflect this by offering opportunities for students to use symbols or objects to represent their knowledge. In maintaining developmentally appropriate mathematics practices, it is important to acknowledge the varying rates that students learn then plan for reaching their highest cognitive aptitude. This can be done by incorporating key Vygotskian concepts. The zone of proximal development (ZPD) is the range between what a child can do independently and what a child can achieve with support (Vygotsky, 1978). Teachers may guide students or students may work with more capable classmates to scaffold mathematics activities so students can be successful. Just as teachers thoughtfully and purposefully scaffold mathematical learning, mathematical pretend play should also be student centered with teachers entering the play to scaffold.

A developmentally appropriate mathematics curriculum in kindergarten should be based on the recommendations of the NAEYC and NCTM. Most significant to the use of pretend play, developmentally appropriate math includes building on children’s informal knowledge, deeply interacting with mathematical ideas, and basing teaching on developmental domains.

**Does Pretend Play Have a Place in Mathematics?**

The three key elements previously mentioned that make kindergarten mathematics developmentally appropriate also support the use of pretend play as a context for mathematical learning. Pretend play incorporates children’s real-life experiences with math, fosters student interaction with mathematical ideas, and is based in child development. Backed by the previously stated findings of pretend play integrated with academic areas, it is well established that children play to make sense of
the world around them. Therefore, it is developmentally appropriate for kindergarteners to engage in pretend play to construct math concepts and apply math skills they witness in everyday life. The past decade has brought about a wave of scholars in mathematics education and child development reporting on pretend play and mathematics, concluding positive sociocultural connections, components of mathematical constructivism, and improved problem solving.

**Sociocultural connections**

Pretend play and mathematics are mutually connected because of their sociocultural parallels. Mathematics is derived from societies’ needs to represent relationships, and it remains thoroughly imbedded in modern sociocultural practices. Although adults may not give them due credit, children inherently observe and interact with mathematical dimensions in their everyday life. Examples include sorting toys and laundry, identifying numbers on a remote control, and asking for more or less when eating dinner. However, students in a school setting need an engaging context in which to further build on and apply this informal mathematical knowledge. Pretend play provides a relevant context of people, places, and problems with which to apply math. Children engaging in mathematical pretend play can manipulate and explore math skills and concepts observed in familiar experiences and contexts. This sociocultural connection is supported by a study on preschoolers’ pretend play in math-enriched settings. When math related artifacts from real-life were added to the classroom’s pretend play center, the frequency of math concepts in their speech and actions increased (Cook, 2000). Because children’s pretend play reflects their sociocultural norms, adding
a mathematical focus builds on their cultural backgrounds, enhances their interest in relevant math, and helps them make sense of math socially (NAEYC/NCTM, 2010).

Another sociocultural facet that mathematics and pretend play share is communication. Pretend play involves verbal and nonverbal cues as well as physical movements to communicate what a character is feeling or how a character can solve a problem. In mathematics, students are expected to communicate their reasoning, analyze others’ thinking, and use mathematical language to express their ideas. In fact the NCTM specifically states communication as one of the five process standards for students in prekindergarten through twelfth grade (2011). The purpose of communication in mathematics is to prepare students for solving real-life problems in which they will need to express their thinking or work with others to come to a solution. Pretend play is an effective way for students to communicate their mathematical understanding because it takes place in a social real-life context.

Symbolic representations are found in various forms in mathematics and pretend play. Most obviously, mathematics uses symbols for numbers, operations, measurement, and data. Representation is another of the NCTM’s process standards (2011), involving the use of representations to record mathematical ideas, solve problems, and model. Abstract mathematical concepts are made more concrete through the use of symbols, and in pretend play children use objects to represent other characters or things in the imaginative context. Symbolic representations were observed in a study on preschoolers engaged in mathematical pretend play. While children displayed three types of symbolic representational levels, symbolic substitution was positively related to math skills (Hanline, Milton, & Phelps, 2008). Symbolic substitution in pretend play relates
positively to math abilities because math also involves abstract thinking and the use of symbols. Pretend play has a place in kindergarten mathematics because of the sociocultural parallels, emphasis on communication, and use of symbolic representation.

**Constructing mathematical knowledge**

Integrating mathematics and pretend play not only builds sociocultural connections, it constructs mathematical knowledge. Although the topic of pretend play and mathematics is relatively new to educational research, key theorists and researchers have been citing strong correlations for decades.

Students are socially active constructors of their own knowledge. Accordingly, educational reformer John Dewey viewed education as a socially interactive process. He stated that “number…is not a bare property of facts, but is a certain way of interpreting and arranging them—a certain method of constructing them” (McLellan & Dewey, 1985, pp. 21-22). Therefore, a math curriculum needs to have real-life experiences embedded in it in order for students to construct their understanding of math. Psychologist Lev Vygotsky echoed this with his conclusion that the arts act as a medium through which students construct knowledge (1978). He examined the social aspects of children’s pretend play and theorized that children think in complex ways by making rules, using symbols, and creating narratives. Both Dewey and Vygotsky noted the importance of social interaction for constructing knowledge. In both mathematics and pretend play, children bring different experiences and background knowledge to contribute and build upon in group play. Because pretend play is a socially collaborative narrative, classroom instruction that infuses it supports students in constructing their own knowledge through creative experiences of imagination, acting, and reflecting rather than imitating a
procedure. Kindergarteners are emerging in their mathematical skills and concepts. Constructing their understanding of mathematical knowledge is a process and negotiation reinforced during pretend play.

