Blackbox in the Sandbox: The Decision to Use Technology with Young Children With Annotated Bibliography of Internet Resources for Teachers of Young Children

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Many forces and trends help shape the early childhood curriculum. These are usually accompanied by a variety of conflicting theories of development and learning. Some topics appear to provoke more controversy than others; the use of technology with young children ranks high on the list of provocative topics. There is no doubt that technology is an important aspect of education today, but there has been much debate about developmentally appropriate uses of computer-based materials and techniques with both preschool and primary school children.

CURRENT ISSUES IN EARLY CHILDHOOD EDUCATION

A report issued by the Alliance for Childhood Education, a child-advocacy group in Maryland, created headlines by demanding a halt to the introduction of computers to classrooms until more research is conducted on their educational benefits. The group stated that computers have had no proven effects on children and that they may be both physically and intellectually harmful to children under the age of 11 (Cordes & Miller, 2000). Though the editors of the report admitted that they don't really understand the effects

computers have on children, their alarmist approach (Newsweek, 2000) and their claim that they have documented the facts (p. 1) will no doubt empower anti-technology advocates for years to come. The group's report follows the typical rhetoric of impassioned believers—some of whom for years have stirred a variety of pots that involve either technology or the education of young children. Though seemingly well intentioned, their causes sometimes have attracted groups and participants with views closer to the edges of the societal spectrum than mainstream thought. The notion that research is needed in this area is well founded, but the report ignores some important research and makes the same kinds of sweeping assumptions that the group castigates others for delivering.

There are few facts and many opinions about the use of computers by young children. Some people say that they instinctively know that technology—whether television or computers—is not good for young children. Others worry that their three-year-olds will not be accepted at Princeton if they are not computer literate by four. How should teachers approach these all-too-common responses? How can they bridge the gap between these divergent beliefs?

Evaluating current research on appropriate practice with regard to technology use with preschool and primary school children gives teachers a basis for making decisions. Being able to separate myths from reality and irrational beliefs from common sense provides some security and comfort as teachers reflect upon their current teaching practices and develop rationales for their pedagogical choices.

RESEARCH AND APPROPRIATE PRACTICE

Research on appropriate practice regarding the use of technology with preschool and primary school children is a continual debate. The literature provides parents and educators with as many beneficial effects as it does harmful consequences for using computers with young children. Each side can be seen as an extreme, either advocating that all children should use computers or that no child under a certain age should use a computer. A middle-of-the-road approach is more reasonable and realistic in our technological world. Children quickly learn to use the technology they experience in their daily lives (National Association for the Education of Young

Children [NAEYC], 1999). Age appropriate computer use can enhance children's learning experiences and provide interesting ways to strengthen curriculum.

COMPUTERS AND COGNITIVE DEVELOPMENT

Teachers should be able to use technology reflectively and effectively. Examining a young child's cognitive development is the key to understanding age appropriate computer use. Then, exploring the types of computer activities available to young children will help us determine what will suitably develop the child's mind. From birth to the age of three, a child's brain is developing rapidly and real, three-dimensional objects offer the best learning experiences (National Educational Technology Consortium [NETC], 2000). The NETC (2000) has provided critical questions a parent or teacher can ask when evaluating whether a child is ready to use computers at this stage of development:

- Do images and events on the screen represent experiences that have meaning for children?

- Are children able to make connections between what is on the screen and what is in the real world?

- Do children really understand who controls the computer, or are they randomly hitting keys (p. 1)?

For the child younger than three, computer use may be premature if the answers to these questions are negative. Mastering an understanding of real world relationships is necessary before children begin to experience technology. This is a key ability to look for in children before allowing them to use computers.

