Trends

Technology

LEWIS A. RHODES

Personal Tools for Professional Growth

When we hear and read about technological revolutions, the computer is usually the technology under discussion. Less visible, however, is the revolution in communications—the personalizing of "mass" communications. ASCD's recent decision to make available on audiocassette selected articles from *Educational Leadership* raises questions about the implications of this revolution for organizations dedicated to the support of professional development.

To most of us, mass (nonprint) media have always had two characteristics: (1) quantity production and distribution that produced economies of scale and (2) group access. As audiocassette players became smaller and cheaper, this pattern began to change. With the proliferation of "Walkman" clones, we gained a freedom of access that allows us to listen to what we want, when and where we want—while we walk, jog, drive, and even sleep.

The second step toward more flexible personal access is now being influenced by the increasing popularity of home video cassette recorders. Here, too, decreased size and cost are making it possible for us to have the quality and economy of mass-produced visual materials without the limitations of someone else's schedule. Some producers, recognizing the untapped potential market for nonentertainment themes, are now developing how-to videocassettes in areas as diverse as home repairs and divorce procedures.

This personalization of communications technology has important implications for education. The most immediate and direct consequence concerns time. Lack of time for personal and professional growth is the major learning disability that plagues most adults. As school and district staffs gain out-of-school access to video- and audiocassette players, what possibilities does this open for the organization of staff development activities? Lending libraries? Development of district-specific "wrap-around" home-study materials? ASCD would like to know because, to a great extent, our staff development materials are designed for use in organized preservice and inservice programs. We already feature audiocassettes of presentations from association meetings and, of course, have an extensive library of staff development videotapes available in VCR formats. But we do not design these materials specifically for the individual viewer or listener. The accompanying materials and suggested activities usually assume group viewing.

If you are already personalizing your staff development activities, or beginning to think about it, we'd like to hear your ideas. What types of materials are needed? In what ways are present materials inappropriate? As human beings we continually strive to increase our effectiveness. We now have an opportunity to take advantage of increasingly available *technologies* as well as *time* not currently being used for staff development. How can these best be combined to support our common personal and organizational goals?

Lewis A. Rhodes is Assistant Director for Technology, Association for Supervision and Curriculum Development, Alexandria, Virginia

Mathematics

STEPHEN S. WILLOUGHBY

Professional Lives of Mathematics Teachers: International Comparisons

The Fifth International Congress on Mathematics Education was held in Adelaide, Australia, last August. Several interesting facts about the professional lives of mathematics teachers came to light at the conference. Twenty of those are listed below. Numbers 1 through 16 describe circumstances in the United States, and 17 through 20 highlight some contrasts in other nations that compete with the United States economically and in other ways. International comparisons are especially interesting at a time when our political leaders are condemning American education and prescribing low-cost nostrums for improving it.

1. In 1981, 43 of the 45 states that responded reported a shortage of secondary school mathematics teachers.[1]

2. Between 1972 and 1982 there was a 77 percent decline in the number of secondary school mathematics teachers prepared. Only 55 percent of those

Stephen S. Willoughby is Past President, National Council of Teachers of Mathematics, Reston, Virginia, and Professor of Mathematics and Mathematics Education, New York University, New York City.

who were prepared actually entered teaching.[2]

3. In 1982–83, 6,500 mathematics and science teachers left teaching for nonteaching positions, and 1,600 left teaching to retire.[3]

4. In 1981, 1,400 bachelor's degrees were awarded in the fields of mathematics and science education. (Presumably fewer than 800 graduates entered teaching.)[4]

5. Hiring principals judged 50.2 percent of newly hired mathematics and science teachers to be unqualified. (Generally, principals consider anybody who is certified to be qualified.)[5]

6. In New York State a person can be certified to teach high school mathematics with 24 credits, of which six must be calculus. Before 1979 calculus was not required. In New Jersey a person can be certified to teach mathematics with an 18-credit minor, with neither calculus nor a course in the teaching of mathematics required. Many high schools in both states offer calculus, which could theoretically be taught by teachers who have never taken the course.

