

# **Minding the Store: Strengthening Student Numeracy Through Role Play**

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## **Overview**

*Minding the Store: Strengthening Student Numeracy Through Role Play* is a curriculum unit that engages students in the authentic task of opening and operating a classroom store. The main objective of this unit is to improve student facility with mathematics. It has been designed for a kindergarten classroom of approximately twenty-five to thirty students of mixed ability and background. However, the lessons comprising this unit are intentionally designed to be both feasible *and* flexible. They could easily be adapted and made more complex for older students. Further, while the primary focus of the unit is mathematics, it would be effortless to integrate other subjects into the lessons. For example, if students choose to sell self-portraits at their store, Art becomes a secondary focus. If they choose to grow and harvest flower seeds, Science.

The impetus for this unit comes from research that supports charging students with authentic mathematics tasks, such as opening and operating a classroom store, to strengthen numeracy. Rich, truly challenging situations are real to students. As children rise to meet the multiple objectives of these problems in multiple ways, engagement is often high. Students more readily buy into the assignment. Children, especially kindergartners, are discovering new things about their world every day. They are trying to make sense of their world. They are noticing patterns, asking questions, and manipulating words, numbers, and materials. This unit taps into children's natural proclivity for problem solving. Hopefully, over the course of this unit, students will come to view themselves as creative and constructive members of a mathematical community – hard at work.

*Minding the Store: Strengthening Student Numeracy Through Role Play* unfolds in several stages. First students identify a viable product to sell in their store. Then they determine start-up cost and asking price. They work to produce, package, label, sort, display, and market their product. Then they open the store and make transactions with customers, keep records, and stock shelves. They organize, display, and analyze data

from the store to figure out how things are going. As a culminating component of the unit, students take a field trip to a local business to compare notes with business owner. Throughout the unit, students are having frequent discussions with their peers and their teacher about the mathematics of it all. Through all of these stages, students are strengthening numeracy.

## **Rationale**

The dictionary built into my word processing program defines numeracy (nu-mer-a-cy) as *competence in the mathematical skills needed to cope with everyday life and the understanding of information presented in mathematical terms like graphs, charts, or tables.*<sup>1</sup> Just as literacy empowers people to understand and engage with the written world around them, numeracy empowers people to comprehend and work with mathematics. It is possible to get through life as an illiterate or an innumerate person. However, quality of life may be greatly increased for the literate and numerate citizen. Here applies the century-old maxim, knowledge is power. A numerate citizen can detect when numbers are off or do not add up. She knows to ask questions like "What will the interest rate be on my mortgage?" and "What is the charge per minute for my cell phone plan?" The numerate person can take the mathematical information that affects his life and weigh it with other factors when making decisions.

Managing a bank account, budgeting for life's expenses, and analyzing data when making medical, professional, or political choices are some of the numeric endeavors common to daily life. If a person is not sufficiently numerate, he may be swayed by emotion, propaganda, or misinformation into making poor or even detrimental decisions. The rising number of Americans currently defaulting on their mortgages is a prime example of this. Our public education system is a big contributing factor to the state of numeracy, or innumeracy, in our nation. Studies consistently report American students performing below their peers in other industrialized nations, including Japan, Canada, France, and China.<sup>2</sup> Though reports such as these should always be considered with reference points (like student populations and type of education system) in mind, in an increasingly global economy, news like this is cause for concern.

To bring the challenge of innumeracy closer to home, some numbers from the School District of Philadelphia's recently published five-year strategic plan illuminate the severity of our problems. The district serves a population of nearly 200,000 students. Of those children, a staggering 47% drop out before completing high school. 52% of 11th grade students tested last year scored below basic in math on the Pennsylvania System of School Assessment (PSSA). 398 was the average SAT 1 math score for seniors taking the exam in the 2007-2008 school year, compared to the state average of 498.<sup>3</sup> The numbers paint a grim picture of the numeracy and general academic-preparedness of Philadelphia School District students.

