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ABSTRACT

In 1998, information was collected on 416 schools, colleges, and departments of education in the United States. Respondents--mostly deans and education faculty--were asked to rate their institutions in terms of a variety of indicators of capacity, including course work, technology facilities and support, skills of graduates, and field experience opportunities. The tentative recommendation of the survey was that teacher training institutions should concentrate on increasing integration of technology throughout their programs through faculty staff development and field experiences rather than on developing additional technology courses. In 1999, a follow-up survey was conducted of those institutions that had above-average ratings on all four factors of technology integration, facilities, field experience, and application skills. Types of responses for each survey item were tallied to identify common themes. Ten tables show the numbers and percentages of respondents providing each type of answer to each question, and the discussion following each table includes excerpts from the narrative responses. Two tables show ratings the respondents gave for the usefulness of various sources of technology training and for technology plans. Responses to the 1999 survey tend to support the theory that infusing technology into teacher preparation requires a comprehensive approach that attempts to balance facilities, faculty professional development, course work, and field experience. (AEF)

Research Paper: Staying Connected with Professional Development

Information Technology in Teacher Education: A Closer Look

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Introduction: The 1998 IT in Teacher Education Survey

In 1998, the author and others collected information on 416 schools, colleges, and departments of education (SCDEs) in the United States (Moursund & Bielefeldt, 1999). Respondents (mostly deans and education faculty) were asked to rate their institutions in terms of a variety of indicators of capacity, including course work, technology facilities and support, skills of graduates, and field experience opportunities.

A factor analysis of the 32-item survey indicated four groups of items in which the questions were closely related to one another:

- Integration of technology in to the program (7 items)
- Facilities (11 items)
- Field experience (4 items)
- Applications skills (4 items)

Of these, integration (the actual of use of technology in the program) was the best predictor of other aspects of capacity. When questions were clustered in to factors, we observed scattered significant differences on demographic characteristics (e.g., institutions affiliated with the National Council for Accreditation of Teacher Education tended to report more integration of technology), but we could not identify any particular type of institution more likely to report high technology capacity.

Six items, having to do with hours of course work, faculty technology skills, technology planning, and distance education, were not statistically related to any of the factors. The number of hours of technology training integrated in to other course work had a moderate correlation with other ratings of capacity;

however, technology-specific course work had little correlation even with the reported technology skills of graduates.

Our tentative recommendation was that teacher training institutions should concentrate on increasing integration of technology throughout their programs through faculty staff development and field experiences rather than on developing additional technology courses.

High-Capacity Programs

One limitation of large survey studies is that they often do not include information on how the respondents achieved the levels of capacity they reported. In an effort to better ground our findings and to provide guidelines for other institutions, we conducted a follow-up survey of those institutions that had above-average ratings on all four factors in the 1998 survey. In identifying these high-capacity institutions, we first limited our search to those institutions that responded to at least 30 of the 32 survey items, the mean level of response. Then we calculated a total score for each institution on the survey items in each of the four factors. Those scores were compared with the average scores for each factor.

We selected SCDEs that rated themselves highly on all four factors because we believe that aspects of technology capacity are necessarily related. Observers of college classrooms have reported that effective use of technology depends on a combination of facilities, technical support, professional development, and leadership (Barron & Goldman, 1994; Strudler, McKinney, & Jones, 1995). High capacity in one area, such as equipment, may have a limited effect on teaching and learning if it is not complemented with the training and other support needed to make use of the facilities. This relationship was observed in our 1998 survey, in which there were moderate correlations ($r=.34$ to $.62$) among the four factors we identified.

Using the previously described procedure, we identified 62 institutions that reported above-average levels of capacity on all four factors. In the spring of 1999, we sent these SCDEs a follow-up survey that asked respondents how they achieved their reported levels of capacity in technology preparation of new teachers. Specifically, we asked each institution to describe what helped or hindered them in providing technology facilities, integration of technology in their programs, field experiences, and graduates with basic technology skills.

In addition, we asked follow-up questions about two findings from the 1998 survey. Noting that the survey did not find a relationship between high numbers of technology course hours and other measures of capacity, we asked each respondent to describe the role of required technology courses in teacher preparation. We also asked respondents to rate (on a scale of 1–4) the importance of several alternative methods of providing technology training, including formal course work within and outside the education program, training integrated in to other education and noneducation course work, prior training in high school or community college, and informal learning.

