Early Mathematics within Rich Story and Conversation

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Mathematics is abstract for young children. One way to help children develop better understanding of core early mathematical concepts is by providing concrete learning experiences, thereby making mathematics more accessible to them. Additionally, children will choose to spend more time on subjects or activities they enjoy, which in turn leads to further motivation to learn more about that subject. Thus, the challenge for preschool or kindergarten teachers is fostering children's "love" for mathematics. This article will focus on how to provide preschool and kindergarten age children opportunities for giggles or wonderment in mathematics related activities. Suggestions for how to create an engaging, authentic context where children can actively participate and interact using interesting story and intentionally facilitated classroom discourse are discussed in this article.

In the Classroom

Imagine a classroom with young learners, ages 4 or 5. Children are seated in a circle and engaged in a choral counting activity: 1, 2, 3, 4, … Teacher is pointing to each numeral on the board as children are counting. Does this scenario look familiar to you? It is a common practice in many classes with young children, and it has its own promises. However, it does not have any giggles or wonder in it. Children will be motivated to learn more mathematics naturally if they like or "love" mathematics because they enjoy mathematics and choose to spend more time on mathematics related activities (Jansen et al., 2016). Additionally, higher scores on the 2015 National Assessment of Educational Progress (NAEP) assessment were achieved by students who enjoyed and had interest in that subject area according to the Nation's Report Card for 2015 (Institute of Education Sciences [IES], 2015). The correlation between interest and test score, as reported in IES 2015 Nation's Report Card, was strongest for mathematics.

Young children learn within the flow of daily activities. Young children, especially during Piaget's (1952/1977) pre-operational stage, learn or construct knowledge as they actively participate in activities. The abstract nature of content, especially in mathematics, can lead to slower progress in children developing sophisticated understanding of core concepts. One way to make abstract mathematics content more concrete, hence more accessible, for children is to create an engaging, authentic context where children can actively participate and make learning meaningful for teachers and for students. Jung and Conderman (2013) cite intentional teaching as one of the prerequisites for authentic mathematics instruction and learning as well as for children's positive viewing of mathematics. An excellent teacher, as defined by Copple and Bredekamp (2009), carefully thinks through what, how, and why to facilitate children's love for and enjoyment of learning.

Contextualizing learning in mathematics can help children create meaning for abstract mathematics concepts. It can also allow children to bring their everyday experiences into the act of learning mathematics. Contextualizing mathematics might mean creating story contexts as children engage in mathematical activities or it may mean bringing story contexts, such as using picture books, to structure learning of mathematics. A study of 155 kindergarten students in the United States whose teachers

incorporated story contexts with experimental group students demonstrated moderate effects of story contexts in improving students' mathematics learning (Casey et al., 2008). Van den Heuvel-Panhuizen et al. (2016) found that "a three-month picture book reading program, during which the teacher read two picture books that contain mathematics-related content in class each week, had a positive effect on kindergartners' mathematics performance" (p. 338) in their study with 18 kindergarten classes in the Netherlands. Therefore, integration of an interesting story context and intentionally facilitated classroom discourse with preschool or kindergarten age students will help advance learning of mathematical concepts at a deeper level as children giggle and wonder through their experiences.

Rich Story Contexts

Stories with rich plots provide entry point to fictional or real-life situations. Good story transports readers to the world or circumstance of focus in the book. A good story helps readers make sense of what is real and what is not. A good story helps readers explore, analyze, predict, and organize information. A good story also helps readers learn more about the self, others, as well as various topics. In short, a good story can stretch children's imagination, foster understanding of more abstract concepts, and make learning exciting.

What young children would view as a good story would depend on their respective interests. For example, a child who is fascinated with a dinosaur will hunger for anything that has to do with dinosaurs. Children's interest is the first criterion to consider when selecting children's books (Schickedanz & Collins, 2013). Other criteria for selecting appropriate and palatable books for children include the complexity level of plots, richness of language, quality illustrations, and authentic representation of diversity (Schickedanz & Collins, 2013; Uscianowski et al., 2017).

Some topics like favorite food items, birthdays, or family customs like going to visit grandparents are common themes that most children can identify with, have much to comment about, and have personal experiences of. Children also enjoy books that tell stories about common childhood experiences like learning to share, how to make friends, and adjusting to a new sibling. Children are eager to add their own perspectives to what is being expressed in the story plot when the stories are relevant and authentic to their own lives. These books with rich story contexts offer wonderful opportunities for lively, extended conversations among children and teachers.