As a result of this deficiency, the School District of Philadelphia and similar underperforming school districts, have adopted rigorous curricula that are aligned with the content that is annually tested by the PSSA. Pressure is put on teachers to cover vast

amounts of material and close large achievement gaps over the course of a school year. The effects of this strain are felt all the way down through the kindergarten level. In their kindergarten year, children are undergoing many developmental changes. They are learning to communicate, socialize, empathize, problem-solve, use their imaginations, and practice self-control and self-regulation. They are fine-tuning their gross and fine motor skills. Unfortunately, when academics are overemphasized, no room is left for the creative play that is essential if children are to meet these developmental milestones. Structured play or what some teachers call "free time" is disappearing from kindergarten classrooms at a time when American children probably need it most.

The Alliance for Childhood, a nonprofit association of educators, health professionals, and child advocates who are troubled by the decline in children's health and well-being, have documented the disappearance of play in kindergarten classrooms. One study of kindergarten classrooms in New York and Los Angeles revealed that children spend four to six times more hours per day in academic instruction than they do in free play. That is approximately two to three hours per day for reading and math versus thirty minutes or less for play. Many classrooms had no play time at all as teachers explained that it was not mandated by the curriculum or valued by school administration.<sup>4</sup> Of the 268 full-day kindergarten classrooms studied in the two cities, it was noted that classic play materials such as blocks, props for dramatic play, and sand and water tables have for the most part disappeared.<sup>5</sup> When I started teaching kindergarten five years ago, I was dismayed to find the same thing in my Philadelphia classroom. The room was filled with textbooks and academic supplies. The blocks and dress-up clothes had been relegated to the hallway junk closet.

Play is a critical pursuit for five and six year olds. It has been documented to build competency in multiple ways. Research shows that children who are regularly involved in socio-dramatic play have stronger language skills, superior social skills, greater empathy, larger imaginations, less aggression, greater self-control, and more complex levels of cognition.<sup>6</sup> In light of the School District of Philadelphia's high drop-out rates, it seems critical that students be encouraged to develop these attributes at a young age. My rationale for creating this unit is to simultaneously address both the issues of the innumeracy of America's and specifically, Philadelphia's, children and the disappearance of play in kindergartens. Many respected mathematics educators advocate teaching children by giving them authentic tasks to complete. These are tasks that employ play *and* promote mathematical learning. The lessons I have created for this unit are centered on such tasks.

The National Council of Teachers of Mathematics (NCTM) has prescribed a set of standards for the teaching of mathematics. On the subject of how teachers must go about choosing math problems to give to students, the council has this to say:

Teachers should choose and develop tasks that are likely to promote the development of students' understandings of concepts and procedures that also fosters their ability to solve problems and to reason and communicate mathematically. Good tasks are ones that do not separate mathematical thinking

from mathematical concepts or skills, that capture students' curiosity, and that invite them to speculate and to pursue their hunches.<sup>7</sup>

Here math is not treated as a separate subject, but as one that is integral to students' lives. Currently, a typical mathematics lesson in my kindergarten classroom has one objective that my students must meet and one activity for them to complete as a means to that end. For example, the objective of a lesson might be to sequence numbers and I might show them how to play a card game during which they must order their cards from lowest to highest. The next day our objective might be counting backwards and the activity might be the students pretending they are rocket ships counting down to blastoff. While these activities are fun for students and serve an explicit purpose, they do not challenge students to problem-solve, or communicate as the NCTM recommends. These tasks are not vital to my students' classroom lives.

But bona fide learning experiences often appear to be messy. When students are given a rich, truly problematic situation to resolve there are often several objectives to meet and several ways to meet them.<sup>8</sup> While this can be initially off-putting to teachers like myself who are accustomed to doing one objective/one activity lessons, the payoff in student learning is well worth it. Instruction that centers around students working on authentic tasks is inherently differentiated. As teachers, we are continually encouraged to differentiate instruction. We are urged to tier instruction so that students with multiple skill levels will be able to meet with success. Mathematical tasks that the NCTM encourages educators to employ are open-ended to a degree, which provides everyone with equal opportunities to learn.<sup>9</sup>

This approach to mathematics instruction encourages students to apply what they know to the problem at hand. When they do this they may be combining mathematics strategies they have acquired both in and outside of school. For example, a student may have been taught to make change by her grandmother. She may have also been taught to write numbers by her teacher. As the student attempts to keep track of sales in the register logbook, she is combining both sets of skills to solve a more complex problem. Whatever the case, students bring their mathematical knowledge to the classroom experience and develop new mathematical skills and ideas in the process.<sup>10</sup>

Ideally, the overarching goal here is to build a creative and playful mathematics environment that gives all students opportunities to enrich their numeracy. A satisfactory school experience can be characterized as one that is both internally rewarding and keeps students engaged.<sup>11</sup> I have rationalized that students' perceptions of mathematics are built on the kinds of math work they do in school. By making the work that they do purposeful and original to their classroom experience, I hope that my students will develop a penchant for mathematics which will carry them through their school years and beyond.

