Problem Solvers Teacher's Guide

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Problem Solvers

ZERO TO THREE
Early connections last a lifetime

Problem Solvers Teacher's Guide Authors' Note

ZERO TO THREE Is thrilled to share the *Problem Solvers* curriculum with the early education community, as we continue our work of ensuring all children have access to rich and engaging learning experiences. As with all ZERO TO THREE resources, *Problem Solvers* represents an intentional braiding of research-based learning activities; joyful play and exploration; and nurturing relationships. We are deeply grateful to the **Honda USA Foundation** and **Dr. Seuss Foundation** for providing the funding to support the development of *Problem Solvers* and make it available to early educators nationwide.

We have been especially fortunate to have the assistance of **Dr. Sandra Linder**, a mathematics and instructional strategies expert, as our reviewer for the *Problem Solvers* curriculum. Dr. Linder is a Professor of Early Childhood Mathematics Education in the College of Education at Clemson University and reviewed all *Problem Solvers* activities to ensure they were pedagogically sound and age-appropriate for toddlers and preschoolers. We are so grateful for Dr. Linder's thought partnership as we brought *Problem Solvers* to life on the page (and in the classroom!).

The *Problem Solvers* curriculum is unique in that each activity is paired with a specially-composed song. The songs in Problem Solvers were the creative brainchild of **Dr. Jennifer McDonel**, Associate Professor of Music and Director of Music Education at Radford University. Dr. McDonel composed and performed the music featured in the *Problem Solvers* curriculum, and was a dynamic collaborator in bringing our math activities to life through song. Her engaging music offers children a new pathway for exploring critical early math concepts while also nurturing their music development through listening and movement.

We also owe our deepest thanks to the *Problem Solvers* Expert Work Group for their guidance in developing this project. Expert Work Group members offered us insight into the theoretical foundations of early math development and instructional approaches, and, most importantly, asked the tough questions that helped us understand early math as an organic, child-led series of explorations.

Our Expert Work Group was comprised of the following outstanding professionals, and we are deeply grateful for their support:

Art Bardige of What If Math, Cambridge, MA
Jie-Qi Chen, PhD of the Erikson Institute, Chicago, IL
Donna Johnson, MS of the Erikson Institute, Chicago, IL
JoAnna Schofield, MLIS of the Stark County District Library of Canton, OH
Jennifer Ward, PhD of the School of Education at Kennesaw State University, Kennesaw, Georgia

Most importantly, we would like to share our endless gratitude to the six pilot sites who took a chance on a brand-new early math curriculum. These sites implemented *Problem Solvers*' activities, provided weekly feedback on their effectiveness, collected child data to track learning, and met with us regularly to suggest strengths and improvements.

We are incredibly thankful for the talented teachers below who helped us ensure that *Problem Solvers* was not only an age-appropriate, engaging, and rich learning tool for young children, but also user-friendly and informative for educators as well.

Our outstanding *Problem Solvers* educators and pilot sites included:

- The Little Scholars Club, Chicago, IL
  Jeanette Rodriguez, Gladys Armenta, and Alaina Luciano
- Young Horizons Child Development Centers, Long Beach, CA
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- Radford Early Learning Center, Radford, VA
  Samantha Stevers
- YMCA of Southern Maine/Casco Bay Branch/Northern York County Branch
  Trisha Mullins, Lindsey Atwood, and Sabrina Jendzejec
- Jubilee JumpStart, Washington, DC
  Nancy Martinez, Erica Dozier, and Alexus Ford
- Georgetown Hill Early School, Germantown, MD
  Sandra Garduno

Problem Solvers Author Biographies

Rebecca Parlakian, MA, Ed, is a child development expert who serves as senior director of programs at ZERO TO THREE, where she manages a portfolio of federally and privately funded projects related to healthy child development and high-quality teaching. Rebecca has coauthored five parenting education and professional curricula and has developed a wide range of parenting resources on topics related to child development, early STEM skills, challenging behavior, fatherhood, and racial equity. Her written work has appeared in a variety of publications, including the *ZERO TO THREE Journal* and *Young Children*. She also contributes a regular blog to *PBS Parents*. Rebecca holds a master's degree in education and human development, with a concentration in infant–toddler special education, from the George Washington University, where she is currently serving as faculty.

