IDEAS

1. Delivering Content to Achieve Industrial Technologist Performance Behaviors

by John W. Sinn

While this article can stand alone, the reader will be better served to also read the two companion pieces that preceded this one in previous journal issues. They are "Building a Model for Technology Studies," Volume 22, Number 2, Summer/Fall 1996, and "Universal Performance Behaviors: What Ought to Be in the Technologist's Toolkit," Volume 23, Number 1, Summer/Fall 1997. The first article described the model and the underlying rationale that guided its development. The second in the series articulated and identified behaviors that ought to be part of the array of competencies, or behaviors, of all technologists, regardless of their specific professional assignment. The body of thought presented in these three articles has been influenced by the author's work as director of the Center for Quality, Measurement, and Automation (CQMA) in the College of Technology at Bowling Green (Ohio) State University. CQMA's experiences with a number of technology transfer projects for business and industrial clients have contributed much to the refinement of the ideas presented here. Also, participation in the development of an Applied Quality Science bachelor's degree program further tested, refined, and demonstrated the efficacy of the model as did more recent experiences with a research project conducted for the American Society for Quality Control to define core knowledge for technologists. Details and reports of these experiences may be obtained from the author. **JS**

The preceding note refers to the previously discussed model of technology and the behaviors of technologists. These lead to this brief discussion about the content and the organization of instruction thought best to prepare students and trainers to function as effective technologists. The models and the behaviors can be said to comprise a "toolkit" that technologists draw upon in their professional work. This third element, content and organization of instruction, tells us how that toolkit can be outfitted.

CORE KNOWLEDGE

The term *core knowledge* is used in preference to the term *content*. Core knowledge is demonstrated in technologist behaviors that combine appropriate cognitions and appropriate process actions. Thus it is fitting to mix content with active process to educate and train technologists. Five core areas are derived from the model and the technologists' functional behaviors: (a) primer tools, (b) cultural tools, (c) data tools, (d) documentation tools, and (e) synchronous leader tools.

Primer tools introduce and provide an overview of the total technological system. The intent is to provide understanding of the broader system. Problem solving and team building are also introduced. As the name suggests, primer tools should be used in introductory-level courses as a foundation for all other content and knowledge. The logic of the primer tools is to provide the context for micro and macro functions that could occur in various ways within technological studies. There are 12 primer knowledge tools:

- Technology systems and industrial technology introduced.
- Teams, problem solving, change, and improvement in industrial technology and systems.
- Technical foundations for industry and technology.
- Materials and processes.
- Process engineering, design, and innovation.
- Automation and computer integration.
- Maintenance and safety.
- Quality systems.
- Service and training.
- Cost analysis and productivity improvement.
- Technology and management.
- Industrial technology and the future: Local, organizational, and global cultural issues.

Cultural tools are based on the primer tools and provide basic cultural definitions. They deal with the total system for world class organizational functions, technical empowerment, and change. They enable students to understand such things as why we are changing as related to broader market forces and the nature of internal and external environmental issues, among other macro circumstances. These tools form the basis for a robust and rigorous general education course that focuses on issues such as defining technology within the context of organizational mission and philosophy, organizational values and culture, characteristics of technological behavior, global resources, environment and development, technological diversity, and management and decision making as related to technology. There are 12 cultural tools:

- Technological organization and culture: Introduction to the toolkit.
- Evolution of the technological culture: Significant developments and values introduced.
- Characteristics of the technological culture: Kaizen change system for improvement.
- Critical technical and innovative underpinnings: Understanding product and process.
- Quality and productivity issues: Understanding and serving the customer.
- Managing, decision making, and control in the technological culture.
- Data-based improvement and solutions for change.
- Documentation for quality and productivity improvement: Kaizen foundations.
- Technological change, empowerment, and the learning organization.
- Political correctness and ethical issues.
- Environmental and resource issues.
- Soul of Technology: technology transfer, global development, and ongoing improvement.

Data tools focus on data for improvement and provide basic statistical definitions and an orientation to the total system of technical problem solving and improvement. The basic statistical concepts that should be addressed focus on gathering and assuring integrity in data. A first technical course in quality or statistics can bring to bear many of the issues essential for foundations of total quality and international standards. As with other tools, data tools provide incremental focus on building teams for technical problem solving by introducing and applying standard deviation, variable and attribute charting systems, sampling, repeatability and reproducibility, capability, measurement systems, and geometric dimensioning and tolerancing. There are 12 data tools:

- Team skills, organization, and data-driven technical problem solving.
- Brainstorming, root causes and effects, and identifying the problem.
- Basic definitions for data-based improvement, and foundations for improvement.
- Attribute data, histograms, bar and pareto charting: The obvious starting point.
- Variable data, comparisons to attribute charting, and short-run systems introduced.
- Metrology and onspection systems: Basic measurement issues.
- Gage repeatability and reproducibility (R&R), inspection, and measurement improvement.
- Capability analysis, interpreting out-of-control conditions, and SPC in transition.
- Quality characteristics, data-based actions, and systems documentation for ongoing improvement.
- Advanced measurement concepts and systems: Geometric and coordinate considerations.
- 8-D disciplined approach to data and systems-based documentation and problem solving.
- Design of experiments introduced: Enhanced team processes for improvement.

Documentation tools build on basic data and cultural concepts and enable technologists to use basic tools for analysis and problem solving. Systematic approaches to analysis of information and documentation are presented and pursued and are focused on continuous improvement techniques. Derived in part from the previous data set of tools, a broader framework for supplier and customer communication is provided. Tools in this group include costs, flow charting, process documentation, standard procedures, quality plans, failure mode analysis, quality function deployment, mistake proofing, and others. There are 12 documentation tools designed specifically for assessment functions:

- Total quality, world class, and productivity: Foundational Kaizen definitions and functions.
- Basic economic considerations for Kaizen quality and improvement.
- Advanced team skills and approaches: Making Kaizen meetings and teams work.
- Synchronous techniques: Just in time, Kaizen improvement further defined.
- Ongoing process control plan (OPCP): Kaizen systems for improvement.
- Understanding our process: Kaizen foundations.
- Standard operating procedures (SOP): Documentation for Kaizen improvement.
- Failsafing, mistakeproofing, enhanced design, innovation, and the five whys.
- The Kaizen service function: Understanding customer and supplier relationships.
- Benchmarking, evaluation, and measuring our successes.
- Robust Kaizen documentation for problem solving: QFD and FMEA.
- Future documentation: ISO and other concurrent systems considerations for problem solving.

Synchronous leader tools lead to the ultimate of technologist performance. These focus the previous tools more fully toward team-based technical problem solving and leadership and are particularly concerned with infrastructural issues for ongoing improvement in the organization and of people. This set of tools can make up a course that capstones the previous tools. They are intended to present and tie together a myriad of broad issues over the longer term. They focus on how to grow talent for the organization, enable new product developments, and ensure robust quality and appropriate technical support systems. Significant issues to be addressed include how to lead in building systems for using data and documentation in problem-solving teams, synchronizing the myriad of vital functions organizationally and technologically for getting product out day to day in a managed fashion, and planning, developing and re-engineering the organizational culture and talent to meet future demands for competition. There are 12 synchronous leader tools:

- Ongoing improvement, synchronized change: Leadership and implementation.
- ISO and QS 9000, quality and launch systems: Broad relationships for our synchronous future.
- Leadership and supervision for the future: Synchronized quality planning and improvement.
- Enhanced design processes, innovation, and applied research for product development.
- Technical material and process considerations for product improvement and development.
- Synchronized data systems for quality planning and management.
- Advanced product and quality problem solving: Documentation systems synchronized.
- Automation and quality relationships: Data acquisition and communication systems.
- Maintenance functions and total productive maintenance: Maintainability and reliability.
- Safety, ergonomics, and human factors: Improved quality and productivity work environment.
- Growing talent, knowledgable workers, and the learning organization.
- Design of experiments, finite element analysis: Robust problem solving.

Organizing Teaching and Learning

These 60 content tools comprise useful knowledge that can be drawn upon in constructing learning experiences to achieve technologist behaviors. This can happen when they properly are commingled with relevant teaching and learning techniques. Put another way, whenever possible, instruction and training should be structured to provide settings, activities, processes, and situations that closely parallel those that occur in the practicing technologists' environment.

Problem solving and team building ought to permeate the learning process whenever possible. Planning for both long- and short-term functions, knowledge of product and process, and abilities to work at different levels and on teams in cross-functional ways reflect types of technical management issues. Instructors of technology subjects should seek to integrate these elements that are related to professional practice in their courses. In this way the core knowledge will be acquired in a context that carefully replicates professional activities. When so integrated, course or training outcomes in the form of student performance behaviors can be more easily achieved. This is demonstrated in the remainder of this article wherein selected elements of core knowledge are discussed along with teaching/learning modes and critical work contexts that require complex behavioral interactions.

The Technical Cultures

The *technical culture* can be achieved in organizational training programs through indoctrination courses for new employees or in training programs for senior employees. For example, when explaining internal or external customer or supplier functions, emphases could focus on values, civility, political and social characteristics, and other "core" issues.

A recently published case study that describes the use of the 12 data tools for training provides an example of knowledge of cultural issues required for building the technical culture. During the training in data-based tools, it became clear that various cultural issues had to be attended to, including the following:

1. Assisting in developing and nurturing the growth and evolution of teams. This included everything from identifying and writing procedures to actually showing people how to do the procedures.
2. Reinforcing cultural changes associated with empowerment—most people really did not believe that they could/should do things on their own. This is simply a self-confidence issue in many respects.
3. Establishing standard procedures for conduct and protocol for meetings. Simple rules had to be identified and established.
4. Writing standard procedures for collection and use of data, helping to provide the discipline in people to actually do the task correctly, and assuring that variation in process could be seen.

This demonstrated the significance of cultural issues and the reader should be aware that as the changes occurred in learning to use the actual tools, technical infrastructural changes also needed to occur in the culture of the organization (Barker & Sinn, 1997).

Other content also addresses and explains technological functions. In the curriculum this could happen within the technical concentration and may also be acquired in business studies and other areas that provide understanding of how we function and survive in a competitive global marketplace. In the school setting the preceding also occurs under the general education component.

In both training or school settings, students should have reflective experiences that encourage creative thought, diversity, openness to change and flexibility, and other already identified core values. In all of these venues trainees and students should have regular opportunities to enhance communication skills and perform presentation functions that assist in defining culture and reinforce the technical concentration.

Data, Documentation, and Synchronous Leader

Data, documentation, and synchronous leader content is connected to technical teams and are fundamental tools in producing technical solutions and managing change and improvement. The myriad of data and documentation tools are requisite to adequately conduct analysis and assessment functions and for successful problem solving for improvement. While these should be taught directly, they also may be applied in other technical courses and at the team level. Significantly, when documentation and data are managed properly and synchronized with all other functions, they provide the basis for effective leadership and change.