The constructivist theories of Piaget (1971, 1972), Bruner (1966, 1973), and Vygotsky (1978) permeate early childhood education. The idea that knowledge is constructed through social interaction appears throughout their research. Theories of child development also provide a basis for deciding when computer use is appropriate. Piaget, a developmental psychologist, realized that young children think much differently than older children, but

not because they are less intelligent (Huitt & Hummel, 1998). He discovered that children, from the ages of two to seven, are in the preoperational period. During this stage, they began to sort and classify objects as well as draw inferences about the relationships between objects. In this stage of development, children use words and symbols to communicate and manipulate their environment in order to learn. As their linguistic abilities increase, pre-schoolers formulate and articulate more complex thoughts and ideas (Dwight, 1999). However, preoperational children do not think logically and have difficulty rearranging their thoughts (Huitt & Hummel, 1998). It is recommended that early childhood teachers teach at a level that is not ahead of the children's development.

Children learn by doing and by thinking about what they are doing. The learning experience therefore needs to be at an appropriate cognitive level. Children in this stage also explore new roles while developing simple, problem-solving abilities through creative play (Dwight, 1999). The use of concrete experiences is suggested so that children can manipulate objects and interact with their environment. Piaget's stages are a guide for both parents and teachers when making decisions about which kinds of computer activities are best for young children.

Clements (1999) wrote that very young children have shown comfort and confidence using software that creates an environment for learning. Children who use developmentally appropriate software are engaged in creative play, mastery learning, problem solving, and conversation (NAEYC, 1996). The child is in control of the experience and is able to manipulate the speed and actions of the software. Children can also repeat an activity as often as they like. This aspect of computer use is important to understand and explain to parents, because it places the child in a position of control that is developmentally appropriate.

RATIONALE FOR USING TECHNOLOGY

We are in the midst of a cultural revolution created by the computer. Unlike film, television, and early attempts at computer integration into the classroom, computer-based technology has become the engine that runs most of the necessary machines and conveniences in our lives. A position statement by NAEYC (1996) reported that early childhood educators need to be

prepared to use technology to benefit children because technology plays such a significant role in American life today.

Teachers at all levels need to be able to defend their pedagogical practice with regard to the use of technology. They should be able to present a rationale to parents and caregivers for the educational methods they employ. Too often teachers use techniques without knowing why they are using them. As children use more technology, and as it fills our homes and lives, we produce change at a rapid pace. Technology use by young children is becoming more widespread each year. Early childhood educators need to critically examine the use of technology and learn to exploit the advantages it has in the classroom. Douglas Clements (2001) reminded us "Computers …open new and unforeseen avenues for learning" (p. 2). Our job now is to implement and assist this learning.

 However, questions remain about how technology can best assist the learning process and what types of learning should be facilitated, because not every use of technology is suitable (Clements, 1999). A repeated concern is that computer use will replace many of the crucial learning experiences such as play, music, and art that are provided in an early childhood curriculum. Technology can be used to support children's developmental needs when time is not taken away from foundation skills (NETC, 2000). Another fear is that children will become isolated and less social if they use computers. Clements (1999) was quick to dispute this myth by maintaining that "children prefer to work with a friend rather than alone and they foster new friendships in the presence of the computer" (p. 2). It was also noted that more natural peer helping occurs when children are using computers. Vygotsky told us that when children are exposed to the perspectives of another, whether a child or an adult, the experience may be built upon or scaffolded so they are able to reach a new level of development. Computer software has a direct impact on the types of social interactions that take place around the computer. Some computer software packages promote social dialog between children, create group problem solving situations (NAEYC, 1999), and provide an environment for scaffolding to occur.

DeVoogd (1997) stated that early childhood journals usually offer warnings about how not to use the computer rather than providing recommendations for good practice using the computer with young children. Clements (1999) suggested using open-ended programs to encourage collaboration and drill-and-practice software to foster turn taking. Software that allows children to

paint and draw, design things, create picture stories, or think logically, and recognizes children as constructors of their own knowledge is developmentally appropriate and child responsive. However, some software packages can create an environment of competition and aggression. Many computer games exhibit these qualities. Both teachers and parents should be aware of this possibility and be encouraged to read software reviews and try out software products before purchasing them.

