

Technology in the Primary Curriculum

Common Understandings

Children use language, investigative processes, and technology as their primary learning tools. Language tools include reading, writing, listening, and speaking. Investigative processes include problem-solving, reasoning, exploration, and interpretation. The tools of technology include not only computers but also a variety of hardware: printers, cameras, video recorders, cellular phones, scanners, and hand held devices along with appropriate software applications. Each technology tool, individually or in combinations, may be applied in a variety of purposeful settings that include both teacher-planned activities and activities initiated by children (Nebraska Department of Education, 1999).

Consider how children's multimedia journals might encourage emerging literacy skills. Children's storytelling might begin with artwork, either created directly on the computer or drawn with crayons and paper and then scanned into the system. A child could then narrate her story into the system using a microphone and play back the soundtrack, modifying it until it was satisfactory. Written text might be added to the system by either the teacher or the child and linked to the spoken words so that clicking a mouse on an individual word screen would call up the child's own voice. These "story files" could then be stored and shared with other children and parents. Telecommunications allow communicating the "story file" to grandparents on the other side of the world.

Adults must utilize their intellectual energy and creativity to advocate for appropriate uses of technology in the hands of young children. Teachers may then guide young children's natural curiosities with extended activities planned to promote authentic work and real world problem solving. Despite revolutionary advances in the field of educational computing, technology remains simply a tool. "Potentially powerful and stimulating, the computer is only an inert object that never can be a substitute for the personal touch of the classroom teacher" (McKenzie, 1998). How teachers use technology in their schools is critical. Without proper integration of these tools into the curriculum, the benefits of technology to foster children's learning cannot be fully achieved.



Jamie McKenzie (1998) states in an article for *The School Administrator* that teachers will welcome new technologies into daily use when schools pay attention to a few simple lessons.

- Make learning goals very clear
- Identify the classroom opportunities for integration of these tools
- Provide extended funding and commitment
- Emphasize robust staff development, adult learning, and the creation of a supportive culture

- Combine rich information with powerful tools
- Match rigorous program assessment to learning goals/standards and student indicators/benchmarks

McKenzie further explains how technology expectations are to be written into the curriculum guides. Every curriculum document should identify learning experiences and strategies, which require the use of new technologies. For example, “Language arts curriculum must state clearly that students in second grade right up through the end of high school will compose 10–15 papers annually using word processing software in combination with rich electronic information” (McKenzie, 1998). Social studies and science curriculums name the opportunities for analysis of data, global e-mail partnerships and investigations using electronic information. “It is not about training, it is about learning” (McKenzie, 1998). Teachers need to discover personally the power of the new technologies combined with rich information. They also need a support system in the form of mentors, coaches, or just-in-time help which often does more to promote risk taking and growth than formal class offerings.

The research of Rachel Cohen (1999) with young disadvantaged preschoolers in Paris, France shows that the learning potential of very young children is enhanced when the children have opportunities to interact with the computer and work in small groups. They were able to discover and build written language. But first we must give students basic skills to become efficient users of technology tools.

Cohen also offers suggestions for structured, relevant introductions, including lots of teacher guidance, and student opportunities to apply those skills to accomplish the content goals. A balance is always healthy when considering technology tools versus other learning tools. Selection is based on which tools make the work easier for each individual student. It is through our best collective efforts that research and design for interactive technology will offer valuable opportunities for young children’s learning and development.



Equity of Access

Parent and active community participation in school planning processes provides a diverse perspective on meeting the needs of all students. It is only when equity of access to the tools of technology is addressed that all students can attain their highest potential. Ongoing, total-school assessment and evaluation, accomplished through the lens of the community allows the school to be strategic in budgeting, purchase, and staff development to support technology needs.

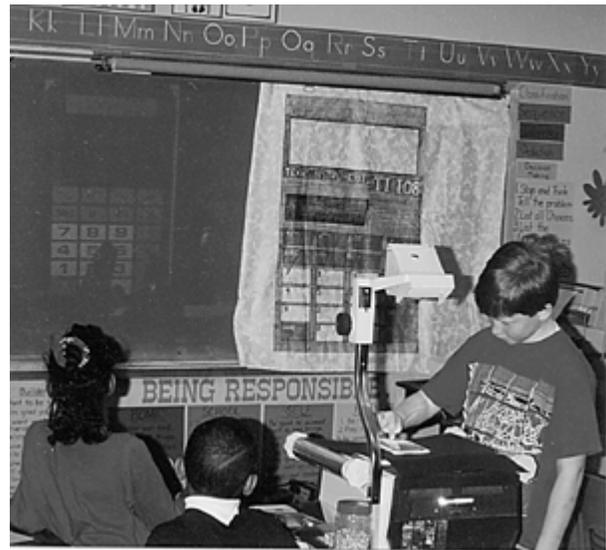
As school districts require student achievement to be measured against essential learning goals, teachers, administrators, parents and community must reach consensus on what is to be learned.