A good story book can have rich mathematics content or not. Books that are available within a preschool and kindergarten classroom can be mathematized during book read-alouds (Hintz & Smith, 2013). Almeda (2017) and Uscianowski (2017) assert non-math as well as math books are beneficial to children, depending on the teacher's purpose for book reading. If a teacher's purpose is to increase children's problem-solving skills, a book that has explicit math content or another book without math content will suffice. If a teacher's purpose is to have children practice number sequence, a book with number content would provide opportunities to count with children during reading. Let's take a look at a non-math book example as a case of creating rich and engaging ways of mathematizing everyday activities. We chose "Red Panda's Candy Apples" by Ruth Paul.

The book, *Red Panda's Candy Apples* by Ruth Paul, is a story about getting along with others. The book begins with the main character, Red Panda who loves candy apples, attempting to sell six candy apples that he made. The author points out repeatedly throughout the story how much Red Panda loves candy apples and is experiencing difficulty as he is selling his candy apples. Red Panda's customers, in order, are Rabbit, Hedgehog, Mouse, Duckling, and Bushbaby. Only one apple remained when both Duckling and Bushbaby wanted to buy one candy apple for self. Red Panda suggests sharing one remaining candy apple to Duckling and Bushbaby, but they did not want to and began to fight over that one remaining candy apple. In the tussle, the Bushbaby ends up crying and the coin jar falls over. While Red Panda was picking up the strewn coins, Duckling offers the candy apple that caused the fight to Bushbaby. This is when Red Panda goes to his basket and gets the one candy apple that he had been saving for himself and was willing to sell that candy apple, thus, allowing Duckling and Bushbaby to have a candy apple each.

Red Panda's Candy Apples is an appropriate book to read in preschool and kindergarten classrooms because the book's focus of learning how to get along is a topic that is familiar to all children at this age. Other components of the book like candy apple being a favorite to Red Panda and to other animals, the customers, leading to a fight over one candy apple due to the desire to eat all, not just half, as well as the experience of buying favorite food resonate with young children. This book's illustrations enhance, rather than overpower, the text and the interesting but not too complicated story plot. Young children will also identify with Red Panda and enjoy the story. From a teacher's perspective, "Red Panda's Candy Apples" book would be a great book to use for Social Studies and Literacy. What if a teacher was to select "Red Panda's Candy Apples" book for mathematics learning, would this book be appropriate?

Fostering Mathematics Learning Through Rich Story Context

Though not explicitly written to teach mathematics, *Red Panda's Candy Apples* provides many mathematical opportunities within its rich story context. Numbers, although not explicitly written in sequence, are represented in clear illustrations through drawings of different number of candy apples as well as coins. Math operations (e.g., subtraction of candy apples or adding coins to the money jar) are implied in the plot with many characters but within the simple message of everyone wanting a candy

apple. Mathematical terms (e.g., first, second, bigger than, half) are interwoven in the text as the story develops through the interaction of characters in the story, various customers, and Red Panda. This story of learning to get along through the story of Red Panda selling candy apples provides many opportunities for the teacher to engage children through extended conversations, open-ended questions and posing problems.

Thinking ahead about various mathematical questions about the story that can be asked during the book reading with the children is a must with both math and non-math books, but especially for non-math books (Almeda, 2017; Hintz & Smith, 2013). A teacher can pose a concrete mathematical question by asking children to first describe what is illustrated on the page (e.g., How many candy apples are on the table?), and having them share their ideas of what will happen on the next page after the first customer buys one candy apple. Second, children can count the number of candy apples on the table on the next page to check their guess. A teacher can probe children's thinking further by posing open-ended questions about what is happening on a page and asking children to describe their reasoning for their responses to open-ended questions (e.g., How did you know there would be more coins in the jar when there is one less candy apple?). Therefore, the answer to the question of whether a non-math book can be a useful book for mathematics learning is a definite yes.

Intentional reading

For *Red Panda's Candy Apples* book to be used for children's mathematical learning, this book needs to be intentionally read numerous times. This would allow children to build a high level of familiarity with the context of the story or plot. The first reading needs to provide children time to simply listen to and enjoy the story. The children will need to hear about the plot of Red Panda learning to share something you love with others as well as visually see the pictures of candy apples on the table, Red Panda's friends who are his customers, coins in the coin jar, etc. Children will also be exposed to new vocabulary (e.g., customer, crackle, biggest, celebrate) as they become intimately aware of Red Panda and his journey in selling candy apple story. The focus of the second reading is to foster children's further interaction with the story context. The teacher can review the plot through the use of the "wh" questions (what, where, when), as well as apply the story context to children's own lives. The teacher could ask children to share their own experiences of times when they had difficult time sharing something they love and/or when they argued or got in a conflict because they wanted all of something they love. The third reading could focus on children and teacher engaging in a productive mathematical conversation. The teacher would create an intentionally facilitated classroom discourse using the story as main context. Further elaborations on how to have a productive classroom mathematics discourse will be explained next.