In addition to the social aspect of constructing knowledge, children also construct specific mathematical knowledge through pretend play. Jean Piaget, a Swiss psychologist and developmental theorist, recognized the role of pretend play in the construction of logical thinking. He identified logicomathematical knowledge as one form of play (Piaget, 1972). This involves relationships. Relationships among numbers, shapes, and other symbols are a foundation of mathematics, while pretend play relies on children taking on roles in society and exploring their relationships. Children use pretend play to communicate their logicomathematical understanding in two ways: quantitatively and representationally. While quantitative behaviors include one-to-one correspondence, counting, and numeric operations, representational behaviors rely on representing numbers with symbols, objects, or pictures to represent numbers (Emfinger, 2009). These may appear in pretend play as serving each person one cup at a tea party or drawing pictures and writing numbers on a restaurant menu. Also during pretend play, Piaget stated that children form cognitive structures called schemata through interactions with the world and either assimilate or accommodate new information. In mathematics, as students construct mathematical knowledge, they relate information. Pretend play then leads children to assimilate and accommodate the ideas and concepts. It is during pretend play that children practice, consolidate, and externalize the behaviors and newly acquired skills they see in the world. Pretend play assimilates a new experience to children’s schema, such as when math-related props incorporated into pretend play gradually evolve
to exhibit students’ understanding of comparisons, sorting, and sequencing (Edo, Planas, & Badillo, 2009; Piaget, 1972). These are just a few of the mathematical skills that children develop early on through pretend play before formal mathematics instruction. Providing plenty of time, materials, and opportunities for students to engage in pretend play is a vital component of early childhood mathematics instruction (NAEYC/NCTM, 2010). Pretend play is necessary for students to explore and manipulate mathematical ideas with their peers in order to construct their own personal understanding.

**Problem solving**

Lastly, the combination of pretend play and mathematics is correlated with increased problem solving abilities in students. The actual process of solving a problem is as important as the end result. The plot of a scenario in pretend play is essential to how a child will resolve a character’s problem. Likewise, the strategies a student uses in math are just as important as achieving a correct solution. Integrating pretend play and mathematics places value on how students problem solve and approach the process rather than emphasizing reaching one predetermined correct answer.

Problem solving is another process standard the NCTM specifically states all instructional programs should enable students to do. Good problem solvers construct new mathematical knowledge, solve problems in various contexts, apply a variety of strategies, and monitor and adapt (NCTM, 2011). This can be supported by implementing a curriculum and using teaching practices that provide problem solving opportunities. Because young children learn most effectively when information is related to their daily life, then problem solving tasks should be presented within everyday contexts. We want to prepare students to solve mathematical problems cooperatively
outside of school, so it makes sense to have students practice through pretend play scenarios. Children are working together towards a common goal, sharing ideas and strategies, and modifying throughout the process until the problem is solved all while engaged as a character in a familiar setting.

In order to stimulate students’ problem solving abilities, teachers must carefully select purposeful scenarios with which students can grapple. Chamberlin (2010) divided problem solving tasks into four ascending levels: exercises, word or story problems, mathematical problems, and authentic mathematical problem solving tasks. This last and highest level places the task within a very realistic context in which students become enveloped. When students are thoroughly immersed in all elements of the problem solving task, “a high level of affect may translate to greater student interest and persistence in tasks, an identification of great value in the problem, and enhanced self-efficacy in doing the problem,” (Chamberlin, 2010, p. 66). Even kindergarteners can tackle a level four problem solving task during pretend play. They thrive on the social collaboration, authentic realism, low affective filter, and self-confidence that they are contributing prior knowledge and experiences to help solve a common problem.

Additionally, research on pretend play in children’s mathematics indicates a positive correlation with divergent problem solving, achievement, and attitudes. Pretend play is effective in promoting creative problem solving abilities. Convergent and divergent are two types of problems. While a convergent problem has one correct solution, a divergent problem has multiple solutions. An experimental study reported a positive reciprocal relationship between preschoolers’ pretend play and their divergent problem solving abilities (Wyver & Spence, 1999). Students engaged in pretend play
demonstrated an increased ability to solve divergent problems and, vice versa—those trained to solve divergent problems showed increased rates of pretend play skills. While children engaged in convergent play scenarios utilized a wider range of problem solving strategies, they more frequently applied them incorrectly. When pretending to be villagers using blocks to build buildings in as many different shapes as possible, the divergent group resorted to trial-and-error, were more flexible in approaching a problem, and abandoned ineffective strategies throughout their problem solving (Pepler, 1981). Furthermore, children’s flexibility elicited from playing with divergent materials transferred even to convergent problem solving. These results reveal the need for students to engage in divergent problem solving in open-ended pretend play.

In addition to improved problem solving abilities, student achievement in and attitude towards math improves through pretend play. Five- and six-year-olds in a pretend play math curriculum scored above the national norm for mathematics in the Netherlands (van Oers, 2010). In one instance, students pretended to work at a shoe store and referred to their own length of shoe to crudely measure, compare, and estimate the sizes of shoes that would fit their father. Likewise, seventh graders in Turkey engaging in pretend play math instruction scored significantly higher on math achievement, retention, and attitudes compared to a traditional geometry class (Duatepe-Paksu & Ubuz, 2009). The students acted as characters in an imaginative setting solving real life problems in a geometry unit. Moreover, video segments of preschool through fifth-graders at a dramatic play center documented students incorporating mathematical skills, such as one-to-one correspondence, counting, adding, subtracting, and representing numbers with symbols (Emfinger, 2009). Also, the National Theatre’s Transformation
drama project positively impacted primary students’ mathematics achievement and attitude. The mathematics value-added scores of students in the Transformation group were higher and more positive than scores in the control group. This same group also rated more positive attitudes towards math and made more progress in math during the remainder of the school year (Fleming, Merrell, & Tymms, 2004). The overwhelmingly positive results from these studies support the need for young students to explore mathematical ideas through pretend play to build problem solving strategies.

**Conclusion**

From the literature review we have gleaned answers to the initial questions put forth to determine pretend play’s place in academic kindergarten, the benefits of pretend play in academic content areas, developmentally appropriate mathematics for kindergarteners, and the benefits of pretend play in mathematics.

To summarize, pretend play does have a place in academic kindergarten because it is positively correlated with self-regulation, socio-emotional development, symbolic thinking, and academic skill development. Integrating pretend play in academic content areas is beneficial to literacy, social studies, and science. Pretend play fosters students to use a wider oral vocabulary to reenact narratives, deepens reading comprehension, and enhances engagement with all forms of literacy. In social studies, pretend play is associated with time on task, peer cooperation, and higher achievement on tests. Science instruction combined with pretend play promotes higher science achievement, enhanced cognitive skills, and positive social interactions. In creating a developmentally appropriate mathematics curriculum, the NAEYC and NCTM recommend building on children’s experiences and knowledge, interacting deeply with mathematical ideas, and
basing teaching on children’s development. Lastly, pretend play does indeed have a place in mathematics instruction because of the positive sociocultural connections, components of mathematical constructivism, and improved problem solving.