THE COMPUTING ENVIRONMENT

The physical environment around the computer also effects children's social interactions. Having extra chairs around the computer, easy access to the computer, and good visibility at the computer can enhance the social development taking place (NETC, 2000). It is important to point out that much of the benefit from computer use at an early age is derived from the interactions children have with adults or older peers that help them learn. Clements (1999) recommended:

> Placing two seats in front of the computer and one at the side for the teacher so the teacher can encourage positive social interaction. Placing computers close to each other can facilitate the sharing of ideas among children. Centrally located computers invite other children to pause and participate in the computer activity. Such an arrangement also helps to keep the teacher participation at an optimum level (p. 2).

With this physical layout in mind, teachers can provide the beneficial aspects of social interaction that computer use can create. It has been reported that computer activities produce the best results when combined with appropriate off-computer activities. Keeping computers physically in the classroom is generally recommended today rather than isolating them in labs. Seymour Papert (1993) told us that computers in labs have little impact on learning and less on educational practices. A colleague of Piaget, Papert (1980) also believed that learning results from one's interaction with the environment. They both saw learning as a constructive process in which the child has to play an active role.

We have allowed technology to enter our lives, and change the way we live, communicate, and learn. Our charge now as teachers is to adapt to

these changes. We need to adopt methods and strategies that exploit this change in our lifestyle, culture, and learning.

We should know why we are using technology, plan for its use, and understand that to use it effectively, we must begin to incorporate other, newer pedagogies. Collaboration, critical thinking, and concrete learning experiences help to make computing a worthwhile, developmentally appropriate activity for young children. The following suggestions will help early childhood teachers and parents who want to use technology with their young children:

- monitor the quality of the software children use,

- regulate the amount of time a child works on the computer,

- use all the senses when working on the computer by providing real-life experiences that match those being learned electronically, and

- provide greater amounts of time for manipulation of physical objects in balance with some time on the computer.

All activities should be done in moderation. The child's attention span will usually determine the length of the activity.

INTERNET RESOURCES FOR THE EARLY CHILDHOOD CLASSROOM

Internet access for early-childhood professionals can be beneficial for professional development, communication, gathering and exchanging curriculum ideas, and for obtaining games, pictures, sounds, and sites to use with young children. Many early childhood classrooms don't have computers or Internet connections (Jacobson, 2000). Though some may question the use of technology by young children, its benefits for teachers are myriad. Pictures, sounds, animations, and "virtual" visits to zoos, aquariums, and special places like the White House or the forest where Pooh lives can provide concrete experiences that bring to life many topics of interest to young children.

We've developed a list of special places for early childhood teachers to visit on the Internet. They will direct you to a variety of activities and free

resources that will enhance your classroom activities, bring the world to your students, and offer personal and professional development. This technology primer for the Internet will provide guidance for using computers in your early childhood program.

ANNOTATED BIBLIOGRAPHY OF EARLY CHILDHOOD INTERNET RESOURCES

Lesson Plans and Activities

Quia: Where Learning Takes You
http://www.quia.com

Quia gives teachers online tools to create, customize, and share learning activities. Quia provides a variety of educational services, including a directory of thousands of online games and quizzes in more than 40 subject areas, templates for creating 12 different types of online games (i.e., flash-cards, matching), and free teacher home pages.

Carol Gossett's Kindergarten Connection: A Network of Educational Resources and Materials
http://www.kconnect.com/

The Kindergarten Connection is dedicated to providing valuable resources to primary teachers. The site provides teachers with innovative hints and tips, fun and practical lesson plans and activities, and a children's book review section.

Kathy Schrock's Guide for Educators
http://school.discovery.com/schrockguide/

This is one of the best educational sites on the web for teachers and school personnel. It is an easy to use, categorized list of sites useful for enhancing curriculum and professional growth. It contains links to lesson plans, teaching tools, a clip art gallery, and a puzzle maker.

