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ABSTRACT

This report reviews the skills and attitudes students need for success in today's technology-oriented workplace. The several facets of technological literacy are first clustered into three broad categories: attitudes or generic skills, applied skills, and specialized skills. Attitudes or generic skills are accuracy and precision, anticipating needs, creativity and imagination, critical thinking/problem solving, ethical standards/confidentiality, lifelong learning/retraining, synthesis of information, systems thinking, and troubleshooting. The applied skills are computation and calibration, layout/design, listening, measurement, speaking, and writing. Specialized skills include evaluation of software, file maintenance, keyboarding, networking, and search and retrieval. In the section that follows, each skill area is briefly defined. Three examples of each skill are presented from various grade levels and subject areas. Space is provided for writing down possible activities to promote technological literacy both in classroom management and ongoing instruction (learning activities). Suggestions for infusing these concepts conclude the report. (YLB)

Technological Literacy Skills Everybody Should Learn

INTRODUCTION

In a series of interviews with employers, NWREL staff have explored various dimensions of technological literacy and what it means in the workplace. After analyzing what others have said about the subject, and asking a group of school representatives for their advice, we have compiled the following approach to defining technological literacy skills all teachers can enhance.

We suggest technological literacy is a combination of skills and attitudes--some very general and others very specific. Almost every work situation today requires a different set of technological abilities, many of which will always be very closely tied to a particular task (e.g., word processing), body of knowledge (e.g., biotechnology) or occupational area (e.g., marketing). Yet, most observers believe jobs of the future will also require a broader set of aptitudes and attitudes that mark the technologically literate worker--skills that sound very similar to the reforms most educational agencies are addressing in the 1980s.

Our research indicates that there are several facets of technological literacy that can be clustered into three broad categories:

1. Attitudes or generic skills that can be taught in any class:

   Accuracy and Precision
   Anticipating Needs
   Creativity and Imagination
   Critical Thinking/Problem-Solving
   Ethical Standards/Confidentiality
   Lifelong Learning/Retraining
   Synthesis of Information
   Systems Thinking
   Troubleshooting

If these skills sound familiar, they represent what effective teachers in effective schools have been emphasizing for years. With high interest in how young people are being prepared for the year 2000, perhaps it's time to make these outcomes intentional and not accidental. If the public (particularly parents) see what schools are doing, they may be even more supportive when it's time to buy hardware and software, provide equipment and materials and offer their expertise on how the workplace is changing.

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2. Applied skills requiring direct instruction as well as practice under various conditions:

Computation and Calibration
Layout/Design
Listening
Measurement
Speaking
Writing

In this domain we can respond to the critics who say students are acquiring plenty of theory today, but have few opportunities to give their knowledge the test of reality. Not every teacher will be able to spend time on each of these skills, yet students will remember most skills they've used in as many different situations as possible. If these insights can occur in an interdisciplinary fashion, so much the better!

3. Specialized skills that may require the expertise of someone who knows what to do and how to teach it:

Evaluation of Software
File Maintenance
Keyboarding
Networking
Search and Retrieval

This is where most teachers are not afraid to ask for help. Just about every school has someone who knows bits from bytes, and there is a growing number of organizations with resources to offer.

So how does this come together for a teacher already besieged with more demands on time than ever? For example, a district-wide language arts task force should pick a few of the most relevant technological skills that can be strengthened in English classrooms. Then it's up to the individual teacher's own creativity to help students make the technological connections later on. What we're talking about is comfort in using these skills daily, not just a one-time demonstration that is soon forgotten.

The local district language arts task force examining technological literacy skills might devise a list such as this:

WHAT MAKES A PERSON TECHNOLOGICALLY LITERATE	WHAT WE CAN DO IN LANGUAGE ARTS TO PROMOTE TECHNOLOGICAL LITERACY
Generic Skills/Attitudes	
Accuracy	Neatness in written work, proper grammatical usage, correct spelling
Planning Ahead	Helping students develop personal schedules for timely work completion, including reading and preparation
Creativity/Imagination	Helping students think through nontraditional approaches to a required project
Ethical Standards	Holding a discussion on why copying a copyrighted work is a problem
Lifelong Learning	Talking about how and why people read books and enjoy TV, movies and plays as a balance in their lives and as a way to learn new things
Systems Thinking	Putting on a class play requires team work and coordination of many tasks

Applied Skills

Writing	Helping students express themselves in a cogent style
Speaking	Encouraging students to speak clearly and forcefully in both individual and group situations
Layout/Design	Organizing a report or project so that written elements and illustrations are pleasing to the eye

Specialized Skills

Evaluation of Software	Discussing with students the advantages and disadvantages of using software to correct spelling errors
Keyboarding	Encouraging students to utilize a personal computer in preparing and revising written work

In the section that follows, each "skill" area is briefly defined, followed by three examples from various grade levels and subject areas that we have gathered through actual school observation and discussion. In the right column is your chance to speculate on possible activities you can do to promote technological literacy both in classroom management and ongoing instruction.