The problem is no longer determining if kindergarteners can tackle higher-level problem solving tasks but how teachers can start integrating them with pretend play. The researchers who studied actual classes integrating pretend play and mathematics are pioneers in this field. Unfortunately, while they blazed the trail for this form of mathematics instruction, the trail has dimmed because their self-made lessons are not available to other educators leaving us without much support in getting started. Kindergarten teachers all over the country are in need of a curriculum that can be immediately and seamlessly applied into the classroom. My Mathe-Dramatical Play Tasks Kit provides engaging scenarios in which small groups of students engage in pretend play to solve an open-ended mathematics problem, all while covering the Common Core Mathematics Standards in a structured and engaging way. Pretend play and mathematical learning can no longer be viewed as paradoxical because my Mathe-Dramatical Play Tasks Kit purposefully interconnects them.
Chapter 3: Explanation of the Mathe-Dramatical Play Tasks Kit

The beneficial elements of pretend play and developmentally appropriate math in kindergarten can be applied to mathematics instruction to enhance its effectiveness. However, curriculum developers lack solid examples of pretend play ideas for mathematics learning or they offer superficial suggestions. Kindergarten teachers are in need of meaningful pretend play learning experiences that build children’s mathematical skills and challenge their thinking. New and innovative curricula need to be developed and made available. Kindergarten classrooms across the nation are cutting or severely reducing students’ pretend playtime to recess or a low-quality free choice activity. Implementing the Mathe-Dramatical Play Tasks Kit makes kindergarten teachers proponents of play in the academic classroom because the tasks combine the numerous benefits of high quality sociodramatic play with developmentally appropriate mathematical problem solving. This Mathe-Dramatical Play Tasks Kit is a curricular tool that enhances mathematics by restoring the traits we want children to possess—cooperation, imagination, and problem solving.

Throughout the literature review, I used the term pretend play to refer to the imaginative play, dramatic play, and sociodramatic play in various research studies. Specifically, the Mathe-Dramatical Play Tasks Kit integrates mathematics with sociodramatic play. Sociodramatic play is the most cognitively sophisticated level of pretend play involving two or more children adopting character roles, imagining they are in a familiar setting, and acting out an unscripted scenario. At a more cognitive level, it includes representation, negotiation, perspective taking, and problem solving, which are necessary for divergent thinking (Emfinger, 2009). “Socio” is the social part that
incorporates common elements of society: people, places, and problems from their everyday life. Children take on the role of someone from society, such as a shoe salesperson or mail carrier to explore scenarios in their daily world. The “dramatic” aspect incorporates elements of a drama or narrative: character, setting, problem, and solution. The “play” part involves imagining the setting and appearance of characters, as well as pretending that regular objects represent something else. Because mathematics is a cultural activity, the imagined settings in sociodramatic play relate to familiar societal places, such as an airport, playground, or restaurant. Lastly, “mathe” stands for the mathematical portion of the sociodramatic play scenarios. Within this context children encounter open-ended mathematics-based problems to resolve.

The Mathe-Dramatical Play Tasks Kit provides scenarios with educational objectives. It is essential to know what the task kit is and what it is not, for the purpose of incorporating it into kindergarten classrooms. It is not a collection of word problems or routine mathematical questions. Students are not duplicating a process to arrive at one correct answer for a close-ended question. It is not teacher-directed in which students are guided step-by-step. It is neither simple functional play with math manipulatives nor game play bound by rules with the ultimate goal of winning. On the other hand, the Mathe-Dramatical Play Tasks Kit includes real-life problem solving scenarios for students to act out and resolve open-ended mathematical tasks. These scenarios elicit students’ imagination to take on a realistic character and engage in uninterrupted high quality pretend play. It is student centered and they are in charge of the process, having the freedom to try various strategies, reflect, and change direction. Students work in cooperative groups of four to act out and resolve a real-life mathematical task. It not only
reinforces students’ current knowledge and links schemata during pretend play, but it also challenges students to apply skills and construct a deeper conceptual understanding through problem solving. The teacher’s role is to ask open-ended questions to elicit descriptive student responses and provide scaffolding when necessary to guide student play in a productive direction. All of this occurs while remaining developmentally appropriate for kindergarten students based in childhood development.

The kit is easily organized in a file box format according to Common Core Math Standards for Kindergarten. Start by determining your current unit of study and finding the focus math standard listed at the top of the cards. For easy access, the following domains are color coded: counting and cardinality, operations and algebraic thinking, number and operations in base ten, measurement and data, and geometry. Within these color coded sections, each standard is labeled on a tab of a task card. There is a teacher task card for directions and a student task card that is geared towards emergent readers for reference at the pretend play center. Use the teacher task card to read the problem solving scenarios to the students, gather materials, pre-teach vocabulary, and ask oral assessment questions. The materials on each task card list materials that can be cheaply made by teachers, parent volunteers, teacher assistants, or students. The classroom teacher may consider modeling the scenario to demonstrate appropriate behavior, cooperation, proper use of props, and how to remain on task. The student task card includes pictures, high-frequency words, and symbols to assist emergent readers in following the tasks during their sociodramatic play. The narrative four-square format includes the setting, characters, problem, and steps towards a solution. Students cooperatively act out the problem solving scenario and negotiate mathematical
understanding through sociodramatic play. If students do not understand the task, the teacher should rephrase the purpose and provide guidance by asking leading questions.

Every kindergarten classroom is structured differently, so I have provided some suggestions for implementing the Mathe-Dramatical Tasks Kit. As listed on the task cards, each task is designed with four characters. This way a small group of students can work together cooperatively by contributing from an individual character’s perspective.

Time is allotted for students to rotate characters. In regards to the time frame, a suggested time of 20 to 30 minutes is allotted for each group to thoroughly act out the scenario, apply various strategies, and come to a solution. The suggested time is divided up so that students have the opportunity to take on each role. Teachers with center rotations may choose to designate one of those centers for Mathe-Dramatical Play.

Multiple groups can rotate through it in one day or over the course of a week. Teachers who teach whole group may divide the class into small groups and assign them different locations in the classroom to engage in dramatic mathematical play at the same time.