Early Childhood Literacy Project
http://www.mcps.k12.md.us/curriculum/littlekids/

The instructional focus of the project is to integrate technology into instruction and increase early childhood students' skills in reading and writing. Great lesson plan that use technology are presented with examples of student work.

Edupuppy – Everything for Early Childhood Education – Preschool to Grade 2
http://www.edupuppy.com

Edupuppy houses a wonderful grouping of resources for teachers and parents of young children. Everything describes the more than 40 topics that have portals at this site. Materials for all curricular areas are included.

Crayola: The Power of Creativity. It Starts Here
http://www.crayola.com/

The educator section features lesson plans, new art techniques using familiar products, Crayola Dream-Maker, and an area to publish student's stories and poems on crayola.com. Crayola Dream-Maker provides exciting hands-on lessons linking math, art and other subjects through design projects.

PBS Teacher Source
http://www.pbs.org/teachersource/

This site contains 1,400 lessons and activities, including ones related to the popular "Arthur" stories. At this site teachers can search for lesson plans that are correlated with national and state curriculum standards.

Idea Box: Early Childhood Education & Activity Resource
http://www.theideabox.com/

Idea Box provides teachers with numerous activities, ideas for crafts, songs and games to use in the classroom. Each day a new idea is posted and teachers can subscribe to a free weekly newsletter through their email address.

Education World: Early Childhood: Play Time
http://www.education-world.com/early_childhood/play/index.shtml

This specialty site focuses on early childhood playtime and provides resources on free play and ideas about dramatic and creative movement activities. These resources include articles, lesson plans, game ideas and reviews of other related sites.

PBS Teacher Source
http://www.pbs.org/teachersource/prek2.htm

More than 2,500 lesson plans and activities for preK-2 educators. Monthly themes, current issues, and professional development opportunities are also included.

DMOZ Open Directory Project – Reference: Education: Early Childhood
http://dmoz.org/Reference/Education/Early_Childhood/

The Open Directory Project is the largest, most comprehensive human-edited directory on the Web. Under the category of early childhood education, the directory contains links to magazines, mailing lists, organizations, class web sites, and web guides.

Story Arts Online
http://www.storyarts.org/

The art of storytelling and its importance in the classroom is rationalized on this web page. Lesson plans, activities, articles and a curriculum ideas exchange are all available.

The Kids on the Web: Children's Books
http://www.zen.org/~brendan/kids-lit.html

This site houses a number of links to literature sites for children, including author's homepages, online books and poetry, and places for children to exhibit their work. The list applies to children ages 3 to 18.

CLWG: Children's Literature Web Guide
http://www.ucalgary.ca/~dkbrown/index.html

The Children's Literature Web Guide organizes the abundance of Internet resources related to books for children and young adults. This site has compiled a list of book awards from various sources, provides resources for parents, storytellers and teachers, and houses discussion boards with tips for helping readers and lists of conferences.

Sea World/Bush Gardens Animal Information Database
http://www.seaworld.org/

Teachers can find educational resources such as lesson plans, games and activities relating to sea life and habitat at this exciting site. Students can access an animal sounds library and listen to a variety of animal sounds.

Specialty Sites for Pictures and Sounds

Microsoft Clip Gallery Live 2000
http://www.microsoft.com/clipgallerylive

Clip Gallery Live provides over 120,000 graphic images and sounds, including photographs, Web animations, and clip art. Teachers can use clip art to enhance their communications to students and parents in printed documents, on the Web, and in presentations.

The Amazing Picture Machine
http://www.ncrtec.org/picture.htm

This site is a NCRTEC index to a numerous graphical resources on the Internet. Teachers can learn how pictures and other graphic resources might be useful in a classroom and find sample lesson plans demonstrating picture use.

TeacherFiles.com
http://www.teacherfiles.com/index.htm

This web page is filled with resources, ideas, activities, lesson plans and clip art for teachers. Educators are encouraged to work together to develop and expand on effective curriculum by sharing ideas.