For example, we have found that, it was only after gathering and applying a significant amount of properly documented data that the solution could be brought forward in a meaningful and productive manner for an actual product application for improvement. This also tells us that making critical design improvements for production quality while getting product out the door requires a maturity rooted in data, documentation, and synchronous leader experience.

Team-Based Empowerment and Cross-Functional Change

An empowered environment does not just happen by chance. It must be carefully designed and implemented. It should be based on a strong philosophy and a technological infrastructure. This core knowledge is oriented to change and education. The major impetus behind empowerment is education about the tools required to solve technical problems to achieve quality and productivity improvement. This drives technological change. Here, the technologist is the essential leader for the future, a technological change agent who is critical to cultural competitiveness. Instruction and training would provide for learning in self-management situations, individual and team evaluations, and continuous learning for improvement. These can be structured in such courses and experiences as applied business, the social and hard sciences, mathematics, and statistics.

An exciting elaboration of the team-based empowerment and cross-functional change principles and tools comes from a course taught by this author. It includes the following:

1. Teams of students linked with mentors and projects on campus for internal infrastructural improvement on real projects at the university.
2. Multiphased reports on the status of the projects and applications of the tools are provided and placed on the web.
3. Much of the course and cross-functional teamwork is accomplished virtually electronically with no paper and decreasing amounts of "physical" meetings (traditional classroom time and teams).

Projects have ranged from building better university recruitment systems to defining and analyzing departmental quality systems and from analyzing and improving residence hall services to ordering, storing, and handling of materials purchased for campus operations.

A second example is contained in an undergraduate Total Quality Systems course and a graduate Quality and Reliability course, in which graduate and undergraduate teams are innovatively linked to cross function for actual product improvement. Recently, students have focused on the manufacture of aluminum triangles. Teams have designed, tested, modified, and produced approximately 35 triangles over the past several years. Interestingly, these have been used by the "customer," Epsilon Pi Tau, in its initiations around the world. Full-blown production of these products occurs in all respects. An ongoing enterprise environment is fully physically simulated, but under control for academic study. All aspects of change and empowerment, with a shared product and laboratory, are explored by graduate/undergraduate teams, including a focus on technical support, quality, and production deliverables as separate entities but with shared cross functions. While the teams do have shared meetings, as with cross-functional teams in any organization, they also meet as groups in separate graduate and undergraduate circumstances. Pivotal in the process is the distinction of leadership and management occurring at the graduate level, with graduate students mentoring undergraduates while working together toward shared objectives.

Finally, real projects for industrial firms provide instructional/learning experiences. Usually they are built around all of the technologist behavior attributes. Industrial projects, like much that has already been described, have grown out of industrial advisory committee activities over the past several years. A recent project exemplifies the approach, which was conducted at a manufacturing facility located near Bowling Green State University and was focused on improving the operation of a stamping press. Students met on site (rather than at the university) each week during the entire semester. Student teams were mentored by the manufacturing manager who also supplied essential facilities and information to support, nurture, and grow the team.

To be successful, the teaching/learning situations must exemplify those elements that parallel technologist behaviors. Thus, innovative and change-adaptive approaches help. For example, team teaching between faculty and industrial persons in courses taught at industrial sites for undergraduate and graduate students can be successful. These applied technical problems and projects were arranged and pursued. Other approaches include linking graduate students as team leaders with undergraduates on projects and placing nontraditional empowered teams in traditional curricula, similar to what some industrial firms do. These are not easy-to-administer approaches, but because they are effective learning situations, they are worth the effort (Sinn, 1996; Waggoner, Rex, & Sinn, 1993).

In two preceding articles, a conceptual model of technology and the derived behaviors common to all technologist practice were presented. In this article, the content and organization of learning and instruction to accomplish these behaviors is reviewed. These three comprise a set of guidelines for training courses in industry and core studies in college or university technology curricula.

Three questions were addressed to help elaborate on the model and introduce the technologists' toolkit:

- What are universal technologists' behaviors?
- What core content, or tools, should be in the technologists' toolkit?
- How should teaching be organized and how may learning experiences be structured to best achieve technologist behaviors?

Just as the technologist ought never leave well enough alone, this article raises the following questions:

- Is there additional content that should be identified as core knowledge?
- Do data, documentation, and synchronous leader tools help explain critical knowledge for all technologists?
- Should such content be organized and taught in the form of tools?
- In much the same way that the 60 content tools speak to re-engineering and changing organizations, might the technologists' toolkit actually be core knowledge that, if adapted widely, can lead to a positive transformation of technological studies?
- Might considerations such as in these articles establish the technologists' rightful place and purpose in our culture?

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Material on courses mentioned in this article may be viewed at web site: http:bgsu.bgnet.edu/colleges/technology/Manufac/CQMA/302.
Once at the web site, actually pulling down the project presentations and classwork requires installation and use of acrobat reader software (freely available as a "click-on" once at the site).

Dr. Sinn is a Professor and Director of the Center for Quality, Measurement, and Automation in the College of Technology at Bowling Green State University, Ohio. He is a Laureate member of Alpha Gamma Chapter of Epsilon Pi Tau.

2. A Primer on Mentoring
by Michael A. De Miranda and Ethan B. Lipton

This article is designed for educators and industry leaders who are involved or interested in the development of faculty in higher education to meet the needs of students, institutions, and industry. Informal and formal mentoring strategies that aid in identification and support of qualified and qualifiable faculty are discussed. Also, strategies to facilitate an atmosphere for mentoring are presented along with an example of a successful mentoring program. We also discuss the term *diversity* as one of the desirable goals that mentoring may help to achieve, while emphasizing it in a context of the realities of our changing society of which those of us who prepare professionals must be aware.

RATIONALE

Obviously, we all want highly qualified faculty in technology. They are essential in the effective preparation of students to enter and advance in the technology professions.

The term diversity is often defined using the word variety. It may encompass a wide range of types of diversity including, but not limited to, ethnicity, age, or gender. Gerth and Weiner (1994) presented an interesting view to consider:

> Diversity is about how "us" and "them" are defined, how "we" separate ourselves from others and how such distinctions impact on human life. The differences are manifold—indeed, they include all the possible groupings of individuals by characteristics they share or do not share. At its core the discussion of diversity in higher education calls upon us to revisit questions about the skills and sensitivities needed for constructive relations among people who are different, the principles that animate a just and democratic society, and the variety of knowledge that is important for scholars both to seek and to teach. The gift that diversity gives is the insistent invitation to ask hard questions about what we mean by education, how we teach, which people should be included as students and teachers, and what we are accomplishing in our colleges and universities. If we let it, diversity can renew our campuses. (p. xi)

Professionals involved in industrial and technology education must be concerned about quality and diversity as they relate to (a) the nature and needs of our students, (b) the nature of the workforce into which our students will be entering and developing, and (c) the makeup of our profession and department faculties.

SUCCESSFUL MENTORING STRATEGIES

A mentor serves as a trusted counselor, advisor, role model, and teacher. He or she is paired with a mentee for purposes of professional and personal development.

Mentoring strategies play important roles in the development of a highly qualified and diverse industrial and technology education faculty. They may assist in the identification of qualified and qualifiable faculty; they may assist with access into, and promotion within, all areas of industrial and technology education professions; and they assist in the development of much-needed role models. Mentoring programs and the institutionalizing of an atmosphere conducive to mentoring and mutual support impact both majority and underrepresented populations among students, potential students, faculty, potential faculty, the community, and society. They benefit individuals, the institution, and the profession.

Informal Strategies

A valuable strategy for identifying a potential faculty member is broad awareness. Broad awareness is a simple yet complex informal strategy that requires prospective mentors to be alert to, and monitor, professional activities of others. Broad awareness can best be explained by the following example:

> *While at a local conference planning committee session, a department chair observes that a new faculty member is actively participating in the discourse around the table. This person lacks experience in conference planning and many of her comments may not be well focused. But the chair detects a sincere desire on her part to contribute. In subsequent professional meetings and symposia throughout the state, this chair notices this young faculty person's participation.*

This example has classic characteristics of a potential young leader who could develop into a valuable faculty member. The identification and informal monitoring of young professionals who exhibit early signs of leadership and professionalism, however undeveloped, are key first steps towards the identification of potentially qualifiable and diverse faculty.

Broad awareness requires mentors to not read into the actions of undeveloped talent, but rather look to see the positive potential of these behaviors. A second step of this process occurs following identification. This step requires the entry of an informal mentor role model called *the quiet advocate*. The quiet advocate begins the nurturing process of a potential mentee, being guided by four actions: expose, include, inform, and correct. The quiet advocate exposes strengths and contributions by including the mentee in success or win-win activities. These activities should represent opportunities for the mentee to gradually gain confidence, recognition, and responsibility. During this period the quiet advocate monitors, assists, and provides constructive guidance to the mentee. An important strategy for the developmental success of the mentee is for the quiet advocate to guard against the mentee entering into perilous situations and overload conditions.

This period of quiet advocacy and informal development could extend from one to five years or more. In order to keep the goal directed on the potential development of a faculty member, the quiet advocate must keep the mentee focused on completing a terminal degree (if one has not been achieved) suitable for the faculty appointment and/or meeting the necessary requirements for tenure and promotion. The quiet advocate is really an informal champion of the mentee. As time passes, the role of quiet advocate should evolve into a recognized mentor. To strengthen this informal mentor-mentee relationship, mentors may invite mentees to collaborate on research projects, co-author scholarly works and professional presentations, and co-chair and assist in professional activities. They may also provide important advice on selection of teaching assignments, professional activities, and other related activities.

Formal Strategies

Wunsch (1994a, 1994b) advocated formal mentoring programs, with planned structure aimed to assure that mentoring occurs in a systematic and productive way. Many universities and colleges have established some structured, institutionalized programs that may be valuable. They may be accessed to fully meet the needs or utilized as components of a new program.

Academic departments in technology can also create or capitalize on existing formal mentoring programs. Most formal programs are designed to develop qualifiable faculty candidates or assist junior faculty in meeting the requirements for retention, tenure, and promotion.

Formal institutionalized programs designed to assist in the development of qualifiable faculty candidates generally are categorized into mentoring, scholarship, fellowship/assistantship, and incentive loan programs. These programs usually require that a faculty mentor or advisor be assigned to each participant for purposes of program and professional guidance. The mentors in these formal programs are required to document the deliverables and guidance they will render to the mentee. These deliverables include regular advisement meetings, research assistance, and professional development activities in which they will jointly participate.

From the perspective of the department, these formal mentoring strategies facilitate direct involvement of senior faculty in the educational and professional development of potential and/or junior faculty. The valuable insight that departments gain into the potential and characteristics of a prospective faculty member are unparalleled. The "closeness of fit" between a potential qualified faculty member and the culture of a department can be accurately assessed.

