the experiences and outcomes expected of student teaching.

One emerging trend in the United States that has the the potential to address some of the problems related to supervision in teacher education is the concept of "professional development schools." These schools would be the educational analogue of a teaching hospital, where best practice, induction for new professionals, and inquiry into educational problems and issues pertinent to that school would all exist. Creating such sites where university faculty, teacher trainees, and teachers and administrators in the school work together to achieve these three goals would go a long way toward providing a context in which research on learning, teaching, and supervision could flourish.

See also: Teacher Education Programs: Structure; Teacher Education, Governance of

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J. M. Cooper

Teacher Education, Technology in

Through the expansion of computer-related possibilities, technology is presenting the educators of teachers with new issues and challenges. Two of the major challenges are: (a) educating teachers to use technology in educationally effective ways, including teaching them about computer-related technology; and (b) incorporating technology within the delivery of teacher education. The first challenge relates to technology as content, and the second to technology as a tool or delivery channel.

1. Technology as Content

Teacher education has long included as part of its content domain the effective use of technologies as learning tools and resources. Different technologies

have been emphasized at different times: text materials, still pictures, overhead transparencies, slides, filmstrips, films, audiotapes, language laboratories, radio, television, computers, multimedia productions, and telecommunications (Saettler 1990). However, the impact of these various technologies on teacher behavior and student learning remains unclear (Clark 1983, Collis 1991). Consequently, an abiding issue in teacher education is how to organize more effectively instructional experiences related to the understanding and use of technology in schools and classrooms for both preservice and inservice teachers.

These instructional experiences must be organized so that teachers: (a) develop an overall awareness of how technologies can be used in education and learn adequate skills in handling these technologies; and (b) gain insights into how the context for the application of these technologies in a particular educational setting affects the implementation of the technologies and their influence on student learning. Together, these two aspects define technology as a content area in teacher education.

This content focus began as early as the 1920s, with the appearance in teacher education programs of courses in visual instruction and visual aids. Over time, these were replaced by courses in audiovisual media as teaching aids, generally with a skill and production orientation.

1.1 Computer-related Technology as a Content Area

This area has received intensified interest with the arrival of computer-related technologies as educational tools. As early as 1970 "a basic computer appreciation course" was being advocated as part of the initial training of all teachers (Lewis and Tagg 1988). By the early 1980s a variety of forces, including parents, groups of teachers, and major government initiatives, began to call for all teachers to become "computer literate" and receive training in how to use computers in their teaching. Instead of computer appreciation, a much broader challenge emerged: "We face the need to train, as rapidly as possible, the entirety of the teaching profession to use the new technologies" (Organisation for Economic Cooperation and Development 1986, cited in Eraut 1990 p. 17). Throughout the world, different projects and initiatives arose which were strongly influenced by experts from outside the field of education who tended not to be conversant with specialists in other areas of educational technology or teacher education (Eraut 1989). These projects generally included broad-scale, computer-related teacher education as part of their scope (see Commission of the European Communities 1989 for a European review).

The push for computer use in schools led to challenges for teacher education with regard to organization, content, and staffing. In addition, issues concerning the delivery of instruction on technology and ways of preparing teachers to teach about technology were being raised and addressed.

1.1.1 Issues relating to organization. A major issue for teacher education relating to computers is the organizational structure in which such education is offered. Two questions in this respect are: where and how does computer-related technology fit into existing "technology courses" in teacher education? The general response is that it should not be integrated into them, but requires newly developed courses, separate from both the traditional courses in educational technology and the traditional methodology courses in teacher education programs.

This was the case, for example, in preservice education in Canada in 1984 (Collis and Muir 1986) and in most of the inservice short courses that appeared in European countries (Commission of the European Communities 1989). Surveys in the United States do not show much change in this overall pattern, with some form of "computers in education" course being taught as a separate (and generally required) course for preservice education students within most colleges or faculties of education (Brownell 1990, Lintner et al. 1991). More internationally, the International Association for the Evaluation of Educational Achievement (IEA) "Computers in Education" survey of 19 national educational systems found that the most frequent form of inservice training experienced by teachers relating to the application of computers in education was an introductory computer-specific course. It was followed by other types of computer-specific courses (Pelgrum and Plomp 1991).

1.1.2 Content considerations. The content of these courses has been a subject of debate since their inception. In the early 1980s the argument was often between those who advocated learning programming and technical skills (including those who wished to allow teachers to develop their own educational software), and those who felt that a more general approach was more appropriate (including topics such as applications of computers in society) (see Collis 1988 for a review). The next aspect of the content debate concerned the role of applications software in the content of teacher education courses (e.g., should all teachers be taught how to use word processors and database software?). Another major issue related to the application of computer-related technology within curriculum areas. All of these topics and others were expected to be covered in a limited time, which provoked much discussion as to the most appropriate balance of content.

