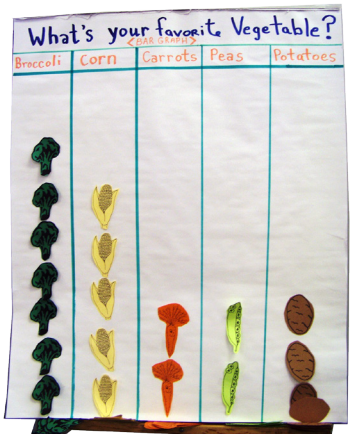
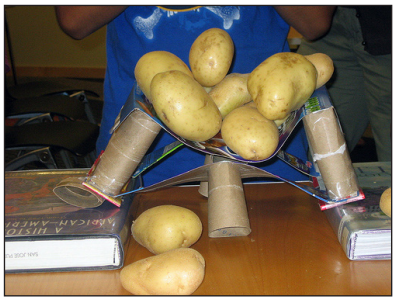
Show children how math can be more than the sum of its parts

By Marlene Kliman





Before reading ahead, jot down three things that come to mind when you think of math in after-school programs.

If you answered "homework," "learning time" or "tutors," you're not alone. To bolster school math success, many after-school programs include extra math support during homework time, with help from after-school staff members, tutors or online homework services (U.S. Department of Education, 2003). Typically, homework or academic time takes up the first part of the afternoon, perhaps after a snack and some playtime. After homework, the fun begins, and that fun rarely involves math.

Restricting math to homework or academic time shortchanges children. They learn that math has little place in life beyond school. Furthermore, if they see that schoolteachers or tutors are the only ones who do math with them, they learn that math is not for everyone: It's for people with special skills. Yet, this mind-set is easy to change.

If not addressed early, problems that children have in math can create a life-long stigma. But teaching children how math applies to other parts of life — such as construction or doubling a recipe — can help them to embrace math and the tools that it offers.

But I'm not a math teacher!

All after-school educators, regardless of background, can weave math into everyday activities with children. Whether they liked or succeeded at math in school, most adults successfully use quite a bit of math in their lives. They pay bills, estimate amounts, double recipes, and figure out what time to leave to catch the 7:38 a.m. bus. Those everyday math skills are all that's needed for mixing math into after-school activities. Consider this scenario:

> "A lot of the teachers at our center, math was not their favorite subject in school."
> after-school site director[1]

Eleven children in grades K-5 are gathered in an after-school classroom immersed in activities during free play time. At the crafts table, a group is chatting as they string together colorful necklaces from a collection of beads and yarn. On the floor, several children have set up toy cars, action figures and dinosaurs and are engaged in creating and acting out their own fantasy world. In the reading corner sit two children with piles of books before them.

Yolanda, one of the after-school staff members, announces that it's 10 minutes until it's their turn to use the gym. Everyone knows that means it's clean-up time. The after-school program, located in a public school building, has only a closet for storing materials overnight, so everything must be put away. As children sigh and ask for just another minute of playtime, Yolanda asks everyone to get up, stretch and look around the room. Then she poses a question: About how many things do you think we need to pick up and put away? About 10? About 100? About 1,000?

A child in kindergarten looks over at the beads scattered on the table, and says "I think about a thousand or a million!"

A fourth-grader at the book corner says, "Definitely more than 10. We've got about 10 books, and it's more than that."

A second-grader adds: "Well, if you have 10 books, we have twice that. Maybe 20 or 30 things on the floor. Then all those beads. I don't know, 100?"

A fifth-grader scans the scattering of loose beads and adds, "We have at least 100 beads here. So, it's more than 100 but less than 1,000."

A first-grader begins pointing to objects around the room and counting by twos: "2, 4, 6, 8" but stops when he can't remember what comes next.

Yolanda explains that to find out how many, each child will count and put away 10 things at a time. They'll see how many they have put away in all and whether they're done.

While the older children each put away 10 things on their own, Yolanda helps the younger ones count out 10 objects correctly. Once everyone is done, the group counts off by tens to find how many they've put away so far. Yolanda counts along, as some children need help with counting by tens.

With a total of 110 and still more to put away, the group realizes that there are in fact more than 100 items. Everyone counts and puts away another 10 things, and they count on by tens, starting at 110. This time, only a few beads remain. They count those separately, for a total of 234.

In this scenario, children in a range of grades are doing math as a part of daily cleanup: They estimate the total amount, they count by ones (important practice for younger children) and by tens (important for the older ones), they gain a visual sense of how much 234 is, and they develop meaning for an amount that's "more than 100 but less than 1,000."

Just as important, children are contributing their own mathematical ideas and learning from one another.

The after-school staff member's role is to ask a math question — how many — and to help children count by ones and tens. She uses her everyday math knowledge to make sure everyone is involved.

Mixing in math after school

After-school programs are replete with opportunities for mixing in math. As a starting point, slip three questions into your time with children each day. You can ask them during snack time, when children are doing projects, during circle time, out on the playground and just about any time.