Productive classroom mathematics discourse

Classroom mathematics discourse or conversation can be rich if teachers intentionally think about the contextual situations. Contextual situations can include elements from children's everyday experiences such as number of tables or chairs in their classroom or some fictional elements represented in the story books. These contexts or elements from fictional or realistic settings can help children develop a strong number sense and may provide meaning and purpose in carrying out addition and subtraction when they are ready.

First, children need to become familiar with the contextual situation. This familiarization of the context will help children with the development of a shared understanding as well as the desire to know more about the context. If this contextual situation is from a story book, rich mathematical conversations can occur when children have had sufficient opportunity to "experience" the story. With the *Red Panda's Candy Apples* story example as our contextual situation, the very first mathematical discourse question is "What do you see and how many?" This first question must be left intentionally open to allow children the option of quantifying any objects they see on each page. Below is an example of potential conversation that can happen in a preschool classroom after the posing of the open-ended first mathematical discourse question with the *Red Panda's Candy Apples* story:

Child 1: I see one rabbit.
Teacher: Is there only one rabbit?
Child 2: I see birds.
Teacher: How many birds do you see?
Child 2: I see two birds.
Teacher: Do you all see two birds? Can you show me 2 with your fingers?... Can you show me two with your fingers in a different way?... How do we know that is 2?... What else do you see?
Child 3: I see candy apples. There are 6 of them.
Teacher: How do you know there are six?
Child 3: I counted them quickly in my head.
Teacher: Is there anyone who sees 6 candy apples in a different way?
Child 4: I sees 3 and 3 and that makes 6.
Teacher: Can someone help us understand what your friend said?

The teacher's questions, in the above exchange, included different ways of thinking about the same quantities. The teacher helped children explain their thinking through use of questions (e.g., *How do you know there are six?*) as well as asking other ways of thinking about the same question (e.g., *Is there anyone who sees 6 candy apples in a different way?*). Within productive mathematical conversations, providing children opportunity to explain their thinking process matters more than whether children provided the correct or incorrect answer.

Story problems

Another component of mathematical discourse is having children think about each page of the storybook as a story problem. Teachers can pose story problems through use of what is about to happen in the story or what had just happened questions. Questions that ask children about what is about to happen in the story (e.g., "*How many red candy apples and coins will Red Panda have after the rabbit bought one candy apple?"*) propel the children to count the number of candy apples left and count

the number of coins in the money jar. Story problem questions about what just happened in the story (e.g., *"Red panda had some candy apples on the table. The white rabbit got one and now he has 4 candy apples. How many red candy apples did red panda have before rabbit bought one?"*) can lead to rich mathematical explorations with children.

The story problem question about what just happened requires children to figure out an unknown number that is part of acting the problem out. It is different from the usual cases where you act out to determine the unknown at the end. Research indicates children will have a more difficult time with this type of story problem question because children need a starting number to count backward or forward (Carpenter et al., 2015). The context of the story, however, can help children make sense of the "unknown start" story problems. Children can explore different strategies to problem solve the "unknown start" question, *"The red panda had some candy apples on the table. The white rabbit got one and now he has 4 candy apples. How many red candy apples did red panda have before rabbit bought one?"* by using visual clues represented on each page. The children can look at the prior pages of the book to visually see what has happened with the candied apples and the characters in the story problem did. The purpose of this exploration is not about finding an answer, but it is about sense making. Creating and using visuals or some physical representation of the scenario described in the story problem are all very productive approaches in solving these kinds of problems. The mathematical representation of this problem will look like "? – 1 = 4". This is a very hard question for a preschooler and even hard for a first grader. However, this problem is not as abstract within the context of a story because the children can better understand the role of context in quantifying objects. The example verbal question, *"The red panda had some candy apples on the table. The white rabbit got one and now he has 4 candy apples. How many red candy apples did red panda have before rabbit bought one?"* is not as abstract as when the question is represented symbolically in a mathematical equation and consists of typical questions a preschool or kindergarten teacher could ask when having extended conversation about the *Red Panda's Candy Apples* story.