Teachers now know the definition of sociodramatic play, what the Mathe-Dramatical Play Tasks Kit is and is not, how it is organized, and how to implement it in a kindergarten classroom. The following section provides all the teacher and student task cards for the Common Core Math Standards for kindergarten.

Ready…set…act out math!
Chapter 4: Mathe-Dramatical Play Tasks Kit

This section contains the Mathe-Dramatical Play task cards for the classroom teacher and students.
Lend a Book Library
Count by Ones and Tens; Write numbers 0 to 20

Common Core Standards: Counting and Cardinality
1. Count to 100 by ones and by tens.
3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0 to 20.

Problem Solving Scenario: (read to students)
• “At Lend a Book Library, two patrons check out books by taking some books off the shelf of 100, counting them, and giving their library card to the librarians. Two librarians write on the card how many books each patron checks out. When done reading, the two patrons return books to the shelf. The only problem is, because the computer scanner stopped working, the two librarians have to count the books on the shelf to make sure all 100 are there. 1. How will the librarians use numbers to write how many books patrons check out? 2. How will the librarians count by ones and then by tens to make sure all 100 books are on the shelf? Ready…set…act out math!”

Materials:
• space/corner of classroom (library)
• table (book shelf)
• 100 books
• index cards, pencil, crayons (library cards)

Key Vocabulary:
• count by ones
• count by tens

Time:
• 20 minutes total
  ▪ Write: Five minutes to write the number of checked out books on the library cards
  ▪ Count: Five minutes to count 100 books by ones and by tens
  ▪ Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, enter the library to check out books. Ask questions and record student responses to assess student understanding.
• “I would like to check out these books. Why did you write that number on my library card?”
• “These books were great. I returned them to the shelf. How will you know that all the books are back?”
# Lend a Book Library

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<thead>
<tr>
<th>Setting</th>
<th>Characters</th>
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<tbody>
<tr>
<td><img src="image1.png" alt="Library Building" /></td>
<td><img src="image2.png" alt="Teacher" /> <img src="image3.png" alt="Student" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Problem</th>
<th>Solution</th>
</tr>
</thead>
</table>
| ![Stacks of Books](image4.png) ![Circle with No Symbol](image5.png) | 1. Write  
2. Count |
Common Core Standard: Counting and Cardinality
2. Count forward beginning from a given number within the known sequence.

Problem Solving Scenario: (read to students)
• “At Kids Count R Toys, two customers each shop for two toys from the shelf to take to the register. However, the power has gone out and the cash register does not work. 1. How will one cashier use a number line to find the price of the first toy and count forward to find the total cost? 2. How will the second cashier use numbers and pictures to show on the receipt the cost of the first toy and how they count forward to find the total cost? Ready…set…act out math!”

Materials:
• space/corner of classroom (toy store)
• table (toy shelves)
• various toys with paper tags numbered 1 to 10
• number line 0 to 20
• index cards, pencil, crayons (to make a receipt)

Key Vocabulary:
• count forward

Time:
• 20 minutes total
  ▪ Count: Two minutes to use the number line to count forward
  ▪ Write and Draw: Three minutes to make the receipt with numbers and pictures
  ▪ Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, enter the toy store as a customer. Ask questions and record student responses to assess student understanding.
• “I would like to buy this toy that costs $___ and this toy that costs $___. How will you find the prices without a cash register?”
# Kids Count R Toys

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<td><img src="image2.png" alt="Characters Images" /></td>
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<tr>
<th>Problem</th>
<th>Solution</th>
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</table>
| ![Problem Image](image3.png) | 1. Count ![Count Image](image4.png)  
2. Write and Draw ![Solution Images](image5.png) |
Common Core Standards: Counting and Cardinality
4a. When counting objects, say the number names in the standard order, pairing each object with one number name and each number name with one object.
4b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.
4c. Understand that each successive number name refers to a quantity that is one larger.

Problem Solving Scenario: (read to students)
• “It is a busy time of year for the post office. Everyone in the neighborhood is taking letters to the post office to be delivered to homes. The only problem is when the mail carriers get to the neighborhood they have to deliver the mail in number order without backing up on the one way street. 1. How will one post office worker put the letters in number order from 1 to 20 to make it easier for the mail carriers to deliver them? 2. How will two mail carriers deliver letters to the homes that match the address without going out of order? Ready…set…act out math!”

Materials:
• space/corner of classroom (post office and neighborhood)
• table (street)
• 20 paper lunch bags labeled 1 to 20 (homes)
• 20 envelopes
• pencils

Key Vocabulary:
• count

Time:
• 30 minutes total
  • Order and Match: 10 minutes to address envelopes, take to post office, put the envelopes in order, deliver envelopes in order
  • Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, enter the post office and neighborhood to send a letter. Ask questions and record student responses to assess student understanding.
• “I want to send this letter to house __. Can the mail carriers deliver it before other letters?”
## One Way Mail Delivery

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<td><img src="image4.png" alt="Solution" /></td>
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</table>

1. **Order**

2. **Match**
New Year’s Day Parade
Count up to 20 Objects in Various Arrangements

Common Core Standard: Counting and Cardinality
5. Count to answer “how many?” questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1 to 20, count that many objects.

Problem Solving Scenario: (read to students)
• “It is a stormy New Year’s Day and the famous parade is being shown on TV. Four parade leaders are in charge of setting up their part of the parade: marching band, floats, horses, and giant balloons. The only problem is that the storm has caused TV stations to go out, so viewers now have to listen to the parade on the radio at home. 1. How will each parade leader put 20 people, animals, floats, or balloons into a shape (line, rectangle, circle) to walk in the parade? 2. How will the parade leaders use the radio to quickly count and describe how the people, animals, floats, and balloons are arranged to the listeners at home? Ready…set…act out math!”