## **Objectives**

The main objective of *Minding the Store: Strengthening Student Numeracy Through Role Play* is for students to strengthen their understandings of the ways mathematics operate in their lives. This is the overarching theme of the unit. We can solve authentic, real-life problems using mathematics. So, what can be accomplished through opening and operating a classroom store?

Students will deepen their number sense. Through repeated discussion, demonstration, and real life application, they will become more facile with counting, comparing, and manipulating numbers. As students find solutions to problems that arise along the way, they will be naturally practicing and improving their arithmetic skills. For example, in order to determine if a profit has been made, students must add up sales and subtract start-up costs to get a very real and important answer to their question. As students engage in lively discussions about product placement or making change, they will be expanding their mathematical vocabularies. Quantity, cost, bar graph, dime, nickel, penny and quarter are just a few of the terms students will use to talk about the mathematics they are doing in this unit. This enterprise in entrepreneurship will increase the level of mathematical discussion in the classroom as students work with the teacher and with one another to be successful.

Truly the most vital objective of this unit is to engage students in authentic math work that captures their attention and imagination. By illuminating the ways in which mathematics is integral to students' everyday experience, such as minding a store, some mathematical "life" is breathed into the classroom. Engaged in this unit, students will search for solutions, notice patterns, set up relationships, ask pertinent questions and grapple with big ideas. They will strengthen their numeracy.

This is a unit that integrates multiple components of the Mathematics curriculum. Mathematical reasoning, computation, and problem solving are embedded within the lessons. Determining start-up cost and asking price for a product is an endeavor in estimation and computation. Taking inventory and making change fall under the umbrella of number systems and relationships. Graphing and interpreting sales data are elements of statistics and analysis. A list of the specific Pennsylvania standards to which the unit has been aligned is included as an appendix.

## **Strategies**

*Minding the Store: Strengthening Student Numeracy Through Role Play* is intended for kindergarten students ranging in age from five to seven years old. My classroom contains approximately thirty children with mixed abilities and previous experiences. Some students have had several years of pre-school education, while for others, this their first exposure to a structured classroom environment. Students' understanding of mathematical concepts range from knowing no numbers, colors, or shapes, to being able to add, subtract and seemingly count ad infinitum.

The lessons for this unit have been designed with practicality and feasibility as a top priority. It can be very challenging to manage a class of thirty kindergarteners. So,

teachers can determine how far into each lesson they are able to delve. The strategies employed in the following lessons are flexible, with multiple points of entry and accessibility. The lessons could easily be adapted and made more complex for teachers working with older children or with smaller groups of students. The format for the majority of the lessons is whole group discussion or activity, pinpricked with moments of small group activity and bursts of industry. At times, the lessons may take on a workshop quality. With regards to time span, the unit consists of five lessons to be taught over the course of several weeks or even months, depending on how interested students become in operating their classroom store. The lessons are long and kindergarteners' attention spans are not. For this reason, each lesson should be spread out over the course of several days or even weeks, with regards to the students' comprehension and engagement levels.

This unit is designed to create a rich and challenging environment. As students work collaboratively toward the common goal of opening and running a classroom store, they will be learning from one another. Working in this shared manner allows students to explain their mathematical thinking to each other and to the teacher. Multiple teaching strategies will be employed to ensure that there is a high level of student engagement with the project. These include: whole group brainstorming and idea sharing, small group work sessions, teacher-student dialogue, student-student dialogue, role play when running the store, and a field trip to a local business to observe its operation and ask questions of its proprietor.

Assessment will be ongoing throughout the unit. Student drawings, computations, and oral explanations in conjunction with teacher observations and frequent checks for understanding will be used to drive instruction. Students with special needs will receive the same accommodations that they normally do, including preferential seating for those who may find it difficult to remain focused on a discussion or demonstration. During individual, paired and small group activities, students will be matched up with peers of differing abilities in order to learn from and to help one another.