Using role play

Another activity for facilitating productive mathematical conversation is having children engage in role plays. Using the *Red Panda's Candy Apples* story, children can act out the story context as the teacher re-reads each page. See below for a description of a scenario where children can interact with the different mathematical contexts of the story through role-play.

> *The teacher sets up a table with appropriate number of candy apples and money jar on it. The teacher calls two children, Aaron and Lilliana to act out the page where hedgehog wants to buy a candy apple. Aaron wants to be the red panda and Lilliana happily agrees to be the hedgehog. The teacher first asks all of the children in the classroom,* "How many candy apples are now on the table?" *then states,* "Show me with your fingers". *When everybody has provided an answer with show of fingers, the teacher asks Aaron, aka red panda, the same question,* "How many candy apples do you have now, Aaron?" *Aaron, then, would state out loud his answer. The teacher would then ask, "*and how do you know, Aaron?" *Aaron would then count the candy apples on the table according to his strategy to show the teacher how he came up with this answer.*

With each role play, posing the same question to the entire class and to the specific children role playing is critical. This step helps children see and hear variations in how different children are making sense of quantities. Some of the children might still need to count one by one, while others may recognize the quantity without the need to count the items as Aaron could demonstrate: *"I know there are 4 candy apples because 2 on this side and 2 on the other side and 2 and 2 makes 4"*.

Now back to the scenario and continuing.

> *Now, Lilliana will act out what is on the book page by taking some time before finally choosing a big candy apple. After Lilliana makes her choice, Aaron will give the candy apple to Lilliana and state with a sad tone of voice,* "That is my favorite one". *Before Lilliana puts the coins in the jar as payment for her chosen candy apple, the teacher will first ask all of the children to show how many coins Red Panda has in his jar after holding up the money jar for everyone to see first. After seeing children's number of fingers held up, the teacher has a conversation with children about how they knew how many coins were in Red Panda's jar. After the conversation about children's mathematical thinking process on how many coins were in Red Panda's coin jar, Lilliana, then, can put her coins in the jar.*

The role playing of or acting out the story (or context) on different pages help make this story personal to children. They counted up, represented the number(s) with their fingers, and shared different strategies they used when they figured things out. The teacher's request for children to represent what they see with their fingers is a part of another intentional mathematical discourse. When children used their fingers to show a number instead of saying the number out loud, they used multiple representations by turning their verbal observations to physical representations.

Another way to build on this story context is to have children modify the story presented in this book. The children can decide to have a different item than candy apple, the total number of items, and how many items each of Red Panda's customers will want. The process of creating a modified or "new" story book will provide children opportunities for multiple representations of quantity. The children will have the opportunity read a number in symbolic form, show the numbers as quantities, and practice ordering numbers as well as backwards counting as children create their own story problems. Thus, intentionally thought-out questions that are open-ended and specifically asking children to share their making sense process of quantities within the story context as well as role-playing provide young children opportunities for rich conversation that provides a venue for exploring mathematical concepts that tend to be abstract.

Furthering the Case of Red Panda with More Books

Red Panda was chosen to illustrate examples of rich mathematical conversations in a so-called "non-math" book. We showed how we can keep the fun and excitement of the story plot while creating extensive mathematical learning opportunities as well. We had two purposes from the case of using Red Panda. First, we wanted you to reconsider your story reading time and recognize promises of your favorite story books from a slightly different perspective. There might be many opportunities for mathematical conversations. Second, we wanted to share with you some productive mathematical practices you can easily incorporate into your classrooms. Now, we want to expand our work from the case of Red Panda to some other cases which you can implement productive mathematical teaching practices we discussed above. We suggest six more books: *Baby Goes to Market, Caps for Sale, Press Here, Ten Apples Up on Top!, Five Creatures*, and *The Mitten*.

These books are chosen, not only because we love reading these books, but we know, from our own experiences, children love the story plot, the characters, and the potential for fun mathematical activities in these books. In **Table 1** and **Table 2**, we provide the story theme for each book and the key ideas addressed in the story as well as various mathematical opportunities (i.e., key mathematical ideas, mathematical teaching practices, and examples of purposeful questions) teachers can integrate into children's learning experience.