Kathy Kinsner, MS, Ed, is the senior manager of parent resources at ZERO TO THREE. She has 4 decades of experience as an educator and producer of nonfiction media for parents, teachers, and children. Her roles range from her Emmy-winning work as a producer on the PBS series *Reading Rainbow* to director of curriculum and instruction for Roads to Success, a nonprofit college and careers program serving low-income high school students in three states. At ZERO TO THREE, Kathy has developed a variety of parenting and grandparenting resources, including collaborations with the American Academy of Pediatrics, the CDC, Head Start, the Mount Sinai Parenting Center, and NAEYC. She holds a master's degree in education/reading from Bowling Green State University and a master's degree in television, radio, and film from Syracuse University.

What Is *Problem Solvers*?

The *Problem Solvers* Early Math Curriculum provides early educators with a set of 22 age-appropriate, play-based activities designed to introduce math concepts to children aged 30 months through 48 months. *Problem Solvers* can be used on its own or in conjunction with other curricula as a tool for increasing children's exposure to early math experiences.

Each activity in the *Problem Solvers* curriculum is aligned to one or more early math learning objectives. These objectives span seven sub-domains including: counting, simple calculations (adding/subtracting), shape awareness, position and direction (spatial awareness), patterns, sets, and measurement/comparison. Each activity includes:

- A play-based experience that introduces specific early math objectives.
- A song composed to reinforce the activity's early math learning objectives.
- A read-aloud activity that aligns to targeted objectives.
- A family handout (in English/Spanish) that offers suggestions for at-home early mathematics activities to share with children.

Aren't They Too Young?

Robust research shows that early math experiences and exposure to math language have positive and lasting impacts on children's math skills, both in preschool and once they enter formal education.[1, 2] Children attending preschool can attain higher levels of understanding in math when they are supported through well-planned, stimulating, and developmentally-appropriate activities.[3] In addition, recent research shows a strong correlation between parents' use of math language in interactions with preschool children and children's use of math language and their acquisition of math concepts.[4, 5, 6] To enhance continuity between early education and home settings, *Problem Solvers* offers resources designed to engage early educators and families as partners in children's early math learning.

Early Math Learning Objectives

The early math learning objectives used in this curriculum are derived, in large part, from the Head Start Early Learning Outcomes Framework (ELOF): Ages Birth to Five, which is designed to illustrate the continuum of learning for infants, toddlers, and preschoolers across five central domains. The ELOF is grounded in comprehensive research around what young children should know and be able to do during their early years.

Please see **Appendix A** for a table outlining the early math understandings that children are developing from 30 to 48 months; this table also suggests key math vocabulary teachers can share with children to support their learning. **Appendix B** indicates the early math concepts covered by each of *Problem Solvers'* 22 activities and approximate preparation times for each activity.

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[1] Levine, S. C., Suriyakham, L. W., Rowe, M. L., Huttenlocher, J., & Gunderson, E. A. (2010). What counts in the development of young children's number knowledge? *Developmental Psychology*, 46(5), 1309-1319. http://dx.doi.org/10.1037/a0019671

[2] Levine, S. C., & Baillargeon, R. (2016). Different Faces of Language in Numerical Development: Exact Number and Individuation. In *Core knowledge and conceptual change*.

[3] Aldemir, J., & Kermani, H. (2016). Integrated STEM curriculum: Improving educational outcomes for Head Start chidlren. *Early Child Development and Care, 187*(11), 1694-1706.

[4] Pruden, S. M., Levine, S. C., & Huttenlocher, J. (2011). Children's spatial thinking: Does talk about the spatial world matter? *Developmental Science, 14*(6), 1417–1430. http://doi.org/10.1111/j.1467-7687.2011.01088.x

[5] Spatial Reasoning: Why Math Talk is About More Than Numbers | Development and Research in Early Math Education [Web log post]. (2017, December 17). Retrieved from https://dreme.stanford.edu/news/spatial-reasoning-why-math-talk-about-more-numbers

[6] Skwarchuk, S., Sowinski, C., & LeFevre, J. (2014). Formal and informal home learning activities in relation to c children's early numeracy and literacy skills: The development of a home numeracy model. *Journal of Experimental Child Psychology, 121*, 63-84.