1. Attitudes or Generic Skills

The following are attributes employers often place highest on their lists of desirable work maturity traits. Whatever we can do to reinforce these skills will smooth the pathway in an everchanging work world.

In this column, note ways your teaching can reinforce each technological literacy skill:

Accuracy and Precision: With time and equipment worth thousands of dollars at stake, even simple procedures in a technology-oriented workplace must be done with exactness and close attention to detail. Carefully following directions is critical.

Classroom Management:

Examples:

Learning Activities:

- Teacher requires exact headings on written assignments and good punctuation.

- Math teacher asks students to use calculator to check the steps in their problem solving.

- English students describe hidden messages on TV to practice observation skills.

Anticipate Needs: New use of resources requires the ability to think ahead and make specific plans.

Classroom Management:

Examples:

- Band members submit plans for making up class assignments before concert tour.

- Consumer finance class prepares personal budgets each month.

Learning Activities:

- Teacher and students list all information needed and related costs before sending electronic messages to sister school in Japan.

Creativity and Imagination: Most computer-based systems are vastly under-utilized because users seldom think big enough or "different" enough in developing or modifying a system or applying it in new ways.

Classroom Management:

Examples:

Learning Activities:

- Fifth graders adapt software for a computer-based classroom recordkeeping system.

- Eighth grade homeroom brainstorms solutions for student tardiness.

- Student government suggests new ways to involve all students in extracurricular activities.

Critical Thinking/Problem Solving: Information is often easier to get with technology, but its effective use requires careful sorting out of options.

Classroom Management:

Examples:

Learning Activities:

- Teacher continually asks why, how, what are alternatives?

- Students list pros and cons of stricter grading policy.

- Math students must show two real-life applications for a newly-learned calculation.

Ethical Standards/Confidentiality: **Security and privacy must be maintained as information becomes more available.**

Classroom Management:

Examples:

- Social studies students list kinds of identifying numbers that are kept on them or their family.

Learning Activities:

- Student council conducts hearing on who should review grade point averages of class officer candidates.

- Computer science class develops software security code for student athletic records.

Lifelong Learning/Retraining: **Change will continue to make yesterday's technology and practices obsolete, requiring us all to continually update and learn new skills.**

Classroom Management:

Examples:

- Elementary students identify 5 health-related occupations that did not exist 10 years ago.

Learning Activities:

- High school students complete a learning style inventory to identify their preferred methods to acquire information.

- Second year metals technology students interview experienced machinists who are attending a Skills Update Seminar at a local community college.

Synthesis of Information: **Compiling and analyzing and "boiling down" information is essential as problems become more complex and data more accessible.**

Classroom Management:

Examples:

- First graders compile list of pet names and omit duplicates.

Learning Activities:

- Fifth graders interview different sources for opinions on same subject and write summary.

- Drama teacher suggests individual report on trends in local civic theater production.

Systems Thinking: Technology's potential can be under-utilized unless users see the "big picture" and put related elements together in a logical sequence.

Classroom Management:

Examples:

- Third graders create greeting card manufacturing company with all students holding a job to move products to customer.

- Junior high student body officers prepare flow chart to schedule activities leading to Winter Dance.

- Biology students observe patterns and probe effects of acid rain on community environment.

Learning Activities:

Troubleshooting: Complex functions in automated equipment will require the ability to follow routines, to check easily overlooked functions and to understand the way things work together for a particular outcome.

Classroom Management:

Examples:

- Fourth graders evaluate each other's written work and make corrections.

- Eighth grade science students track down answers to why aquarium has occasional algae growth.

- Third grade student discovers connectors between terminal and printers had not been plugged in.

Learning Activities:

2. Applied Skills

The following skills were listed by employers as examples of how students will need to make connections between theory and everyday practice. Technological change is so rapid that we all must continually relearn and use "old" skills in new ways.

Computation: Technology can speed up calculations at fantastic speeds, yet input must still be based on an understanding of what the numbers mean and the desired outcome.

Classroom Management:

Examples:

- First graders drill on basic addition using microcomputer program as well as flash cards.

Learning Activities:

- Sixth grade middle schoolers participate in Math Olympics to recognize problem solving.

- Accounting class calculates yields on hypothetical personal investments using classroom terminals with 10-key pad.

Layout and Design: Graphics capabilities on computers invite creativity and imagination in use of proportions, color and other visual techniques.

Classroom Management:

Examples:

- First graders use classroom micro to recreate color book drawings.

Learning Activities:

- Social studies class creates graphs to display population trends.

- High school newspaper staff prepare copy blocks for upcoming issue.