These plans become the guidelines for preparing students to enter the next academic challenge or the world of work. When the essential learnings are used to generate quality standards and indicators / benchmarks, the gaps found between what we teach and what is learned becomes apparent. When priorities for meeting the needs of all students are established, budgeting for the acquisition of multiple tools of technology becomes one piece of the puzzle for improving schools and increasing student achievement.

Integrated Curriculum

Teacher use of technology tools in teaching models applications of technology to authentic tasks. Students involved in planning research will incorporate the use of technology when it is a part of the classroom environment and all share equal access regardless of their individual adaptive needs.

When technologies are integrated into the curriculum as vital elements of instruction to solve real problems dealing with important issues, children gain the ability to use them as natural tools for learning, just as they would a pencil, chalk, or paint brush (Shade & Watson, 1986). To maximize the potential of all tools of technology they need to be viewed on the same level with the other instruments of instruction.



One of the ways teachers plan for integrated curriculum, teaching, and learning is by pursuing projects inspired by children's interests and curiosity about the world around them. During these projects children build competence in identifying criteria for quality work, planning and carrying out activities in meaningful ways, and reflecting on work to evaluate learning.

Curriculum which is inquiry based and problem-solving focused is the basis for learning in the context of the child's world. When students learn based on what they already know about a subject and what they want to learn about that subject, and when they reflect on what they have learned by communicating that learning to others, authentic learning has been accomplished. Tasks have meaning for children when they are based on solving authentic problems which relate to real world issues. Students who function as explorers, researchers, engaged learners, and problem solvers make lasting meaning and achieve authentic learning.

When children help set the goals for learning based on what they want to know, there is no question about clarity. Teachers then can incorporate the standards and benchmark/indicators of each subject area into that project. There is no reason the student should not know the expectations for learning as the planning develops. Students can contribute to planning activities for their learning as well as creating rubrics for a quality piece of work. In this students learn reflective practice, self assessment, and evaluation of processes and products.

Technology-powerful classrooms have been shown to have positive effects on the instructional process on basic and advanced skills. To be effective technology must become part of the whole educational environment. Studies have shown these kinds of gains made by students (Bialo & Sivinkachala 1996; Dwyer, 1994).

- Exploration and representation of information was expressed dynamically and in many forms
- Students interacted more socially when working in pairs
- Students communicated effectively about complex processes
- Students became independent learners and self-starters
- Students knew their areas of expertise and shared spontaneously
- Students used technology routinely and appropriately
- Writing skills increased
- A better understanding and broader view of math was obtained.
- Students gained an ability to teach others their new knowledge.
- Greater problem solving and critical thinking skills were obtained (Kosakowski, 1998).

Teachers are better able to assess whether new methods/strategies are making a difference for children when they observe or listen to children. Children have unique learning styles which must be addressed in multiple modes, and students also communicate knowledge in multiple ways. The tools of technology increase the opportunities for presentation of knowledge through modes most beneficial to the individual learner. Never before have the choices of demonstrating knowledge been so plentiful. Technology also can assist a teacher in recording information on teaching strategies, observations, student activities, social interactions, for district assessment.

Strategies and methods of teaching are enhanced through use of technology. For example, teachers can use multimedia presentation devices, video cameras, digital recorders, scanners, tape recorders, computers, or CD-ROM to present information, model its use for students, apply new knowledge, record observations, document learning, interpret results, self assess, report to parents, administrators, or the public, communicate with



colleagues, or take a virtual visit around the globe. Students can be challenged to think and talk about which strategies helped them and ways they could use these same strategies to communicate their knowledge to others.