Instructional Approaches Used in *Problem Solvers*

Problem Solvers activities reflect current best practices in terms of both early mathematics instruction and equity principles for math instruction. Following are the guiding principles on which the curriculum was based:

1. **Math is everywhere!** Children and teachers are encouraged to notice math in the classroom, school, and community. Activities also demonstrate how math is used in a variety of settings and tasks—from grocery shopping to garbage collection.
2. **Honor child development.** Toddlers and preschoolers bring unique skills and abilities to early education programs. This curriculum seeks to provide children with a play-based entry point for exploring and acquiring foundational math understandings.
3. **Center children's skills and knowledge.** Each *Problem Solvers* activity begins with a discussion designed to lift up and explicitly value children's background knowledge and experiences. These conversations communicate children's belonginess in *Problem Solvers* activities from the very start.
4. **Ensure each activity has multiple entry points for learning.** *Problem Solvers* was designed to provide children with two play-based learning experiences—a group activity and a partner activity. In addition, the curriculum includes a specially-composed song (with suggested child engagement) and a book recommendation and extension activity for each unit. These different pathways allow children many entry points for exploring, practicing, and mastering the math objectives addressed across the curriculum.
5. **Encourage students to share their mathematical thinking.** Throughout the activities, teachers are prompted to use open-ended questions to elicit students' mathematical thinking. Each activity also closes with a group discussion in which the teacher poses reflective questions. These questions are designed to encourage children to share/show their math thinking and discoveries.
6. **Partner with parents to encourage school-home continuity.** A partnership approach communicates to children and families the central belief of this curriculum: all children are mathematicians. Sharing information with families about the *Problem Solvers* curriculum also helps children generalize their skills across their home and school environments.

In addition, we undertook research into equitable math instruction that centers Black, Hispanic/Latinx and Multilingual students, addresses barriers to math equity, and aligns instruction to early math objectives. This growing field focuses primarily on elementary-aged students, but several of the foundational principles driving equitable math instruction also can—and should—be integrated within early education settings. These principles include[7]:

- **Teach rich, thoughtful, complex mathematics.** In *Problem Solvers*, children experience a wide variety of challenging activities that encourage them to explore, imagine, test, and refine their understandings. This learning unfolds over 22 activities and seven domains of early mathematics.
- **Cultivate mathematical identity so that everyone can see themselves as mathematicians.** Children are encouraged to see themselves as "Problem Solvers" as they explore and experience the curriculum. Teachers reinforce children's growing mathematical identity by asking them to share their thinking and by showing respect for children's ideas and understandings. The idea that every child can use math to be a Problem Solver is a repeating theme across the curriculum.
- **Intentionally integrate physical movement in math classes.** This principle is particularly important when working with very young children who are driven to move! Many of the activities in *Problem Solvers* invite children to move about the classroom to complete a component of the activity.

[7] Cintron, S. M., Wadlington, D., & ChenFeng, A. (2021 May). *A pathway to equitable math instruction: Dismantling racism in mathematics instruction.* https://equitablemath.org/wp-content/uploads/sites/2/2020/11/1_STRIDE1.pdf

- **Allow for engagement in productive struggle.** Activities that are too easy are not fun or engaging; when children are not engaged, they are not learning. Productive struggle means that children are appropriately challenged—with scaffolding (support and/or coaching), they can master the task at hand. *Problem Solvers* offers teachers suggestions for increasing (or decreasing) the challenge level of each activity to allow for individualization and to provide an appropriate (rigorous) level of challenge.
- **Rely on teamwork and collaboration as much as possible, so that students can learn from and teach each other.** Each *Problem Solvers* lesson includes a small group activity followed by a partner activity to extend the math learning. This approach encourages peer relationships—as children are beginning to develop their first friendships between 30 and 48 months—and also creates opportunities for children to teach and mentor one another. Pilot sites that implemented the program in mixed-age settings noticed this coaching behavior happening organically as they implemented *Problem Solvers* over a series of weeks.