Participation in the overarching project of this unit, opening and operating a classroom store, will illustrate students' understanding of mathematics as a tool for everyday problem solving. Each child will participate in the stages of creating a viable product, producing, packaging, labeling, sorting, and marketing that product, opening and running the classroom store, organizing store records and data, and analyzing that data to make improvements to their business. Along the way, they will have repeated opportunities to share what they are learning with the teacher, the customers, and most importantly, with one another.

### **Classroom Activities**

#### Lesson 1: Necklaces, Bookmarks or Tee-Shirts – Oh, My!

Two main goals are the underlying focus of this first lesson. The students must identify a viable product to sell and determine the needed start-up materials and their cost. These

are lofty, but not unattainable goals. Therefore, the lesson should be spread out over several class periods or days, depending on how long students need to meet them. The materials needed for this lesson are teacher's chart paper and markers, samples of items that could be made and sold in a student store (bead necklaces, book marks, tee-shirts, bags of trail-mix – whatever is at hand that would aid in discussion), supply catalogs, paper, pencils, crayons and math manipulatives (linking cubes, counting bears, number lines, etc.) for students.

Begin by bringing students together as a whole group. Introduce the concept of opening a classroom store in a way that engages students. For example, the teacher might say, "The principal, Mr. Soandso, came to see me yesterday. He said that he has noticed what great problem-solvers you are becoming. He asked me if we could open a store in our classroom. He gave me twenty dollars to buy the supplies we will need to get started. He said that we don't have to pay him back until after our store is up and running and we are making some money of our own. What do you think about this idea? Do you think we could have a store in our classroom? Why or why not?" Jot students' ideas onto chart paper to keep a running record of students' thoughts.

After students have bought into the idea of starting a classroom store, it is time to move on to choosing a product to sell. Students will need to consider what is likely to be a popular product among the school community. Do students want to sell something novel, that everyone will want one of? Or, do students want to sell something consumable, that customers will keep returning to buy more of? At this juncture, the curriculum unit can be bent to the needs of the class. For example, if the school does not have an Art teacher, students may decide to paint and sell portraits. If there never seems to be enough time for Science, students may decide to grow and harvest flower seeds for sale. If students have been learning about nutrition, they may wish to make a healthy snack for sale. By choosing a product that is both desired by the school community and tailored to the needs and interests of the class, this truly becomes a curriculum unit that may be uniquely and specifically implemented time and again. This discussion may be held entirely as a large group. Alternatively, students may think-pair-share or make sketches before sharing ideas with the whole group.

Following a consensus on the product, the next goal is to determine start-up cost. As a whole class, students will brainstorm a list of the materials they will need to have on hand to make their product. The teacher should show examples of products that perhaps other children could have had in their classroom stores. For example, if showing a bead necklace, ask, "What did these children need to have to make this? Beads? String?" After practicing this thought process on a few samples, students should list the materials they will need for their product. The ideal product is made of cheap, easy-to-come-by materials. Bookmarks are a great example. Most classrooms already have the materials needed to make these. Teachers can model referencing supply catalogues to determine how much a material costs.

Students can work individually, in pairs, or small groups to determine how much start up money they will need. For example, "If beads are 1¢ each, and each necklace will have

10 beads, how much will it cost to make each necklace?" Working through problems like this will expose students to a plethora of real-life math problems. Students may want to use manipulatives to work through some of the problems. If a limit, like the \$20 in the example above, has been set on start-up money, students must also determine if the cost of the materials they will need to purchase is within their means. If the product proves to be too expensive, it's back to the drawing board.

## Lesson 2: To Market, To Market, Get Ready to Sell

The goals driving the second lesson of this unit are for students to first determine the asking price of their products and then to "manufacture" the products, getting them ready for sale. This lesson will also take time to develop and should be spread out over several class periods or days accordingly. Materials needed for this lesson are the same as for lesson one. Additionally, materials that can be employed in packaging, labeling, sorting and displaying the students' products will be needed. For example, zip-lock bags, labels, masking tape, price tags, empty baskets, sign making materials, etc. will be useful to have on hand.

