Assessing "Research-Based" Curricula

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Preschools are being required to use research-based curricula. This paper reviews math curricula for young children and demonstrates that the research on which curricula are based vary in quality.

Most early childhood programs are being asked to choose curricula that are "research based." This requirement is the result of increased attention to children's academic needs as they enter kindergarten, and has the potential of improving our delivery of curricula to young children. However, the meaning of "research based" has not been delineated. Therefore, most publishers of curricula for young children have adopted the language, and identify their programs as "research based." A careful analysis of the underlying research of three important math curricula could help practitioners make more informed choices. This analysis will also provide a list of criteria for selection of other early childhood curricula, which will require practitioners to take a brief look at the type of research that purports to provide the research base for the curricula.

Each of the following analyses will include a brief summary of the goals and structure of the math curriculum, a summary of the researchers' history in research in math in early childhood, a brief review of the type of research that directly support the use of the curriculum, and an evaluation of the potential effectiveness of the curriculum, based on observations of classrooms using the curricula.

Pre-K Mathematics (Klein, A., Starkey, P., and Ramirez, M., 2003) is a scripted math program for four year olds. Its primary goal has been to close the gap in math achievement between low-income children and middle class children. Much research has documented this gap, which exists as children enter school and grows as children progress through school. These researchers have demonstrated through several years of careful research that their curriculum can begin to close this gap (Starkey, Klein, and Wakeley, 2004).

Pre-K Mathematics has a clearly delineated scope and sequence. The scope and sequence is carefully connected to the development of mathematical concepts that are needed in formal math education in elementary school, concepts that low-income children often lack. The lessons are designed to be presented to very small groups of children for short periods of time. The lessons are supported with daily math activities that are plentiful in the children's environment.

These researchers have many years experience and long lists of published research that document achievement gaps, math concept development, and demonstration projects in math achievement. Starkey, Klein and Wakeley (2004) have field-tested this curriculum for at least five years. The classroom teachers in their studies have had continuous training, close supervision, and much success with children. In one year of instruction children using the *Pre-K Mathematics Program* have nearly closed the conceptual gap between themselves and middle class children entering kindergarten (Starkey, Klein and Wakeley, 2004).

Children using this curriculum have been observed using the language of math in free play situations. They use counting and organizing in their classrooms. Children have been observed building three-dimensional shapes and naming sides, faces, and angles of those shapes. The children enjoy their lessons, seem proud of their accomplishments, and are having a lot of fun in the process.

Many early childhood practitioners when introduced to this scripted curriculum are uncomfortable with the structure of the lessons. Many practitioners have deemed "scripted curricula" as not developmentally appropriate. Developmentally appropriate practices (Bredekamp, S. and Copple, C., 1997) encourages teachers to teach children concepts that they are ready to understand, in ways that enhance

children's social/emotional development as well as cognitive development. I believe through observation that this curriculum can be both effective and developmentally appropriate.

Big Math for Little Kids (Ginsberg, H, and Greene, C., & Balfanz, R. 2002) takes advantage of the fact that young children are really excited by big numbers. Additionally, these authors believe that a lot of repetition is necessary in the early years to support children's development of early math concepts. They promote rote counting and recognition of numbers to 50 for four year olds, and the use of a number chart that begins with zero instead of one as do most number charts. All of their activities promote fun, movement oriented activities in both large and small groups. *Big Math for Little Kids* is not as scripted as Starkey, Klein, and Ramirez's curriculum, but it does follow a scope and sequence that matches children's cognitive development. The curriculum kit comes with an excellent teacher's guide in a binder with suggestions for daily large and small group activities. The instructions to teachers also recommend that teachers repeat concepts when children are struggling to learn them, perhaps with new activities. The curriculum kit includes story-books for the teacher to read many times each, and individual coloring books of the stories for each child in the class.

Herbert Ginsburg is a cognitive research psychologist who has written hundreds of articles and many books on the subject. He is considered among the most prominent of cognitive psychologists in the country. He is well known for his views on the importance of listening well to children's thinking using clinical interview techniques. He has conducted many research projects on mathematical reasoning of children, and educational strategies. Carole Greenes has similar credentials. She has studied mathematical reasoning in children from preschool through high school. She has written more than 200 articles and books on the subject. Robert Balfanz is an expert in translating educational research into classroom practice. These researchers make a powerful team of experts.