- **How many?**

To develop solid number sense, children need

*Please see **MATH** on page 7*

many experiences estimating amounts and comparing with "benchmarks" such as 10, 50, 100 and 1,000. Cleanup is a natural context for making estimates. One time, children might estimate the number of beads; another time, building blocks; another time, crayons, books, sports equipment or a combination.

Snack time and arts and crafts present more opportunities. Are you opening a box of crackers for snack? Show everyone how many are inside and then ask children to make an estimate before you count together or read the package label to find out. Likewise, gather a couple of estimates before opening a bag of pompoms or a packet of paper. Keep the focus on how everyone made estimates, rather than the closest answer. That way, children of all ages and ability levels will feel comfortable participating.

• How much time?

Even children who can tell time may have little time sense or understanding of how long things take. Engage children in predicting how long something will take, then time them (or ask a child to do so to provide practice with clocks). Whenever possible, bring in benchmarks to help children connect familiar activities and amounts of time: How long will it take to run across the playground and back? About a minute? Ten minutes? A half-hour? Can we clean up the room in 1 minute, if we all work together? Can we do it in 5 minutes? And next time children ask you "How much longer until..." help them use the clock to deduce the answer themselves.

• How tall, wide or long?

Size and shape play into almost everything children do in after-school programs: crafts projects, cooking and simply talking. Look for opportunities to ask children how tall or wide, long or high something is and to show you by a comparison to something familiar. How big was that spider you just saw? Was it about the size of your thumbnail? Was it about the size of your thumb? Can you build a block tower up to your waist? Can you build one as tall as you are?

If you have rulers, tape measures or measuring cups, leave them out for children to play with. Give them a few days to become comfortable using them correctly. You might need to show them how to line up the ruler with the object they're measuring and how to "repeat" the ruler to measure more than a foot. Then, slip some measurements into the questions you ask. Do you think that spider was about an inch long or about 6 inches long? Do you want more than a half-cup of cereal?

The importance of learning to like math

Like generations before them, many children, especially girls, lose interest in math as they proceed through the grades (Eliot, 2009). In recent years, disenchantment with math has been growing with mounting pressure to perform on standardized, high-stakes assessments and accompanying pedagogy that leaves little room for culturally relevant and interdisciplinary projects (Gasbarra and Johnson, 2008).

After-school providers have a distinct opportunity to promote positive attitudes about math and an understanding of its relevance. By mixing math into the activities and routines that make up the afternoon, they demonstrate that math can be an integral and useful part of the things that children enjoy. By showing that they themselves use math, they serve as role models for children. Unlike in public school, where 85 percent of teachers are white (Feistritzer and Haar, 2005), in after-school programs, staff members more closely reflect the diversity of the enrolled students. Children need to see that people who look, act and talk like them can do math.

Do we need to tell them it's math?

You know the children best. It's up to you to decide when to let slip that some of the questions you're asking are math, but there's no doubt that you need to tell them. Those who have had negative experiences with math at school may at first shy away from anything that seems remotely mathematical. However, to help them build enthusiasm and a sense of efficacy in math, it's important to show them that you're enthusiastic and competent, too. So, don't hesitate to share your own math thinking as you talk with children.

Keep in mind that math doesn't need to look remotely like what you did in school or what children bring for homework. It can be part of all the socializing, projects, interdisciplinary activities and opportunities for creativity and choice that make after-school programs such a positive place for children.

"It has been wonderful to mix math into cooking. We cook every day, so now we also do math every day."
after-school staff member[2]

"Staff (members) recognize when they're doing math, like figuring out how long until snack time, and they tell kids about it. They see that math is everywhere and (they) point it out to kids."
after-school site director[1]

"Children are beginning to see that math is everywhere and it isn't scary."
after-school staff member[2]

"In their minds, math has expanded to more than the pencil and paper they do in school. They see it's something fun now. "
after-school staff member[2]

Footnotes

[1]As quoted in Miller and Lewis-Warner, 2006
[2]As quoted in Kliman, et. al., 2009

References

Department of Education, 2003. *When schools stay open late: The national evaluation of the 21st-Century Learning Centers Program, first year findings*. Washington, D.C.: Department of Education.

Eliot, L. (2009). Pink Brain, Blue Brain. NY: Houghton Mifflin Harcourt.

Feistritzer, E. and Haar, C. (2005). *Profile of teachers in the U.S.* 2005. Washington, D.C.: National Center for Education Information.

Gasbarra, P. and Johnson, J. (2008). *Out before the game begins: Hispanic leaders talk about what's needed to bring more Hispanic youngsters into science, technology and math professions*. NY: Public Agenda. 2008.

Kliman, M., Jaumot-Pascual, N., Ko, L., and Martin, V. (2009). *I believe in math final report*. Cambridge, MA: TERC.

Miller, B. and Lewis Warner, K. (2006). *Mixing in Math interim evaluation report*. Brookline, MA: Miller-Midzik Research Associates.

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