A unique program closely associated with these types of mentoring programs is the California State Forgivable Loan/Doctoral Incentive Program. This program is designed to seek and develop qualifiable candidates to compete for positions within the California State University (CSU) system. In this formal program, students are matched and "sponsored" by university faculty and departments. The faculty/department members agree to mentor the student through graduate school to the completion of a terminal degree. During this time the student receives financial and professional support (up to $10,000 per year for up to three years) in the form of a forgivable loan. Should the student compete successfully for a faculty position within the CSU system, the loan is forgiven at a rate of 20% per year of service (Lipton, De Miranda, & Cain, 1995).

While many formal mentoring strategies are designed to aid and develop a prospective diverse faculty pool, formal mentoring strategies must also focus on the retention, promotion, and tenure of new and junior faculty. Within a department, school, or university, a formal mentoring strategy can greatly increase the productivity and retention rate of new faculty. One such program established at California State University, Los Angeles is the Faculty Mentor Project (FMP). This project is designed to increase the efficiency and productivity of new faculty by pairing them with a well-respected senior faculty member within their department. The aim of the FMP is to facilitate the professional and social enculturation of new faculty members into the university community. The mentor-mentee relationship of the FMP is quite different than other formal and informal mentoring projects discussed earlier. In the FMP, the mentor-mentee relationship is a peer relationship in which the mentor and mentee are from the same department. From the perspective of the new faculty member, this type of relationship is quite valuable in getting "up to speed" in a timely and efficient manner. From a mentor perspective, this relationship represents an opportunity to bring a new faculty member to a level of departmental contribution much earlier than the usual one to two year adjustment period. The mentor also acclimates the mentee to department, school, and university structure that will enable the new faculty member to more appropriately participate in university activities required for tenure and promotion. This formal mentoring program represents a form of professional partnership in which the mentor guides, coaches, and then fades as the mentee grows confident and ever more accustomed to the academic environment.

Reverse Mentoring

As a mentor-mentee relationship matures, many benefits and opportunities emerge for both participants. One result of a successful mentoring relationship, be it formal or informal, is the opportunity for *reverse mentoring*. Developed out of trust and mutual respect between the mentor and mentee, reverse mentoring is a value-added interactive process that complements a professional atmosphere within an academic department. It emerges when the energy, enthusiasm, and current cutting-edge content knowledge of a junior faculty member are mixed with the wisdom, knowledge, expertise, and experience of a more senior member. This combination may result in new ideas, vision, and perspectives that benefit the more senior faculty member, the more junior faculty member, and the entire department. The mentee, now more mature and confident, begins to include, inform, collaborate, and correct his or her mentor, when appropriate. Both mutually lead and assume the roles of the quiet advocate for each other. This most exciting outcome of a mature mentoring relationship is an excellent indication of a successful mentoring process and a valuable indicator that the highest goals of mentoring are being achieved.

DEVELOPMENT, IMPLEMENTATION, AND ASSESSMENT

Successful mentoring programs are the result of planning and preparation. They should be developed and implemented only after a review of appropriate research and careful consideration of the needs and variables of the institution, department, and constituencies. Wunsch (1994a) provided an expanded version of the following checklist, well designed to stimulate questions needed to implement a comprehensive mentoring program:

- Assessing individual and institutional needs for mentoring.

- Defining goals and outcomes for mentoring.
- Positing the program in the organization.
- Determining and obtaining program resources.
- Developing and coordinating the program.
- Selecting and monitoring participants.
- Assessing the program.

These provide an overview of issues that must be considered. Their successful implementation will require commitment by the participants, the department, and the institution.

The development of faculty in technology programs who can work, manage, and lead in a diverse environment ought to be a mission of our institutions and programs. The preparation of graduates who are well prepared to meet the challenges of careers in technology professions requires a highly qualified faculty. Members of a diverse faculty who are prepared to provide the appropriate learning experiences may also provide critical elements as role models for all students and faculty.

Informal and formal mentoring designed to facilitate the development of highly qualified and diverse faculty enrich and strengthen academic institutions. As academic programs in technology evolve and grow, the need for highly qualified diverse faculty will increase. Mechanisms and strategies to meet the challenge of the 21st century must be implemented and institutionalized to meet the requirements of industry and education for a diverse professional workforce. These challenges can only be met if the academic role models are in place to inspire, motivate, educate, and meet the needs of America's greatest strength—diversity.

Richardson and Skinner (1991) asserted that "the principal obstacle to changing the learning environment to better accommodate diversity and quality is the degree to which current arrangements serve the purposes of those who operate the higher education enterprise" (pp. 253-254). The future of our professions, and that of our students, may be enhanced through continued examination of issues related to quality and diversity. Open minds must apply this knowledge and available resources to develop, implement, and institutionalize successful mentoring programs to meet the needs of students, institutions, industry, and society.

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Dr. De Miranda is an Assistant Professor of Technology Education and Manufacturing in the Department of Technology at California State University, Los Angeles. Dr. Lipton is Associate Dean and a Professor in the School of Engineering and Technology at California State University, Los Angeles. They are, respectively, Co-Trustee and Trustee of Alpha Psi Chapter of Epsilon Pi Tau.

3. Government Policies Impact Technology Education in India

by R. Natarajan

Since the country's independence in 1947, a series of well-conceived policy statements has been enunciated. They include the Scientific Policy Resolution (1958), The Technology Policy Statement (1983), The National Policy on Education (1986), and a series of Industrial Policy Resolution Statements beginning in 1948, the latest one being drafted in 1991. A draft for a new technology policy was circulated for discussion in 1995. It is generally accepted that science, technology, and education are critical ingredients for national economic and social development. While science and technology influence the utilization of natural resources and capital, education is concerned with human resource development. July 1991 marked the beginning of a sea change in our perception of national economic development. The New Economic Policy and the New Industrial Policy (of 1991) were aimed at promoting globalization, privatization, and liberalization.

In post-independence India, the goals of education have been tuned to be in line with national goals and aspirations. These include economic development to further the material well-being of people, social and political development for living harmoniously and promoting a democratic and just society, and intellectual, cultural, and aesthetic development to enrich the quality of life. There is no doubt that there has been a discernible and credible quantitative expansion in science and technology, research and development, and technology education in India since independence. Whether quality, excellence, and relevance to national needs have been achieved and ensured is a moot point.

FUTURE DEMANDS ON THE TECHNOLOGY EDUCATION SYSTEM

It is becoming necessary to prepare engineering graduates for an increasingly quality-minded corporate environment. The engineers of the present and of the future must contend with rapid changes and should possess traits such as a strong grasp of engineering fundamentals, communication skills, a desire for continued and lifelong learning, a flair for innovation, and the ability to work effectively with others in a group environment. Increasingly, the fact that engineers will work in different countries, with different laws, cultures, procedures, and standards relating to the education and practice of engineering, places additional responsibilities on the educational systems.

The structure and sequence of engineering programs have remained unchanged for too long. Major changes are necessary in order to produce integrative curricula that will promote interdisciplinary skills and relevance to real-life problems. Concomitantly, India must produce a new breed of faculty, with research and development expertise and who are also capable of generalizing in their instruction and are familiar with pedagogic techniques based on educational technology.

THE 1986 NATIONAL POLICY ON EDUCATION

The National Policy on Education (1986) called for the All India Council for Technical Education (AICTE) to be vested with statutory authority and to organize mandatory periodic evaluation of engineering institutions and programs by a National Board of Accreditation (NBA); the NBA was established in September 1994. Accreditation is a process of quality assurance involving appraisal by groups of external peers. To a large extent it is analogous to the ISO 9000 certification; just as the latter is welcomed by the corporate sector, it is hoped that accreditation will achieve the desired purpose.

Accreditation is a process of quality assurance whereby an approved institution or program is critically appraised at intervals, not exceeding six years, by a group of external peers as to whether an institution or a program meets the norms and standards prescribed by the Council from time to time. Accreditation does not seek to replace the system of award of degrees and diplomas by universities and boards of technical education. Accreditation is intended to accomplish the following objectives:

1. To assist the public, prospective students, educational institutions, professional societies, potential employers, and government agencies in identifying those institutions and their specific programs that meet the minimum norms and standards prescribed by the Council.
2. To provide guidance for the improvement of the existing institutions and programs and also for development of new programs.
3. To stimulate the process of bringing about continual improvement in technical education in India.

THE 1991 ECONOMIC AND INDUSTRIAL POLICIES

The New Economic Policy and the New Industrial Policy of 1991 incorporated the concepts of liberalization, globalization, internationalization, and privatization. They also incorporated the following significant features: emphasis on consumer concerns, such as quality, cost, and variety; encouragement of competition; quality assurance and the need to continuously upgrade quality, and at reduced costs; a borderless, boundary-less world, incorporating free exchange of money, ideas, and expertise; fostering of strategic partnerships and alliances in the best service of the consumer; and human resource development.

The recent economic and industrial policy reforms call for integration of the Indian economy and industry with their global counterparts. This calls for quantum leaps in our levels of productivity and efficiency to survive in the face of international competition. In addition to resource constraints, we will have to conform to international levels in terms of energy use and environmental appropriateness, in addition to quality, reliability, and costs. Simultaneously, we have to maximize employment opportunities.

CHALLENGES

It is essential that the technical education sector responds rapidly and properly to the changing scenario. There is a wide range of technical institutions, even at the degree level, in the country—the Indian Institutes of Technology (IITs), Regional Engineering Colleges (RECs), governmental colleges, university colleges, aided colleges, and self-financing colleges; some are unitary institutions, some autonomous, and the majority are affiliated with universities. Except in a few cases, administrative and management structures are archaic and rigid; there is no scope for innovation, effectiveness, or efficiency.

Over the years, curricula have been modernized, obsolete equipment and instrumentation have been replaced by modern counterparts, but not so for administrative and management systems. In fact, they are struggling to cope with the information technology revolution—how to deal with information transmission such as FAX and email, and the concept of the paperless office, after having been submerged in a flood of paper and signatures and countersignatures. It was more important to safeguard against making mistakes than to accomplish tasks. And it is not as if these checks and balances prevented mismanagement and maladministration!

Resource Allocation for Technology Education

There are traditional sources of funds for technical institutions such as central government, state government, government departments and agencies, research and development agencies, public and private sector industries, international agencies, alumni, and students. Funding from government sources is drying up in the context of the new economic and industrial policies that call for privatization and a decreasing role for government in higher education, and in the face of increasing demands for funding primary education. Hence, there is a dire need to look for more funding from other sources and innovative strategies for attracting these funds. The technical institutions must not expect a dole from the donor organizations but be prepared to market and offer their strengths to earn the enhanced funding.

The Private Sector

Private sector initiatives in technical education are just over a decade old, and most of their resources are derived from donations and tuition fees. Their principal activity is undergraduate education, and the opportunities for additional resource generation are very limited. It takes a considerable amount of time before competence, expertise, and infrastructure are assembled and developed to such an extent that industrial research and consultancy can be offered.

