Math in Early Childhood

by Francis Wardle

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In my classes at Red Rocks Community College I always ask my students if they enjoy math. In my early childhood classes over 95% of the students say they dislike math; in my child psychology classes, over 90% claim to dislike math.

One hundred percent of my early childhood students are women; about 95% of my child psychology students are women.

Further, when I teach a math unit in my curriculum class I am always appalled that the only math activities for young children that my students know and use in their programs are counting, labeling geometric shapes, and "writing the numbers."

Why does any of this matter? It matters because more and more of our students struggle with math; further, it is very, very clear that the foundation of future math ability and dispositions is a sound grounding in math during the early years. Our children are not getting this!

Nature versus nurture

Any discussion of math and gender in contemporary society immediately elicits fierce debate regarding nature (those who claim boys are hard-wired to be able to learn math) and nurture (those who advocate there are many things we should do to increase the math ability of all of our students). But, from observing the overall nature/nurture debate in the scientific community, two things are clear:

- Almost everything has a biological component (many even argue that criminal behavior and aggressive tendencies are biologically based); and
- Almost everything can be improved by maximizing the environment (Berger, 2006; Berk, 2006).

The latter is where we should concentrate. How can we use the environment to maximize the mathematical abilities of all of our students? This includes increasing parental expectations of the impact of effort on math ability, as opposed to relying solely on innate ability (Stevenson, Lee, & Stigler, 1986). Here are a few suggestions. None of them, unfortunately, are easy!

Eliminate content standards in early childhood programs

Studies show that children who play with unit blocks in early childhood do better in algebra in middle school. But it's important to note that the outcome of playing in the block area is not demonstrated until middle school! Math standards during the early years will automatically focus on low level, rote skills: memorization, repetition, and adult views of math knowledge. What makes this most destructive is that young children are operating within Piaget's preoperational stage, which means they cannot think logically. Thus, bureaucrats creating standards and assessment often include things that children this age simply cannot even do.

Meisels and Atkins-Burnett have criticized the National Reporting System used by Head Start (2004). While this is an assessment, not a standard, it is clear that "assessment is driving curriculum" in many early childhood programs. In fact, in one Head Start I visited they were actually rote-teaching responses to this assessment; in another program the entire curriculum was developed around the Head Start Outcomes. Standards are based on a step-wise approach to learning, with the next step always being the objective — even if it is developmentally and otherwise inappropriate (i.e., kindergarten entrance skills) (Wardle, in press).

Meisels and Atkins-Burnett point out that the NRS focuses on isolated academic skills, skills not expected until school-age, and narrow labeling and memory skills, as opposed to underling concepts, precepts, and structures. Finally, this assessment encourages the use of curricula that support passive transmission of knowledge, instead of creative and active learning (2004). Criticism of high-stakes tests — the backbone of standards — is complex. The major problem is that these tests are based on faulty learning theories that focus on fancy psychometric concepts of reliability, validly, criterion reference, task analysis, and behavioral norms, while ignoring the critically important concepts of child development, culture, and each child's individual and complex learning schemas (Nitko, 2004).

One of the critical ways cultures differ in this country and around the world is in gender role expectations and behaviors.

Use a variety of ways to build a large body of knowledge in young children

Math knowledge and dispositions are not created in a vacuum. Math is about manipulating things: objects, shapes, concepts, and relationships; reproducing and documenting the world; and constructing, building, and estimating. The Reggio Emilia philosophy and the Project Approach understand this clearly (Wardle, in press). Thus, we must provide a myriad of opportunities for young children to have direct, concrete experiences in the real world. What is the value of discussing the speed of light if you don't understand light? Seeing snow accumulate day after day is a real way to understanding increase in quantity. Carrying a large boulder teaches about mass; swinging on a rope about force, angles, and speed. Field trips, extensive classroom projects, exploration in nature (Friedman, 2007), extensive use of the playground, observing the weather, etc., must all be central to our math curricula (Wardle, 2003).

Focus on play, exploration, and constructive approaches to learning math

Homer Simpson would call this the D'oh! for early childhood experts! But, with the current focus on discreet academic outcomes and pushed-down curricula, we are losing sight of this mantra. We have a wealth of scholarship that illustrates what math education should look like at the preoperational age (Kamii, 1985; Piaget & Inhelder, 1958). We must return to this approach: play, discovery, manipulation, constructing knowledge through interacting with the environment, and developing a positive disposition to ordering, patterning, predicting, estimating, figuring out a system, etc. (NCTM 2000). A positive disposition towards math must be developed during the early years.

Empower minority communities

We also must explore issues of sexism, including in minority communities. The other day I was enjoying a family picnic and observed a seven-year-old girl climbing a tree. Her African American mother immediately told her in no uncertain terms to climb down. I good humorously inquired, "What's wrong with her climbing a tree?" to which her mother replied, "Girls don't do that!" One of the critical ways cultures differ in this country and around the world is in gender role expectations and behaviors. While respecting these cultural differences, we must find ways to enable all children to become successful in math during the early years, regardless of their sex and ethnicity. We must passionately counteract the stereotypes that only white and Asian boys can be good at math. There are some excellent math and engineering organizations for female, minority high school students, but this is often too late.

