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This Digest examines the relationship between K-12 teachers' use of computer-based technologies to deliver and support classroom instruction and the training provided to prospective teachers by teacher education institutions. It offers an overview of obstacles faced by teacher educators in providing appropriate technology instruction and outlines

approaches to addressing these obstacles.

TEACHER USE OF INSTRUCTIONAL TECHNOLOGIES: DEMANDS &

OBSTACLESSeveral factors have conspired to produce the expectation, and in some instances the requirement, that today's K-12 teachers possess among their qualifications the ability to utilize instructional technology, particularly computer-based technologies. These factors include: (1) the need to provide relevant and authentic instruction that reflects contemporary and future social and economic demands on students (Thornburg, 1992); (2) the compatibility of certain computer-based technologies with newer, research-based approaches to teaching and learning (Bracey, 1993; Campoy, 1992; Sheingold, 1991; Thornburg, 1992); (3) student and parent expectations (Topp, Mortensen, & Grandgenett, 1995); and (4) guidelines and mandates from federal, state, district, and professional bodies (Ramirez & Bell, 1994; Thomas, 1994; Widmer & Amburgey, 1994).

The Office of Technology Assessment (1995b) estimates that the number of computers in K-12 schools increased by 300,000 to 400,000 a year during the past decade. The total number of computers in schools is estimated to reach 5.8 million during 1995, one for every nine students. Despite this growth, a number of investigations into computer use in K-12 classrooms have concluded that computer-based technologies are not being fully exploited by the majority of teachers. The literature suggests that: (1) relatively few teachers routinely use computer-based technologies for instructional purposes (Hunt & Bohlin, 1995); (2) when computers are used, they are generally used for low-level tasks such as drills and word processing (Office of Technology Assessment, 1995b); and (3) computers are not sufficiently integrated across the K-12 curriculum (Office of Technology Assessment, 1995b).

The most common reasons given for the low level of computer use in schools are limited access to equipment and lack of training (Bosch & Cardinale, 1993). A number of studies and reports reveal that both new and veteran teachers feel inadequately prepared to use computers in their classroom (American Association of Colleges for Teacher Education, 1987; Bosch & Cardinale, 1993; Topp et al., 1995). In a survey of recent graduates, the Office of Technology Assessment (1995b) found that while more than half reported being prepared to utilize drill and practice, tutorials, games, word processing, and publishing applications; less than 10% felt competent to use multimedia and presentation packages, electronic network collaboration capabilities, or problem-solving applications.

OBSTACLES TO TECHNOLOGY USE IN TEACHER EDUCATION

While the limited use of computers in K-12 classrooms cannot be attributed solely to preservice teacher education, schools, colleges, and departments of education (SCDEs) are considered to be lagging behind in meeting the needs of new teachers to develop technological competencies (Walters, 1992). Critiques of teacher education's performance in training new teachers generally focus on three areas. First, teacher educators do not sufficiently model appropriate use of computers for instructional purposes, either in courses or field experiences (Bosch & Cardinale, 1993). Second, these programs do not, typically, incorporate technology across the curriculum (Walters, 1992). Third, the instruction that is provided to preservice teachers tends to focus more on the older and simpler instructional applications of computer technology (e.g., computer assisted instruction, word processing) and less on exposure to and practice with newer, more sophisticated tools (e.g., electronic networks, integrated media, problem-solving applications), which support development of students' higher-order thinking and problem-solving skills (Baron & Golman, 1994; Office of Technology Assessment, 1995a).

Improving the performance of SCDEs in preparing technologically proficient teachers will require expanding technology use among teacher educators. Topp et al. (1995) and Baron and Goldman (1995) identify several obstacles to infusing technology into teacher education programs. They include: (1) limited availability of equipment; (2) lack of faculty training; (3) no clear expectation that faculty will incorporate technology in academic activities; (4) lack of funds; (5) lack of time to develop facility in using equipment and software; (6) doubt about the pedagogical validity of using some of the newer technologies since the appearance of literature about these tools is relatively recent; (7) lack of technical support; (8) lack of appropriate materials, particularly integrated media materials suitable for teacher education instruction; and (9) absence of clear programmatic goals for the teacher education program as a whole.

An additional obstacle is disagreement among teacher educators about the best approach to preparing teachers who are proficient in computer-based instructional technologies. One source of contention is whether computer literacy courses, which expose preservice teachers to K-12 computer applications and teach them how to use basic computer tools, should be phased out. Instead of discrete computer literacy courses, computer instruction would be integrated into existing methods and foundations courses (Weibe, 1995). A related concern is the need to infuse technology, in a coordinated fashion, across the college curriculum, into the liberal arts content areas where students acquire their subject-area skills and knowledge, as well as the education specialities (Office of Technology Assessment, 1995a).

CHANGING TEACHER EDUCATION

Within the teacher education community, efforts are being made to overcome these obstacles. These efforts appear to fall into two major categories: (1) strengthening the capacity of SCDEs to prepare teachers to use instructional technology and (2) developing models and materials.

One example from the first category are the new unit standards (effective fall 1995) developed by the National Council for Accreditation of Teacher Education (NCATE), will affect the 475 SCDEs accredited by NCATE. These standards reflect recommendations from the International Society for Technology in Education (ISTE) and include guidelines that address content and pedagogical studies for initial teacher preparation, faculty qualifications, resources for teaching and scholarship, and facilities for operating the SCDE (Thomas, 1994).

Examples from the second category can be found in the recent Office of Technology Assessment (1995a) report, Teachers & Technology: Making the Connection. The report highlights four SCDEs where technology support has become an integral part of a revised teacher education program. These model programs are characterized by: (1) a required course for preservice teachers, which teaches them how to use instructional technologies; (2) exposure to technology-rich K-12 classrooms; (3) supportive SCDE leadership; (4) collegial support for change; and (5) close interaction between the SCDE and local schools.

Additional examples can be found in the national study on Technology and Education Reform. This study, sponsored by the Office of Educational Research and Improvement, shows how instructional technologies such as microcomputers, video, multimedia systems, and networks can support and advance school reform efforts and the associated reform of teacher education (Means, 1994).

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