Respect and Retrospect

By Don Holznagel

Educational technology has been part of the research, development, and technical assistance work at Northwest Regional Educational Laboratory (NWREL) since its inception in 1966. The Northwest Educational Technology Consortium (NETC) is but the latest in a long series of technology-related projects and initiatives, most funded by U.S. Department of Education programs but a number supported by private sources.

Almost four decades of effort have kept NWREL at the forefront of knowledge in the field, and resulted in products and services that address the continuing sense of educators in the Northwest states that technology is important in both instruction and administration of schools and districts. We've also had a regular task of interpreting the needs of education to the technology industry, which seems to have always had answers without really understanding the questions.

The meaning of "technology," in practical terms, has changed over the years from an initial focus on computers and software to a much broader range of electronic devices and applications. These changes have been driven by rapid developments in the high-tech industry. Some educators have always recognized two things:

- Each new technology offers new opportunities to improve instruction.
- The relevance of formal education to each new generation of students depends in part on whether their school experience incorporates the technological tools they take for granted in their experiences outside school.

I can't remember a time when students haven't been ahead of teachers and administrators in their understanding of the current technologies and of the importance of the technologies to their futures. This is the first of a number of enduring themes 40 years' experience has taught.

During these many years, a large number of individuals and organizations have contributed to keeping NWREL in touch with both technology and the needs of educators in the Northwest and in the forefront of connecting technology with the improvement of education. With the intention of paying respect to a number of them, I regret that space and time will not allow me to name them all.

Enduring Themes

Every new generation of teacher has walked into the classroom to face the challenges of the teaching and learning process. These are a few of the themes all teachers must consider:

- How to teach and inspire youth to learn
- How to teach principles as well as facts
- How to address each student's individual combination of needs

Each new technology seemed to offer solutions to one or more of these challenges. And although each has fallen short in some manner, in the long run, we seem to take more steps forward than back.

At the inception of NWREL, programmed instruction became popular because it was readily adapted to computers. During the next decade, learning systems involving computers—massive storage and software that kept individual student records—became popular. The heavy focus on drill and facts turned off some educators while the ability to individualize diagnosis and instruction pleased others.

At about the same time, the invention of the easy-to-learn BASIC language enabled many people to use computers to solve their own problems without having to become a computer expert. Educators who saw problem solving as an important lifelong skill and one crucial to learning in math and science, also saw this different use of computers in instruction. Administrators saw computers as a means to turn out school district payrolls on time and to efficiently schedule high school students into the best combination of classes suiting their individual needs.

In 1967, NWREL's newly formed Technology Program under the leadership of Duane Richardson, began a project called REACT (Relevant Educational Applications of Computer Technology) that used two working groups to address the inservice needs of both administrators and teachers. While research and development to improve assistance for schools has been a core strategy for NWREL in general, it was applied in this case to the need for staff development tools for educators confronted by the opportunities and pitfalls of technology. This strategy included the "how to" of hardware operation and programming, as well as a component addressing the curricular and instructional implications and applications that were known or projected.

The concept that the importance of any technology is directly related to the extent to which it can address major instructional and administrative problems, and enable educators to think about education processes in new ways, has been a continuing theme of the work at NWREL. The development of software applications to exemplify the value of various technologies to schools has been a part of many technology projects and has led directly to the development of materials for staff inservice programs. These materials have been used in technical assistance activities in regional schools.

Computers on the Move

The REACT materials were the beginning of a strategy that continued into a collaborative project with the Alaska Department of Education to develop instructional materials in print and soft-

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ware for both teacher training and student instruction. The materials included microcomputer program libraries and support materials designed to address the need to individualize instruction for a group of students at various points in the K–12 age range, the typical situation in remote schools with one teacher and few students. The project was codirected by Bill Bramble for Alaska and Judy Edwards for NWREL, and some NWREL technology staff were stationed in Juneau from 1976 to 1982. In 1979, Edwards was recalled to take over the leadership of the technology program at NWREL.