It is in this context that industry partnership and sponsorship are essential for technical education. Government incentives to industry for promoting technical education and R & D are positive factors, not only for resource management, but also for making the educational processes effective, relevant, and purposeful.

IMPLICATIONS OF THE 1993 DRAFT TECHNOLOGY POLICY

This policy statement gives more importance to technology inputs and technologists than earlier policy statements. While it is necessary to increase the percentage of the GNP deployed for research and development, mechanisms must be evolved to ensure maximum effectiveness of these inputs. In addition to devoting attention to the input side, it is also necessary to monitor the outputs, both in terms of the quality and quantum of outputs and results.

The 1983 Technology Policy Statement observed that "technological advances are influencing life-styles as well as societal expectation." Technology policy should make contributions in both areas, by promoting those that result in wholesome lifestyles and tempering societal expectations in consonance with our meager resources and our ability to distribute them equitably among our people.

The recent United Nations Development Program Report on global development has bemoaned the "jobless growth" currently characterizing the economies of many countries. The principal expectation of those in our population who pursue professional education is preparation for employment. Educating and training the country's population without simultaneously creating employment potential and opportunities will lead to social and societal discontent, frustration, chaos, and anarchy. The critical index of development is the number of jobs created per thousand population, not the total number of educated and trained manpower, not even the total number of jobs created.

Our technology education system needs to be re-engineered, keeping our resources, our needs, and our goals in focus. We also need to forge strategic and organic alliances and partnerships between industry, academe, and the government to achieve synergistic results.

Dr. Natarajan is Professor of Mechanical Engineering and Director of the Indian Institute of Technology, Madras, India.
This is based on a presentation at the second Jerusalem International Science and Technology Conference in Israel, January 1996.

4. Science and Technology Education Sponsored by an International Organization

by Silvio Schlosser and Baruj Zaidenknop

ORT Argentina is an organization of the World ORT Union, the largest non-governmental training organization in the world as well as a worldwide Jewish charity that assists disadvantaged individuals and communities to become self-sufficient. ORT is best known for educating and training people in skills that will provide them with sustainable employment in today's and tomorrow's marketplace. Founded in 1880, ORT (Organization for Rehabilitation through Training) now has programs established in more than 60 countries,including the United States, Israel, and China. It also teaches and trains more than 250,000 people in its schools and colleges annually.

ORT uses the most up-to-date methods and equipment to train students for careers that will make them independent and contributing members of their society. As a truly independent organization, ORT has the freedom to pioneer new ways of teaching and training both students and teachers. Its schools often lead the way in education, and since it is an open organization, everyone across the world can benefit from innovations.

There are two ORT technical schools in Argentina whose curricular innovations and reforms are the results of careful analysis. Experts study the social and economic situation of the country and the demands of the productive and academic sectors on the educational system, particularly the technical high school area. An important part of the curricular reform process is the application of a classroom-workshop methodology in technological education combining the contributions of technology with work carried out with not more than 15 students per teacher.

The technological process here is conceived as a process of creation motivated by man's natural wish to find ever newer and better ways of satisfying human needs. It involves decision making, the analysis of alternatives, planning design, and a careful evaluation of costs. During the stage of production proper, the product that has been designed takes form. Final evaluation includes the feedback of the entire process and whether the original motivational force has been satisfied.

But the result of the technological process largely depends on the know-how that has to be added to the wealth of techniques, materials, and devices of proven usefulness. The whole training process in the technological area is characterized by a high level of integration of technical and scientific areas by the rapid succession of modifications required by society. Science-Technology-Society (STS) forms an inseparable unit in current technical and technological education.

In our technological junior high workshops, students aged 12 through 15 become acquainted with processes designed for widely varied applications. They learn to handle materials and transform them into final products in a carpentry workshop; embark on the process of technical design in a science and technology workshop; and develop a creative attitude toward technology as a creative process in expressive workshops. In a mechanic workshop they develop psychomotor aspects using techniques and dexterities related to metalwork, with very strict "tolerance limits" and safety measures. They learn to design, produce, operate, and troubleshoot electric circuits in an electrical workshop, and they engage in observation, analysis, and production of electronic devices in an electronics workshop.

ORT Argentina's technical schools have other unique workshops. The computation workshop deals with important attitudes. As computers are increasingly used in all the branches of human activities and hardware and software evolve, creative attitudes of adaptation are required. A mass media workshop teaches the creative and critical appreciation of the messages of social communication. In an integrated technology workshop, independent work stations are equipped for the design and development of experiments, problems and possible solutions in numeric control, industrial automation, automatic control of continuous processes, flexible production systems, and robotics. The work done here is considered "integrated experimental science" and includes mathematics, mechanics, electricity, electronics, computers, and science and technology. The final project workshop, another ORT innovation in Argentina, is an integrated activity: the students go through the stages of conception and design, feasibility, documentation, programming, manufacture, evaluation, and feedback. Under the watchful eye of the workshop teacher, the student chooses a subject and integrates the information and skills learned in different areas and subareas of the technical junior high.

We believe that a solid background of ethics and moral values is needed to complete the education of our youngsters. Therefore, together with technological training, our schools deal with ethical codes by which to regulate their decisions, mostly through Jewish education. Here again ORT's programs are unique, since ours are the only technical schools to include such subjects in the official curricula and to attach equal importance to science, technology, humanities, and ethics.

The changes wrought by this new technical junior high since 1988 have been enormous, and after some years the time was getting ripe for further changes.

Growth of ORT Argentina's Technical High Schools

ORT Argentina's first technical school, now operating within the Argentine network of private schools for well over 30 years, originally offered just one track—electronics—and a curriculum similar to the other technical schools. This was the first of a series of purely technical and technological tracks, very much consistent with ORT Argentina's mission.

ORT Argentina's two technical schools, each of which serves 2,000 students, currently offer the following tracks:

- **School No. 1**

Electronics, chemistry (laboratory and biotechnology), construction, business studies, musical production, computers.

- **School No. 2**

Business studies, computers, electronics, mass media, industrial design.

Among those listed are four innovative and creative options introduced in the last 10 years to respond to the needs of the students' new reality: mass media, industrial design, musical production, and business studies.

Some Characteristics of the New Tracks

The students in the mass media track are taught skills in planning and developing program production for the various media, which implies the general elaboration, filing, and the systematic preservation of audiovisual material. They learn to produce programs; design and produce different communications pathways; analyze and evaluate communication programs and establish patterns to improve them; handle graphic, sound, visual, and linguistic communication codes; design and project the suitable productions by means of new codes and contents; and work in communication systems (photography, radio, cinema, television, magazines, newspapers, etc.) using all sorts of languages. To make this possible, the school offers a state-of-the-art television studio with an editing island, a photo lab with 16 work positions, and four radio studios with professional consoles and other first-class equipment.

The business studies track confronts the students with learning situations and up-to-date criteria for the use of computer science as a tool for their professional and technical training. Students are trained to do clerical work in industrial and commercial enterprises, banks, and public administration offices; to serve as assistants to certified public accountants in market or business research; and to give support in home and foreign trade to public and private entities.

After three years with a very intensive curriculum of over 50 class hours per week, the industrial design graduates can enter the marketplace and/or continue their studies at colleges or universities. They are expected to understand the basic contents and applications of science, to recognize the value of scientific processes for problem solving, and to understand the relationship between science and technology and between the need to know and the satisfaction of needs, combining their logical capacities and scientific skills with the use of the ever-changing technological tools of their specialization. They can use mathematics, understand and make themselves understood in two foreign languages, and handle expressive languages and information in order to gain access to, produce, and convey technical and cultural production. Students come in contact with professional practices at school through situations that are similar to the ones they will encounter in their technical and professional life. They can design and carry out the production of objects that respond to different demands through the application of new technologies and analyze the requirements for the realization of products of all sorts. Such a strict preparation is related to a series of fundamental distinctive features in training: students are taught to analyze and synthesize; to use formal logical and mathematical reasoning; to form work teams; to develop visual representation and graphic, verbal, and written expression; and to plan and anticipate results, unexpected difficulties, and alternative solutions.

The fourth special track is musical production. The economic and cultural transformation of contemporary society all over the world has given rise to new demands and requirements from the school systems as well as new occupational profiles that were unknown in society barely a few years ago. The musical production projects increasingly require state-of-the-art technologies both for the process of musical creation itself and for the production of records, cassettes, laser, video-laser, sound tracks for videos, moving pictures, and "live" productions. The action of a technician in musical production is becoming increasingly necessary for the planning, production, and diffusion of music. The musical production track makes good use of educational technology during the learning and teaching processes. It also applies the classroom-workshop methodology and combines technology with work in small groups: not more than 15 students per teacher. The technological impact is very clear in this track and redefines and demands the permanent updating of the curricular contents and methodology of work.

In these four special tracks as with all the other tracks, students must successfully carry out a comprehensive work before graduating (usually in response to the needs of some outside institution or enterprise), integrating the knowledge and the methodological instruments acquired during their senior high. This is also innovative in Argentina. Exhibiting mature and professional attitudes, students develop projects they propose, seek advice from experts, do research into the relevant field of knowledge, and discuss their project with other people in an atmosphere of responsible freedom, supervised by a teacher. By the end of the year the student's project is evaluated by a panel formed by the teacher, other experts and/or users of the project's products or results, external professionals, or experts from the enterprise the project has been designed for. For a project involving devices with medical applications, for example, a doctor reviewed the work. Every year the schools exhibit the work of the students, even beginners, in an open exhibition that has proven to be increasingly successful.

Teaching Materials and In-Service Teacher Education

ORT's program is also unique in that it prepares the teaching materials it does not readily find, and experts in the Jewish Education Department, for example, together with experts from ORT Argentina's Teachers Training College of Jewish Education, have prepared books on the Bible and Jewish history, including very specific materials for the 500th anniversary of the expulsion of Jews from Spain. These books were widely appreciated within the Jewish educational network in Argentina, while Brazilian, Uruguayan, and Venezuelan Jewish schools have also asked for copies for their students and teachers.

Two other departments of ORT Argentina are specifically devoted to the production of teaching materials: the Creative Education Department and the Technical and Pedagogical Office. To these we have to add all the pedagogic resources and teaching materials produced by the teachers of the schools themselves, particularly in the areas of science, technology, and integrated experimental sciences.