Bring students together as a whole group and review what has been done so far. For example, the teacher might say, "We have been working very hard to decide what we will sell in our classroom store. We have come up with the clever idea to make and sell \_\_\_\_\_ (necklaces for example). Now we need to figure out what to do next. What are the steps we need to take before we can open our store?" Write students' ideas on chart paper. If students miss big ideas, ask questions to get them thinking in the right direction. When all is said and done, steps should include, but may not be limited to: determining an asking price for the product, manufacturing the product, packaging the product, marketing the product and setting up a "store" area in the classroom where the product may be displayed and sold.

After all the steps have been noted, guide students in sequencing the steps. What should be done first, second, third, and so on. Depending on the product, the sequence of the steps may change. For example, if making necklaces, it might be a good idea to make them and then market them. Actual pictures of the necklaces could be incorporated into promotional ads as a marketing tool. On the other hand, if making trail mix for example, it would be prudent to wait until the day before opening the store to make the product, ensuring its freshness.

The following days or class periods will be devoted to "manufacturing" the products. Students may all be given the same tasks. For example, one day students could string beads into necklaces. The next day they could package them. The following day, they could label and price them. On the final day, they could make promotional posters. Alternatively, students may be split up into small groups, with each group being assigned a different task. For example, one group cuts the string and sorts the beads, one group strings the necklaces, one group packages them and one group labels them. Whichever strategy is most conducive to the classroom environment should be employed. The latter strategy lends well to discussing the concept of an assembly line. The classroom will

become an industrious workshop over these class periods. The teacher should be alert to teachable math moments that arise during this process. For example, are students putting beads on necklaces randomly, or in an alternating pattern? Is it easier to count out pretzels for trail mix by ones or twos? Are bookmarks a solid color or a symmetrical, contrasting color design?

Throughout this lesson, students should also be thinking about the asking price for their product. They will need to factor in the cost of the materials, the “value” of the time they have spent working on the project, the price customers will be willing to pay and whether or not they will be losing money, breaking even or making a profit. These concepts should be covered during whole group discussions held intermittently throughout lesson two.

### Lesson 3: Minding the Store

The main goal of this third lesson is for students to open and operate their classroom store. The classroom store can be open for a finite number of days. However, if it is successful, it should be continued throughout the year as students take turns rotating through the various jobs. Multiple experiences minding the store will expose students to a variety of real-life mathematical problem-solving opportunities. The more practice they have with it, the more facile they will become with the terminology (inventory, cashier, making change, etc.) and mathematical operations (adding, subtracting, counting, graphing, sorting) associated with the store.

Materials needed for this component of the unit may vary depending on the specific needs of each class. Of course, the product will need to be ready to sell. Some type of cash register – real, toy, or small empty containers for sorting coins (egg cartons work well.) – will be needed and some change to start with. Some type of receipts – again real blank receipts or “home-made” will be fine – should be on hand to complete sales. A clock and “Open”, “Closed”, and “Will Return At \_\_\_\_\_” signs can be made or bought for the store. There are many components like this that can be added to the classroom store to make the experience more authentic and engaging for the students (clerk uniforms, name badges, sale signs, give-a-penny-take-a-penny and donation jars, etc.). The teacher will also need chart paper and markers for large group discussions.

Bring students together as a whole group and review their accomplishments so far. Explain that the store is almost ready to be opened but a few more things need to be figured out first. For example the teacher might say, “We have been busy making our product. We have been packaging, labeling, determining a price to charge our customers for it, and advertising it around school. We are almost ready to open our store. But first we need to figure a few things out, like when our store will be open and when it will be closed. What else do we need to figure out?” Write students’ ideas on chart paper and if students miss big ideas, ask questions to get them thinking in the right direction. Topics covered should include setting the hours for the store, determining the jobs students will need to do while the store is running (cashiers, “shelf” stockers, inventory keepers,

greeters, etc.), setting a work schedule and running through some role play scenarios regarding speaking to customers and making change.