Table 1 Key Ideas and Mathematical Opportunities for Select Children Books

	Baby Goes to Market by Atinuke	***Caps for Sale*** by Esphyr Slobodkina	***Press Here*** by Herve Tullet
Story theme	A mom and a baby go to the market and mom's shopping basket fills up as they stroll around.	A cap peddler's encounter with monkeys.	Reader interaction with dots.
Ideas addressed in the story	This book introduces children to an outdoor market in Southwest Nigeria and the generosity of vendors.	This book introduces children to an unfamiliar job and a fun incident with monkeys.	Relational thinking (what happens when you tilt the page to the left/right) Imagination (dots getting bigger, smaller or dots moving out page)
Key mathematical ideas	• Counting various items not presented in a numeric order (Number range 1-6) • Same, more, and less • One less-One more • Cardinality	• Counting sequence from 1 to 17 • Cardinality • Describing equal groups (caps in groups of 4) • Units and composite units (one cap and four caps in each color) • Sorting and comparing • Skip counting	• One-to-One correspondence (each tap will make a new dot on the page) • Counting • Cardinality • Conservation of numbers (if I shake the dots on the page, is the number still the same or different?) • Same, More, and Less • Patterns (Red-Yellow-Blue presented in a line) • Describing equal groups (5 dots in each color) • Number Relations (3 dots on one page 2 yellow and 1 red so 2+1=3)

	Baby Goes to Market by Atinuke	***Caps for Sale*** by Esphyr Slobodkina	***Press Here*** by Herve Tullet
Mathematical teaching practices	• Counting and multiple representations of numbers (e.g., Can you show 4 with your fingers? Can you show me 4 by using apples instead of bananas?) • Role playing actions of the baby, mama, and the vendors • Posing story problems using pictures in the book (e.g., "Baby had some bananas. The baby has 4 bananas now. How many bananas did the baby have before she ate one?") • Asking purposeful questions (see below for example questions)	• Counting and multiple representations of numbers (e.g., Illustrate the story and produce a number sentence or show me with your fingers how many red caps does the peddler have?) • Acting out the story with different numbers (e.g., "Let's pretend peddler had 2 caps of each color") • Posing story problems using the context of the story (e.g., "What if the monkeys took only the blue caps, how many caps would the peddler have left?") • Asking purposeful questions (see next row for example questions)	• Counting and multiple representations of numbers (e.g., Illustrate the story and produce a number sentence or show me with your fingers how many red dots we have on the page?) • Represent the color dots with different numbers (i.e., draw/glue dots – e.g., 1 red, 4 yellow, and 2 blue dots - on paper to determine how many of each color) • Represent the dots with another object (e.g., "We are going to wear hats and we will act out like dots from the story. Each time I tap on a shoulder of a child with red hat, another child with red hat will join to the group) • Posing story problems using the context of the story (e.g., "There was only 1 blue dot but now there are 5 blue dots. How many dots did I add? What if I tapped the yellow dot 7 times instead of 5 times, how many dots would I have?") • Asking purposeful questions (see next row for example questions)
Purposeful question examples	• How many … did … give to the baby? • When baby ate one of. … how many are left? • How many …. in the basket? • Are there more … or … in their basket? • What do the baby and mama had more of in their basket?	• How many caps does the peddler have including his own checked cap? How do you know? • How many caps does the peddler have not including his own cap? How do you know? • How many caps does the peddler have after his nap under the tree? How many are missing? • Can you create a visual illustrating peddler and his caps and write a number sentence showing how many caps he has? • How many of each color does the peddler have?	• Are there more yellow dots or less yellow dots on this page? Explain. • How many yellow dots and how many red dots are there? How many dots overall? • How many dots of each color are on this page? 5 yellow, 1 red and 1 blue. If there are 5 yellow and 1 red and 1 blue, how many dots overall are on this page? • How many dots do you see on this page? How did you know there are 15 total? I see 5 of each color dots so there are 15.  • Can you show/tell me how you see the 15 dots on this page?

Table 2 More Key Ideas and Mathematical Opportunities Using Select Children Books