Although consensus did not emerge, a survey of required preservice computer courses in the United States in 1991 indicated some convergence on content, as also happened in other countries. The content that was chosen for more than two-thirds of

the required computer-related preservice courses in the United States included: LOGO as a programming language; applications software—word processing, database, and spreadsheet; an introduction to educational software; hardware topics; computer ethics; and future uses of computers (Lintner et al. 1991). These findings concur with the those from the IEA 1991 survey, in which the categories "Applications of Computers" and "Problem Analysis and Programming" were found to be the two major topic categories included in most inservice teacher training programs (Pelgrum and Plomp 1991).

In contrast to earlier computer-focused content lists, then, there has continued to be an evolution of opinion on the appropriate content for teacher education relating to computers. Programming is typically being dropped as a content area and the reference to computers is being changed to a broader range of "new communications and information technologies." The recommendations for the inclusion of information technology (IT) in initial teacher training made by the United Kingdom Department of Education and Science (1992) summarized emerging thinking in the field.

> The IT capability of all students completing their initial teacher training should be sufficient for them to make effective use of IT in the classroom and at the same time provide a sound basis for their subsequent development in this field. This capability should encompass at least:
> (i) The ability to make confident personal use of a range (albeit limited) of software packages and IT devices appropriate to their chosen subject and age range;
> (ii) The ability to review critically the relevance of software packages and IT devices . . .;
> (iii) The ability to make constructive use of IT in their teaching . . .;
> (iv) The ability to evaluate the way in which the use of IT changes the nature of teaching and learning. (p. 1)

1.1.3 Staffing considerations. Another issue of considerable significance for teacher education is that of appropriate qualifications for the deliverers of computer-related teacher education. Since the field is so new, few persons working as professional teacher educators have completed a sequence of professional training in the area of computer applications in education or have had personal classroom experience with computer applications in teaching. In the 1989 report of the Council of Europe's Standing Conference of European Ministers of Education it was noted that "the importance of observing proper practices in the use of NICT (new information and communication technologies) in actual teaching and learning situations, whether for initial or for in-service training, cannot be overrated. . . Teacher training is no doubt also affected by the fact that the trainers themselves do not possess sufficient knowledge or experience" (cited in Eraut 1990 p. 152). This problem will remain critical, given the importance in effective teacher education of providing models, coupled with the regular emergence of new forms of computer-related technologies such as multimedia and telecommunications (Moonen and Collis 1991).

One implication is that a great deal of teacher education in the computer-related area is undertaken by groups outside the mainstream teacher education field. It is common for teachers with classroom computer-use experience to "move up" to become inservice providers and leaders. More generally, the 1991 IEA survey showed that universities and teacher training colleges do not have a leading role in inservice teacher education relating to computers in the majority of countries (16 of the 19) responding to the survey. Most frequently a mixture (often uncoordinated) of different agencies provide inservice instruction, including ministries of education and local education authorities; associations (teachers' associations, or computer science associations); business and industry (computer manufacturers, software developers); educational support institutes (national curriculum centers, local resource centers); teachers; parent groups; and universities and teachers' colleges. This mixture varies from country to country. The questions of who can provide leadership and how quality and continuity can be monitored in this sort of conglomeration are critical issues for teacher education.

1.1.4 Delivery issues. Much debate has centered on the best style of inservice delivery, with considerable criticism of the most frequently used model—that of a short-term course away from the teacher's school (see, e.g., Rhodes and Cox 1990). The importance of ongoing support and context-specific inservice training (i.e., offered within a teacher's own school) frequently cited. However, the logistics and costs of providing these options remain prohibitive.

1.1.5 Preparation for teaching about technology. Besides teaching teachers about computer-related technology and how to apply it in instruction, another demand on teacher education relates to the fact that a new subject area has evolved in schools in many different countries, a subject area with a title such as "computer literacy," "principles of information technology," "informatics," "computer science" (Pelgrum and Plomp 1991). There has developed a "moral imperative to teach today's pupils about the role and function of the computer" (Tucker 1987 p. 37) and teacher education is expected to prepare teachers for this new subject area.

Although many of the issues and problems involved in preparing teachers for teaching a new subject area are the same as those already examined with respect to preparing teachers for the application of computer-related technology in their overall

teaching, certain aspects are noteworthy. One of these is that no convergence has occurred in schools as to what should be the content or measurable goals of these often compulsory new courses. Only in 1991, for example, did the National Council for the Accreditation of Teacher Education in the United States adopt a set of standards for teacher education institutions preparing teachers for specializations in computer-related education (International Society for Technology in Education 1991). Earlier standards had been suggested for the preparation of computer science or informatics teachers (Task Force on Curriculum for Secondary School Computer Science 1985), but no sense of a methodology and curriculum for teacher preparation has emerged internationally.

