Technology Education for Democracy

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Abstract: Educators use new technologies to support creative expression, to increase literacy, to address special learning needs, to develop students' problem solving skills, and to prepare youth for adult life. Yet, to cultivate democracy, educators should ask whether what they do with computers and other electronic media in education: 1) promotes justice; 2) restores reciprocity; 3) confers divisible or indivisible benefits; 4) favors people over machines; 5) minimizes long-term disaster or maximizes short-term gain; 6) favors conservation over waste; and 7) favors the reversible over the irreversible (Franklin, 1990, p. 126). Favorable answers lie in examples of the use of technology in classroom practice in which: curriculum is based on student themes, learning is socially mediated, traditional discipline boundaries are crossed, teachers and students collaborate on projects and case-studies, and students learn the cultural and political significance of what and how they learn. Technology education for democracy is based on the participation of students and teachers in adapting technology holistically to shape classroom reality.

Resume: Les educateurs utilisent les nouvelles technologies pour encourager ('expression creatrice, favoriser l'alphabetisation, repondre a des besoins particuliers d 'apprentissage, elaborer des strategies de resolution des problemes et preparer les jeunes a la vie adulte. Pourtant, afin de promouvoir la democratie, les educateurs devraient se demander si l'utllisation des ordinateurs et des autres medias electroniques en education : promulgue la justice; retablit la reciprocite; accorde des benefices divisibles ou indivisibles; favorise la personne plutot que la machine; minimise les desastres d long terme ou maximise ies gains a court terme; favorise la conservation plutot que le gaspillage; et favorise le reversible plutot que l'irreversible (Franklin, 1990, p. 126). On obtient des reponses affirmatives d ces questions quand le programme d'etudes est axe sur les themes qui touchent les etudiants, quand l'apprentissage passe par la mediation soclale, quand les limites des matieres tradltionnelles sont depassees, quand les projets et les dossiers sont abordes en collaboration avec les etudiants par les enseignants et enfin, quand les etudiants prennent conscience du sens culturel et politique de la matiere et des methodes d'apprentissage. Pour qu'ii y ait democratie, les etudiants et les enseignantsdoivent modeler la realite dessalles declasse en abordantd'unefaeon holistique l'enseignement des nouvelles technologies.

> As a community we should look at what the new technologies of message-forming and -transmitting do to our own real world of technology and democracy.
>
> *Ursula Franklin*

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INTRODUCTION

The health of democracy depends upon individual, local initiative that shapes political and cultural reality. To preserve democracy and to cultivate cultural richness and diversity, teachers have an important role to play in encouraging student initiative. The methods teachers use, including the application of new information technologies, carry important messages to pupils about the nature of society and their place in it. Technology can be used to direct students' learning or to empower them to direct their own learning. Working with students to adapt technology to support initiative in the classroom is education for participatory democracy, education designed to give students a moral advantage.

This paper provides a framework for examining classroom practice to see how technology is being used to support democratic participation. In this framework, technology is construed broadly as systematic practice and technology education is construed as the weaving of technology into the fabric of the curriculum. Six diverse examples illustrate how various image- and message-forming technologies may be used alongside older technologies to support a holistic curriculum. The framework is based upon ideas articulated recently by Franklin (1990).

We live in a technologically dominated world, a world governed largely by systematic practice characterized by "organization, procedures, symbols, new words, equations, and most of all, a mindset" (Franklin, 1990, p. 12) centred primarily on short-term consumer-driven goals of production and only secondarily on holistic, long-term concern for sustainable growth in a global community. With our minds set on technological detail supporting a comfortable life today, we often act in conflict with human and democratic values that underlie our vision of tomorrow. Thinking critically about examples close at hand is a good way to address the conflict between a production-oriented prescriptive mindset and a growth-oriented holistic mindset.

In her published addresses on the real world of technology, Ursula Franklin chose examples through which to examine critical questions about human endeavor. A deep concern for justice underlies her analysis:

> Central to any new order that can shape and direct technology and human destiny will be a renewed emphasis on the concept of justice. The viability of technology, like democracy, depends in the end on the practice of justice and on the enforcement of limits to power. (1990, p. 14)

The use of message-forming and -transmitting technologies can impede justice and concentrate power by reducing reciprocity in communication. To maintain a modicum of reciprocity in predominantly one-way media, newspapers publish letters to the editor, radio stations have phone-in shows, and local television stations give some air time to local spokespersons. The telephone lends itself well to reciprocal communication, communication in which power and influence is shared. Electronic mail and electronic conferences allow reciprocal communication among small groups with common interests. It is not the media

themselves that lead to reciprocity but the systematic use of the media, the technology of media control.