Clip Art Review
http://www.webplaces.com/html/clipart.htm

This site contains clipart organized by category including education, animations and sound bites. Teachers can use these images and sounds to enhance learning projects.

Sites for Teachers to Use with Children

Dr. Seuss's Seussville
http://www.randomhouse.com/seussville/

This is Dr. Seuss's playground in cyberspace. Students can play games, chat with the "Cat in the Hat," win prizes and find out about new Dr. Seuss books, and CD-ROMs.

Preschool Coloring Book: Let's Get Ready to Color
http://www.preschoolcoloringbook.com/

This site provides teachers, parents and preschoolers with a number of printable coloring pages, online coloring pages and journal topic pages, which preschoolers use to draw pictures to express how they feel.

SchoolExpress.com
http://www.schoolexpress.com/

Teachers can find online learning fun for students including crossword puzzles, word finds, jigsaw puzzles and more. Teachers can access free worksheets in most subject areas including thematic units and treasure hunts and download hundreds of free educational software programs in subjects such as math, phonics and language arts.

Education 4 Kids: An Internet Resource
http://edu4kids.com/

Learning is fun at this site that contains drill games in math and language arts, including flash cards for young children. Teachers can also access reading lists of children's books classified by grade level.

ZooNet
http://www.zoonet.org/

If you are developing curriculum about animals, ZooNet will provide you with animal pictures and zoo galleries. It is a time saving site useful for creating early childhood materials for home and school.

White House for Kids
http://www.whitehouse.gov/WH/kids/html/home.html

Socks, the cat and Buddy, the dog take kids on a tour of the White House. Children can learn about where the White House is located, the history of the White House, historical moments of the presidency and kids in the White House.

The Official Berenstain Bears Website
http://www.berenstainbears.com/

Students can find many fun learning activities including an interactive storybook, puzzles and mazes. Students can also visit the post office and email any book character they choose as well as view videos of their favorite bears.

Sesame Workshop—Homepage
http://www.ctw.org/

Pre-school children can find games, stories and other activities to learn from on this site. Students can email Sesame Street characters and build their own web page.

Professional Organizations and Professional Development for Teachers

AmeriCorps Early Childhood Technical Assistance Center
http://nccic.org/amercorp/ectac.html

The Early Childhood Technical Assistance Center provides free resources to encourage quality early childhood programs in the United States. Here, you can access a wealth of information and activities to ensure quality preschool education.

Association for Childhood Education International (ACEI)
http://www.udel.edu/bateman/acei/

ACEI promotes and supports the optimal education and development of children, from birth through early adolescence in the global community. They also influence the professional growth of educators and the efforts of others who are committed to the needs of children in a changing society.

Early Childhood Organization Inc.
http://www.echo.asn.au/

This organization is a group of educators whose prime concern is the education and welfare of children aged from birth to eight years.

Educational Technology Integration – Sun Associates
http://www.sun-associates.com

Sun associates provides evaluations, technology assistance and workshops for educators. Focuses on the evaluation, integration and development of technology in classrooms.

Idaho Early Childhood Education Network
http://www.iecenet.org/

The IECENet was established to meet a wide range of information needs of early childhood education professionals, providing education resources, as well as professional development opportunities for teachers, child care providers, and administrators working with young children, birth to eight years of age, and their families.

NAEYC/Apple Early Childhood Internet Resources
http://ali.apple.com/naeyc/default.shtml

The page contains web resources that have been recommended by presenters at the 1998, 1999 and 2000 National Association for the Education of Young Children Annual Conference. This Early Childhood Weblinks project has topic links such as anti-violence, child development, discipline, professional development, technology and much more.

National Association of Elementary School Principals Hot Topics—Early
Childhood Education
http://www.naesp.org/hot_hot_early_chld.htm

This site contains research pertinent to teachers and school administrators
about P-3 education. Links to topics like curriculum, program development,
practices, readiness, family support services, and technology are provided.