Equity requires that we rethink the way we look at and use the resources we have now. Some schools have for example redirected a major part of their textbook budget to purchase new technology. Today's CD-ROMs can replace some of the outdated printed materials, particularly reference materials or out-of-date textbooks. What are you willing to give up or trade for more technology dollars? Are the benefits grounded in solid philosophies about how children learn and the part technology plays in assisting them in forming higher-order thinking skills and problem solving versus accumulation of information, facts, and data without processes to determine usefulness and application. Young children learn so much from experiencing their environment we must be concerned about technology becoming the only source of information to the exclusion of meaningful experiences with persons, places, and things first hand.

Adaptive Needs and Accommodations

Some children have individual needs which require adaptive accommodations. Software and hardware allow the teacher to create customized, open-ended activities for individual learners. Customized boards, setups, and overlays can be made with text, sound and icons to help with communication, reading, and writing skills. Other areas which benefit from a customized adaptation might include: positive guidance, English Language Learners, daily living, and vocational skills. Teachers can get in touch with organizations in their areas to see what is being done. An Alliance for Technology Access (ATA) Center is a great starting point. This is a group of parents, consumers, and professionals who work to help children and adults with disabilities gain access to the benefits of adaptive technology. (Their web site is: <http://www.ataccess.org>)

Educational applications of technology to meet adaptive needs facilitate the following goals for children:

- Encourage movement for development of fine motor skills by use of input accommodations, for example, switches and touch screen
- Improve range of motion with specific response adaptations
- Train visual attending, gaze shift, tracking, scanning by use of specific software for visual impairment
- Develop auditory attending skills for hearing impaired students
- Develop receptive language skills for language delayed or English Language Learners
- Develop the ability to follow directions by use of both language versions of software
- Provide a means to use expressive language in composing and recording stories
- Discourage inappropriate behaviors by providing positive reinforcement
- Provide positive reinforcement for target behaviors by careful selection of software
- Provide opportunities for peer interaction and turn-taking
- Provide environmental control of computer use area to facilitate engaged learners

- Provide age-appropriate recreation / leisure activities through software selection
- Provide opportunities to learn and respond to specific content by use of accommodations in input or output devices

Example of Integrated Learning with Technology

When all of this information is merged, what does a technology-literate classroom look, sound, and feel like?

The following example is adapted from one described on the web site for *The Project Approach* (Gibson, 1999). It begins with the children's observation of an ant colony near the school which prompts lots of questions about ants and their activities. Encouraged by the children's natural curiosity with the following questions: "Why do ants travel in single file?" "What do ants eat?" "Do ants come from eggs?" "Why are they here now?" the teacher may respond with, "How could we study about ants?" Some responses might be:

- We could watch them.
- We could put food out for them.
- We could make an ant farm for them.
- We could watch a video about ants.
- We could look at books about ants.
- We could search the Internet about ants.
- We could find someone that knows a lot about ants.



These comments indicate a high level of interest and readiness to learn. The children use paper and pencil to record observations of the colony. Some children choose to draw pictures of what they see. Some want to take some ants inside for observation. Others want to move the whole colony inside. The investigation has begun! The teacher and associates record the conversations children are having during their observations of the colony. Children and adults talk about what is observed. Questions are asked. Each question raises more questions. After all questions are recorded on a chart, the team discusses ways to find the answers to their questions. During this process the teacher is planning ways to enrich the children knowledge.

Activities

- Purchase an ant farm for in the classroom observation
- Do a search on the Internet
- Take a virtual visit to the Smithsonian to see the types of ants that exist
- Observe outside and find the accurate name for the ants we see
- Use a software draw program to record observations
- Invite the park ranger in to talk about the ants we might find in the wooded area near the school, and invite him to go with us on a field trip to observe

- Record the conversations the children have as they watch the ant farm in the room. “Why are they making tunnels?” “How can they carry such big pieces?” “Why is one ant bigger than the rest?”
- Photograph ant activity over time
- Take a field trip to the farm to observe ants at work in a different location
- Give a presentation to another class on what has been learned through their investigations
- Videotape their presentation to be shown to parents at conference time

When children were asked how do we find out the answers to your questions, a multitude of possibilities became available. Together they decided to find answers to the following:

- How can we record what they do?
- If we put out food, what will they eat?
- Where will they take it?
- Will more ants come to help the others?
- Shall we leave the ants here or should we get rid of them?
- How do we show others what we have learned?

These tasks were investigated. Children recorded information by making drawings of what they saw. They then dictated to an adult what they saw happening. Together a chart was made to show which foods were favorites of the ants, where they took the food, and how they worked together as a team. A book titled “If You Were an Ant” by S.G. Calder was read and reread to the children.