In view of our fast-growing student body, the new tracks offered by our senior high, the incorporation of new teachers and new equipment, with ever newer and more modern technology, the changes in the curricula, and the new teaching modalities—in short, the growth and development of all the branches of its educational activity—ORT Argentina came up with still another new proposal: the creation of a summer school inservice for teachers. The objectives were many and varied:

- To establish a systematic mechanism to upgrade ORT Argentina's 750+ teachers.
- To consolidate and spread ORT Argentina's methodology.
- To update curricular contents, improve techniques, and facilitate classroom work.
- To foster an attitude of permanent education in the teachers.
- To contribute to the self-esteem of the teachers and to their sense of belonging to the institution.
- To improve the quality of the teaching-learning process and the interpersonal relations in classrooms, labs, and workshops.
- To retain the better teachers in ORT Argentina.
- To foster research work and permanent education.

Status Achieved

ORT Argentina's work has been tremendously successful. Originally a small technical school with lower-than-average students, it is now the leading technical school in the country: a leader in curricular modifications, in number of students, and in the creation of new tracks. This has been achieved through serious thinking, fore-thinking, and administration.

Summing up, the following are the noteworthy elements of ORT's uniqueness:

- A classroom-workshop methodology.
- Its technical junior high.
- Four special workshops: computation, mass media, integrated technology, final project.
- The introduction of humanities in technical schools.
- Four pioneer tracks: mass media, business studies, industrial design, musical production.
- The special curricula and teaching materials.

We have managed the following in our schools:

- To succeed in transferring scientific concepts to the classroom, which necessarily implies a continual exchange with scientists to help our teachers and students process the information accurately and respectfully.
- To establish a suitable environment beyond the formal and informal regulations issued by the authorities. The concept of institutional environment must include the student, not only in his or her capacity as a learning individual but also as a subject who can interact and generate knowledge.
- To assist the teachers in the ORT Argentina network to gain greater professional esteem through up-

grading and updating courses and seminars.

It has been said that in order to reach development and economic power in the 21st century, manual work and a good supply of raw materials won't be enough: we will need to apply the resources of the human mind. Knowledge is never depleted, as are capital and raw materials. There is no single recipe to produce the sought-for economic changes and social welfare. Whatever the strategy, the solution will have to be achieved through education, research, and the development of technology. And this is the road that ORT Argentina has chosen.

Mr. Schlosser is General Director of ORT Argentina, Buenos Aires. Mr. Zaidenknop is Deputy Director of ORT Argentina.

5. Preparing Technical Educators for Interactive Instruction

by Patrick H. O'Neill

This paper highlights new methods in teaching strategies utilizing state-of-the-art technologies. It is based on experience in classroom instruction and learning at a regional vocational school and is applicable at various levels of education in technology and for work.

BACKGROUND

At Southeastern Regional Vocational-Technical High School, a regional comprehensive secondary school located in South Easton, Massachusetts, students graduate with a diploma from the Department of Education, Commonwealth of Massachusetts, and a competency-based trade certificate. The school serves some 1,300 students who come from multicultural backgrounds as well as various socioeconomic communities ranging from high to low income and high to low crime influence.

The guiding concept for the developments is to position the school to meet the demands of a rapidly changing workforce. Recently, the school began Phase 2 of a 5-year strategic plan to integrate all academic offerings with vocational-technical programs. This includes eliminating the general track and introducing more outcome-based practical application course content. An ongoing part of the strategic plan provides for the faculty to receive advanced technological training and interactive tools and strategies to create the environment of a 21st-century classroom.

This is done because we believe that effective teaching should mirror effective learning. Unfortunately, educators have not mounted a serious effort to organize teaching around the learning process. Instead, education has been viewed as an institution or an administrative system or set of instructional techniques. The ultimate act of restructuring is to change the process of instruction and its related acts (planning, curriculum design, and assessment) so they best reflect what we know about learning.

STAFF DEVELOPMENT FOR INTERACTIVE TECHNOLOGY

Faculty training initiatives include the establishment of a Teacher Technology Center that provides training in both Macintosh and PC operating systems and applications. Over 200 teachers attended courses in 1996. In addition, courses in current education research and trends and techniques of updating classrooms are offered on-site by several nearby institutions of higher education.

Faculty and staff are encouraged to explore innovative programs and methods, a strategy which leads to teacher empowerment. Teacher empowerment has led to the creation of teams that design strategies to correct recognized problems in an efficient manner. One instance resulted in students successfully taking ownership of their own learning and daily performance. Class work has become more personalized or customized so students could find lessons more interesting and rewarding. An element of cooperative learning was introduced to increase students' responsibility for learning by holding the student accountable for group participation and requiring the student to assist in helping others learn.

Planning for technology implementation has been an ongoing process at the school since 1992. Community members, faculty and staff, current students, and graduates all serve as advisors on the application of technology in both academic and vocational areas. Consequently, Southeastern has planned to include interactive technology into its system until every program and teacher is equipped to deal with the technological demands of classrooms of the future. The school has utilized talents and expertise from within and has researched the product line of many vendors to assemble a system that will grow with its needs as it advances into the 21st century. A key to planning lies in the belief that the best vision of technology in education is one where technology is used to support the overall mission of the school system.

EXEMPLARY PRACTICES

The Graphic Communications program with state-of-the-art equipment is comparable with today's industry standards. Each component in the production process is computer generated with Prepress, once done in a darkroom, now done in a chemical-free computer room. Prepress system assignments are generated by the instructor in Quadra 700, and students use Power Macs to set print and lay out design. A display on 21" monitors allows for clear interpretation of the print. Tektronix color printers, QMS tabloid printers, and an AGFA Imagesetter produce quality print that meets industry standards. Software used in the program is of current industry standard and includes Adobe Photoshop, Adobe Illustrator, Corel Clip Art CD, and Kodak Photo CD. The CD output can be viewed by students on a 27" JVC monitor as well as LCD overhead panels and a 4000 Lumen overhead.

Students in Building Trades receive

CAD before they enter Grade 11. This CAD program works on Dell Pentium stations including a 27" monitor/VCR, HP plotters, and HP Deskjet 2000. Each student learns the AutoCAD and VisualCAD software packages and is required to design his or her "dream home."

The Computerized Office Technology program uses a learning package in which all computers are IBM and networked through the Novell system. Students work dependently and independently of the teacher in a variety of settings: medical, legal, general. Once students are proficient in a competency, they intern in a regular office setting to get a sense of real life office practices while utilizing the technology in which they have been trained.

Students in Health Services programs are exposed to a program series that includes CD-ROM medical terminology, which brings up the latest in vocabulary and definitions within a context of "live-work" scenarios that students are more likely to identify with and remember longer. Also, several computerized dolls (male/female, adult/child) allow for realistic simulations of patient and infant care.

Science labs utilize the programs of several vendors, for example, Optical Data Corporation's *Living Textbook Laserdiscs.* Using a Power Mac, a laserdisc, a large monitor, and the microscope-adapted Flexcam camera, biological and physical science experiments are demonstrated in full motion by the instructor to the entire class. Such an experiment can also be shown via telecommunications to a large group of students assembled in the school's cinema.

In addition to these programs, the school also has the services of a contemporary audio-visual department that can augment any curriculum. An audio-visual computer with a scanner produces multimedia presentation and visual aids for use throughout the school. The Video Toaster is used to add dimension and text overlay in tutorial and special interest videos.

We can report that there is a heightened awareness of the need to incorporate elements of a technological society in these classrooms. Students and teachers communicate through several mediums that assist in the sharing and manipulation of the learning process. Teachers have become facilitators, and students, in the best sense of the term, are fine-tuned apprentices, ready to accept the challenges of a rapidly changing society. Both are learning the immediacy of interactive technology as it is occurring. Classrooms that are no longer boring or mundane, but instead are active as a result of electronic resources, have become the centerpiece for the restructuring movement. Faculty and students involved in interactive technology training are excited by the prospects. Those who sit on the edge get closer and closer to the process. Continuing professional development, cooperative teaching, and train the trainer strategies are expected to get everyone on board eventually.

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Dr. O'Neill is Director of the Southeastern Regional Vocational-Technical School in South Easton, Massachusetts.

6. Technology-Based Programs and Drop-Out Prevention

by Phillip L. Cardon and Kip W. Christensen

In the United States, a large number of students leave the educational system before they receive a high school diploma. Many of these students are ethnic and racial minorities, may be academically and physically challenged, or have emotional and psychological problems. Such students are broadly considered at risk of dropping out of school before obtaining their high school diploma.

Many of these high school dropouts would remain in school if there were successful alternative high school education programs available that were structured to better meet their specific needs.

Some of the most successful alternative education programs in the United States use technology to help students remain in school. The purpose of this article is to help teachers, principals, and school administrators understand that the use of technology in alternative education programs can help retain at-risk students in secondary education. This is briefly discussed under the following topics: characteristics of at-risk students; some effects and consequences of at-risk students dropping out of school; alternative programs and the use of technology; alternative program factors that contribute to the retention of at-risk students; some technology-based alternative programs that have been implemented to retain at-risk students; and technology to assist physically challenged at-risk students.

CHARACTERISTICS OF AT-RISK STUDENTS

McCann and Austin (1988) defined

at-risk students with three characteristics:

> First, they are at-risk of not meeting educational goals or local and state graduation standards, and not being ready to become productive society members. Second, they are children whose behaviors interfere with the education of themselves and other students and require disciplinary action. Third, they are students who have family background characteristics that place them at risk. (pp. 1-2)

At-risk students are students who are considered more vulnerable to permanently leaving school than is the average student. The term d*ropout* is used by most Americans to describe a person who leaves school early without a diploma and with no intention of returning to school. Both at-risk students and dropouts have unique characteristics that should be considered when looking for ways to retain students in school.

At-risk students have characteristics that are different from average students. Batsche (1985) provided a list of the common characteristics that defines the profile of at-risk students.

Individual characteristics include a history of school absenteeism, poor grades, low reading and math scores, low self-esteem, a history of behavioral problems, difficulty identifying with others, often work full time while attending school, the majority are male, are generally members of a minority group, and have feelings of being isolated and alienated (p. 1).

Family characteristics include family has several small children, father is seldom at home, father is often not employed, father did not obtain his high school diploma, mother was seldom home when student was an adolescent, there is little or no reading material at home, and the mother is the head of the family (p. 1).

Gardner (1988) reported that Goldman identified individual characteristics of at-risk students. She said, "As students, they are generally low achievers. They also differ from their more successful peers in development of self-esteem, task performance, cultural aspirations and life experiences" (p. 37).

Individual Characteristics

The individual characteristics of at-risk students may not be noticeable at an early age, but may become evident when the students enter their teenage years (Batsche, 1985). This makes identification of at-risk students difficult when they are in their early years. Therefore, it is important to look for these identifying characteristics during the early teenage years.

One familiar characteristic of many at-risk students is truancy, the absence from school without the parents' knowledge or permission (Hersov & Berg, 1980). According to Bell, Rosen, and Dynlacht (1994), characteristics of students that contribute to truancy include "school phobia, poor social and emotional functioning, ethnic or racial dissonance, failure to learn, a learning style not in pace with the classroom, learning disabilities, and health problems (which are often a symptom of underlying social or emotional problems)" (p. 204).