A good friend of mine, George Brantley, runs a program for young, gifted African American children. He related to me that he believed once he built his program "they (parents of gifted children) would come." But, to his surprise, they did not. "It seems that minority parents have little problem allowing the system to identify their children with a special need or disability" he commented, "but they don't want their children singled out as being gifted!"(Wardle, 2003). Similarly, the mother of a gifted minority child moved him to a university-based, predominantly white program because his Head Start would not adapt to meet the needs of her gifted son.

Explore ways to address gender stereotypes in the classroom

Interestingly, many of my early childhood students have often asked me, "What can I do about a boy who only wants to play in the block area?" But they never ask me, "What can I do with girls who only want to play in the housekeeping area?" There is considerable evidence that girls spend more time in art, dramatic play, and literacy activities in early childhood than they do in science and math activities (Sanders, 2002;

Wardle, 1991). This is partly because women teachers are more comfortable in these activities. We must find ways to encourage all children in our programs to engage in a variety of activities — literacy, dramatic play, physical activities — and math and science! And I don't mean counting activities or work sheets; I mean the kind of activities that we know develop a solid foundation for later math success (NCMT, 2000).

Teach prospective early childhood teachers how to teach math to young children

All colleges offer basic math classes. And the teachers are excellent at teaching adults, but they know nothing about teaching math to young children. In our community college we teach emergent literacy, the arts in the curriculum, special needs, and occasionally music and physical movement classes. But we don't teach how to teach math to young children. It is particularly critical that we prepare early childhood teachers — including future elementary teachers — to teach math to preoperational children, because they do not think in traditional mathematical ways.

Pay early childhood teachers and caregivers equal to K-12 teachers

Three realities today require that we move as quickly as possible to place early childhood teachers and caregivers on the same salary and benefit scale as their K-12 counterparts: 1) the accumulated brain research unequivocally documents the critical importance of the early years (0-8) to future school success, and the central role of human interactions in optimum brain development (Shore, 1997; Lally, 1998). If we believe this to be true, we must then pay staff who have such an important task; 2) Gronlund (2006) points out that as early childhood standards (and assessments for these standards) have proliferated, we have experienced considerable misuse of these instruments because teachers are not adequately trained and prepared in these areas; and 3) in many public school buildings Head Start and state-funded early childhood programs operate side-by-side with the traditional K-12 programs. However, in almost every case the early childhood professionals are paid less than their K-12 counterparts. This results in lack of respect from K-12 teachers, parents, and from within the early childhood profession.

Recruit more men into early childhood

This topic has been covered by many authors (Cunningham & Dorsey, 2004; Fagan, 1996; Neugebauer, 1999; Sanders, 2002; Sargent, 2002; Wardle, 2004). It won't go away! Added to the many common reasons for including men in our programs is the increasing evidence that not only do men and women provide different kinds of stimulation and interactions with young children, but that young children seek out different interactions from men than from women. Women tend to provide support, nurturing, comfort, and basic needs; men provide play, stimulation, and excitement (Cohen, 1998; Lamb, 2000; Parke, 1996). Our children need both!

Conclusion

In many cases math is the forgotten discipline in early childhood programs. Because a solid math background is critical for so many well-paying careers, this is a situation that must be addressed. It is particularly a concern for children who tend not to do well in math: girls and minorities (except Asian boys). A concentrated effort must be made to rectify this deplorable situation.

It is particularly critical that we prepare early childhood teachers — including future elementary teachers — to teach math to preoperational children, because they do not think in traditional mathematical ways.

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Using Beginnings Workshop to Train Teachers

by Kay Albrecht

Ouch!: Wardle identifies gender stereotypes as a big hurdle for early childhood teachers (particularly female ones) to overcome. Explore how comfortable teachers are with math and science as compared to dramatic play and literacy. To do this, set up some meaningful math and science activities for teachers to explore during a staff meeting. After the exploration, discuss comfort levels, applications, and seek to uncover subtle biases. Talk candidly about what you discover during this conversation. Then, explore ways to make changes.

Creative and active math learning: The challenge is to plan and implement meaningful, active, and creative math activities that embrace the way preoperational children think. Start with the basics of understanding what the preoperational stage as proposed by Piaget is. Get the book *The growth of logical thinking from childhood to adolescence* (Piaget & Inhelder, 1958, New York: Basic Books) if you don't know or look in any child development text book for a summary. Then, take the list on p. 56 (manipulating things; reproducing and documenting the world; and constructing, building, and estimating), and start brainstorming ideas and looking in resource books for suggestions.

Knowledge is power: If you and your staff need to know more, find some of the references and tackle them even if they look too hard. Use a reading club format to get teachers interested and on board.