A second issue relates to the role definition of the computer-specialist teacher in the school. Frequently such a teacher is not only called upon to teach computer-related courses but is also expected to assume a broad range of responsibilities in the school. These responsibilities include providing inservice training, providing ongoing dissemination of information, advising the administration about technology, providing leadership in the change process relative to integrating technology throughout the school, evaluating software, and serving as the school technical expert. How to prepare teachers adequately for this wide range of responsibilities remains a challenge for teacher education.

2. *Technology as a Tool and Delivery Channel*

A second element in a discussion of technology and teacher education concerns advances in the use of technology as a tool within teacher education, not in conjunction with learning about technology and its applications, but as a tool for purposes that may in themselves have nothing to do with technology. This component, which might be called "technology as a tool and delivery channel," can be discussed under two major headings: the impact of technology in non-technology-related teacher education, and the use of technology to expand options in teacher education at a distance.

2.1 Use of Technology within Teacher Education Courses

Outside courses where the goal is to have students learn about applications of technology in the teaching and learning process, to what extent are teacher educators actually using technologies for educational delivery? Comprehensive data on this matter are difficult to find, although occasional reports describe interesting examples, generally involving video or interactive video. It is evident that widespread use is made of "simple" traditional media such as books, overhead projectors, and slides.

As regards computer-related resources, the use of computer-based tools for word-processing, desktop publishing, and computer-based library searches are now commonplace personal skills expected of preservice teachers. Teachers may also learn to use statistics software or gradebook software as research or professional tools. Despite these examples of the use of personal tools, however, it seems in general that the use of computer-related technology is employed relatively infrequently as an instructional medium in teacher education itself.

2.2 Technology for Teacher Education at a Distance

An exception to the situation described above is one rapidly growing variation on the delivery of teacher education, namely the move toward distance delivery of some of its components. This movement is most relevant for inservice teacher education, in which there are benefits for the teacher (both practical and pedagogical) of being able to study in a flexible way from his or her home or school rather than attend a course fixed in time and place of delivery.

There are many international examples of the use of telecommunications to support teachers in distance participation in teacher education. These can be placed into one of two general categories: those relating to course delivery at a distance and those enabling teachers to participate in a variety of other aspects of professional education (e.g., special projects or activities, or to provide "just-in-time" or ongoing opportunities for teacher education). Central to these distance opportunities are several kinds of technologies: telephone, cable television, radio and television broadcasting, audio and video recordings, video, audio, and computer conferencing, other forms of computer-mediated communication, and audiographic technology (see Roberts et al. 1990).

2.2.1 Course delivery at a distance. Examples of inservice courses being delivered at a distance entirely or partly by means of a computer-steered telecommunications channel can be found in many countries, including Canada (with a sophisticated and extensive system in terms of organization, technology, and pedagogy), the United States, Malaysia, and Denmark. The LEARN Network in Denmark, for example, has developed and delivered a number of inservice courses via telecommunications to Danish and Norwegian teachers, all of whom can remain at home and work while participating in the courses (Larsen and Malmberg 1991).

2.2.2 "Just-in-time" or ongoing teacher education. Outside the framework of inservice courses, many other opportunities for teacher inservice education are occurring through the medium of telecommunications. In the category of special projects, the PLUTO International Network Project is a noteworthy example (UNESCO 1991). The Project has used a telecommunications infrastructure to connect European teacher education institutions. In this way,

educators of teachers, preservice teachers, and classroom teachers in 10 European countries are able to identify and experience new forms of classroom activity. Distance education is a new model for teacher education.

There are other examples of how the concept of inservice teacher education is being expanded in terms of delivery and organization. More fundamentally, there is a move away from the situation where a teacher education institution decides on an appropriate sequence and timing of inservice education and toward a "just-in-time" model based on teacher choice. Throughout the world, information networks, accessible through telecommunications, are giving teachers access to collections of instructional materials, to dialogues with computer educators and other teachers about particular educational issues (not necessarily involving technology), and to large amounts of pedagogically relevant information. For example, in the United States, the Educational Native American Network connects teachers in schools for Native American students with each other and also with a wide range of informational and teaching resources including resources specifically aimed at teacher education. A similar service, the Campus 2000 Network, operates in the United Kingdom, with targeted services for special education teachers as well as teachers in general. The "Physics Forum" has provided, via an on-line system, different types of inservice support and education to more than 1,000 secondary school science teachers throughout North America. In the Netherlands the PTT (national telephone utility) cooperates with the National Curriculum Institute to provide a similar on-line information and communication service to teachers. Other examples could be cited, together showing that the distinction between teacher education and ongoing professional support and development is rapidly blurring.