Welcoming Mistakes

The stance of welcoming mistakes is both a critical instructional practice *and* an equity principle in math instruction. Traditionally, there has been a high value placed on getting the "right" answer in math. Precision is, of course, central to learning and applying mathematics. Too often, though, an over-emphasis on correct answers can lead students to develop an early (and lasting) sense of themselves as "bad at math."[8] Yet we know that all children have the potential to succeed in mastering mathematical skills and concepts.

The truth is that *thinking like a mathematician* is a messy process. Trying, failing, and trying again (often using a different approach) is an integral part of mathematics learning. Normalizing mistakes creates a classroom culture that lifts up all children as effective math learners.

In *Problem Solvers*, we de-emphasize the notion of the "right answer." Instead, we encourage educators to first explore the student's thinking or strategies. Teachers are prompted to ask children to share or show how they came to their answer, regardless of whether the answer is correct or incorrect. This approach makes mathematical thinking transparent to other students and creates a natural opportunity to check for accuracy. Mistakes can be important opportunities for learning—but only when they spark an interaction that deepens a child's understanding of the targeted skills.

8 Boaler, J. (2015). *The myth of being "bad at math."* https://www.aspeninstitute.org/blog-posts/myth-being-bad-math/

Structure of *Problem Solvers*

Each *Problem Solvers* activity includes the following components:

CHILDREN ARE LEARNING TO...

Details the specific early math learning objectives of the activity.

MATERIALS NEEDED

Outlines the materials required for the activity. See **Appendix D** for a complete list of required materials for the entire curriculum.

PREPARATION

Explains the steps teachers need to complete in order to prepare the activity. Note **Appendix B** indicates the approximate preparation time required for each of the 22 activities.

ACTIVITY INSTRUCTIONS

Engage: The *Engage* section is an opening activity or discussion designed to elicit children's existing knowledge on a topic or skill area. The discussions in *Engage* are typically free-flowing and open-ended with no right or wrong answers. The goal is to engage children and get them excited about what's to come.

Expand: The *Expand* section introduces a math-based game or activity for a small group of children. The activity is designed to be playful and participatory. Suggested discussion questions and/or instructional approaches are embedded into teacher instructions here.

Explore: The *Explore* section suggests an extension to the opening activity. This is frequently a partner activity designed to promote early friendships and peer-based learning as well as to offer children a different pathway to practice the same learning objectives.

Reflect: As a closing, the *Reflect* section invites children to share their thinking and experiences. This conversation is designed to give children the opportunity to articulate their mathematical thinking. It is also an opportunity for the teacher to highlight the practices of someone "doing math": we learn from mistakes and persist in trying new approaches.

Individualizing the Activity: Provides teachers with concrete suggestions for making activities more or less challenging to match children's current skills and needs. Note that some of the "more challenging" adjustments may require additional preparation.

Making Connections Across the Day: Suggests ways that teachers can include opportunities to practice new math skills in daily routines and teacher-child interactions. The goal is for math to become a part of everyday conversations, play, and routines; this shift increases children's exposure to math language and concepts, as well as offers them the chance to generalize learning they have mastered during the activity.

Song: Provides the lyrics to the activity's song and suggestions for involving children in the song.

Making Literacy Connections: A read-aloud activity that reinforces learning objectives. Includes discussion questions that focus on narrative aspects of the story (making predictions, describing characters' feelings, etc.) and math concepts that are embedded in the story. Finally, this section suggests a simple extension activity that builds on the book and supports the targeted early math learning objectives.

Handouts: Provides supporting materials necessary to run the activity.

Family Handouts (English/Spanish): Offers suggestions for at-home caregiver-child activities that support the activity's early math learning objectives. This resource should be provided to families when the activity is first introduced to children in order to (1) communicate what topics are being covered in the classroom and (2) provide parents with tools and information to support early math learning at home.

What Age Children Are the Activities Designed For?

The curriculum is designed for children aged 30 months to 48 months of age. Teachers can find instructions in the **Individualizing the Activity** section for making each activity more or less challenging. Note that several pilot sites implemented the activities with children up to age five years and reported that, with minor changes to increase the challenge level, the children remained engaged.

In What Order Should We Deliver *Problem Solvers* Activities?