Another question that we felt required elaboration had to do with technology planning. In 1998, we asked only whether an institution had a written, funded, regularly updated technology plan. Sixty-five percent did not (or the respondents were uncertain whether one existed). Those that did have a plan had somewhat higher scores on the different factors, but the presence of a technology plan explained at most about 5% of the variance. We felt we needed more information on the role of technology planning. We asked the high-capacity institutions (half of whom had plans) to rate, on a scale of 1–4, how important a formal technology plan is to implementing information technology in teacher education, and to describe the characteristics of an effective technology plan. The survey questions appear as an appendix.

Twenty-two of the 62 high-capacity institutions (35%) responded to the 1999 survey. As a group, these SCDEs had mean scores on each of the factors that were .8 to .9 standard deviations above the means for the full sample of 416 institutions (Table 1). As might be expected, standard deviations at this upper end of the sample distribution were considerably compressed.

Table 1. Mean Scores on Factors for SCDEs

Factors	Facilities		Integration		Applications		Field Experience	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
416 SCDEs 1998	30.7	7.9	17.3	6.0	15.9	3.3	9.5	3.6
22 Respondents 1999	38.2	3.9	22.7	3.8	18.5	1.7	12.7	2.3

Note that the questions under each of the factors should be treated as independent scales. There are different numbers of questions and different numbers of possible points under each of the factors. We do not consider the total score on the 1998 survey to be a reliable measure of capacity because the meaning of high or low scores on some items depends on interpretation. For instance, some institutions felt that a low score on required technology courses was a strength because it meant technology was integrated throughout the programs.

Respondents came from five of the six Regional Educational Technology Consortia areas. Overall mean ratings for schools in different regions were similar. The proportion of public and private institutions (55% vs. 45%) was the same in both samples. Compared with the full sample, the high-rating SCDE respondents had a somewhat higher median number of graduates in 1998 (136 vs. 120) and a higher percentage of NCATE affiliation (86% vs. 62%).

Procedure

The author and a research assistant coded each open-ended response from each respondent on the 1999 survey. Types of responses were not specified in advance; each reader was free to propose categories of responses and to sort respondents' comments in to those categories. Units of response could be sentences, phrases, or (in the case of respondents who tended to write in lists) individual words. On most questions, the two readers proposed similar meanings for 60–80% of the response units on the first reading. Combining or subdividing categories so that both readers used the same list of categories brought the agreement to 80% or more.

Results

The types of responses for each item were tallied to identify common themes. Tables 2–9, 11, and 13 show the numbers and percentages of respondents providing each type of answer to each question. (Note that the percentage of respondents for each answer is independent of percentages for other answers; the column totals are not meaningful.) The discussion following each table includes excerpts from the narrative responses. Tables 10 and 12 show the ratings respondents gave for the usefulness of various sources of technology training and for technology plans.

Technology Facilities: Helped and Hindered

Table 2. Elements Reported to Support Provision of Technology Facilities (22 Respondents)

Responses	# Responses	% Respondents
Interest, leadership, commitment	18	82%
Financial resources	16	73%
Infrastructure and technical support	7	32%
Building renovations and upgrades	5	23%
Integration of technology in curriculum	3	14%
Influence of or integration with K–12 technology programs	3	14%
Long-range planning	3	14%
Training, professional development	2	9%
Integration of technology with other departments; sharing	2	9%
Accreditation standards	1	5%

Table 3. Elements Reported to Hinder Provision of Technology Facilities (20 Respondents)

Responses	# Responses	% Respondents
Lack of financial resources or budget allocations	11	55%
Size or age of facilities	5	25%
Personnel; lack of technically experienced faculty	4	20%
Lack of commitment to technology	2	10%
Lack of time	2	10%
Lack of planning or poor planning	2	10%
Lack of technology in K–12 schools	1	5%
"Mainframe mentality"	1	5%

Two factors stood out in helping institutions provide students and staff with adequate facilities: Commitment (mentioned by 82% of respondents) and money (mentioned by 73%). Finances were also the most commonly cited hindrance (55%) to providing facilities.

Another element—organizational infrastructure and technical support—was included as part of facilities on the original 1998 survey. However, seven respondents felt support was important enough to mention on its own.

Various elements were reported by different institutions as helping to drive technology improvements. The most important of these was building renovations, which provided opportunities to rewire and upgrade classrooms. By the same token, facilities that were difficult to upgrade (either because they were too old or being built too quickly) were cited by one quarter of respondents as an important hindrance.