An important measure of justice in technologically driven enterprise is the extent to which everyone benefits. Government effort that ought to be directed primarily towards indivisible benefits for all — clean air and water, education, health — is instead diverted towards the infrastructure supporting the private sector. Public funds spent on transportation and communication systems and government policy on tarifs and trade favor private interests with loud voices. Individual citizens, those most directly affected by large-scale enterprise, need to understand the technology of reciprocal communication in order that they may give voice to their concerns.

Prescriptive technologies, designed for profit and efficiency, favor *machines over people*. For example, in the early days of the telephone, women who served as telephone operators in small communities, knew the people and daily events. They wove channels of communication that maintained reciprocal communication among citizens. Now their work has been largely replaced by automated switching networks that provide rapid one-to-one links but which have no other role in building community. Automation often reduces the control and commitment of individual workers. The same can be said about curriculum technology in which learners and even teachers feel they have little say about content and methods.

In some large-scale endeavors, affected voices are heard. In the Berger inquiry into the proposed Mackenzie Valley pipeline, authorities listened to those who would be most affected, and sought alternatives designed not to maximize gain but to minimize disaster, to favor conservation over waste, and to favor the reversible over the irreversible. Is public education responding in the same way to Franklin's concern for viable technology in a viable democracy?

In Canadian education, the public expresses its values formally through goals published by provincial ministries of education, goals indicating that teachers should develop in students practical knowledge, resourcefulness, adaptability, creativity, a feeling of self-worth, self-reliance, esteem for others, respect for the environment, and "a sense of personal responsibility in society at the local, national and international level" (Ontario Ministry of Education, 1983, pp. 6-7). More specifically, students taking computer studies courses in Ontario are expected to learn to:

> appreciate the specific benefits and possible problems that have resulted, particularly in Canada, from technological achievement; and to
> - evaluate their own attitudes and values as these relate to the possible uses andabuses of computer technology in society. (Ontario Ministry of Education, 1983, p. 7)

How is public education organized to attain such goals and objectives?

Canadian educators have a technological mindset towards curriculum. The path of curriculum development and implementation proceeds from legislation to ministerial goal setting to preparation of curriculum documents to school board program planning to school course offerings to realization in the classroom. Whatever goals, policies, and directives may be set for teachers, what counts in the final analysis is what teachers actually do. This paper therefore presents particular examples of how dedicated teachers, caught up in daily routines of lessons and evaluation, work in and around existing structures to prepare their students well for participatory democracy.

Students should not be led to think that democracy is a given, nor that the form of democracy we have today is unchanging or unchangeable. They should come to understand that the new technologies of message-forming and -transmitting have become a vital part of the political infrastructure that supports the technological infrastructure. They should come to understand that new technology makes possible new twists to democracy — new means of control and new means of fuller participation; new and tighter hierarchies; new opportunities for destroying the social fabric or for changing its texture, weaving a strong flexible, dynamic web of participation. Certainly, student government and social studies courses contribute to preparation for democracy, but so does participation in shaping the social dynamics of the classroom and in shaping the nature and content of the curriculum. The examples that follow illustrate how various technologies, new and old, have been woven into classroom life to support student participation and student initiative.

EXAMPLES

Example 1. Children as Composers

It is quite common for children to see themselves as authors and artists, but less common for them to see themselves as composers. Children do make their own music and musical instruments, and some even invent their own notation, but rarely are children encouraged in school to compose. This simply is a matter of the expectations and environment that parents and teachers create at home and at school. One of the author's colleagues addresses this problem in her own teaching and research (Upitis, 1990). The technology used in her integrated arts-based education is readily available: selected junk to make musical instruments (elastics and string, plastic straws, pop bottles and their caps, water, copper and plastic pipe), and the usual sorts of art materials for developing notational systems and for related art work. Computers and MIDI-based synthesizers are used to increase opportunities for improvisation leading to composition, and to publish records of students' creative work. In this environment, students naturally take a supportive interest in one another's work and come to see composition as a contemporary activity. How different that is from the common habit of purchasing music to listen to rather than creating it; consumer folk art has displaced participatory folk art.