Some of the students who experience truancy have special needs or disabilities, or are gifted and talented. These students are often sent to remedial courses for special attention and help. They include the very bright as well as the learning disabled (Poirot & Robinson, 1994).

The prevalent use of alcohol and drugs among at-risk students in high school is another area of concern. According to Ediger (1987), students using alcohol and/or drugs tend to display characteristics that include little or no interest in school, personality change, rebellion at home, avoiding responsibility, skipping classes, increase in tardiness, out of touch with reality, avoiding and changing friends, criminal activity to support habit(s), and loss of memory.

The use of drugs by teenagers is a problem that will most likely not go away. Drugs used by popular figures in our culture have influenced students to believe that the use of drugs is okay and even "cool."

Another characteristic of at-risk students is that they sometimes feel alienated from their teachers and the school culture. Because the American school system is based on a single-culture educational system with most of the teachers being White, minorities are more susceptible to feeling alienated at schools. This problem can cause the student to be at risk of dropping out of school by creating a cultural barrier between the student and the teacher (Beck & Muia, 1980). Another problem facing minority students is language barriers. Many students today speak English as a second language, which can develop barriers between them and their peers, teachers, and school administrators (Henry, 1986).

Family Characteristics

Many at-risk students are from impoverished, minority, or single-parent families. All of these groups of students have problems outside of school that challenge their will and desire to stay in school. Contrary to individual characteristics, the family characteristics should be noticeable at any age (Batsche, 1985).

One of the highest indicators of at-risk children is their socioeconomic background. The problems associated with poverty extend from the home into the school. The student may be required to hold a part-time or full-time job while attending school. In addition, they tend to feel alienated from a lack of unification with their peers, teachers, and principals.

Another family concern is that ethnic or racial minority students have a higher dropout rate than White students. For example, in 1993, Hispanics had a 27.5% dropout rate, the dropout rate among Blacks was 13.6%, and the White, non-Hispanic groups were at 9.8% (lower than the 1993 national average of 11.2%; McMillen, Kaufman, & Whitener, 1994).

The last area of concern is that of students from single-parent families. Some students from single-parent homes find it difficult to cope with the challenges of school because they are ill-prepared for the work load and other challenges associated with education (Kunisawa, 1988). Good education and work habits must be taught in the home if the students in today's educational system are to be successful in high school and beyond.

Most at-risk characteristics can be seen before the student ever decides to drop out of school. If these students can be identified early, the educational system can try to retain these at-risk students until graduation.

EFFECTS/CONSEQUENCES

When at-risk students drop out of high school, there can be a number of consequences. These involve individual, social, health-related, educational, and economic consequences.

Individual

Some of the individual consequences of at-risk students dropping out of school include a lack of basic education, an increase in the number of career and economic disappointments, an increase in frustration, and a feeling of being alienated. Dropouts have more difficulty obtaining satisfying, fulfilling, and economically rewarding employment than do high school graduates. This can result in the socioeconomic status of dropouts being generally lower than that of high school graduates. Also, students who drop out of school typically have fewer opportunities for employment and promotion (Rumberger, 1987; Weber, 1986).

Social

When at-risk students decide to drop out of school, they initially do not understand the effects their decision has on society. According to Weber (1987), a large amount of criminal activity is indirectly related to at-risk students dropping out of school. Weber also stated that a dropout is 6 to 10 times more likely to commit or be involved in criminal activity than students in school. In addition, dropouts constitute more than 80% of incarcerated people in state prisons. These inmates do not hold jobs and, therefore, do not contribute to society.

Health Related

Other consequences from at-risk students dropping out of school are related to the individual's health. Studies have shown that high school dropouts are more likely to suffer from high blood pressure and heart attacks than non-dropouts. Other studies have indicated an increase in suicide attempts by dropouts and at-risk students over their counterparts (Weber, 1987).

Dropping out of school could also contribute to higher incidents of other health-related concerns. One study found that increased unemployment was associated with increased rates in mortality, suicide, and admission to mental hospitals. If this is true, then dropouts, who have a higher incidence of unemployment, could also experience higher rates of mortality, suicide, and mental illness. This is only an assumption, since the causal relationship between dropping out of school and subsequent physical and mental health has not yet been confirmed through research (Rumberger, 1987).

Educational

The educational consequences of at-risk students dropping out of school seem to occur in a variety of areas. The dropout problem is likely to be perpetuated in families where one or both of the parents were dropouts. Some of the consequences of students dropping out of school cited by school administrators included permanent intellectual damage to students and the lowering of school standards and achievements.

In the future, jobs will be more difficult for high school dropouts to obtain. According to Walter (1993), by the 21st century, a worker will need almost 14 years of education in order to obtain an average job in the Southeast. Jobs involving technical skills will be in high demand and will require additional education.

Economic

The dropout rate can have tremendous economic consequences. Weber (1987) reported on a study that tried to assess the losses to the nation that could be associated with male dropouts who were 25 to 35 years old. The results showed estimates of $71 billion in lost federal and state government revenues and $3 billion a year in welfare expenditures.

ALTERNATIVE PROGRAMS AND THE USE OF TECHNOLOGY

There are a number of alternative programs operating in the United States that are structured to give at-risk students a successful educational experience. Several of these programs incorporate the use of technology as a primary component of daily student activities.

Twelve factors that Batsche (1985) believes contribute to the retention of at-risk students are as follows:

1. There should be some form of financial aid available to assist the economically disadvantaged students in finishing school.
2. Peer support in classroom and extracurricular activities are important in helping the high-risk student to form bonds that will keep him or her in school.
3. The school should provide realistic training that is related to post-high school jobs. This is closely related to education in vocational and technology fields.
4. Counseling services should be provided to assist students with personal problems that affect their school work.
5. The school should have an alternative program that meets the expectations of the parents and students.
6. Students should be able to talk with teachers as equals and not feel intimidated or powerless in their educational efforts.
7. The students should be able to approach the teachers with questions or problems.
8. The outcomes of the learning situations should be clearly defined.
9. The methods should be appropriate to accomplish the assigned task.
10. The sequence for learning should be well-defined and communicated to the students.
11. The rules for learning should be established and communicated well.
12. The performance standards required by the teachers and administrators should be clearly indicated (p. 3).

These factors are evident in almost every effective alternative education program. Without most of these factors, alternative programs would not be able to meet most of the needs of at-risk students. Some of these alternative programs will be discussed in the following section.

SOME SUCCESSFUL PROGRAMS

A National Blue Ribbon School

A successful alternative program is located in the Berkshire Union Free School District (BUFCD) in Canaan, New York. This program was developed in 1965 to provide public education for at-risk youth who were failing in school and in the community. Most of these students have been diagnosed as having emotional handicaps. These disabilities tend to hinder their educational performance and learning experiences.

The BUFCD program moved into a new 87,000 square foot facility in 1992. The building is filled with the latest technological devices from computers to multimedia work stations. The curriculum is designed to expose each student to as much technology as possible. The program also uses this technology to assist in instruction.

In 1991, Berkshire was named the best school for at-risk students by the state of New York, and in the same year, it was pronounced a "National Blue Ribbon School of Excellence" by the U.S. Department of Education (Richman, 1994).

Smart Classroom

On the West coast, another successful alternative program is located in the Hueneme School District in Hueneme, California. This program utilized a "Smart Classroom," filled with technological tools. With a predominant minority student body (17% Black and 50% Hispanic), this district used its allotment of state lottery funds for modular, media-based instruction. The district also converted a drafting lab and a wood lab into a technology room where students could experiment with computerized robotics, computer-aided manufacturing, computer publications, and aeronautics and pneumatic technology, among other activities.

The Hueneme School District reported that from 1987 to 1990, the district observed a tremendous improvement in the California Assessment Program (CAP) scores. These improvements coincided with the district's implementation of technology-based education in the classrooms. The average daily attendance of the "futuristic science classroom" was 98% in 1990, with very few referrals to the office for disciplinary concerns. The school district stated that the program demonstrated that "daily instruction in a challenging, hands-on, technological environment is associated with improved student attendance, discipline, attitude, and achievement" (Peck & Catello, 1990, p. 55).

Learning Circles

An experiment performed by Spaulding and Lake (1991) suggested that students who fail in traditional classrooms can succeed by using computer networks called Learning Circles. The experiment consisted of dividing low-achieving writing students into two groups—a treatment group and a control group. The students in the treatment group participated in a Learning Circle network using the AT&T Learning Network to communicate with students in Alaska, California, Nebraska, New Jersey, France, and Germany. The students in the control group performed similar projects using traditional media center materials without contacting other locations directly.

Spaulding and Lake (1991) found that the students who participated in the treatment group showed a significant increase in their writing abilities while the students in the control group showed no significant increase in performance. Spaulding and Lake concluded that the use of computer networks and communication technology may help to provide a better education for at-risk students.

Riel (1992) stated that at-risk students who used the AT&T Learning Network felt comfortable communicating with other students. Some of these at-risk students have serious physical and mental problems that would normally influence their peers to not want to associate with them. At-risk students with disabilities or social differences become "invisible" and are viewed by their fellow communicators as regular students. The AT&T Learning Network actually helps most at-risk students feel accepted among their peers and teachers. This feeling of acceptance helps at-risk students decide to remain in school.

The Program in Azusa

The Azusa Unified School District in Azusa, California, offers another alternative program that incorporates the use of technology to help at-risk students. This program focuses on increasing the average daily attendance (ADA) of students in the various schools.

The program consisted of about 45 students, two teachers, and one aid in two classroom centers. They spent four class periods each day working with Integrated Learning System workstations. These workstations consisted of computer terminals and software to enhance the English, reading, social studies, math, and science materials, making them easier to learn and understand. The staff were capable, patient, and caring individuals who wanted to see these at-risk students succeed.

Before the program began, more than 50% of all incoming freshmen did not make it to the end of their senior year, and ultimately did not graduate. After the program was instigated, daily attendance increased, and the drop-out rate began to decline. At the end of its first year in existence, the program was able to retain 95.8% of the incoming 9th grade students and obtain a 93.1% ADA rate. After the second year, the program had an ADA rate of 96.1% and a student retention rate of 93.2%. These numbers showed a tremendous increase over the dismal drop-out rates from two years prior to the program (Jackson, 1991).

OASES

Another alternative education program using technology is the Occupational and Academic Skills for the Employment of Students (OASES) program in Pittsburgh. This program serves over 100 at-risk students in middle school. The program provides the students with a prevocational experience while training them in school. The OASES program teaches the students how to use technology and tools while still emphasizing the importance of academic performance (Monaco & Parr, 1988).

