Educating for the Future: Connecting Early Childhood in the Year 2002 to the Workforce of 2020

Helping All Children Develop a Broad Range of Skills that will Prepare Them for Later Competencies in Science, Math, and Technology

Developmentally appropriate practice (DAP) has been established as a standard for early education classrooms. Yet there has been little exploration on how best to adapt science, math, and technology education to the DAP model. However, preliminary research indicates that children's play, a key element of DAP, is one way to connect children with science, math, and technology.

The idea of play as a valid form of education was first described in 1826 by Friedrich Froebel, “the father of the kindergarten,” in his book *The Education of Man*. In this work, he presents a view that play “is the primary mode of learning for children; that understanding occurs through meaningful and multisensory experiences with the world.” This mode of learning can be referred to as meaningful play—a form of play where the teacher creates an environment through which children can learn.

**Learning Through Play**
There is mounting evidence that learning occurs naturally during children’s play. It has been observed that during preschool free-play time, children spend about half of their time engaging in mathematical activities such as classification, exploring dynamics/change (addition, subtraction), numeration (counting), magnitude comparisons, spatial relations (both in terms of and apart from navigation), and the creation and exploration of shapes and patterns. Young children are good at discovering mathematical concepts about the world around them. Even without particular teacher guidance, children engage in meaningful play as they build with blocks, put together puzzles, and discuss the world around them.

**Manipulatives**
If children are going to learn about science, math, and technology through play, then they need to be provided with playthings that will fuel their inquiry.

Educators do not know precisely what makes a good
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Manipulative, though they do know that some manipulatives succeed in transmitting information, thus allowing children to experiment, while guiding their thoughts in productive directions. One can, however, figure out the traits of a good manipulative by watching children play/interact with different objects. Manipulatives should be designed with an eye toward mathematical concepts. Another successful characteristic of manipulatives is pleasing aesthetic design—clean lines and attractive colors tend to draw children to the material. These aspects may also serve to increase interest in the manipulative, particularly on the part of girls.

Computers
While manipulatives are considered critical for early childhood classrooms, computers are another type of "hands-on" educational tool that may also be used to encourage technology education. Computers may be perceived to have some advantages over manipulatives. To those who do not have training in child development, they may appear to be more "serious" than manipulatives.

Computers should not, however, replace manipulatives in the classroom. Young children need to focus on multisensory and three-dimensional learning experiences.

Young children go through a developmental stage of "magical thinking" in which they cannot always distinguish what is real and what is fantasy. Computer programs often add to the sense of "magic"—for example, a seed can grow into a flower within seconds. Still, having children become familiar with the computer can provide an advantage for those entering the workforce in the year 2020. In doing so, however, software needs to be carefully chosen and developmentally appropriate.

Learning through play is consistent with DAP and useful particularly in the study of mathematics. However, there remain some implementation questions related to the teacher's role. For example, to what extent should the teacher control the activities available to children? Should the teacher's role be to set up a stimulating, colorful, and diverse environment or should she plan activities for children to participate in these environments? And if the activities are planned, should the teacher intervene to make sure that children participate in them?

While the role of play with manipulatives has been firmly established, there is still more to learn about implementation issues in the early childhood classroom.