Materials:
• space/corner of classroom (parade route)
• 20 toy figurines, Legos, blocks, and other manipulatives (marching band, floats, horses, giant balloons)
• 4 toilet paper rolls or pointers (microphones)

Key Vocabulary:
• count

Time:
• 20 minutes total
  ▪ Arrange: 10 minutes for parade leaders to arrange their people, animals, floats, and balloons into a formation
  ▪ Count: 10 minutes for radio announcers to count and announce information

Oral Assessment:
• When a group has completed their task, enter the parade as the parade route coordinator. Ask questions and record student responses to assess student understanding.
• “As the parade route coordinator, I need to get some information about your part of the parade. Tell me how your people, animals, floats, and balloons are arranged. How many do you have? Show me how you count them so you do not lose track when they are arranged this way.”
# New Year’s Day Parade

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<tbody>
<tr>
<td><img src="image3" alt="Problem" /></td>
<td>1. Arrange <img src="image4" alt="Solution" /></td>
</tr>
<tr>
<td></td>
<td>2. Count <img src="image5" alt="Solution" /></td>
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</tbody>
</table>
Equal Pizzas R Us

Compare Groups of Equal, More, or Less

Common Core Standards: Counting and Cardinality
6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group.
7. Compare two numbers between 1 and 10 presented as written numerals.

Problem Solving Scenario: (read to students)
• “Equal Pizzas R Us is the only pizza parlor where you can get two of the same pizzas for the price of one. When one costumer places an order, the cashier writes and draws the number of toppings (1 to 10) so the two pizza makers know what to make. Each pizza maker starts with the crust, sauce, and cheese, but there is a problem. Each pizza maker has a different number of toppings at their station, but they must put an equal number of toppings on both pizzas. 1. How will the two pizza makers compare who has more and less of each topping? 2. How can the pizza makers make equal groups of toppings for both pizzas? Ready…set…act out math!”

Materials:
• space/corner of classroom (pizza parlor)
• 2 circular pieces of cardboard or poster board (pizza)
• 20 pictures cut out of each pizza topping: pepperoni, tomatoes, mushrooms, onions
• index cards, crayons, and pencils (to write the order)

Key Vocabulary:
• more/greater than
• less
• equal

Time:
• 30 minutes total
  • More, Less, Equal: Seven minutes to record an order, compare amount of toppings, and make equal groups of toppings
  • Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, enter the store as a customer. Ask questions and record student responses to assess student understanding.
• “Hello, I would like to place an order for two pizzas. I want each pizza to have ___ pepperoni, ___ tomatoes, ___ mushrooms, and ___ onions.”
• “How do I know that both of these pizzas have an equal number of toppings?”
Equal Pizzas R Us

Setting

Characters

Problem

Solution

1. More and Less

2. Equal
Common Core Standards: Operations and Algebraic Thinking
1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations.
2. Solve addition and subtraction word problems, and add and subtract within 10.

Problem Solving Scenario: (read to students)
- “The Count and Go Bus is the newest way to get around town. Instead of using gas, the bus moves when you count more or less passengers. It is so popular that only ten passengers can ride at a time. One bus driver says the next stop and drives. One bus announcer helps the passengers get on and off the bus and announces if there are now more or less. Two number attendants use numbers and pictures to write down how many are on the bus, how many get on or off, and how many are left over or all together. This card goes into the tank to make the bus go. Be careful. If the numbers do not match up then the bus will not go. 1. How will the bus announcer know if there are more or less passengers? 2. How will the number attendants work together to use numbers and pictures to show how many passengers are all together or left over on the bus? Ready…set…act out math!”

Materials:
- space/corner of classroom (bus stop)
- 10 stuffed animals, dolls, or puppets (passengers)
- 10 chairs (bus seats)
- index cards, pencils, crayons

Key Vocabulary:
- more, less
- all together, left over

Time:
- 20 minutes total
  - More or Less, All Together or Left Over: Five minutes to count the passengers on the bus, help some get on or off, add or subtract
  - Rotate roles and repeat.

Oral Assessment:
- When a group has completed their task, walk to the bus stop as a passenger. Ask questions and record student responses to assess student understanding.
- “Hi, we would like to get on at the next stop. How many are on the bus right now? When my ___ friends and I get on how many will there be all together?”
- “We need to get off at the next stop. How many are on the bus right now? When my ___ friends and I get off how many will be left over?”
### The Count and Go Bus

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<td><img src="image1.png" alt="Bus in the city" /></td>
<td><img src="image2.png" alt="Bus driver" />, <img src="image3.png" alt="Passengers" /></td>
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<tr>
<td><img src="image4.png" alt="Bus" /></td>
<td><img src="image5.png" alt="123" /></td>
</tr>
<tr>
<td><img src="image6.png" alt="Petrol" /></td>
<td><img src="image7.png" alt="123" /></td>
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</tbody>
</table>

1. More or Less
   - ![Passengers](image8.png)

2. All Together or Left Over
   - ![Shapes](image9.png)
Common Core Standards: Operations and Algebraic Thinking
1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations.
3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation.

Problem Solving Scenario: (read to students)
• “The I Scream for Ice Cream Sundaes is having a special on chocolate and vanilla sundaes. Customers win a free sundae if they can come up with a combination of chocolate and vanilla scoops that has not been ordered yet for the special number of the day. For instance, if two is the special number of the day, then a customer can order one vanilla and one chocolate scoop. After a customer orders, one server scoops the combination into a bowl. One cashier draws and writes the combination on the menu until all combinations for the special sundae are found. 1. How many combinations of chocolate and vanilla ice cream can the customers find for the special number of the day? 2. How will the workers use drawings and numbers to show the combinations on the menu for the special number of the day? Ready…set…act out math!”

Materials:
• space/corner of classroom (ice cream store)
• 10 brown and 10 white wads of tissue paper (chocolate and vanilla ice cream)
• bowls
• poster board or butcher paper, crayons, and pencils (menu)

Key Vocabulary:
• combination

Time:
• 30 minutes total
  • Write and Draw: 15 minutes to order, make, and record the sundae combinations on the menu
  • Rotate roles and repeat for a different number of the day.

Oral Assessment:
• When a group has completed their task, walk into the ice cream store as the owner. Ask questions and record student responses to assess student understanding.
• “How do customers use this menu to see what combinations have been ordered?”
• “I see you ordered ___ chocolate and ___ vanilla scoops. How do you know this is a ___ scoop sundae?”
# I Scream for Ice Cream Sundaes

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<tr>
<td><img src="image" alt="Question Mark" /> <img src="image" alt="Question Mark" /> <img src="image" alt="Ice Cream Bowl" /> <img src="image" alt="Spoon" /></td>
<td>1. Write and Draw</td>
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1. Write and Draw
Common Core Standards: Operations and Algebraic Thinking
1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations.
4. For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.