If Canadian adults had had more experience in diverse forms of artistic expression throughout their schooling, they would raise their voices to ensure higher levels of support both for local artistic endeavor and for internationally admired Canadian cultural institutions such as the National Film Board, the Canadian Broadcasting Corporation, and the Canada Council. The public would invest more in enterprises that provide indivisible benefits, strengthening Canada's identity and increasing its cultural richness.

Through the example of integrated arts-based education, the author makes a special plea for the elevation of the artistic and spiritual (which are inseparable). For the good health of democracy, people must regain their mythical roots and a mystical perspective. If people approached more of their living artistically, they would not see science as a preferred path to knowledge and prescriptive technology as a preferred means of action. Through drama, poetry, art, and music, in all their modern, technologically supported and scientifically studied variants, children learn how better to understand and to love themselves and others.

Example 2. Using Computers to Build Self-Confidence

> The classroom atmosphere is the biggest contributor to building confidence...Computers add a vibrancy to the room. Pupils feel good about themselves and they respect each other as equals. The high interest that develops from working on a computer promotes a sense of worth and a desire to learn. (Blair, 1987, p. 34)

A teacher of a split Grade 7 and 8 class inherited a plethora of personal and social problems — inflated or deflated egos, self-destructiveness, disruptiveness, abrasiveness and rebelliousness, ridicule, racial discrimination, cruelty. She deliberately chose to use the one computer in her class in ways which she felt would enhance the self-image of her pupils. She recognized quickly that they did not want the computer to be held over them as a carrot, but wanted to help each other use it. That was her key. Changes in attitude and behavior were not immediate, but they were clear and lasting.

For each pupil needing special attention, the teacher found a suitable approach. A disruptive, ridiculed bully was allowed to work on his own at programming. Gradually he became a respected expert. A self-destructive child spent many happy hours at the computer tutoring and befriending younger pupils. His work habits improved and the way was paved for an improved relationship with his peers. Another pupil with a huge ego learned patience and gained respect also through tutoring of younger children; he then was able to tutor his peers. The teacher set him to work on a computerized adventure game in collaboration with an underachiever, who gained an unlikely friend and also came to take an interest in the teacher as a person. A bright, abrasive, rebellious pupil began to see herself for what she was through reflection on her interaction with acomputerized board game and with a quiet pupil with whom she was paired. She began to focus on mastering the game and was then able to patiently teach her

classmates, who consequently saw her in a different light. A shy pupil who had failed a grade was always competing with his know-it-all cousin. The teacher sought his technical computer expertise, which led to a more cheerful disposition, respect, and openness. He even became a conciliator in disputes between teacher and other pupils. The teacher used an interactive story-writing program to dissolve a strong clique of four girls. Having to seek the opinions of peers on options at each branch point in the story led to increased cooperation and respect for the opinions of others. Similarly, when teacher-selected groups shared clues and maps in a problem-solving adventure game, unexpected friendships emerged. In each case, the teacher found engaging activities that made her pupils see themselves and their peers in a better light.

The teacher favored people over machines, and healthy personal and social growth over computer literacy. Had her priorities been reversed, the personal and social problems in her class would have stood as obstacles to teaching. Instead she chose to address directly the human curriculum of love for self and others. Individual expertise became something worth having, sharing, and tapping. Students came to teach each other in an atmosphere of caring, interest, and cooperation. The teacher developed a holistic curriculum technology, a technology supporting the growth of a caring community of learners. She adapted her teaching to individual needs and daily exigencies.

Example 3. Designing Software for a Sexuality Fair

Human sexuality is a central part of the real adolescent curriculum, yet do teachers and parents discuss it openly and do students have a role in shaping the sexuality curriculum? A remarkable example arose in the fall of 1989 in a Grade 11 computing course at a high school in a small city in eastern Ontario. In preparation for a school-wide spring fair on sexuality, a family planning counsellor presented the computer science teacher with four interactive scenarios that she asked his class to translate into computer programs. (This was but one way she sought to involve students from many subject areas.) Accepting the challenge, his class changed the whole focus of its enterprise. The teacher became a co-developer, establishing greater reciprocity between teacher and students. Other students not in the course came in to help with art work. Many of the students continued on their own after the course to polish their work for use by the school in the spring. They also felt that their programs could be used by other schools, but their teacher and the counsellor felt that other schools would gain more by undertaking their own software development and so bringing the real student curriculum into the computer science classroom. In this example, students contributed to an enterprise of benefit to the entire school, an enterprise designed to minimize disastrous physical and emotional consequences of sexual activity.