The activities begin with introductory counting experiences and progress on to more challenging concepts including patterns and measurement. We recommend beginning with the early counting activities as an entry point with students. After that, we encourage you to follow your student's interests: Are they noticing the different sizes of fall leaves during outdoor play in October? You might choose an activity that explores measurement and comparisons. Do you have several birthdays in your classroom this month? The activity *Bear's Birthday* helps children explore counting, quantity, and early addition around a birthday theme.

In short, the curriculum is effective in the sequence provided, but can also be adjusted flexibly in response to your students, program, and community. We trust teachers to use their best judgment about what skills and which activities their students might enjoy or benefit from most at a particular point in time.

A final note: The *Problem Solvers* curriculum is designed to "loop"—meaning that once you have completed all activities, you can introduce them again. As children mature, they will engage with the activities in a new way and continue to benefit. As noted above, our pilot of *Problem Solvers* found that children up to age five years enjoyed and were challenged by the curriculum.

How Frequently Do I Implement Each *Problem Solvers* Activity?

Each activity is designed to be delivered to children approximately three times per week, for two weeks. Sometimes teachers are concerned that children will be bored by an activity that repeats but our pilot sites found the opposite: children asked for *Problem Solvers* activities and requested past activities. In fact, several pilot sites made the materials for activities available for children as a free play choice.

Research indicates that children need repeated experiences with a concept in order to master it (see summary[9]). The leveling guidance provided to teachers in *Problem Solvers* (offering tips on making each activity more or less challenging) helps to ensure that the learning experience can be individualized to each child's current skills.

9 LoBue, V. (2019). *Why children like repetition, and how it helps them learn*. https://www.psychologytoday.com/us/blog/the-baby-scientist/201907/why-children-repetition-and-how-it-helps-them-learn

How Do I Use the Songs in *Problem Solvers*?

The goal of music education for toddlers and young preschoolers is to help them become skilled listeners by exposing them to a range of musical styles, tempos, and melodies. In the early years, the goal is *not* for children to sing along, but to become thoughtful and attuned listeners who respond naturally to music through playful movement.

The songs composed for *Problem Solvers* are tonally and rhythmically diverse and invite children's participation through listening and movement. While the lyrics build on the activity's learning objectives, the songs stand on their own as distinctive and varied musical experiences. With repeated exposure to the songs, children may begin to sing portions of a song or join in the refrain. However, this is not the expectation or the goal. (Nor do teachers need to learn/sing all the songs!) Rather, teachers should regularly share the music with children to give them experience with *listening*. "Listening" doesn't mean sitting still and quietly—children are encouraged to respond spontaneously to the music through movement and, over time, vocalizations as they begin to anticipate a refrain or phrase.

Teachers can utilize the songs in the curriculum in a variety of ways and settings. For example, they might:

- Play the song to cue the start of the *Problem Solvers* activity time
- Play the song to cue the close of the *Problem Solvers* activity time
- Play during Circle Time as a whole-group activity
- Play the song during free play as "background" music
- Play during pick-up/drop-off to share this element of the curriculum with parents
- Provide the songs to parents as a digital playlist to create connections between school and home learning experiences

There is no right or wrong way to use the music element of *Problem Solvers*, though the goal is to provide children with frequent exposure to each song over the two weeks you are implementing the activity.

How Do I Use the Book Recommendations in *Problem Solvers*?

The intent of the *Making Literacy Connections* section of each activity is to reinforce the concept that **math is everywhere**. Specifically, teachers can use the everyday routine of shared reading to notice, discuss, and explore math concepts with children.

The books suggested for use in *Problem Solvers* represent a range of high-quality literature for toddlers and preschoolers. (Please see **Appendix C** for a list of suggested books to use with the *Problem Solvers* curriculum.) This section of the curriculum provides suggestions for embedding math language and concepts into shared reading experiences. In addition, the extension activity offered for each book provides an additional entry point for children to explore the targeted math objectives. Generally these activities require little preparation and are designed to be introduced following the story.