When everything is in place, it is time for students to begin minding their store! For classroom management purposes, it may be easiest to have the store open when the majority of the class is elsewhere. For example, when the class goes to gym, the “workers” for the day can return to the store with the teacher. By working in small groups this way, the teacher can oversee what the students are doing without needing to monitor the rest of the students. When the rest of the students return, the small group of “workers” can report the day’s business to the rest of the class. This is an excellent opportunity for students to share their mathematical thinking and experiences with one another. The cashiers can explain how he gave change to a customer. The manager can describe how he helped a customer. The inventory keepers can record the number of items that were sold in a logbook.

#### Lesson 4: How’s Business?

Organizing and analyzing data from the store to determine if business is successful is the goal of the fourth lesson. This lesson may be done in tandem with the previous lesson, as the teacher may want to discuss with students how business is going on a daily basis. As with lesson three, the activities described in this lesson may be ongoing for as long as the store is up and running. The materials needed for this lesson are teacher’s chart paper and markers, students’ paper, pencils, and crayons, rulers, math manipulatives, calculators, and records from the store (copies of receipts, logbook entries, cash register totals, etc.)

Bring students together as a whole group and explain that every good business organizes their records in a way that is clear to them. This way they can look at their records to see if business is going well or if there are some changes that need to be made. The teacher should help students organize their data in a way that will help them notice trends or measure results. For example, the class may look over a day’s receipts and find ways to add up the day’s transactions. This amount could then be added to a running grand total of sales. A growing bar graph might be used to determine how close students are to paying back their investor (remember Mr. Soandso?) or how close they are to making a profit. Or, students could graph the sales for each day to see which days of the week are most popular for customers. Further, they could ask the cashiers to note whether the customer was a boy or a girl on the receipts to determine who comes to shop at the store the most. There is a plethora of ways that data from the store can be represented. The teacher should choose options that highlight concepts the students are interested in learning about.

After working together as a class to organize the data into clear charts, tables and graphs, it is time for students to analyze it. Explain to students that after business owners organize their data like they have, they study it and ask questions about it to learn about their business. The teacher might say, “Now that our store has been up and running for

awhile, what are some questions we should be asking about the store?" As students brainstorm, the teacher records their ideas onto the chart paper. Big questions may include: "Are we making money?" "Do we need to make more of our product?" "Should we change our store's hours?" "What are some problems we are having?" and "How can we make our store better?"

The questions generated by students can then be used to guide analysis of the data. Students may work individually, in pairs, or in small groups to work through problems such as determining which day of the week had the best sales or how much more money is needed to reach \$20. After working through these problems separately, using the materials listed earlier, students should be brought together as a whole group again to share their solutions with one another and to explain their thinking. As the group reaches a consensus for each question, plans might be made to improve upon an aspect of the product or the store.

### Lesson 5: Ask the Local Experts – Field Trip

The most important material that is needed for this lesson is a local business. Many local businesses are happy to host field trips. I often find that students' family members work within walking distance of the neighborhood elementary school. Currently one of the students in my kindergarten class has a grandfather who owns a corner store nearby. Another one of my students has a mother who works at the local barbershop. One of my former students, now in second grade, has an uncle who works at the automobile repair shop. Even the ice cream truck that drives through the neighborhood would be an excellent business to visit. Visiting a local business is a fantastic teaching tool. Not only will students get an inside look at the way a business is run, but they will also appreciate the connection between the classroom and their community.

So, before doing this lesson, ask students if they know people in their families or neighborhood who own, run or work at a nearby business. Contact these people to find a local business to visit. Students may assist in composing a letter requesting a field trip (from one group of "entrepreneurs" to another). Once a field trip has been scheduled, prepare for the trip by brainstorming with the students questions they would like to ask of the business owner. After seeing how the business operates, students may ask the business owners the questions they have prepared and other questions that arise. Students may even want to invite the proprietor to visit the classroom store and give them some advice.

The main goal of this final lesson is for students to interact with numerate adults in their community and identify them as mathematical role models. A good question to ask of the business owner or worker might be, "How do you use math each day?" By explaining how math is integral to the operation of a business, the local entrepreneur will be helping students understand that math is part of everyone's daily life. Be it the hairdresser explaining how customers figure out how much tip to give the shampoo person or the ice cream truck driver describing how he makes change for customers,

students will be receiving valuable illustrations of math operations. They may be able to make connections between what they are doing in the classroom and what they are seeing on the field trip.