Also in 1967, the Computer Instruction Network (CIN), a project funded under separate federal auspices, was begun at the Marion County ESD in Salem, Oregon, and served 20 secondary schools in four counties until June 1970. Conceived and directed by Judy Edwards, the project placed computers in the hands of students in three ways:

- IBM 1130 computer permanently installed as a mobile unit school van
- DEC PDP-8 minicomputers delivered to schools on a rotating basis in a small van
- Terminals with dial-up access to large GE timesharing computers

The IBM system van was driven to schools on a schedule, staying at one school for several days. A huge power cable was unrolled at each school and connected to a previously identified outlet in a hallway near an entry door. It was typically located at one school for a week for students to run programs they had prepared on paper tape in the weeks prior to the computer's arrival.

The PDP-8 systems, small enough to be carried inside the school building and fit on a card table, were accompanied by teletypes for keyboard entry and output. These minis were rotated between schools every six weeks. The operating system and interactive BASIC interpreter were stored on paper tape for reloading. The BASIC program was written for a main (core) memory of 4K words (bytes) by two original staff members in the first summer of the project. There was a lot of interaction between the CIN and REACT staffs during the next three years, especially in the testing of REACT materials using the timesharing system during inservice workshops.

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At this time, two university professors who were not only enthusiastic about their subjects but also concerned about acquainting elementary and secondary school students with concepts that could excite them as well, came to influence our work. They were advocates of curricular integration of technology, before the term was commonly used, and promoted the idea that computers, important to education because of what they were already doing for society, could bring relevance to the classroom, as well.

William Dorn, mathematics professor at the University of Denver, was interested in using computers to convey the concepts of mathematics through the process of programming algorithms and model building. These ideas showed that computer programming was not just about learning a vocational skill but an activity focused on problem solving and learning about math in ways other than rote memorization. They were about improving subject area learning while learning about computers.

The NSF-funded Huntington Project, directed by Lud Braun, a professor of electrical engineering at SUNY-Long Island from 1968 to 1972, involved a large number of teachers from secondary schools in identifying the models behind core concepts in the sciences and social studies. These models were used as the basis for computer simulations written in the BASIC language and supported by teacher support materials and student activities. The programs demonstrated to students the value of computer modeling to investigate physical world phenomena, the basis for the rapid progress in many scientific areas.

The use of BASIC made it easy for students to investigate the mathematical models in the programs that supported the simulations. That collection of software was another example of curricular integration and the relevance of science to the world outside the classroom. The programs from this project were used in CIN project schools in Oregon and in instructional software libraries across the country for many years during and after the project, extending to statewide use in Minnesota and even to microcomputers in the decade of the 1980s. Braun,

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now retired from teaching, is still active in investigating the uses of handheld computers in elementary instruction.

The establishment and continuing existence of an emphasis on technology in the work of NWREL through periods of both high and low funding is the result of the foundation laid by the foresight and support of the early leadership of the organization. Larry Fish, the founding executive director, and his successor, Robert Rath, believed in both the importance of technology to improve K–12 education, and in a continuing role for NWREL in innovation, staff development, and technical assistance, interpreting technology to teachers and administrators.

I can't remember a time during those (40) years when students haven't been ahead of teachers and administrators in their understanding of the current technologies and of the importance of the technologies to their future.

Microcomputer Revolution

During the 1980s, microcomputers began to proliferate in schools. Of the many efforts to design and market them in useful packages for home and school, the market began with about a half-dozen micros but gradually the field of major hardware players reduced to three or four. Early in the decade, instructional software produced by the Huntington Project had been converted to micros and upgraded to take advantage of their improved displays. It was clear to educators that useful instructional software could be written easily. Teachers formed companies to produce software applications that were closely followed by educational publishers. The abundance of applications from these software producers generated the need for selection guidelines for teachers.

Some in the computer business thought that the characteristics of better software had to do with efficient storage, fast loading, and operation. Teachers, on the other hand, wanted to know what the software taught and how, whether the content addressed standard objectives for the subject area, was free of bias, and a multitude of other issues such as availability, quality, and effectiveness, criteria which they applied every day in choosing instructional materials.

Beginning in 1980, NWREL Technology Program staff members addressed that growing need by developing and testing a software evaluation protocol to assist teachers in the evaluation of software packages. The project, named Microcomputer Software and Information for Teachers (MicroSIFT), developed the *Evaluator's Guide to Microcomputer Software for Education*. The criteria were the same criteria of instructional design that had served for years as the basis for evaluating instructional materials in print, film, and other media.