Problem Solving Scenario: (read to students)
• “At The Chocolate Box Shop we make dark and milk chocolate candy sold in boxes that hold ten pieces. Unfortunately, the candy will run out quickly today because a worker is out sick. This means customers order 1 to 9 pieces of milk chocolate before the candy runs out. 1. How will the clerk use a number line to figure out how many more dark chocolates are needed to fill up a box of ten? 2. How will the cashier use pictures and numbers on the receipt to show the two groups of chocolate equal ten? Ready…set…act out math!”

Materials:
• space/corner of classroom (chocolate store)
• 9 light brown and 9 dark brown unifix cubes (milk and dark chocolate candy)
• box lid or shoe box (chocolate box)
• 0 to 10 number line
• index card, crayons, and pencils (receipt)

Key Vocabulary:
• add
• more

Time:
• 20 minutes total
  • Count, Write and Draw: Five minutes to order, fill the box, make more chocolate, fill the box, and make the receipt
  • Rotate roles and repeat with a different amount of chocolate.

Oral Assessment:
• When a group has completed their task, walk into the store as a customer. Ask questions and record student responses to assess student understanding.
• “Hello, I would like ___ pieces of milk chocolate. How many more pieces of dark chocolate will I need to fill up my box of ten? How did you use that number line to figure it out?”
• “Can you explain the pictures and numbers on my receipt to me?”
# The Chocolate Box Shop

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<tbody>
<tr>
<td><img src="image1.png" alt="Chocolate Shop Image" /></td>
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<tr>
<th>Problem</th>
<th>Solution</th>
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</table>
| ![Problem Image](image3.png) | 1. Count ![Count Image](image4.png)  
2. Write and Draw ![Write and Draw Image](image5.png) |
Sky Five Airport
Add and Subtract Within 5

Common Core Standards: Operations and Algebraic Thinking
1. Represent addition and subtraction with objects, fingers, mental images, drawings, sounds, acting out situations, verbal explanations, expressions, or equations.
5. Fluently add and subtract within 5.

Problem Solving Scenario: (read to students)
• “The Sky Five Airport is a busy but small place for airplanes to land and takeoff. The problem is it can only hold five airplanes, so all the workers have to count carefully to make sure there are no more than five airplanes or else there will be accidents. The air traffic controller is in charge of calling out the number of planes and how many take off or arrive. The reporter writes down the number of planes that take off or land and how many are left or all together. 1. How will the air traffic controller tell the reporter how many planes are on the runway and how many take off or arrive? 2. How will the reporter use numbers to show if they are adding or subtracting planes and how many planes are all together or left?”
Ready…set…act out math!”

Materials:
• space/corner of classroom (airport)
• at least 5 paper planes (planes)
• notepad and pencils (air traffic report)

Key Vocabulary:
• more, add, all together
• less, subtract, take away, left

Time:
• 20 minutes total
  • Count, Add or Subtract: Five minutes to count and record planes at the airport, land or take off, and count and record airplanes left or all together
  • Rotate roles and repeat with a different amount of planes.

Oral Assessment:
• When a group has completed their task, fly into the airport as a pilot. Ask questions and record student responses to assess student understanding.
• “Attention air traffic controller, I need permission to land. How many airplanes are on the runway now? When I land, how many airplanes will there be all together?”
• “Seeking permission to take off. How many airplanes are on the runway now? When I take off, how many airplanes will be left?”
Sky Five Airport

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<td><img src="image4" alt="Plane Queue" /></td>
<td><img src="image5" alt="Block Count" /> 1. Count 2. Add or Subtract <img src="image6" alt="Addition" /> <img src="image7" alt="Subtraction" /></td>
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47
Common Core Standard: Number and Operations in Base Ten
1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones.

Problem Solving Scenario: (read to students)
• “Welcome to One, Two, a Counting Zoo where families visit to see the famous animal shows. Several times a day the zoo keepers put on a show for the visitors featuring 10 to 19 animals. At the end of each show, the zoo keepers must count to make sure all of the animals made it back into their cages. However, the first cage has to be filled up with ten animals before the next cage will open for the rest of the animals. 1. How can you put all the animals into two cages by first filling up a cage of 10? 2. How will you use numbers and pictures to show how many animals are in each cage so that none are forgotten? Ready…set…act out math!”

Materials:
• space/corner of classroom (zoo)
• 19 stuffed animals or pictures of animals
• 2 hula hoops or 2 large boxes (cages)
• index cards, pencils, crayons, and tape (cage labels)

Key Vocabulary:
• ten
• ones

Time:
• 20 minutes total
  ▪ Count: Five minutes to put on an animal show and put them into two cages
  ▪ Write and Draw: Five minutes to make labels for each cage using numbers and pictures
  ▪ Repeat with a different amount of animals.

Oral Assessment:
• When a group has completed their task, walk through the zoo as the animal trainer. Ask questions and record student responses to assess student understanding.
• “Hello, I’m the animal trainer. I need to know how many animals are in your two cages right now. I am in a hurry so count quickly starting at 10.”
• “I need to move __ animals to my training arena. How can I get them out of here in only two groups?”
# One, Two, a Counting Zoo

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1. Count
2. Write and Draw
Sweet Tooth Cupcake Bakery
Describe and Compare Measurable Attributes

Common Core Standards: Measurement and Data
1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
2. Directly compare two objects with a measurable attribute in common, to see which object has more of/less of the attribute, and describe the difference.

Problem Solving Scenario: (read to students)
• “The Sweet Tooth Cupcake Bakery is the best place in town to get cupcakes of any height and weight. One baker bakes the cupcakes to sell. One shop worker measures the height and weight of each cupcake. Another shop worker writes down the height and weight of each cupcake to make labels. One customer chooses two cupcakes to compare and will buy the one that has more or less height or weight. Unfortunately, all of the measuring cups and digital scales are missing. 1. How will you measure the height and weight of each cupcake? 2. How will the customer compare how tall and heavy two cupcakes are? Ready…set…act out math!”