Tips for Implementation

Our pilot sites suggested the following strategies for making *Problem Solvers* a success in the early childhood setting:

- **Create file folders for each activity.** Sites suggest that once each activity is prepared, it's wise to put all the materials (plus the book) into a labeled folder or box. Other teachers can then "check out" the activity and return it once done. This practice also keeps all materials for each activity together and organized for the next time the classroom teacher wants to use it.
- **Plan ahead for preparation**. Activities in the curriculum require different amounts of preparation time (see **Appendix B**). Sites suggest reading through the activity and preparing materials a week in advance.
- **Make songs available to parents.** Parents whose children participated in *Problem Solvers* at our pilot sites often asked what songs their children were coming home singing! One of our pilot sites made the songs available to parents over the program's social media channel. Sharing the song files via email or providing parents with a digital playlist is another option for sharing this element of the curriculum.
- **Share children's learning with parents.** Pilot sites provided ZERO TO THREE with photos of students engaged in the activities; they also shared these images with parents and noted how thrilled parents were to see their children's learning in action. Documenting children's exploration through the *Problem Solvers* activities can be an important contribution to a child's portfolio and/or to daily communications with families.
- **Make activities and books available in free play**. Pilot sites explained that children often requested *Problem Solvers* activities during free play or choice time. Children also asked for "the math books" during story time. Framing *Problem Solvers* as play—and making activities available to children as playtime—emphasizes the notion that all children are mathematicians and that math is enjoyable.

Additional Resources

To learn more about the development of early math skills and early math instructional strategies, we recommend the excellent resources below:

BOOKS

Brownell, J. O., Chen, J-Q., & Ginet, L. (2014). *Big ideas of early mathematics: What teachers of young children need to know.* Pearson Education, Inc.

Hynes-Berry, M., Chen, J-Q., & Abel, B. (2021). *Precursor math concepts: The wonder of mathematical worlds with infants and toddlers.* Teachers College Press.

Clements, D. H., & Sarama, J. (2014). *Learning and teaching early math: The learning trajectories approach* (2nd ed.). Routledge.

WEBSITES

Erikson Early Math Collaborative: https://earlymath.erikson.edu/

Learning and Teaching With Learning Trajectories: Early Math Birth to Grade 3: https://www.learningtrajectories.org/

Early Math Counts: https://earlymathcounts.org/

Development and Research in Early Math Education (DREME): https://dreme.stanford.edu/

STEMIE: Innovation for Inclusion in Early Education: https://stemie.fpg.unc.edu/

***Finding Math* from the Institute for Learning & Brain Sciences, University of Washington:** https://modules.ilabs.uw.edu/finding-math/

National Center for Family Math: https://nafsce.org/page/familymath

Appendix A
Early Math Skills Emerging From 30 to 48 Months

The table below highlights *some* of the early math concepts that children are beginning to practice, learn, and master at age two and beyond. While every child learns at their own pace, these skills include some of the math concepts that often emerge in young children's play and that are included in the *Problem Solvers* curriculum.

Topic	Math Concepts	Vocabulary Teachers Can Use in the Classroom	Activity
Number Knowledge Understanding numbers and the relationships between numbers	• Subitizing (Ability to immediately recognize and name - *without counting* - the total number of items in a set) • Counting • Number names • Stable Order Principle (number names occur in a specific order) • One-to-one Correspondence (counting one object as you say one number) • Order Irrelevance (it doesn't matter how we count objects, as long as each is only counted once) • Cardinality (understanding that the total quantity of the set is the last number counted)	• Number words: one, two, three, etc. • More / less • Bigger / smaller • Fewer • A lot / a little • Quantity • Amount	1, 2, 3, 4, 5, 6, 7
Operations (Addition and Subtraction): Changing an existing set by making it larger or smaller	• Concepts of "more" and "less" • Ability to compare small sets of 1-3 objects and determine which set has fewer or more objects • Simple addition and subtraction	• More / less • Bigger / smaller • Fewer • Add • Combine • Take away / subtract • Remove • Equal • Quantity	5, 8, 9, 10, 17