Listening: Careful attention is required, both in face-to-face and in electronic communication interaction, if sender and receiver are to complete the message accurately.

Classroom Management:

Example:

- Third graders play "Simon Says."

Learning Activities:

- Junior high English class identifies cliches and red flags in campaign rhetoric.

- Homeroom class practices paraphrasing.

Measurement and Calibration: Complex problems require the gathering of precise data.

Classroom Management:

Examples:

- Third graders practice measuring classroom objects with a ruler, then build scale model of planets.

Learning Activities:

- Ninth grade PE students plot daily heartbeat and blood pressure readings after 15-minute workouts.

- Metals students adjust machine settings after using micrometer to check projects.

Speaking: Voice-activated equipment is already being used; person-to-person conversations and presentations to groups via telecommunications media will require clear enunciation and correct usage.

Examples:

- Kindergarten students practice proper telephone etiquette.
- Seventh grade language arts students give oral book reports using audio and video recorders.
- Senior world cultures class conducts two-way discussion with sister city high school students in Japan via satellite hookup.

Classroom Management:

Learning Activities:

Writing: Programs generated for computer applications require precise grammatical construction and proper spelling; electronic bulletin boards and mail drops typically limit word counts.

Examples:

- Fourth graders prepare copy for fire prevention poster.
- Middle school students transmit school news through other terminals in district.
- English composition students use word processors in department resource center to prepare term paper.

Classroom Management:

Learning Activities:

3. Specialized Skills

At some point in their school experience, students will encounter the need to master some very specific skills that require instruction from experts. This still means any teacher can create conditions which reinforce these requirements.

Evaluation of Software: We will soon have to be able to select among computer programs available for home and work.

Examples:

- Fourth grade classes conduct survey of favorite video games and why.

Classroom Management:

- High school computer science class reviews technical features of word processing pr grams.

- Social studies classes develop criteria to determine which news sources (electronic vs. print) provide best coverage.

Learning Activities:

File Maintenance: Automation means that data of all kinds can be stored, updated, reproduced, catalogued and cross-referenced with the touch of several buttons.

Classroom Management:

Examples:

- Students organize class notes and work sheets chronologically.

- Seventh grade English/Social Studies class enters family trees and other vital statistics into computer.

- Business education class audits yearbook advertising billings.

Learning Activities:

Keyboarding: Alpha-numeric input devices will work using traditional "hunt and peck," but speed and accuracy are still preferred.

Classroom Management:

Examples:

- Elementary students use "Writing to Read" program on classroom computer.

- Junior high student aide inputs pupil grade information.

- High school students use library typewriters for term papers.

Learning Activities:

Networking: With tele-communications capabilities, machines are now "talking" to machines. Human networks are even more critical, however, as persons seek out "high touch" vehicles.

Classroom Management:

Examples:

- Students in World Problems class interview State Department official by satellite via two-way video.

- Elementary class lists "community helpers" they can call on for assistance or information.

Learning Activities:

- Chess club in one school challenges cross-town rival to computer-match using phone lines.

Search and Retrieval: With databases of all kinds at our fingertips, it is essential to determine what source will meet the need and how to best access it.

Classroom Management:

Examples:

- After teaching how to define the problem, librarian helps students dial up electronic data bases for group projects.

Learning Activities:

- Attendance office uses student aides to gather and enter absences and tardies on microcomputer and run daily printouts.

- High school consumer finance class gathers comparative data on clothing costs from ten local outlets and prepares printouts for school bulletin board.

Next Steps You Can Take

Schools strongly committed to technological literacy will probably go further than infusing these concepts into all classes. Those pacesetting schools will create actual course work that addresses these concerns directly. For most crowded curriculums, however, identifying what technological literacy means and suggested classroom activities will be a starting point.

In addition to holding staff in-service sessions on what technological literacy will mean for the class of 2000, we think that committed faculty should start their own in-school network to promote these concepts. Consider setting up a task force of concerned parents and community representatives to plan and carry out your ideas. And if someone wonders what you're doing to prepare young people for today's technological world, show them a list of activities like these.

Editor's Note

IDEAS FOR ACTION IN EDUCATION AND WORK synthesize information from research and practice on topics of current interest. Other titles in the series include:

Removing Barriers to CETA/School Collaboration (out of print)

Improving Learning in the Workplace

Teaching Independent Living Skills to Youth

Volunteering...Pathway to Paid Employment

Striving for Excellence: Middle Schoolers Study "Work"

Learning Responsibility: The Importance of the Home, School and Workplace

Northwesterners Out of Work: The Human Costs of Unemployment

Northwesterners Out of Work: The Effects of Job Dislocation

Choices for Migrant Youth

Out of the Classroom, Into Industry: Summer School for Teachers

Building Work Skills Through Volunteering

Striving for Excellence: Applications of Successful Business Principles

Technological Literacy: What Industry Can Offer

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