3. *Implications of Technology for Teacher Education*

The emergence of new technologies—computer-related, multimedia, telecommunications—is presenting new challenges and opportunities for teacher education. Just as the teacher may no longer be able to be considered the primary source and organizer of learning for his or her students in the information society of the twenty-first century, so too will it be difficult for a teacher education institution be able to provide adequately for or structure teacher education as it relates to technology. Responding to these challenges will require the best efforts of everyone involved in teacher education.

See also: Technology and the Classroom Teacher

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B. A. Collis

Teacher Educators, Characteristics of

The body of research on teacher educators is meager. As Lanier and Little (1986) have written:

> research on teaching teachers stands in stark contrast to research on teaching youngsters . . . . Teachers of teachers—what they are like, what they do, what they think—are systematically overlooked in studies of teacher education. (p. 528)

That same year, Ducharme (1986) conducted a review of research literature in the field. He was able to locate only seven references to teacher educators, most of which focused on education faculty in general. Based on his review, Ducharme concluded that teacher educators knew very little about themselves and, furthermore, that the term "teacher educator" was ill-defined.

While teacher educators have been largely absent from refutable research literature, traditionally they have not been ignored by the literature of hyperbole, innuendo, and quasi-research. Kramer's (1991) polemic, *Ed School Follies*, followed the line of argument earlier expounded in Koerner's (1963) *The Miseducation of American Teachers*. Even Clark (1987) in his scholarly work *The Academic Life: Small Worlds, Different Worlds* relied on anecdotal barbs to make his points about education faculty.

In the late 1980s, however, things began to change. A series of books and reports appeared which systematically examined teacher education and teacher educators. Books by Warren (1989), Clifford and Guthrie (1988), Goodlad et al. (1990), and Wisniewski and Ducharme (1989) included lengthy sections on teacher educators. Howey and Zimpher's (1990) chapter "Professors and Deans of Education" in the *Handbook of Research on Teacher Education* reviewed studies of teacher educators; their *Profiles of Pre-service Education: Inquiries into the Nature of Programs* (1989) includes insightful sections on teacher educators and their work. *Phi Delta Kappan*, the *Journal of Teacher Education*, and other journals have either run feature issues on teacher educators or have published articles on the topic. The RATE committee of the American Association of Colleges for Teacher Education (AACTE) has annually published monographs based on annual surveys of education faculty and cooperating teachers. By the end of the first five years of surveys, over 12,000 faculty and more than 200 cooperating teachers had completed questionnaires.

1. Demographics of Teacher Educators

The AACTE studies from 1987 to 1991, the Ducharme and Agne data (1982, 1989) and the Howey et al. data (1978) are the major sources of information about teacher education faculty in the United States. Based on these data, a composite teacher educator can be described. This teacher educator is a White male in his late forties or early fifties, tenured at either the full or associate professor level. He acquired a doctorate while studying part-time and has been at his current place of employment for over 15 years, during which time he has published six or seven articles in refereed publications. He taught for a minimum of three years in the lower schools prior to his employment in higher education.

This composite teacher educator is from either a middle or lower middle class background. Scholars have contended that teacher educators, inasmuch as they generally come from the ranks of teachers, reflect the social class origins of teachers. Mattingly (1975), Powell (1980), Lanier and Little (1986), and Ducharme and Agne (1989) agree on this point: all suggest that the lower and lower middle social-class origins affect professional lives in higher education. Lanier and Little (1986), by way of summary, observed that:

> A disproportionately large number of faculty teaching teachers most directly have come from lower middle-class backgrounds. It is very likely that they obtain conformist orientations and utilitarian views of knowledge from their experiences at home, educational opportunities in school, and restrictive conditions of work as teachers before coming to higher education. (p. 535)

Lanier and Little's observation that teacher educators likely have "utilitarian views of knowledge" is provocative; if accurate, it may account for the high comfort level many teacher educators have historically had with such utilitarian, mechanistic movements as Competency Based Teacher Education.

This hypothetical faculty member fails, of course, to reflect the variation among teacher educators. For example, in-depth analyses of the data indicate that recently hired, generally younger faculty entered higher education faculty ranks earlier in their careers than did their older teacher education colleagues. Based on their early productivity, it can be predicted that they are likely to publish more in their careers than have the older faculty; they anticipate moving at least once in the future. They are somewhat more likely to be female, but less likely to be non-White.

These demographic data raise provocative issues for analysis and further study. For example, the teaching ranks in United States elementary schools remain largely female, while those who teach them