Materials:
• space/corner of classroom (bakery)
• cupcake liners and tissue paper (cupcakes)
• unifix cubes, balance, and other nonstandard units of measurement
• index cards, pencils, and tape (labels)

Key Vocabulary:
• height
• weight
• more
• less

Time:
• 30 minutes total
  ▪ Measure: 10 minutes to bake and record the height and weight
  ▪ Compare: Five minutes for customers to compare the attributes
  ▪ Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, walk through their store as a customer. Ask questions and record student responses to assess student understanding.
• “I am interested in making cupcakes at home. How do you know how tall they are? How do you know how much each weighs?”
• “How can I find a cupcake that weighs less than this cupcake?”
**Sweet Tooth Cupcake Bakery**

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| ![Prohibited Measurement](prohibited_measurement.png) | 1. Measure ![Measurement Scale](measurement_scale.png)  
2. Compare ![Comparison](comparison.png) |
Super Shoe Store
Classify and Count Objects in Categories

Common Core Standard: Measurement and Date
3. Classify objects into given categories, count the numbers of objects in each category, and sort the categories by count

Problem Solving Scenario: (read to students)
• “You work at the Super Shoe Store. Store workers are getting ready for opening day. However, the store shelves are empty. You wait for the big truck to deliver the shoes, but it dumps them all in the middle of the floor! 1. How will you sort the shoes onto four shelves so that the shoes on each shelf have something in common? 2. How will the costumer know where to look for a certain kind of shoe? 3. How will you keep track of how many shoes are in each category? Ready…set…act out math!”

Materials:
• space/corner of classroom (shoe store)
• 10 to 20 pairs of shoes (cheap toddler shoes, pictures, or die cuts)
• 4 cheap wire racks or a table with 4 sides (shoe shelves)
• index cards, pencils, crayons, tape (shelf labels)

Key Vocabulary:
• sort
• classify
• category

Time:
• 25 minutes total
  ▪ Sort: 15 minutes to sort shoes
  ▪ Classify: Five minutes to create signs labeling categories on shelves
  ▪ Count: Five minutes to count shoes and write numbers on labels

Oral Assessment:
• When a group has completed their task, walk through their store as a customer. Ask questions and record student responses to assess student understanding.
• “I’m looking for tall red boots. Where can I find them?”
• “What kind of shoes are on this shelf?”
• “Why did your store put ___ shoes over here and not with the ___ shoes?”
# Super Shoe Store

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- **Solution**
  1. Sort
  2. Classify
  3. Count
Morning, Noon, and Night Diner
Concepts of Time

Common Core Standards: Measurement and Data
4. Demonstrate an understanding of concepts of time (e.g., morning, afternoon, evening, today, yesterday, tomorrow, week, year) and tools that measure time (e.g., clock, calendar).
4a. Name the days of the week.

Problem Solving Scenario: (read to students)
• “The Morning, Noon, and Night Diner is opened all day every day to feed your hungry bellies. The only problem is you must call first because you need a reservation in order to eat at this busy restaurant. Two hosts answer the phones to take reservations for morning breakfast, afternoon lunch, or evening dinner. Two customers on the phone say the hour, day, month, and year for the hosts to put on the calendar. As time passes, the customers come in on their reservation day and time to eat. 1. How will the customer tell the restaurant host when they want to eat? 2. How will the restaurant host keep track of all the reservation days and times? Ready…set…act out math!”

Materials:
• space/corner of classroom (diner)
• 4 play phones
• 2 clocks with maneuverable hands
• 2 twelve-month calendars
• pencils

Key Vocabulary:
• morning
• afternoon
• evening

Time:
• 20 minutes total
  § Tell: Five minutes to record the reservations on the calendar
  § Write: Five minutes for customers to eat at the restaurant
  § Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, call the restaurant as a customer. Ask questions and record student responses to assess student understanding.
• “Hello, I want to make a reservation for breakfast/lunch/dinner at ___ o’clock. Do you have any Wednesdays open in December ___?”
• “How will I know when it is time to come to the restaurant? What will my clock and calendar show?”
## Morning, Noon, and Night Diner

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</table>
| ![Problem](image3) | 1. Tell Time  
   ![Calendar](image4)  
   ![Clock](image5)  
  2. Write  
   ![Pencil](image6) |

55
Common Core Standard: Measurement and Data
4b. Identify the time to the nearest hour of everyday events (e.g., lunch time is 12 o’clock, bedtime is 8 o’clock).

Problem Solving Scenario: (read to students)
• “You are a camp counselor at the Happy Tails Pet Camp. Animals of all kinds come here to spend the day doing fun activities while their owners are away. Because the pets get bored easily, you will make a schedule for your animal so they have something to do every hour from 8 o’clock in the morning until 7 o’clock at night. When the animal does each activity they earn a treat, but if they are naught they do not. 1. How will you camp counselors make a schedule of activities every hour using a clock? 2. How will you use the clock to know what activities to do each hour? Ready…set…act out math!”

Materials:
• space/corner of classroom (camp)
• stuffed animals (pets)
• clocks with maneuverable hands
• large pre-drawn clocks on butcher paper or poster board
• pencils and crayons

Key Vocabulary:
• time
• hour
• o’clock

Time:
• 30 minutes total
  ▪ Make a Schedule: 15 minutes to create an hourly schedule for an animal
  ▪ Tell Time: 15 minutes to act out the animal’s day of activities every hour

Oral Assessment:
• When a group has completed their task, go to the camp as a pet’s owner. Ask questions and record student responses to assess student understanding.
• “I am __’s owner. What did you do at __ o’clock today?”
• “It looks like my pet had a lot of fun today at camp. How did you keep track of all the fun activities?”
Happy Tails Pet Camp

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| ![Problem Image](image3) | 1. **Make a Schedule**
2. **Tell time** |

57
Common Core Standard: Geometry
1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as *above, below, beside, in front of, behind, next to*.

Problem Solving Scenario: (read to students)
- “Congratulations on being hired to work at the Garden of Shapes. First, you will plant seeds in a garden. Decide which seeds to plant and where. When your shift ends other gardeners will come to water your seeds. However, they won’t know where to water unless you leave them a map showing the seeds and their position in the garden (above, below, next to). Switch maps with another gardener and water each other’s seeds. 1. How will you make a map to show pictures of your seed shapes and words describing where they are? 2. How will you use the garden map to water the seeds by naming their shapes and reading where they are? Ready…set…act out math!”