Spatial Awareness: Relative position of objects and people	• Understanding that objects/ people have a position and an orientation in space • Describing the relative position of an object or person	• On top / under • Over / below • In front / behind • Up / down • Around • Next to • In / out • Between	11, 12
Shape Awareness: Ability to recognize and identify simple shapes	• Discovering and describing the attributes of shapes (number of sides, corners), straight or curvy lines • Recognizing and naming shapes • Combining shapes and discovering relationships between them (like two right triangles can make a square)	• Circle • Triangle • Square • Heart • Corner • Side • Line • Straight • Curved • Long / short	14, 15
Patterns: Identifying and creating patterns	• Recognizing a pattern as a repeating sequence based on a rule • Describing a simple pattern • Extending (continuing) a pattern • Making a pattern of one's own	• Pattern • Descriptive words that help children describe the patterns they see in the world – think about: shape, size, and color words • First, second, third, last	13, 16, 20
Measurement: Making direct comparisons	• Understanding that it is the attributes of an object that are measured (size, height, weight, etc.) • Understanding that each object has many different attributes (height, weight, length, etc.) • Discovering differences in characteristics like size or weight when comparing two (or more) objects • Describing these comparisons using measurement language	• Size (big, medium-sized, small) • Comparative words (big, bigger, biggest; small, smaller, smallest) • Length (long, short) • Height (short, tall) • Weight (heavy, light) • Capacity (full, empty) • Distance (far away or close by) • Similarity (same, different) • Speed (fast, slow) • Temperature (warm, cold)	18, 19

Sets and Sorting: Ability to organize collections into sets based on their attributes	• Noticing attributes (features) of objects • Sorting objects with the same attributes into sets • Comparing sets • After an initial sort, re-organizing a collection by a different attribute—for example, first sorting by color and then by shape	• Descriptive words that help children describe attributes–shape, size, and color words • Words to describe types of objects (e.g., forks vs. spoons)	6, 14, 17, 21, 22

This table was developed using the following resources:

ZERO TO THREE. (2020). *Math4Littles: A User Guide*. https://www.zerotothree.org/resources/3298-math4littles-a-user-s-guide

Erikson Institute's Early Math Collaborative. (2014). *Big Ideas of Early Mathematics: What Teachers of Young Children Need to Know.* Pearson Education.

Appendix B
Problem Solvers: Activities, Skill Areas, and Preparation Time

Activity Number	Counting	Adding and Subtracting	Shapes	Position and Direction	Patterns	Sets	Measuring and Comparing	Prep Time
1	X							*
2	X							**
3	X							*
4	X							**
5	X	X						**
6						X		**
7	X							*
8		X						*
9		X						***
10		X						***
11				X				**
12				X				***
13					X			**
14			X			X		**
15			X					*
16					X			*
17		X				X		*
18							X	*
19							X	*
20					X			***
21						X		*
22						X		*

Note: Asterisks (*) indicate the approximate level of preparation necessary for each activity, with one asterisk (*) indicating a shorter preparation time and three asterisks (***) indicating that more time is required.

Appendix C
Problem Solvers: Suggested Children's Books

Unit Number	Suggested Title	Author
1	Wheels on the Bus/ Las ruedas del autobus	Melanie Williamson
2	Big Fat Hen	Keith Baker
3	Ten Black Dots	Donald Crews
4	Big Fat Hen	Keith Baker
5	Fish Eyes: A Book You Can Count On	Lois Ehlert
6	How Many Snails? A Counting Book	Paul Giganti, Jr.
7	What Comes in 2's, 3's, and 4's?	Suzanne Aker
8	Mouse Count	Ellen Stoll Walsh
9	The Gingerbread Man	Catherine McCafferty
10	Quack and Count	Keith Baker
11	Rosie's Walk	Pat Hutchins
12	Rosie's Walk	Pat Hutchins
13	Ten Little Rabbits	Virginia Grossman
14	Shapes, Shapes, Shapes	Tana Hoban
15	Mouse Shapes	Ellen Stoll Walsh
16	Rap a Tap Tap: Here's Bojangles -- Think of That!	Leo Dillon and Diane Dillon
17	Is Your Mama a Llama?	Deborah Guarino
18	You Are (Not) Small	Anna Kang
19	A Beach for Albert	Eleanor May
20	Too Much Noise	Ann McGovern
21	Five Creatures	Emily Jenkins
22	A Pair of Socks	Stuart J. Murphy