The teacher reminds the child of techniques already taught for recording ideas and information:

- Making a list
- Web
- Draw and label
- Take notes
- Collect key words
- Use headings
- Photos and video
- Models
- Data collection sheets

Library Study Sheet
Information about _____

They live _____ They eat _____

Some of their habits _____

My Observation Sheet
Name _____

I am observing _____

Some things that I see _____

My Information Sheet
A study on _____

What I did _____

When I started _____

What I saw _____

What I think _____

Study was done by _____

The child began the study by using some of the above techniques. Pencil and paper were taken outside to make drawings and take notes. Children lie down in the tall grass outside to try to see things from an ant's perspective. A magnifying glass and microscope aided in detailed drawings. Some drawings were done with crayon and some were drawn in *Kid Pix*. The media specialist helped locate books, CD-ROMs, laser discs and video. A chart was made to show which foods the ants took from the variety offered. The child continued the study at home, involving the family in discussions about what happens when ants come inside the house, and safe ways to get rid of them. The family found additional materials at the public library, and decided to purchase a book at the bookstore for the family library.

They made ant antenna to wear on their heads as they marched to the song "Ants go marching." A short video clip from the NOVA network was shown called "Little Creatures Who Run the World." Children talked about what life would be like as an ant, some dictated stories into the computer to listen to themselves reading it back. More questions kept arising during their work. Why do people poison ants? Are ants good for anything? Do they drink water?



Children became great interviewers of the park ranger. They E-mailed an expert at the Smithsonian with their questions about their specific ants. They still had not answered the question about leaving the ants or poisoning them. They constructed ants from Styrofoam and pipe cleaners. The science teacher provided a microscope for improving detailed observations. Rich drawings and conversations brought forth more knowledge. The magnifying glasses were then taken out to the ant hill as well as used on the ant farm in the classroom. One parent invited the class to come to the farm to visit a huge ant colony. The kindergarten class then invited the first graders to visit and share the information they had gathered. Each child had dictated a story about what he/she knew about ants before and what he/she

knows about ants now. Some students shared their drawings and talked about what it would be like to be an ant. One student with a communication delay took a first grader by the hand and escorted him to the ant farm and handed him the magnifying glass and then took him to the microscope. The first graders had been reading "The Ant and the Grasshopper." When they returned to their room they asked their teacher if they could make a puppet show for the kindergarten students.

After much discussion with the park ranger and the expert at the Smithsonian, the decision was made by the group to let the ants stay where they were. They were not harmful and the poison was dangerous to the environment in many ways.

Parents came for conferences in a week and the children are asked to add a piece of their work to their portfolio that showed how much they had learned about ants, they then described for the parent why they selected that particular piece of work. Children created a rubric for looking at quality in their work or personal reflection. Discovery and literacy development in science, social studies, language arts, mathematics, communication, social skills, self assessment, reflection, and technology, took place during this integrated project.

Activities to balance the project:

- Teacher-created learning centers which are engaging and related to the study
- Children having ample opportunities for free play
- Multiple tools of technology available
- The computer being used to make signs and banners for the dramatic-play area
- A matching game in the fine-motor center providing the concrete understanding for how to use the computer matching game
- Extensions of learning before, during and after the use of technology
- A balance of hands-on, minds-on, engaged learning activities with technology
- A plentiful supply of activities for engaged learning that do not use technology

At the conclusion of any study, it is important for the child to have an opportunity to share the study with others, for example, a teacher, classmate, administrator, another class. Ways of communicating what has been learned may include:

- A *HyperStudio* presentation
- An oral report illustrated with drawings, charts, and models
- Reading a book the child wrote or dictated and illustrated

Hardware and Software

Computers and other equipment for learning need to be in the classroom as opposed to isolated in a hallway or specific room away from everyday activities. Children need to be able to choose the use of such technological tools based upon the work they have to accomplish. When these tools are isolated in laboratory settings for special purposes their impact is minimized. Their use becomes a separate, unrelated subject called “Computer Literacy”. There are multiple ways of using technology within the classroom which direct the type of technology needed. For example, if a computer is to be used in a center for literacy development using Discis books a machine with a CD-ROM is applicable. A classroom may not need every computer hooked up for the Internet if the main use is to be research for group projects. Printers can be shared with a modular grouping of machines. Learning goals should be considered in the selection of hardware and software.