Example 4. A Case For Case-Study

The senior computer studies course in Ontario (Ontario Ministry of Education, 1987) p-.-ovides a framework for student-directed, collaborative project work. Consider for example the first project done by a class under the guidance of their teacher before launching on projects of their own chosing. The school is host to

an invitational track meet, an event that places considerable demands on record keepers. Developing a computer-based system and making it work well was therefore an interesting and realistic challenge for a class.

The course was an opportunity for growth not only in the students. The teacher, originally very skeptical about the course when it was introduced, and wanting a course that was a hard-core programming course, completely changed his view as he began to teach it. Clearly he had to deal with many teaching problems. He had to find effective and fair ways of involving students in distributing grades when working in teams. He had to find ways of encouraging the female members of the class to continue. Most important, he had to develop in his students the discipline they would need to carry out their own projects.

At the end of the course, students talked of their commitment and of the stark contrast to most of their other work in high school. One student who had matriculated but chose to take additional courses to broaden his education before attending university completely changed his attitude towards his work. Students who normally would not be concerned about missing classes would phone the school to say they would be coming even if they were only a few minutes late. The students valued highly having a say in the direction of the course and in doing work that was of direct benefit to others.

For the teacher, each time the course was offered, it had to be re-designed around suitable project opportunities and the interests of the students. The course was an important vehicle of professional development; it was a vehicle for developing a growth-oriented curriculum. The teacher began to adapt what he learned in the case study course to other lower level courses.

Example 5. Home-grown Curriculum: So Chickens Come From Eggs!

Seeing fuzzy yellow chicks break through inside a styrofoam incubator in the living room of a small farmhouse surprised an apartment-dwelling teenager. That surprise surprised even more the student's science teacher, who had brought her class to the farm home where she, her brother, and husband are developing a small organic farm. They are juggling many variables, wanting to develop a market in which they sell organically grown herbs, vegetables, meat, milk, and eggs to local restaurants and individuals or food cooperatives. They also want to make their work a community learning experience through links with the local school board and faculty of education. Their work favors conservation through the technology of sustainable agriculture, a reciprocity with the earth. But that conservation extends to the community as marketplace, thus reducing costs of transportation of produce, and as school, thus ensuring that the benefits acruing to them — the satisfaction of a wholesome relationship with the environment and community — are shared with the community.

Environmental science courses will be offered in the summer and fall, courses in which computers will be used to organize and analyse data, to obtain reference information, and eventually for simulation and dynamic modelling. Of greater significance than the use of computer technology in these courses is the focus on

holistic agricultural technology. Of greatest significance is the teacher's curriculum technology: she has adapted the course for students who have difficulty doing well in the regular classroom but who have practical interests and talents that will serve them well in an experiential education setting.

Example 6. Phosphates In Our River: A Local Contribution to a Global Problem

In a small town on the St. Lawrence River, the system of sewage lagoons drains into a small river opening to the St. Lawrence. The local high school is dealing on several levels with recent concern about phosphate in the water and other environmental issues. First, the school has a history of environmental concern; students promoted recycling before the community officially established a "blue box" program for recycling paper, glass, and metal. Second, the school speaks to the community through a student-produced newspaper funded by local advertising and distributed free of charge to all school families. (The newspaper is produced by students taking a communications technology course.) A group of senior chemistry and biology students and their teachers have begun participation in the Global Lab Project (TERC, 1990), an international project in which scientists, teachers, and students collaborate on research related to ecology and the environment. These students and their teachers work in collaboration with university scientists, graduate students, and government agencies. For example, the students are taking samples for the provincial Ministry of the Environment. They are also involved in the local politics of the problem, and through the political astuteness of their teacher, are learning how to channel their concerns productively. Furthermore, students in technological studies and in computer science are providing support through organization of equipment, technical help with telecommunications, and publication.

Through the energy and enthusiasm of the biology teacher, the entire school is benefiting from resources acquired initially to support participation in the Global Lab Project. These resources include teleconferencing, spectrophotometry, weather monitoring, and most recently, downloading of satellite data. Furthermore, work at the school caught the attention of the federal Minister of the Environment who asked for information that she might use as an example in the House of Commons. This example is important because it shows how individual initiative can be linked to networks of similar initiatives so that local, activity can be of global benefit.