Other good questions to ask on the trip include: "How do you keep track of your money?" "Where do you get the things that you sell?" "How did you learn to do this job?" "How do you advertise to your customers?" "How do you know if you are making money?" and "What are your business hours?" If time and access permits, the class might take a subsequent field trip to another business and compare the two experiences. Such opportunities encourage students to share what they have learned with someone outside of the school setting. Students will be expanding their understanding of the ways math is used in life. They may even be persuaded by this experience to think about how they will use math to be successful in the future.

## **Annotated Bibliographies/Resources**

### **Reading List**

Andrews, Angela. *Little Kids – Powerful Problem Solvers: Math Stories from a Kindergarten Classroom*. Portsmouth, New Hampshire: Heinemann, 2002.

A description of a kindergarten classroom where students are both engaged and challenged mathematically.

Carpenter, Thomas. *Making Sense: Teaching and Learning Mathematics with Understanding*. Portsmouth, New Hampshire: Heinemann, 1997.

A portrait of effective mathematics classrooms.

Copely, Juanita. *The Young Child and Mathematics*. Washington, DC: National Association for the Education of Young Children, 2000.

Classroom vignettes, strategies, and activities that encourage teachers to enrich mathematics instruction in order to improve student understanding.

Fosnot, Catherine. *Young Mathematicians at Work: Constructing Number Sense, Addition, and Subtraction*. Portsmouth, New Hampshire: Heinemann, 1999.

A description of young children's developing number sense.

Paulos, John. *A Mathematician Reads the Newspaper*. New York: Basic Books, 1995.

A collection of essays describing the ways the news media employs mathematics. Paulos highlights the benefits of being numerate and the pitfalls of innumeracy.

### **Teacher Bibliography/Resources**

Griffiths, Rose. Money and Shops, Role Play and Real Life. *Mathematics Teaching*, 174, 20-22, 2001.

An article that discusses how teachers can use role play to give real life application to students' mathematical knowledge.

Mathematics Learning Study Committee & National Research Council. *Adding It Up:*

Oers, Bert van. Are You Sure? Stimulating Mathematical Thinking During Young Children's Play. *European Early Childhood Education Research Journal*, 4(1), 71-87, 1996.

A description of the ways teachers can use opportunities that arise in role play to expand children's mathematical thinking.

Trafton, Paul. *Learning Through Problems: Number Sense and Computational Strategies: A Resource for Primary Teachers*. Portsmouth, New Hampshire, 1999.

Techniques for using problem solving to strengthen students mathematical abilities.

### **Student Bibliography/Resources**

Website by Harcourt School Publishers.

[http://www.hbschool.com/activity/counting\\_money/](http://www.hbschool.com/activity/counting_money/)

A kindergartner-friendly website for practice with counting money.

Bair, Sheila. *Isabel's Car Wash*. Morton Grove, Illinois: Albert Whitman & Company, 2008.

In this children's book, Isabel uses money from her friends to buy the supplies she needs to start a carwash business that will hopefully make money for everyone!

McMillan, Bruce. *Jelly Beans for Sale*. New York: Scholastic, 1996.

A non-fiction, picture book that shows children using pennies, nickels, dimes, and quarters to buy colorful jelly beans.

Thayer, Tanya. *Counting Money. Earning Money. Saving Money. Spending Money. (First Step Nonfiction Series)*. Minneapolis, Minnesota: Lerner Publications Company, 2002.

A non-fiction, picture book series that explains, in a very relatable way, how money is counted, earned, saved and spent.

Wells, Rosemary. *Max's Bunny Business*. New York: Viking Children's Books, 2008.

In this children's story, Ruby and her friend Louise start a lemonade stand business, but Ruby's little brother Max has some clever business ideas of his own.

### **Parent Resources**

U.S. Department of Education, Office of Educational Research and Improvement (OERI)  
National Institute on Early Childhood Development and Education

<http://www.ed.gov/pubs/EarlyMath/>

This website offers practical and engaging activities for parents and their two to five year old children.

## **Appendices/Standards**

The Core Curriculum used by the School District of Philadelphia is aligned with the Pennsylvania Department of Education (PDE)'s set of Academic Standards. *Minding the Store: Strengthening Student Numeracy Through Role Play* is also aligned to these standards, which may be viewed in further depth at [www.pde.state.pa.us/](http://www.pde.state.pa.us/). The standards specifically addressed in the lessons of this unit are as follows.