Other "drivers" included long-range planning, the pressure of NCATE accreditation requirements, and the general integration of technology in the program.

Integration: Helped and Hindered

Table 4. Elements Reported to Help Faculty and Students Integrate Technology in to Classroom Practice (22 Respondents)

Responses	# Responses	% Respondents
Training, professional development	15	68%
Technology infrastructure	11	50%
Expectations of teachers, administrators, NCATE	9	41%
Personnel: faculty initiative and skill	8	36%
Incentives for faculty	5	23%
Technology skills of incoming students	2	9%
Student course work	2	9%
Support from K–12 schools	1	5%

Table 5. Elements Reported to Hinder Faculty and Students from Integrating Technology in to Classroom Practice (21 Respondents)

Responses	# Responses	% Respondents
Lack of infrastructure	11	52%
Lack of time	6	29%
Lack of enthusiasm or buy-in	4	19%
Lack of mentors or examples in practice	3	14%
Lack of K–12 technology capacity	3	14%
Other competing requirements of the program or institution	3	14%
Lack of financial resources	2	10%
Lack of training or professional development	2	10%
No hindrances	1	5%

The most helpful technique for promoting integration of technology in teacher education was reported to be professional development for college faculty (mentioned by 68% of respondents). Related to the first point, faculty initiative and skill in using technology were also described as being important to integration (36%).

Lack of professional development was mentioned by only two institutions. A greater concern for most respondents was technology infrastructure and facilities. About half the respondents felt that their facilities limited their ability to integrate technology; the other half felt their facilities were a strength.

Forces helping to drive integration efforts included expectations of teachers (for technology use by students), administrators (for technology use by teachers), and NCATE (for technology use by programs). The growing use of technology in K–12 schools also provides more opportunities to apply integration skills (see Field Experience in the following section), as well as an increasingly computer-adept student body coming out of high school.

Field Experience: Helped and Hindered

Table 6. Elements Reported to Help Institutions Provide Technology-Related Field Experiences (22 Respondents)

Responses	# Responses	% Respondents
Integration of technology field experience in the college program	7	35%
A high level of K–12 facilities and support	6	30%
Effective mentors (college supervisors and K–12 teachers)	6	30%
Funding (grants and bond measures) for facilities and training	6	30%
Dedication and willingness to learn; initiative	5	25%
Professional development at K–12 and college levels	5	25%
NCATE standards	1	5%

Table 7. Elements Reported to Hinder Institutions from Providing Technology-Related Field Experiences (18 Respondents)

Responses	# Responses	% Respondents
Lack of K–12 teachers using technology, whether or not it is present	11	61%
Lack of technology in K–12 schools	8	44%
Lack of time, lab access, or other resources in the college	4	22%
Lack of coordination by the college or university	2	11%
Lack of initiative by students	1	6%

The conditions reported to support technology-related field experience were diverse, with similar numbers of respondents (five to seven) mentioning integration with the college course work, levels of technology in K–12 schools, availability of mentor teachers and supervisors, initiative on the part of students, and training for K–12 teachers and college faculty. There was much greater agreement on the main limitation on field experience programs: the lack of capacity in K–12 schools. That includes both lack of hardware and a lack of teachers using technology (whether or not it is present).

Other hindrances included lack of technology facilities at the college, failure by the college to coordinate field experience opportunities, or failure by individual student teachers to take advantage of technology in the schools.

Applications Skills: Helped and Hindered

Table 8. Elements Reported to Help Students Achieve Proficiency with Word Processing, E-Mail, World Wide Web, and Electronic Gradebooks (22 Respondents)

Responses	# Responses	% Respondents
Technology-specific course requirements	17	77%
Integration of technology in the program; expectations of proficiency	11	50%
Technology infrastructure	4	18%
Ongoing training and support (formal and informal)	3	14%
Strong student background in technology	1	5%

Table 9. Elements Reported to Hinder Students from Achieving Proficiency with Word Processing, E-Mail, World Wide Web, and Electronic Gradebooks (20 Respondents)

Responses	# Responses	% Respondents
Lack of infrastructure	9	45%
Few or no hindrances	7	35%
Not enough course work, or courses offered too late in the program	4	20%
Lack of interest of skill in technology integration on the part of faculty	4	20%
Lack of time for training and program development	2	10%
Large and diverse classes for students	1	5%

Most respondents agreed on what helped their students master basic computer skills: the technology training courses provided in their programs. The other main influence on student technology skills was the overall use of technology in the program: the expectations of faculty and the access and support provided by the institution.