	Ten Apples Up on Top! by Theodor Geisel (or well known as Dr. Seuss)	***Five Creatures*** by Emily Jenkins	***The Mitten*** by Jan Brett
Story theme	A lion, a tiger and a dog try to put as many apples as they can up on their head.	Describing a household of 5 creatures (3 people and 2 cats) by using different descriptors	A lost mitten becoming a warm spot for different wild animals
Ideas addressed in the story	This book provides an imaginary context where animals compete to get as many apples as possible on their head.	This book provides a glimpse into a family of 5 (pets included) by looking at how they are similar and different	This book starts with a realistic context of a grandma knitting a pair of white mittens for her grandson and moves to an imaginary context where animals try to make their way into this mitten to warm up during a cold winter day.
Key mathematical ideas	• Forward and backward counting apples in an increasing order (Number range 1-10) • Same, more and less • One less-One more • Cardinality • Combinations of ten	• Counting from 1 to 5. • Different partitions of number 5 • Cardinality • Sorting and comparing	• One-to-One correspondence (each animal will take a spot in the mitten) • Counting from 1 to 8 • Cardinality • One less-One more
Mathematical teaching practices	• Counting and multiple representations of numbers (e.g. Can you stack 10 cubes up on top? Can you stack 10 cubes by using two different colors?) • Acting out the story with stackable cubes for different numbers. Students can try to carry their stacks on a tray to provide more challenge and fun. • Posing story problems using pictures in the book (e.g., "The lion had 3 apples on top but the tiger had 7 apples. How many more apples does the tiger have up on top? The lion had 3 apples on top but the dog had one more. How many apples did the dog have up on top?") • Asking purposeful questions (see following for example questions)	• Counting and multiple representations of numbers (e.g., Can you build five by using different colors? Can you show 5 by using your two hands?) • Acting out the story with different numbers (e.g., "Let's pretend we are a family of 5 with 3 cats and just two parents. Let's pretend to be a family of 6 with 3 dogs and 3 people") • Posing story problems using the context of the story (e.g. "What if there were four who liked to eat fish, then how many did not like eating fish? If the dad and the orange cat like taking daytime naps, how many do not like taking daytime naps?") • Asking purposeful questions (see following for example questions)	• Counting and multiple representations of numbers (e.g., Illustrate the story and produce a number sentence or show me with your fingers how many animals are in the mitten?) • Acting out the story with different number of animals (e.g., "Let's pretend to be an owl, a badger and a hedgehog, how many animals are in the mitten?") • Posing story problems using the context of the story (e.g., "What if there were 2 owls and a rabbit in the mitten, how many animals are in the mitten? How many feet are in the mitten?") • Asking purposeful questions (see following for example questions)

	Ten Apples Up on Top! by Theodor Geisel (or well known as Dr. Seuss)	***Five Creatures*** by Emily Jenkins	***The Mitten*** by Jan Brett
Purposeful question examples	• How many apples up on top did the lion have if he had … now? • When the tiger put one more apple on top of … how many are there up on top now? • How many apples do the tiger and the dog have together? • The lion has … how many more apples would the lion need to have … apples up on top?	• How many cannot unbutton buttons if there are … who can button buttons? How do you know? • How many do not like eating beets if there are … who liked to eat beets? • Can you illustrate different combinations of five and write a number sentence showing how many in all?	• When … got into the mitten how many animals are there now? Explain. • There are … animals in the mitten once the … got in, how many before? • There were only a rabbit and a mole and … more animals joined, now how many animals in the mitten?

Conclusion

Children, especially during preschool and kindergarten years, benefit from concrete, relevant, authentic context to situate their learning. Stories can be a useful medium for children. Rich storybooks about common childhood experiences provide wonderful opportunities for children to negotiate their behaviors, learning, and skills in various subject areas in a fun, safe venue. Teachers can use the story plot as a platform to challenge their children in mathematical thinking. Children, in associating fun stories and acting out reading-related activities that are mathematically-oriented, acquire positive outlook on mathematics and are more likely to retain mathematical concepts.

Intentional preparation by the teachers is essential for children's initial and long-term learning in mathematics. Teachers of preschool and kindergarten age children need to know and organize developmentally appropriate mathematics instruction by selecting context rich stories that provide opportunities for children to apply and better make sense of the more abstract mathematical concepts. Productive mathematical discourse begins with determination of grade appropriate mathematics focus then providing activities that allow numerous opportunities for children to engage and re-visit the same topic from different lenses. Teacher's inclination to end a mathematical conversation when a child gives a correct response can limit young children's problem solving and exploration of mathematics.

The use of rich contexts and intentional questions that asks children to explain their answers as well as to represent mathematics in multiple ways facilitates mathematical discourse in the classroom. Teachers can facilitate children's formalization of abstract mathematical ideas when they provide opportunities for children to use the story context to make connection between prior learning and new mathematical experiences. With preschool and kindergarten age children, the thinking process matters more than the answer. Therefore, teachers listening to children's explanation of their thinking process and challenging them to think about the same question in different ways through a mathematical dialog will foster mathematical learning in young children.

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