

Executive Function Skills in Preschool Number, Counting, and Cardinality Activities

Three-and-a-half-year-old Javier and 4-year-old Jamie are pretending to shop in their play center grocery store. They buy three toy apples. After finishing their shopping, they put their apples into the play kitchen pantry. Another student briefly enters the kitchen, removes one apple from the cabinet, pretends to eat it, and then says, “I finished my apple!” Their teacher says, “How many apples do you have now?” Javier and Jamie can solve this problem in different ways. They could go to the pantry and count the remaining apples, or remember that they started with three apples and use subtraction to figure out how many apples are left after one is removed. With either approach, Javier and Jamie rely on their counting and executive function skills to do this activity.

Many number, counting, and cardinality activities provide children opportunities to practice their executive function (EF) skills. EF skills are cognitive skills used to intentionally evaluate and control our own thoughts and actions.

What Number, Counting, and Cardinality Skills Do Children Learn in Preschool?

With support from their teachers and repeated practice, preschoolers can learn:

- The correct number sequence.
- That number words are used for counting.
- That every item in a set is counted only once.
- That the last number word used when counting tells how many items are in the set (i.e., the cardinal number principle).
- That adding leads to more items and subtracting leads to fewer items.
- That adding one more always leads to the next number in the counting sequence.
- How numbers are related to each other (for example, six is one more than five).

Returning to the number activity in the vignette, Javier and Jamie’s knowledge about numbers helps them figure out how many apples they have altogether after adding and removing apples from the pretend pantry.

How Are Executive Function Skills Used in Number, Counting, and Cardinality Activities?

While counting, Javier and Jamie’s EF skills helped them:

- Keep track of how many apples are in the pretend pantry by mentally “updating” this information (working memory).
- Consider different ways to solve the problem: Javier can solve by counting down from the starting number or counting from one (cognitive flexibility).

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In this and other math activities, EF skills can support children's:

- Ability to remember numerical goals (working memory), such as in the DREME Math Moment: Counting Clean-Up, in which children locate and count a certain number of items while putting materials away (such as cleaning up at least three toys).
- Understanding that adding items leads to more items, such as in the DREME Center/ Small Group Math Activity: Tower Power, in which children add a certain number of blocks to a tower they gradually build.

Why Focus on Math and Executive Function Skills?

First, many researchers have found that EF and math skills are related to each other, and that children's EF skills are related to how well they complete math activities or learn math concepts or strategies [1]. Second, we focus on EF and math because both sets of skills are malleable—meaning that they can improve with practice [2, 3]. The DREME Guided Small Group Math Activities include built-in supports to help teachers prioritize teaching opportunities for children to practice their EF during spatial and geometry activities.

See the additional DREME articles on executive function and math to learn more about how specific EF skills play a role in math activities.

References:

- [1] Mazzocco, M. M. M., & Kover, S. T. (2007). A longitudinal assessment of executive function skills and their association with math performance. *Child Neuropsychology*, 13(1), 18-45. <https://doi.org/10.1080/09297040600611346>
- [2] Clements, D. H., Sarama, J., & Germeroth, C. (2016). Learning executive function and early mathematics: Directions of causal relations. *Early Childhood Research Quarterly*, 36(3), 79-90. <https://doi.org/10.1016/j.ecresq.2015.12.009>
- [3] Banse, H. W., Clements, D. H., Sarama, J., Day-Hess, C. A., & Joswick, C. (2021). Supporting executive function development and early mathematics through a geometry activity. *Young Children*, 76(3), 75-82.