7. Prospective education majors in American colleges have the fourth lowest SAT scores of 26 possible majors (ahead of home economics, ethnic studies, and trade and vocational majors).[6]

8. New York City public schools have joined with several local universities to prepare teachers through one summer of courses and a one-year internship. (Would this be acceptable for attorneys, physicians, engineers, or accountants?)

9. A New Jersey program allows individuals to become teachers with no education courses at all if they have the required content courses (see 6) and complete an internship. (Would 18 credits of physiology plus an internship be accepted to practice medicine?)

10. The United States General Accounting Office has suggested that teachers of other subjects be allowed to teach mathematics and science with no content courses at all—if they are trained in "effective procedures." (If there were a shortage of brain surgeons, would the GAO suggest converting excess proctologists to brain surgeons with a short training session in "effective techniques"?)

11. Current salaries for certain New York City employees are:

- Police and firefighters: year 1—$21,811; year 4—$27,433.
- Sanitation workers: year 1—$19,398; year 3—$24,868.
- Clerical assistants (sanitation department): year 1—$15,000.
- Teachers: year 1—$14,527; year 5—$18,845; year 8—$24,237.

12. In 1984, the average starting salary for teachers nationwide was $13,000. As of July 1984, the average salary offer from industry and government for people starting with bachelor's degrees in mathematics and statistics was $23,400; the average offer for those with master's degrees was $28,764.[7]

13. Salaries (in real dollars, after inflation) for teachers have declined 10 percent in the past ten years.

14. In New York City, teachers' salaries as a percentage of total school expenditures dropped from 47 to 37 percent between 1972 and 1982; for New York State the figure dropped from 40 to 30 percent. The percentage of dollars for buying textbooks also dropped and is currently less than 1 percent.

15. The percentage of all federal taxes paid by corporations nationwide dropped from 28.3 percent in 1950 to 8.1 percent in 1982.[8]

16. Corporations presently pay 16.1 percent of their domestic earnings to the United States but 55 percent of their overseas profits to foreign governments.[9]

17. In virtually every industrialized nation in the world, except the United States, the government has the principal responsibility for education. (Thus, a large portion of the taxes paid by U.S. corporations to foreign governments supports education in those countries.)[10]

18. European and Japanese educators at the International Congress reported that high school teacher salaries are about the same as salaries for other educated people such as engineers, accountants, and attorneys. They were amazed and appalled at the figures cited in 11.

19. Delegates from the Soviet Union reported that the average salary for teachers is 300 rubles, and for other educated people (such as engineers) the average is 175 rubles.

20. During their six-day school week, Japanese teachers have an average of 16 contact class hours, and Chinese teachers have an average of 12 (compared with 25 in the United States). They spend a substantial amount of time keeping current in content and professional matters, planning, working with individual students and their families, and on other professional matters.

Any rational person should recognize that we need to do more than set minimal standards; require more effort from teachers while giving them less support and respect; require high school students to take more mathematics courses (who will teach them?); encourage local industry to adopt a school (what if you don't have a local industry that is interested in adoption proceedings?); and so on. A major effort must be made to enhance the attractiveness of teaching school—*now*, especially in mathematics and the quantitative sciences, where the shortage of qualified teachers is most severe.

Raising all teachers' salaries to about the same level that industry and government pay mathematicians and statisticians would require at least $40 billion per year—a lot of money, but cheaper than maintaining prisons, paying unemployment compensation, and trying to survive the other failures that will be caused by inadequate education for today's and tomorrow's students.

Even if salaries were doubled, we would still need major improvements in conditions within schools; more time spent on the task of education (stop interrupting classes for individual music lessons, athletics, pep rallies, announcements from the principal's office, and the like); and higher standards for becoming and remaining a teacher.