Big Math for Little Kids has been field tested for four years. The tests demonstrate the effectiveness of the curriculum (Ginsburg, Greenes, & Balfanz, 2004). Subsequent to initial field-testing the researchers developed teacher-training programs aimed at improving the quality of instruction using the curriculum. The curriculum is more effective when teachers have specific training in its use. The curriculum is currently under study in New York as a comparison to other math curricula in current use. Data from those studies should be ready by 2007.

Observations of classrooms using this curriculum demonstrate that children and teachers have fun, and are able to focus on repetitive activities by using body movements, songs, and other activities.

Building Blocks (Clements, D., and Sarama, J., 2003) for early childhood has been imbedded in the complete curriculum of *DLM Early Childhood Express*. For those looking for a math curriculum that stands alone, *Early Childhood Express* may include more than is wanted. However, the math curriculum includes a scope and sequence that matches developmental trajectories as researched by Sarama and Clements (2004). Additionally, this curriculum has a computer program that follows the scope and sequence, and in my opinion advances children's reasoning ability in ways that traditional lessons cannot (Clements & Sarama, 2003; Clements & Sarama, 2002; Sarama & Clements, 2002). Soon *Building Blocks* will be available from SRA/McGraw-Hill in a stand-alone curriculum.

The Clements/Sarama curriculum emphasizes playful, real life activities, as well as geometry which has been promoted by the National Council of Teachers of Mathematics as being nearly equal in importance to number skill. The computer games follow the hands-on activities, in order for children to cognitively make the jump from realia to symbols. Dr. Clements emphasizes the importance of doing activities with objects first, introducing computer games after children have begun the process of learning the concepts with realia.

Doug Clements has been researching children's cognitive development as it relates to math development for many years. The number of research based articles he has written about this subject is in the hundreds. His area of expertise has focused on math development and computer enhancement of cognitive development. Julie Sarama also has an impressive research background in mathematics, computer programs, and professional development in early childhood education, having published more than 100 articles.

Observations of children using this model are impressive. Classrooms are infused with math concepts emanating from traditional classroom activities and common early childhood experiences. Children who use these basic conceptual understandings to play the computer games are able to use symbols in new and meaningful ways. For example, I observed children building stairs, and parquetry type puzzles on the computer. I believe the cognitive advancement that is made comes from the need to use symbols to achieve the final results. Children must click on symbols that represent rotation and flipping in

order to fit the pieces in the right spaces. Having to click on the symbol and then execute the action requires the child to imagine the action and outcome, rather than using simple trial and error movement which occurs when children do this activity with actual puzzle pieces. I believe that the use of the symbols of the computer to create the action causes the child to be more conscious and aware of the processes of flipping, and rotating.

Building Blocks has been in field testing for at least six years, and the findings of the research are very positive (Sarama & Clements, 2004). Teachers who are in this study receive training, newsletters, and access to authors of the curriculum. Children who have had the opportunity to use this curriculum are well prepared for kindergarten.

Conclusions

The research-based curricula described here have the potential to provide preschoolers with a math curriculum that can prepare them for the more structured lessons of elementary school. Most professionals agree that a curriculum is only the beginning of the process. Children also need teachers who are sensitive, responsive, and knowledgeable about development and the concepts that children need to be successful in kindergarten. Teachers who have a deep appreciation for developmentally appropriate practices will be able to employ these curricula to the advantage of the children in their classes (Bredekamp & Copple, 1997).

Questions that administrators and other professionals may want to keep in mind as they choose research-based curricula for their students are:

1. Do the authors have extensive research background in the field?
2. Has the curriculum been field tested for at least several years?
3. Does the scope and sequence match what is known about children's developmental trajectories?
4. Can the curriculum be matched to current curriculum standards?
5. Can the curriculum be implemented in developmentally appropriate practice?

The above curricula meet and exceed all of these criteria. There are certainly others that do as well. However, not all of the curricula that are on the market will meet these criteria. Some may have been written by practitioners who are not as well versed in children's conceptual needs as the above authors, or who do not have the extensive research background that the above authors have. Early childhood professionals are currently being bombarded with marketing of "research based" curricula that may or may not meet the high standards we would like to set for ourselves.

Finally, I believe that early childhood professionals need encouragement to choose a research-based curriculum. Much research has been focused on young children's math learning ability, and a great deal is known about the scope and sequence of curricula presentation. It is difficult for the classroom teacher to keep up with the best research available. The curricula described here, support the teachers' efforts to provide up-to-date lessons that are developmentally appropriate.

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