Appendix D
Problem Solvers Materials List

Activity	Materials Needed
1	20 cube blocks 2 small baskets 2 envelopes Sticky notes Marker
2	1 teddy bear or animal puppet 12 birthday candles Salt-dough, play-dough, modeling clay (enough to make a small cake) 4 dice (chunky toddler dice preferred) 8 index cards 2 envelopes or resealable bags
3	10 index cards (4" x 6") Round dot stickers, all one color 10 manipulatives per child (dried beans/pasta; plastic bear counters, beads, cubes, etc.) 4 small baskets Colored paper, 1 piece per child
4	Bag of dried beans (Great Northern or Navy beans) or other counters 4 small cups or bowls Glue Cardboard or manila folder (6 pieces) 1 piece colored paper Hook-and-loop fastening, such as Velcro® tape 1 popsicle stick
5	Masking tape or painter's tape Measuring tape (up to 9 feet) Clear packing tape 20 animal figures 2 baskets
6	Round black dot stickers, ½ or ¾ inch in diameter 20 index cards 4 envelopes or resealable bags Dried black beans or other counters 5 small bowls Small tray (optional)
7	Acorns and/or sunflower seeds (optional)

8	Masking tape A sock (to be used as a hand puppet) Red felt (optional) Googly eyes or black permanent marker 2 wide-mouth plastic jars (like mayo jars), deli containers, or boxes with lids removed 20 small counters that will fit inside the jars above (cube blocks, cotton balls, or small toy mice in keeping with the activity theme) 2 baskets
9	3" cardboard circle Aluminum foil 12 people figures 12 animal figures 24 interlocking square plastic blocks (like Unifix, Duplo, Lego, or similar) 6 baskets
10	4 baskets 56 index cards 4 stuffed animals or dolls
11	16 index cards 2 manila folders or pieces of cardboard
12	4 manila folders Removeable dot stickers (alternative: sticky note pad) Scissors Glue or tape 2 stuffed animals Photos of each wall of your classroom, printed in color on 8 ½" x 11" copy paper (make the images as large as possible)
13	Placemat, plate, cup, fork, and spoon (optional) Large pieces of construction paper (like 12"x18"), one per child and one for teacher 12 paper plates or bowls Glue sticks, 1 per child 2 trays (optional)
14	4 small bowls Sturdy cardboard, 2 manila folders, or 1 sheet of posterboard Scissors Glue Masking tape or colored duct tape (optional) 2 cloth bags
15	1 large piece of white paper per child Shape cut-outs for crafting (look for collections that include circle, square, and triangle) 4 bowls or baskets Drawing or construction paper, 1-2 sheets per child Attribute blocks created in Activity 14 (optional)
16	3-4 pieces of felt or colored paper (all the same color) 1-2 pieces of construction paper 5 metal pots or bowls or sturdy food containers 5 wooden or metal spoons

17	4-6 toy vehicles, including at least one piece of construction equipment and one car/taxi/bus (used to transport people) 10 small blocks (all one color) 10 small blocks (of a second color) Glue or tape
18	Several spools of ribbon, all the same color. At least 12 feet is required. Scissors 8 pads of sticky notes (3"x3") A child-safe item from the classroom that is 12-18" long (a book, a pillow, a stuffed animal, etc.) Doll
19	4 clean, plastic containers with different capacities—for example: • 8 oz./one-cup water or juice bottle • 4 oz./half-cup water or juice bottle • Margarine/butter container • Spice jar • Sour cream or yogurt container • Baby food container 4 spoons or scoops (different sizes) 4 small cups 2 measuring cups (1/4 cup or 2 ounce capacity) Plastic bin with lid (approximately 11x14x3") or a water table Water 2 dot markers 4 pieces of paper Marker
20	4 glue sticks Transparent tape 4 colors of construction paper—2 sheets each Index cards or cardboard 15 popsicle sticks or unsharpened pencils Real feathers used for crafting (optional) 4 bowls or containers
21	12 envelopes Marker 4 cloth bags 3 boxes or bins 3 small binder clips 6 index cards 10 larger toy cars (or blocks) and 10 smaller toy cars (or blocks), in 2 colors 2 baskets or bins
22	4 large paper plates or shallow boxes 6 envelopes