National Association for the Education of Young Children
http://www.naeyc.org/

NAEYC is the nation's largest organization of early childhood professionals
and others dedicated to improving the quality of early childhood education
programs for children from birth through age eight. The site contains links to
important information for early childhood professionals.

National Early Childhood Technical Assistance System
http://www.nectas.unc.edu/

NECTAS is a national technical assistance consortium working to support
states, jurisdictions, and other groups to improve services for young
children with disabilities and their families. The consortium is composed of
the following six organizations: Frank Porter Graham child Development
Center, Federation for Children with Special Needs, Georgetown University
Child Development Center, National Association of State Directors of
Special Education and Zero to Three.

National Institute on Early Childhood Development and Education
http://www.ed.gov/offices/OERI/ECI/

This site provides information about the Institute and the research and
development centers it sponsors. It describes current research projects,
provides access to a quarterly newsletter entitled "Early Childhood Update,"
gives updates of the ECI Working Group, provides lists of related resources,
and announces upcoming conferences and events.

World Association of Early Childhood Educators
http://www.waece.com/waece/index-in.htm

This organization was created so teachers around the world could exchange
experiences and foster contacts and collaboration among early childhood

educators. The organization is a resource center, with records of pedagogi-
cal initiatives in early childhood education and their results.

References

Bruner, J. (1966). *Toward a theory of instruction*. Boston: Little, Brown.

Bruner, J. (1973). *The relevance of education*. New York: W.W. Norton.

Clements, D. (1999). Young children and technology. In American Association
for the Advancement of Science (1999) *First experiences in science, mathe-
matics, and technology.* Retrieved April 27, 2000 from: http://
www.project2061.org/newsinfo/earlychild/experience/clements.htm

Clements, D. (2001). First experiences in science, mathematics, and technology:
Young children and technology. In *Project 2061: Dialogue on early child-
hood science, mathematics, and technology education.* Retrieved November
11, 2001 from: http://www.project2061.org/newsinfo/earlychild/experi-
ence/clements.htm

Cordes, C., & Miller, E., (2000). *Fool's gold: A critical look at computers in child-
hood.* College Park, MD: Alliance for Childhood. Retrieved June10, 2001,
from: http://www.allianceforchildhood.net/projects/computers/
computers_reports_fools_gold_contents.htm

DeVoogd, G.L. (1997). Young child. *Proceedings of the Eighth International
Conference of the Society for Information Technology and Teacher Educa-
tion, USA, 1*, 1334-1338.

Dwight, V. (1999). A guide to raising kids in the information age. *Parenting,
13(9),* 101-116.

An extreme reaction. (2000, September 25). *Newsweek.* Retrieved September
19, 2000, from: http://www.msnbc.com/news/

Huitt, W., & Hummel, J. (1998). *Cognitive development.* Retrieved September
12, 2001 from: http://chiron.valdosta.edu/whuitt/col/cogsys/piaget.html

Jacobson, L. (2000, January 12). Early childhood professionals ponder value of
Internet access. *Education Week* Retrieved April 27, 2001 from: http://
edweek.org

National Association for the Education of Young Children (NAEYC) (1996).
Technology and young children: Ages 3 through 8. Retrieved September
19, 2000 from: http://www.naeyc.org/about/position/pstech98.htm

National Association for the Education of Young Children (1999). *Technology
and young children: What parents should know.* Retrieved July 16, 2001
from: http://www.naeyc.org/resources/eyly/1996/09b.htm

Northwest Educational Technology Consortium (NETC) (2000). *Early connec-
tions: Technology in early childhood education.* Retrieved July 16, 2001,
from: http://www.netc.org/earlyconnections/

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New
York: Basic Books.

Papert, S. (1993). *The children's machine.* New York: Basic Books.

Piaget, J. (1971). *The science of education and the psychology of the child.* New York: The Viking Press.

Piaget, J. (1972). *To understand is to invent.* New York: The Viking Press.

Vygotsky, L.S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.