The project also assembled a national network of school districts, regional service agencies, and collaboratives that had a common interest in evaluating software for their constituents. They arranged to train teachers who volunteered to test and evaluate software using the *Evaluator's Guide*, contributing opinions based on classroom practice, which were incorporated with others in the widely distributed evaluation reports. The project continued until 1990 when the *Evaluator's Guide* was transferred to ISTE for continued publishing and distribution. Although the evaluations produced were useful to educators, the main value of the project was to focus the attention of developers and consumers on the instructional implications of software, and to place a tool in the hands of educators to guide their approach to software selection.

In the life of the Technology Program at NWREL, we've seen computer hardware advances move from mainframes to minicomputers to microcomputers to laptops to handhelds. In each of these phases, the advances in miniaturization and speed and types of storage made new categories possible and each of the previous categories better. This has made it possible to move from taking kids to computers to taking computers to kids. In schools we have moved from computer sharing to timesharing to personal computing to networking to ubiquitous multi-device wireless computing.

Teachers and administrators have needed help in each of these major changes because the complexity of the technology and implications for new instructional opportunities are both higher. Also, because the rate of acquisition of computer stations has been slow and the time available to learn and practice new instructional strategies slim, many teachers have not had an opportunity to realize the full benefits of the technology during any one phase. Many schools skip phases of hardware and software development because of the cost of hardware and software replacement and staff development in both money and time.

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Back to the Future

Two decades ago, I asked two NSF staff members what a student computer station would be like and cost in 10 years. Their consensus was that storage and speed would grow rapidly while size would diminish. Resulting capabilities like graphics would greatly improve but software would become more complex and more expensive. However, they said the expectation of standard capabilities would vastly increase, so that the cost of a student station that would do what would be considered standard in 10 years would drop to perhaps $800 to $1,000 and level off. That has proved true today, when you can buy a laptop for $800 that will do what is expected these days, and costs less than a microcomputer of far less capability in 1990.

We have seen our tools of delivery change as well over the years. Software transmission has moved from paper tape to timesharing libraries to floppy discs to cartridges to zip drives to CDs. Meetings have moved from physical trips to conference calls to two-way video to Internet collaborative environments. NWREL began to use the Internet in 1993 and convened the first meeting of the Regional Laboratory Network with NSF and Education Department staff in Washington, D.C., to explore the implications and means of using the Internet in K–12 education.

To explore the value of two-way interactive video in our technical assistance work, in 1995 we provided each SEA in our region with an interactive video station and conducted region-wide demonstration meetings. In a companion activity, we used two-way video to demonstrate its capability to provide continuous remote technical assistance to school staff members who had received and were implementing safe schools training.

Technology advances have changed the locations of learning about and with computers. To use computers before 1967, students were taken to a computer center in some other building. Next, the computer was in a computer room in the school, then computers in a laboratory, then in the classroom, and now in the home and in a pocket wherever the student is. We now have the possibility of providing instruction almost anytime, anywhere. How will teachers and administrators deal with these changes?

In the history of services provided by NWREL through different contracts, the importance of assistance in staff development, evaluation tools and guidelines, planning procedures and advice, analysis and interpretation of research for the improvement of classroom practice have been central to the activities of the technology program. That these themes are repeatedly addressed is due to the continuous development in technology, which has provided new tools and software regularly and at an increasing rate.

With each new development in computers or telecommunications come new opportunities for instruction and requirements for upgrading hardware, software, and teacher knowledge. The need for staff development, materials, evaluation and assessment tools, and advice and assistance continues. The questions of staff development, quality of software, and implications for instructional strategies and curricular improvement are hardly different from those in 1967, or at any stage in the interim. NWREL has assisted schools in the region with all those problems from the REACT project in 1967 to the NETC project just ending in 2005. While the current funding is ending, the needs are not, and NWREL will continue to seek ways to meet them. ∎

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Don Holznagel has been working in educational technology and distance education for 37 years. In the course of his work, he directed the NWREL MicroSIFT project and developed its Distance Education Resource Guide. He has provided technical assistance and conducted research in school districts throughout the Northwest region. Don was director of the Technology Program at Northwest Regional Educational Laboratory in Portland, Oregon (1983–1996), and director of technology at Southeast Educational Development Laboratory (1996–1998). Currently he is conducting research and developing resources for NETC.