The quality of education in the Unit-

ed States has been amazingly high given the conditions under which educators have worked. American teachers ought to be proud that we have done the most difficult and important job in the world as well as we have. But, given the deterioration documented here, quality is degenerating quickly at a time when education is becoming more essential for individuals and for nations. Future failure cannot reasonably be blamed on overworked, undervalued, dedicated teacher, nor can it be blamed on schools of education, nor even on commercial textbook publishers. The future quality of education in this country depends *directly* on the actions taken, or not taken, by political leaders and their constituencies at the federal, state, and local level.

[1]Trevor G. Howe and Jack A. Gerlovich, "National Study of the Estimated Supply and Demand of Secondary Science and Mathematics Teachers," paper presented at the High School Chemistry Teacher Conference, Columbia, Missouri, November 1981.

[2]From *Education Week*, March 31, 1982.

[3]Report of the Rand Corporation, *Beyond the Commission Reports* (Santa Monica, Calif.: The Rand Corporation, 1984).

[4]Ibid.

[5]From *Education Week*, March 31, 1982.

[6]*Profiles, College-Bound Seniors* (New York: College Entrance Examination Board, 1984), p. 100.

[7]The College Placement Council, *Final Report* (Bethlehem, Pa.: The College Placement Council, 1984).

[8]"Periscope: Passing the Tax Buck," *Newsweek*, November 21, 1983, p. 37.

[9]Ibid.

[10]Statements 17, 18, 19, and 20 came from the Fifth International Congress on Mathematics Education, Adelaide, Australia, August 1984.

Science

ROBERT E. YAGER AND JOHN E. PENICK

Taking New Goals for School Science Seriously

A new trend in science education is emerging. School leaders are planning science programs to include features from four general goal areas:

1. *Science for Meeting Personal Needs*. Science education should help students use science to improve their lives and cope with an increasingly technological world. Students must identify and deal with problems; they may not "solve" any. They must also learn to make decisions and take actions based on information and evidence. School science must be viewed as practical as well as intellectual. It should affect the way individuals live their lives.

2. *Science for Resolving Societal Problems*. Science education should produce informed citizens who can deal responsibly with science-related societal issues. To prepare for this, students must be introduced to issues and arguments. They must study the views of others while taking and justifying their own positions. They need to identify and involve themselves with current issues, even when using traditional content to help resolve those issues.

3. *Science for Career Awareness*. Science education should make all students aware of the assortment of science and technology-related careers open to students with varying aptitudes and interests. This is especially true today, when one considers the many careers related to science and technology. Resource persons should be invited into the classroom, and students should study the community as they would a natural habitat.

4. *Science as Preparation for Further Study*. Students who are likely to pursue science academically, as well as professionally, must acquire appropriate academic interests, knowledge, and skills. This does not mean acceleration or college level courses. We must provide options ensuring success. Students need opportunities to study in depth, experiment, explain, and test. (Unfortunately, this is the *only* goal area considered in typical science programs.)

Science Literacy. Although national science leaders do not agree on the relative importance of these four goal areas, there is consensus that all must be included in K-12 science offerings designed to meet general education requirements. While some grade levels or courses emphasize goals in one of the areas, a total school program must be balanced to include all four components to achieve true science literacy.

Examples of Meeting New Goals. *Project Life Lab*, an exemplary elementary school program in Santa Cruz, California, uses a garden as a laboratory where nutrition, environmental concerns, and science applications are emphasized. Students experience science in a way that affects their daily lives, focuses on major societal issues, and involves people in the community whose careers are associated with science and technology.

The *Human Ecology* program at Brandywine High School in Delaware focuses on problems and issues in the local community. Topics include health-related issues, such as drug abuse, teenage suicide, proper nutrition, and genetics. Students participate in a community service activity concentrating on a variety of careers and providing direct experience with community improvement.

Topics in Applied Science, a middle-school program in the Jefferson County Schools in Colorado, provides experiences with energy audits, the accuracy of advertising, personal rele-

Robert E. Yager and John E. Penick are Professors of Science Education at the University of Iowa, Iowa City.