TECHNOLOGY TO ASSIST PHYSICALLY CHALLENGED AT-RISK STUDENTS

Technology is available that will allow all students to participate in classroom activities. For example, there are new computer-assistive technologies that help physically challenged students to work with computers (Logwood & Hadley, 1996). Some of these technologies include the following:

1. Keyboard overlays that help prevent the student from pressing an undesired key.
2. Touch-activated devices that can operate a keyboard.
3. Upright goose-neck devices that allow the simulation of mouse operations by moving a long device with the face, head, or mouth.
4. Text-to-speech communication programs that help students with speaking disabilities to communicate with

teachers and other students (pp. 17-18).

These devices allow special needs students to feel successful and independent. Most of the physically challenged students who have used these devices have greatly improved their classroom performance and have shown an improvement in their attitudes toward themselves and others.

Another example of technology that helps at-risk students is the use of computer networks. With the help of a computer network, deaf children can communicate with their classmates and participate in class discussions (Riel, 1992).

The technology-based alternative education programs discussed here demonstrate the importance of incorporating technological devices with teacher instruction in order to assist in the retention of at-risk students. These programs are only a few of the many alternative programs that are operating in the United States to help at-risk students see the value of education and remain in school.

For future generations of children, students, and adults to become successful, contributing members of society, more efforts must be focused on how to help at-risk students remain in school and have successful educational experiences. The use of technology in alternative programs has been shown to be a significant tool in assisting and retaining more at-risk students in high school.

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Mr. Cardon is a doctoral student in the Department of Technology Education at The Ohio State University, Columbus. He is a member of the Alpha Chapter of Epsilon Pi Tau. Dr. Christensen is an Associate Professor in the Department of Technology Education at Brigham Young University, Provo, Utah.

7. Print Versus Electronic: Editors' Insights on the Costs and Benefits of Online Journals

by Brian D. Angell and Gabie E. Smith

In this article explore issues relating to the print publication process and the electronic publication process in order to clarify the unique advantages and disadvantages of each media. The literature describing the primary benefits and costs of online journals is reviewed. The results of a survey of viewpoints of a sample of electronic journal editors on the current state and future directions of online publishing is summarized. Finally, the literature review and the survey data are extended to identify implications for the future of online and print media.

THE SETTING

Over 15 years ago the electronic/computer revolution was predicted to dramatically alter and decrease the use of print publications (Lancaster, 1978). It has been suggested that the catalysts of these changes are electronic information databases, in general, and electronic journals, in particular. Electronic journals have been defined as "any serial produced, published, and distributed nationally and/or internationally, via electronic networks such as Bitnet and the Internet" (McMillan, 1991, p. 97). The term *online journals* has been used for electronic journals for which there is a printed counterpart (Langschied, 1992), although we will use the terms online/electronic journals interchangeably. When initially created, it was thought that electronic journals and databases would reshape the physical structure and purpose of libraries. Specifically, it was predicted that electronic information sources would shift libraries from being storehouses and providers of print materials to being providers of computer-based information systems (Schauder, 1994). In fact, the primary goal of electronic journals was to replace the existing print media (Turoff & Hiltz, 1982).

Although the electronic revolution has not resulted in complete replacement of printed publications by electronic media, the technological advances of the computer age have dramatically altered the relation between information sources and society as a whole. Miller and Dufek (1995) have suggested that electronic information sources such as electronic journals are developing more rapidly than were expected, or even imagined. Many authors have predicted, however, that printed materials will never be totally replaced by their electronic counterparts. The future role of print media has been paralleled to that of horses (Dizzard, 1994). For example, horses are still available for use, but their uses have been dramatically restricted as compared to the past; likewise, print media will be successful only if it is utilized for applications for which print is best. In particular, Bagdikian (1971) has suggested that print is more efficient for certain applications (such as titles of ownership, resumes, and transcripts), and will therefore be a permanent fixture in our society.

BENEFITS AND COSTS—VIEWS IN THE LITERATURE

Collins and Berge (1994) suggested that print journals and online journals can be distinguished by their respective costs of production and distribution, and that online journals are typically less expensive. Print and electronic journals also differ in the timing and type of feedback they elicit from readers (Collins & Berge, 1994; Harnad, 1992). The format of electronic journals can allow for immediate feedback from readers and response from author or editor, whereas this process can take up to two years for print journals. A benefit that has contributed to the rapid growth of online journals is the addition of sound, graphics, and movies, which can be embedded in journal articles (Miller & Dufek, 1995). The ability of online journals to create links to other information sources such as related journals or web sites is another benefit.

The higher acceptance rates of submitted articles (Shamp, 1992; Smith, 1991) of online journals as compared to print journals is another benefit, although higher acceptance rates alone have not been viewed universally as an advantage. Although online journals can speed up the peer review and publication process, there are a limited number of online peer-reviewed journals. In fact, critics have referred to the lack of peer-reviewed online publications as one indication that electronic journals have not lived up to their proposed potential (Wilson, 1991). The resistance of many scholars to publish in an online medium is related to, if not resulting from, the lack of credibility of online publications. For example, many authors in academic settings place importance upon the acceptance by a peer-reviewed journal. This is connected to credibility problems that arise in decisions of advancement at universities where online journal publications carry less weight than print journals (Collins & Berge, 1994).

Accessibility has been cited as another advantage of online journals. Online journals have the potential to reach a much greater number of people than do print journals. The wide accessibility of online journals is due to the Internet's development which McLuhan and Powers (1989) referred to as the foundation of the "Global Village." However, inaccessibility has more often been cited as a disadvantage of online journals, rather than an advantage. The problems with inaccessibility stem from two sources: lack of knowledge that the journal exists and lack of or difficulty with online access to the journal (Manoff, Dorschner, Geller, Morgan, & Snowden, 1992). Resolution of the problem of lack of knowledge that a journal exists seems relatively straightforward: by augmenting the sites that have been specifically developed for indexing and searching journal information on the Internet and carrying them on common servers.

The problem of lack of online access is quite complex. It involves the lack of physical access to a computer or telecommunications system. A significant portion of the global population does not have a computer readily available. In addition, when users have physical access to a computer but are unfamiliar with the use of hardware, software, or the Internet, they lack training access. Lack of training access can hinder the use of online journals.

Inaccessibility constitutes the primary societal cost of electronic journals. There will always be people who do not have access to online information. The social implications of differential access can be great, broadening a gap between those who have access to knowledge and those who don't have access to knowledge. However, social institutions and social climate may have the most influence in changing lack of access to online journals. For example, the assimilation of computer-based technologies in the educational system has trained children to be knowledgeable users of online information and has given them physical access to computer technologies. Although there will be early adopters and late adopters of new technology, the fact remains that a certain percentage of the population will be non-adopters (i.e., those who never use the new technology) who will not have the same knowledge and information available to them as users.

Security of the journal material and security of the subscriber are other important issues related to online journals. Journal security problems are a potential cost to society and the journals themselves. The information included in any online journal can be altered after distribution, particularly when stored in public access sites (Collins & Berge, 1994). This is a cost to society because it leads to dissemination of inaccurate or altered information. Security could be improved by restricting access, but this also restricts readership. Moreover, the security of journal subscribers is a controversial issue. In particular, information regarding log-in time, files accessed and read, topics of interest, and personal information can be ascertained during online sessions. Many users feel that measuring these types of information is an invasion of their privacy, although some journal editors and advertisers claim that this information allows them to serve the subscriber better.

In sum, the literature suggests that the benefits of online journal publication include the lower cost of the publication process itself, speedier publication process, higher acceptance rates for submitted articles, and wider accessibility to the material by readers. Inaccessibility has also been suggested as a major cost of online publications, as well as problems with security of the journal material and subscriber information. Several benefits and costs listed in the literature review are not unique to the online publication process. For example, there is broad range of acceptance rates for print journals, from those that have high acceptance rates to those that are highly selective. In addition, inaccessibility can be a problem with print media as well as online media. Finally, subscriber names and information from print journals are commonly sold or distributed to commercial businesses.

VIEWS OF SOME ONLINE EDITORS

A survey was conducted to assess the perceptions of those experienced with the online publication process. We wanted to determine the extent of agreement between the literature about costs and benefits and what editors of online media say about costs and benefits. So, we conducted a brief email survey of editors of currently available online journals.

Forty online journals were randomly selected (i.e., using a random permutation table) from an index of 1,057 journals on the Electronic Journal Universal Resource Location (http://www.edoc.com.ejournal). The online journals selected included a broad range of discipline and topic areas such as mathematics, dentistry, electronics, poetry, and economics. The editors were instructed to share their own opinions and experiences through their responses to seven questions. The questions sought to determine the following:

1. The primary goal of placing a journal online and whether the particular journal had a print counterpart.
2. Any specific problems encountered in producing their online journals.
3. Differences between online and print formats.
4. Differences in the audience/readership between online and print journals.
5. Forecasts of the future of print and online journals.

The information discussed here is based on the 26 complete responses returned from an original mailing of 40 (a 65% response rate). Generally, editors' responses to the questions concerning the primary goals and problems with online journals mirrored the advantages and disadvantages outlined in the literature review. For example, 19.2% of the editors listed both lowered costs of production and the increased production speed as primary reasons of online journal production.

The most widely cited reason given by 57.7% of the editors for producing an online journal was to explore this alternative publishing method. They were motivated by the creative possibilities of the online format as well as a desire to create a unique product. Editors also mentioned "filling a niche" or the lack of an online journal in the area as primary reasons for the online journal development. Responses to the second survey question revealed that fewer than half of the journals surveyed (42.3%) had an existing print journal counterpart. The lack of print journal counterparts was an important reason for starting an online journal. In fact, filling a niche was listed most often as the primary reason for online journal production.

Other primary reasons listed for producing online journals included subscriber characteristics and the ability to better communicate directly with subscribers. For example, reaching an international audience was reported as a goal for publication. A number (34.6%) of the editors reported that the potential audience was a primary incentive for producing online journals and listed the advantages of reaching broader, younger, or more specific audiences.

The third survey question asked about problems with online journal publication. Technical difficulties was the most widely cited problem area cited by 42.3% of the editors, who frequently mentioned difficulty with email delivery packages and problems with server sites. Interestingly, 30.8% of the editors observed that journal contributors faced similar technical difficulties and that writers were not comfortable with the computer formats of the journals. A separate problem identified by the editors was locating journal contributors. This was related to the lack of scientific credibility of online journals. Several editors also noted that reaching a target community whose members were very paper-oriented constituted a significant challenge.

Commenting on the differences between online and print journal format, cost and speed differences, 50% of the editors described differences in the speed of communications between journal contributors, reviewers, and editors, the review and revision process, or publication of the journal. Although many editors suggested that their online journals were much less costly than print journals, there was still concern over funding sources to sustain and particularly to begin a journal.

On audience and readership characteristics, editors consistently described online readers as being more sophisticated and knowledgeable about technology than print journal readers. Also, perceptions of the Internet and online journals as a global unifying influence were reflected in statements which suggested that online journals reach into corners of the world that would be virtually impossible to do with print media. Also under this question were responses that touched on the lack of a peer-review process that may adversely affect online readership due to perceived journal credibility and accessibility issues, such as the need for good access to the Internet and the fact that print journals can be more easily archived.