RESTORING RECIPROCITY THROUGH WEBBING

Both of the last two projects mentioned are steps around rigid hierarchies — excellent for efficiently attaining predetermined goals—and towards building up flexible, heterarchical structures needed to cope with ever-changing circumstances, needed to minimize disaster. In both cases, use has been made of computer networking for communication among those most directly involved and

to find out about the work of organizations dedicated to the same philosophy. The networks used are those of a Canadian non-profit computer conferencing service, Web (see reference list), connected to an international network of similar services (the Association for Progressive Communications) linking hundreds of activist, service, research, and educational groups. (Help on Web can be obtained by sending a message to "spider"!) How appropriate that the organization should chose as its name the remarkable structure built by spiders for survival. Buffeted by winds, rain, and passing animals, spiders continue to build and rebuild the webs they need until they die, adapting flexibly to each exigency.

Emerging democracies are showing great interest in international collaboration among scientists, educators, and students on addressing environmental and social problems. Communications networks form a promising, though still crude, medium for making local action globally usefu 1. Scientists who participate in such collaboration are making major shifts in their careers as they begin to see how their specialized expertise can be of direct social and political significance.

INFORMATION TECHNOLOGY, DEMOCRACY, AND EDUCATION

Journalist Patrick Watson in collaboration with scholar Benjamin Barber undertook a five-year quest to tell the story of democracy dramatically in a television series. At the end of the accompanying book (Watson & Barber, 1988), the authors raise basic questions on the direction of democracy, the last of which is whether technology is "freedom's hero or Dr. Frankenstein's monster".

> Technology promises to expand infinitely our capacity to control our environment, and to make and remake the human mind; it can do it in the name of human liberation, or on behalf of coercion and repression... The new technologies free us from the yoke of manual labour by centralizing power and expediting its efficient use, but they do this in ways that destroy the spatial and temporal walls that once created privacy, a sphere of rights, and room to breathe, (p. 267)

The same new information technology that serves institutional control can also strengthen individual voices, voices crying to protect human dignity and the environment. Watson and Barber give dramatic examples of individual enterprise in developing communication networks to generate coherent, effective voices of concerned citizens. In Colorado Springs, "electronic cowboy" David Hughes summons his "Electronic Legions" to debate public issues and influence legislators. Housewives in Zushi, Japan, link into a global communications network to summon the support of ecologists and environmentalists in staving off American incursions into the primeval Ikego rain forest. Technology education for democracy prepares voices in the classroom to build webs of communication that increase citizen participation.

Democracy, with all its inherent weaknesses — the unfairness of all voting schemes, the conflict of the rights of one individual with those of another, tension between individual rights and the common good, problems in accommodating cultural and religious diversity, and the awkwardness of supporting a pluralistic society through majority rule — is the system with which many countries govern themselves. However, the essence of democracy is not a political system of government but a shared disposition and set of values including: an interest in nationhood, law and order, civil rights, cultural diversity and richness, social justice, separation of church and state, and support for ideological pluralism. Its strength depends on an appropriate balance of representation — in which responsibility for legislation and action is transferred temporarily to trusted representatives, e. g. through election and through paying taxes — and participation — in which individuals and groups take upon themselves particular issues or causes. The more students assume genuine responsibility for participation by employing powerful new tools for shaping their school curriculum the more they will see democracy as requiring and benefitting from participation.

The teachers whose work is described in this paper understand the concerns that Franklin (1990) raised and have adopted a growth model for their work in which "context is what matters most." (p. 15). They care about justice, reciprocity, indivisible benefits, people, minimizing disaster, conservation, and reversibility; their cares are expressed in their actions. In basing curriculum on student themes, in supporting learning through social interaction, in crossing traditional discipline boundaries, and in collaborating with students on projects and case-studies, teachers help their students understand critically and constructively how technology, broadly defined as systematic practice, shapes the environment in which they live.

Franklin has raised our concern for justice, a justice coupled not with the power of mass control over megaprojects, but with the power of individuals coping with local exigencies, exigencies of the creative urge, of human relations, of human sexuality, of school life, and of providing safe water and healthy food. It is fitting then to end with a word on power from C. B. MacPherson (1965), after whose CBC Ideas lectures Franklin patterned her own:

> The societies which can best meet the demand of their own people for equal human rights, equal freedom for their members to realize their essential humanity, will be the ones that will survive... In the world from now on, power and influence will depend on moral advantage, (p. 66)
>
> The way to national power will be the recognition and promotion of equal human rights. And the pursuit of these ends will bring an enlargement of individual power as well, not the powers of individuals over others at the expense of others, but their powers to realize and enjoy their fullest human capacities, (p. 67)

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