### *PDE Academic Standards for Mathematics*

#### 2.1.3 Numbers, Number Systems and Number Relationships

- A. Count using whole numbers and by 2's, 3's, 5's, 10's, 25's and 100's.
- B. Use whole numbers and fractions to represent quantities.
- C. Represent equivalent forms of the same number through use of concrete objects, drawings, word names and symbols.
- E. Count, compare and make change using a collection of coins and one-dollar bills.
- G. Use concrete objects to count, order, and group.
- H. Demonstrate an understanding of one-to-one correspondence.
- I. Apply place-value concepts and numeration to counting, ordering and grouping.
- J. Estimate, approximate, round or use exact numbers as appropriate.

#### 2.2.3 Computation and Estimation

- A. Apply addition and subtraction in everyday situations using concrete objects.
- E. Use estimation skills to arrive at conclusions.
- F. Determine the reasonableness of calculated answers.

#### 2.4.3 Mathematical Reasoning and Connections

- A. Make, check and verify predictions about the quantity, size, and shape of objects and groups of objects.
- B. Use measurements in everyday situations (e.g., determine the geography of the school building).

#### 2.5.3 Mathematical Problem Solving and Communication

- A. Use appropriate problem-solving strategies (e.g., guess and check, working backwards).
- B. Determine when sufficient information is present to solve a problem and explain how to solve a problem.
- C. Select and use an appropriate method, materials and strategy to solve problems, including mental mathematics, paper and pencil and concrete objects.

#### 2.6.3 Statistics and Analysis

- A. Gather, organize, and display data using pictures, tallies, charts, bar graphs, and pictographs.
- B. Formulate and answer questions based on data shown on graphs.

### 2.8.3 Algebra and Functions

- B. Use concrete objects and trial and error to solve number sentences and check if solutions are sensible and accurate.
- C. Substitute a missing addend in a number sentence.
- D. Create a story to match a given combination of symbols and numbers.
- E. Use concrete objects and symbols to model the concepts of variables, expressions, equations and inequalities.
- F. Explain the meaning of solutions and symbols.
- G. Use a table or a chart to display information.
- H. Describe and interpret the data shown in tables and charts.

### 2.11.3 Concepts of Calculus

- A. Identify whole number quantities and measurements from least to most and greatest value.
  
- B. Identify least and greatest values represented in bar graphs and pictographs.

## Endnotes

<sup>1</sup>Encarta® World English Dictionary © 1999 Microsoft Corporation. All rights reserved. Developed for Microsoft by Bloomsbury Publishing Plc.

<sup>2</sup>Gail Chaddock, Math + Test = Trouble for US Economy, Christian Science Monitor (<http://www.csmonitor.com/2004/1207/p01s04-ussc.html>, 2004)

<sup>3</sup>School District of Philadelphia. Imagine 2014: Building a System of Great Schools. <http://webgui.phila.k12.pa.us/offices/s/strategic-planning>

<sup>4</sup>Alliance for Childhood, Crisis in the Kindergarten: Why Children Need to Play in School (<http://www.allianceforchildhood.org/>, 2009)

<sup>5</sup>Alliance for Childhood, Crisis in the Kindergarten: Why Children Need to Play in School (<http://www.allianceforchildhood.org/>, 2009)

<sup>6</sup>Alliance for Childhood, Crisis in the Kindergarten: Why Children Need to Play in School (<http://www.allianceforchildhood.org/>, 2009)

<sup>7</sup>Paul Trafton, Learning Through Problems: Number Sense and Computational Strategies: A Resource for Primary Teachers (Portsmouth, New Hampshire: Heinemann, 1999) 18.

<sup>8</sup>Catherine Fosnot and Maarten Dolk, Young Mathematicians at Work: Constructing Number Sense, Addition, and Subtraction (Portsmouth, New Hampshire: Heinemann, 1999) 16.

<sup>9</sup>Fosnot and Dolk 24.

<sup>10</sup>Trafton 17.

<sup>11</sup>James Hiebert, Making Sense: Teaching and Learning Mathematics with Understanding (Portsmouth, New Hampshire: Heinemann: 1997) 2.