The last question concerned the future of online and print journals. Financial concerns were primary with one editor pointing out that it is an economic question while speculating that mechanisms may need to be developed to require payment from readers. In this context, another editor discussed challenges of obtaining support from industry advertisers who need to be brought up to speed on the benefits of digital advertising. In fact, editors of journals with broad audiences consider financial sponsorship as a primary indicator of their future. Editors of scholarly journals have the added concern that perceived credibility may affect their future. Several of these editors mentioned peer review is needed in order for online journals to be successful in the future.

THE FUTURE

According to Willis (1991), the success of online journals depends on their capabilities, which are superior to paper. Online journals must be able to organize, report, and archive knowledge (information) with lower production and distribution costs than paper journals can. To a large extent, this goal is achievable due to access, storage, and transmission capabilities of the Internet providers. Print journals are becoming increasingly expensive to produce and distribute (Shamp, 1992). Currently, many libraries and individuals cannot afford print journals because of increasing costs related to production and storage. Online journals may provide educators with an information source not otherwise available to them and their students.

Overall, the forecast for online journals seems to be one of increased usage and endless applications. However, a number of the financial, credibility, and security issues described earlier in this article must first be addressed. At this time, many online journals are subsidized by National Research and Education Network (NREN), but this system of financing is likely to change (Collins & Berge, 1994). The future of online journals seems one of divergent paths. Privatization of the Internet has and will continue to guide changes in regulation, ownership, and use of online journals. The use and sophistication of online advertising will increase because advertisers and editors have only begun to explore the commercial aspects of online advertising. Obtaining information about target users is critical to enlist advertisers, and security and privacy issues related to this need to be solved. Scholarly journals that have limited target audiences will need to find means other than advertisers for financial sponsorship. In addition, scholarly journals will need to standardize, implement peer review, and achieve better recognition among scholars in order to flourish (Piternick, 1989). If they do not, they may become informal specialized newsletters rather than formal journals.

Will there ever be a truly paperless society? Does online success reflect print failure? Opinions may differ as to the future of print media; however, there are several qualities of print journals that online journals do not share. Print journals have a relative permanence with which users are comfortable. Subscribers can touch and hold them. In addition, print journals are typically more portable. They can be taken anywhere, no phone line needed. Most recipients of print journals, however, do not read the journals regularly. Instead, most journal subscribers only select specific articles of interest to read. At the end of the journalism era and during the broadcast media era, print publications were pushed to their limits. Print should continue to survive, but only with a decrease in production and changes in content in order to suit more restricted niches left in the wake of the online journals.

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Mr. Angell is a Lecturer in the Computer Science Department at Frostburg State University, Maryland. He is a member of the Alpha Xi Chapter of Epsilon Pi Tau. Dr. Smith teaches in the Psychology Department at Frostburg State University.

8. Promoting Gender Equity Through a Technology Day Camp

by David W. Dailey

This reports on a technology day camp conducted to promote gender equity through computer and technical activities. Sixteen middle and high school students were involved in three areas including computer-assisted drafting, graphic arts, and manufacturing. Results of a survey of student attitudes toward computers and gender equity are discussed.

By the early 1980s, computer usage was well established in schools, but primarily among male students (Alvarado, 1984; Collis, 1985; Lockheed & Frakt, 1984; Miura & Hess, 1984; Sanders, 1985). Differences in computer use between males and females develop early through gender-segregated activities; male-dominated advertising, messages, and software; and the predominance of males with out-of-class access to computers (Collis & Martinez, 1989; Damarin, 1989; Lockheed & Frakt, 1984; Sanders, 1985). When asked about their software preferences, females chose word processing and business or research applications while males were more interested in programming (Lockheed & Frakt, 1984). Damarin (1989) noted that many programs are based on competition with the computer, the clock, or some type of scoring device leading to further female anxiety.

In 1989, Collis and Martinez reported nearly universal computer experience among secondary students during the previous 10 years, although males still outnumbered females in regular computer use. Damarin (1989) also found male dominance in computer labs while females are often denied access due to self-imposed limitations based on math anxiety and their perception of computers and sciences as a male domain.

Methods suggested for improving computer equity include guaranteed access to females outside of class, group interaction, and use of the computer as an educational tool (Sanders, 1985). Alvarado (1984) suggested that teachers screen software for sexism and provide female role models. Teachers must also self-monitor to avoid sexist generalizations and employ gender-fair language and materials (Darling & Sorg, 1993). Such practices "will allow females to compete equally with males in the technologically based American society, where basic computer competence and ability to learn technologically-related job skills are essential" (Taylor & Mounvield, 1994, p. 304).

In an effort to demonstrate that gender bias and stereotyping can be overcome, a technology day camp for students 13 to 16 years old was conducted at a medium-size university in the upper South. The purpose of the day camp was to promote technology education among secondary students and particularly encourage female students to consider enrollment in technology-based classes in secondary and postsecondary institutions. The term *gender equity* as used herein refers to equal awareness and access to computer resources including hardware, software, and technology programs in general.

TECHNOLOGY DAY CAMP

Objectives

The primary objective of the day camp was to expose students, especially females, to technical fields and career opportunities thereby increasing their awareness and interests in technology. Further objectives challenged male/female stereotypes in technology careers while maintaining a cooperative learning and working environment.

Participants

Students aged 13 to 16 residing in the local county were contacted and recommended by either their technology education teacher or guidance counselor. Initial enrollment was limited to 45 students with a requirement of 51% females. Twenty students enrolled, and 16 completed the workshop, equally divided between males and females. Six middle and high schools in the county were represented.

Day camp instructors included university faculty, local school technology education instructors, and a guidance counselor. The four university members taught graphic arts, computer-assisted drafting, hydraulics/pneumatics, and crafts during the academic year. An additional purpose of the workshop was to provide an opportunity for the all-male university faculty to better understand gender-equity issues. The technology education teachers, two of whom were female, taught at both middle and high schools within the county. The goal of having a mix of university and local school faculty was to improve relationships and increase ongoing interactions. The guidance counselor was also female.

Activities of the Camp

The 16 students were divided into three groups that rotated through three technical areas: Computer-Assisted Drafting (CAD), Computer Electronic Publishing, and Manufacturing. To provide information on alternative energy sources, such as solar cookers in third-world countries, was an additional goal of the camp. Each rotation included some aspect of solar cooker production.

Three 70-minute sessions with a break between each was the model the camp followed during the week. Either a counselor or faculty member presented information on vocational decision making, educational opportunities, and careers in technology fields during breaks. Students also enjoyed smores (a graham cracker, chocolate, marshmallow treat) prepared using a solar cooker.

During the CAD session, students learned basic computer design and layout skills using AutoSketch, a beginning CAD program where they planned and created layouts for the solar cookers. In the Manufacturing area, students watched a video on solar applications in third-world countries and the production of a simple, yet effective solar cooker. To facilitate production, each group of students started with a previously prepared set of plans. A technology education teacher assisted as students measured, cut, and assembled cardboard sheets into an operational solar cooker. The cardboard was covered with aluminum foil, and some models included an insulation layer. Students completed production in four days and demonstrated the units by solar cooking food for a picnic the last day of the camp.

Each group of students designed and printed a t-shirt as a first project in the graphic arts phase of the camp. Students also produced a booklet about the workshop. Layout and planning were considered, and each student used word-processing software to compose a paragraph about his or her experiences of the week. One faculty member rotated between sessions with a digital camera, photographing students at work. Photographs were downloaded and assembled into booklet layouts. Output was to laser-direct imaged plates used to print the booklet. By the end of the week, each student folded and stitched a booklet that he or she had actually produced. Students were introduced to software used by graphic arts professionals including Illustrator, WordPerfect, PageMaker, and PhotoShop. Although hands-on time with each software package was limited, each student learned basic skills and applications practiced by professionals.

On the last day of the camp, students prepared hot dogs, baked beans, nacho cheese, and brownies in the solar cookers they had built. Parents joined students and day camp staff for a picnic of solar-cooked food to close the week. Camp participants also completed a questionnaire designed to measure reactions to camp activities and gender equity.

OUTCOMES

Responses to the questionnaire indicated that students felt that they had become more familiar with computer use and the technology areas emphasized during the week. The following comments to an item on gender equity indicate that male/female stereotypes are dissolving.

"There are jobs out there for both genders and almost any job can be done by both sexes."

"That males and females can do the same things easily."

"Either sex can accomplish any career in Technology."

"In today's workforce, males and females have an equal opportunity in the technology field."

During break time each day, a short presentation encouraged students to begin thinking about career choices, particularly in technology fields. Responses to a question on what students learned about choosing a career elicited the following comments:

"That choosing a career is hard because you have so many jobs to choose from."

"It is sort of hard."

"I learned many new career opportunities involving technology."

DISCUSSION

Based on student responses to the informal questionnaire, it appeared that there was progress in reaching the objectives of promoting gender equity, improving attitudes toward males and females working together, and increasing career awareness. Although student attitudes toward gender equity were evaluated only by means of an informal questionnaire, further research is suggested by means of a controlled study to determine whether such a day camp would actually contribute to positive attitude change.

Of the eight faculty involved in the day camp, only two were female although recommendations in the literature on computer equity included increasing the number of female role models (Alvarado, 1984). Technology fields are still primarily male dominated; however, females are making inroads. Two female students attending the day camp indicated an interest in technology teaching, and at least one had been influenced by a female role model.

Sanders (1985) suggested that groups of girls be targeted since girls prefer to work among friends. Also, allowing girls to work together and promoting the computer as an educational tool rather than a toy would appeal to females. Because of the small groups in each of the sections during the day camp, each student was able to work at his or her own computer, but interaction between students was open and free. All software used during the camp was of a practical nature, and commonly used by industry.

Darling and Sorg (1993) reported that by the year 2000, women will represent 47% of the workforce, with four fifths of the new entrants women, minorities, or immigrants. Even though Title IX legislation was passed in 1972, education without gender bias is still not the norm because discrimination based on gender is "difficult to define, much less prove" (Darling & Sorg, 1993, p. 18). Teachers, rather than legislation, are the key to promoting sex equity in the classroom. They can support students in programs that are not gender traditional; encourage career decisions based on skills, abilities, and goals rather than gender; and encourage females to enter high-wage, new, and emerging technical occupations (Darling & Sorg, 1993). The technology day camp can be a device to promote high-skill, high-wage opportunities among females, and also demonstrate gender fairness in the classroom and laboratory.

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Dr. Dailey is an Associate Professor in the Department of Technology at Eastern Kentucky University, Richmond. He is a charter member of Gamma Mu Chapter of Epsilon Pi Tau.