Materials:
- classroom (garden)
- 2D and 3D shape manipulatives (seeds): square, circle, triangle, rectangle, hexagon, cube, cone, cylinder, sphere
- paper, pencils, and crayons (garden maps)
- word bank with position words: above, below, beside, in front of, behind, next to
- 4 empty small watering cans or squirt bottles

Key Vocabulary:
- square, circle, triangle, rectangle, hexagon, cube, cone, cylinder, sphere

Time:
- 30 minutes total
  - Draw a Map: 20 minutes to plant seeds, draw seeds on map, label seed positions
  - Read a Map: Five minutes to use a map to water another gardener’s seeds by identifying the shapes and their position

Oral Assessment:
- When a group has completed their task, walk through their garden as a new gardener. Ask questions and record student responses to assess student understanding.
- “Hello, I’m the new gardener and it is my first day. What kinds of seeds did you plant in the garden?
- “Wow, these seeds are all over the place. How will I know where to find the ___ seed using this map?”

58
### Garden of Shapes

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<td>2. Read a Map <img src="image4" alt="Map Image" /></td>
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Common Core Standards: Geometry
2. Correctly name shapes regardless of their orientations or overall size.
3. Identify shapes as two-dimensional (laying in a plane, “flat”) or three-dimensional (“solid”).

Problem Solving Scenario: (read to students)
• “At String a Shape Jewelry Design Company, any necklace you can imagine can be made using our beautiful two-dimensional and three-dimensional shapes. Two designers get the jewelry store ready by sorting the sequins and beads into two-dimensional and three-dimensional groups. Two customers come in wanting a necklace. The only problem is they do not know the names of any shapes, so they have to describe them to the designers. 1. How will the designers sort the jewelry into two-dimensional and three-dimensional groups for the customers to choose from? 2. How will the customers describe the shapes of the sequins and beads they want if they do not know the names? Ready…set…act out math!”

Materials:
• space/corner of classroom (jewelry store)
• two-dimensional sequins
• three-dimensional beads
• string, pipe cleaners, or shoe laces (necklace chain)

Key Vocabulary:
• two-dimensional
• three-dimensional
• square, circle, triangle, rectangle, hexagon, cube, cone, cylinder, sphere

Time:
• 30 minutes total
  ▪ Sort: Five minutes to sort sequins and beads into 2D and 3D groups
  ▪ Describe: 10 minutes to describe, identify, and strand the shapes to make a necklace
  ▪ Rotate roles and repeat.

Oral Assessment:
• When a group has completed their task, walk into the store as a customer. Ask questions and record student responses to assess student understanding.
• “Hello, I am in need of a new necklace. What kinds of sequins and beads can I choose from?
• “I am looking for something flat/solid with ___ sides and ___ corners. What shape would that be?”
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1. Sort
2. Describe
Common Core Standards: Geometry
4. Analyze and compare 2- and 3-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts and other attributes.
5. Model shapes in the world by building shapes from components and drawing shapes.

Problem Solving Scenario: (read to students)
• “The mayor of Shape City cannot decide if he wants the city’s new playground to have two-dimensional or three-dimensional shapes. You have been hired as an architect to design and build either the swings, slide, sand box, or monkey bars using shapes. 1. How will you build your part of the playground using only flat two-dimensional shapes? 2. How will you build your part of the playground using only solid three-dimensional shapes? 3. How will you describe to the mayor what is the same and different about them? The mayor will make a decision after you describe your two parts of the playground. Ready…set…act out math!”

Materials:
• space/corner of classroom (playground)
• photographs of swings, slide, sand box, monkey bars to reference
• paper, tape, Legos, building blocks, unifix cubes, straw and Play-Doh (construction materials)

Key Vocabulary:
• two-dimensional
• three-dimensional
• square, circle, triangle, rectangle, hexagon, cube, cone, cylinder, sphere

Time:
• 25 minutes total
  ▪ Build: 10 minutes to build a part of the playground using 2D shapes
  ▪ Build: 10 minutes to build a part of the playground using 3D shapes
  ▪ Describe: Five minutes to describe the similarities and differences in the 2D and 3D playgrounds to the mayor

Oral Assessment:
• When a group has completed their task, walk into the playground as the mayor of Shape City. Ask questions and record student responses to assess student understanding.
• “As the mayor of Shape City, I thank you for your hard work in building two playgrounds. Tell me about the flat shapes you used. Describe the solid shapes you used. How are these the same? How are they different?”
## Shape City Playground

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1. Build
2. Build
3. Describe
Fixing Fossils Shape Museum
Compose Simple Shapes to Form Larger Shapes

Common Core Standard: Geometry
6. Compose simple shapes to form larger shapes.

Problem Solving Scenario: (read to students)
- “The Fixing Fossils Shape Museum has been closed because visitors want new animal exhibits. We need paleontologists and museum workers to find and put together bones for new animals to bring in crowds. Two museum workers choose an animal exhibit to create (select a tangram card) and the first bone shape they will need. Two paleontologists dig for bones to find the correct shapes to piece together the animal. They name the shape of the bones and give them to the museum workers. The museum workers fit together the different bone shapes to form the animal and tell the paleontologists if the bones combine or if they do not belong. 1. How will the paleontologists name the shapes they find digging? 2. How will the museum workers create an animal exhibit using smaller shapes to create larger shapes? Ready…set…act out math!”

Materials:
- space/corner of classroom (digging site and museum)
- tangram cards (animals)
- tangram shapes (bones)
- tray of sand or crumpled brown tissue paper (digging site)

Key Vocabulary:
- square, circle, triangle, rectangle, hexagon

Time:
- 20 minutes total
  - Name and Build: 10 minutes to find, name, and combine 2D shapes to make larger shapes
  - Rotate roles and repeat for a new animal.

Oral Assessment:
- When a group has completed their task, walk into the museum exhibit as the museum owner. Ask questions and record student responses to assess student understanding.
- “These new animal exhibits are going to bring in a large crowd. Paleontologists, what shape bones did you find for this animal?”
- “Museum workers, how did you know these shapes would fit together to create this __ shape?”
## Fixing Fossils Shape Museum

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| ![Problem Image] | 1. Name  
[![Name Image]()]  
2. Build  
[![Build Image]()] |

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65
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doi:10.1080/13502930903101537

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