Open-ended software can encourage children to articulate decision making and planning which leads to greater verbal interactions with others (Forman, 1994). Interactive software enhances the decision-making process, extends math exploration, problem solving, social interactions, collaboration and perspective formation. Some software labeled “integrated learning” may be only a cluster of activities related to a subject area without consideration for development of concepts and goals. Teachers need time to explore, practice with, and plan for the uses of software in relation to

the established goals for learning. Interactive technologies become powerful tools when they are used to create multi-media presentations by students or teachers.

Consider

- Does the software assist students in achievement of high standards within the curriculum?
- Does the software use pictures and spoken instructions rather than written ones so that children can work independently?
- Are children able to control the level of difficulty, the pace, and the direction of the program?
- Is the software created to engage the learner in authentic work for real world application?
- Does the software have a number of different topics at varying levels?
- Do the children get quick feedback so they retain interest?
- Does the program utilize the capacities of today's computers by appealing to children with sights and sound?
- Has the software been previewed or have children been observed using it elsewhere to determine the level of difficulty?
- Are children encouraged to use their imagination and sense of humor?
- Are the children experiencing success and feelings of empowerment?
- In the selection of programs with an element of games, have creative ways been sought to increase the acceptance, popularity, and availability of games that are pro-social, educational, lack stereotypes or violence, and are fun.
- Is the software suitable for this particular student's learning style and needs?
- Is appropriate software available to assist in recording and reporting student progress over time?
- Are there software management programs for teachers and administrators which facilitates the recording and reporting of information to parents and community?
- Are there software selection guidelines or instruments available to assist teachers in making selections?
- Are there publications available which evaluate software selection for young children on a monthly basis?

Internet

Early childhood educators at all levels have begun to use the Internet to communicate and share information. Research suggests that use of electronic networking can help teachers reduce their sense of isolation, connect with peers, and increase their sense of professionalism and autonomy (Honey & Henriquez, 1993). By integrating Internet use into early childhood teacher education programs, teacher educators enhance the experiences of their students and prepare them to be active participants in the global community. By modeling the use of the Internet as a source of learning for the teacher, students encounter technology being used for authentic work.



Safety

Teachers can enhance student success with the Internet by using the following guidelines:

- Adult supervision and close monitoring of young children assures work remains healthy and productive.
- All students need a purpose for their exploration of the Internet. Bookmarks for appropriate sites will facilitate the search.
- Use child-friendly search engines like Yahoooligans, KidsClick, and Ask Jeeves for Kids
- Instruct children in etiquette and vocabulary for the Internet.
- Instruct children to never give their home addresses, telephone numbers, or names without permission from parent or teacher. This would include the name of their school or child care setting.
- Instruct children to never send a photograph to someone you meet on the Internet without permission from parent/teacher.
- Instruct children to never agree to get together in-person with someone you meet on the Internet without permission from parent.
- Limit the amount and time of day children are allowed online. Bookmark favorite sites for appropriate exploration.
- Instruct children to tell you if they receive an inappropriate message or material that is uncomfortable to them.
- Invest in software that provides protection from material which is offensive. Internet service providers may already have systems in place.
- Equipment placed in the area where other class members are present promotes interaction
- Become a side by side co-learner with the student.
- Teachers need an awareness of access to web sites created for the visual and hearing impaired learners as well as adaptive devices for children with other physical, mental, or learning disabilities.
- Instruct children in how to assess quality and accuracy of information.
- Get to know the persons your children are interacting with on the Internet to facilitate positive communications and reduce potential risks.

Districts should consider:

- Fire walls for the school network
- Internet screening software filters for installation on individual machines that provide for screening by location site or URL, by key words, or by use of limiting search engine software

Internet access and use brings further discussions about what is needed to assist students in meeting the essential learnings. Districts become charged with establishing acceptable use policies for maintaining the safety of students. Acceptable use policies should be adopted by the school and community. Instruction in this policy can then be provided for staff, students, parents, and community. By providing continuity in all environments where young children encounter Internet access educators are better able to plan for their safety.

Implications for Future Research:

Advances in computers, communication, and other information technologies have the potential to transform how teachers teach and students learn. Coupled with an improved understanding of brain development in the early years and learning, technology has the potential to improve the quality of education and training available to Americans of all ages (Griffin, 1999).

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