For a third of the respondents, there *were* no serious obstacles to students developing applications skills. The SCDEs that did report hindrances listed lack of infrastructure as the leading problem, followed by lack of technology course work, lack of time to develop courses, and lack of faculty who could integrate technology in to other courses.

Sources of Training

When we asked respondents to rate various sources of technology training for preservice teachers, results tended to mirror responses to the previously mentioned applications skills item. Technology courses within the teacher training program were rated as essential by most respondents, followed by training integrated in to other education course work and informal individual learning. High-school experience and training from outside the program were not considered essential by most respondents (Table 10).

Table 10. Importance of Sources of Technology Training

Source of Training	# Respondents	Unimportant=1	Useful =2	Important =3	Essential =4	Mean rating*
Technology courses within the education program	22	0	1	5	16	3.7
Technology integrated in to other education course work	22	0	3	7	12	3.4
Informal learning from peers or self-study	17	0	4	4	9	3.3
Prior training in high school or community college	21	0	9	9	3	2.7
Technology integrated in to other noneducation course work	22	1	9	9	3	2.6
Technology courses from outside the program	22	5	10	6	1	2.1

* Σ(rating x no. responses) / no. respondents

Role of Technology Course Work

Our respondents emphasized two points about the role of technology-specific course work: First, the courses build confidence and skills; second, they need to be followed up with actual use of technology in other course work. Eight of the respondents reported that the formal courses were basically a transition to the integration of technology; they may even be phased out over time. Also mentioned were the ideas that integration should be specifically taught as well as modeled, and that technology training was "preparation for the future," not necessarily for immediate integration (Table 11).

Table 11. Roles of Required Computer Courses in Training New Teachers (22 Respondents)

Responses	# Responses	% Respondents
A starting point to build confidence and basic skills	12	60%
Should be followed by integration in to other course work	11	55%
Should be minimized or eliminated in favor of integration	8	40%
A resource; provide support and tools for other course work	4	20%
Should specifically teach integration	3	15%
Necessary for preparing students for the future	3	15%

Technology Planning

The perceived value of technology planning apparently exceeds the actual practice of planning. Only half of the high-scoring respondents reported having technology plans, but all but one rated technology plans to be "Essential" or "Important" (Table 12).

Table 12. Importance of a Formal Technology Plan (22 Respondents)

Not needed=1	Useful=2	Important=3	Essential=4	Mean rating*
0	1	5	16	3.7
* Σ(rating x no. responses) / no. respondents				

All respondents—whether they had a plan or not—had ideas about what a useful technology plan should look like. At least half of the respondents said a plan should have specific goals and objectives; attend to integration of technology (not just provide hardware and software, although that is important); involve all important stakeholders; and be based on needs assessment and ongoing evaluation. Another feature mentioned was professional development. A variety of factors having to do with the practicalities of making a plan work were mentioned by several respondents. These included funding, incentives, and an implementation scheme (Table 13).

Table 13. Characteristics of a Useful Technology Plan (22 Respondents)

Responses	# Responses	% Respondents
Includes specific goals and objectives	13	65%
Includes integration with curriculum	11	55%
Involves all stakeholders	10	50%
Provides adequate facilities and support	10	50%
Provides for needs assessment, evaluation, and revision	10	50%
Provides for professional development	7	35%
Provides for adequate funding	5	25%
Is realistic	2	10%
Provides for actual implementation of the plan	2	10%
Includes incentives for following the plan	1	5%

Discussion

The responses to the 1999 survey tend to support our theory that infusing technology in to teacher preparation requires a comprehensive approach that attempts to balance facilities, faculty professional development, course work, and field experience. Responses in each area often referred to other aspects of capacity. For instance, integration was said to depend partly on having adequate technology facilities. Facilities in turn depend on a level of integration that creates demand. Student application skills are said to be related to both integration and facilities, but integration can itself be hindered by a lack of student computer skills.

Outside of the factors themselves, some helping/hindering agents were mentioned under several categories. Money, of course, was a common need, mentioned in all areas except student skill with applications. Professional development was mentioned under all four factors. We did not ask about how to do professional development, but others have identified time as a barrier to faculty learning new technology skills and integrating them in to instruction (Strudler, et al., 1995, p. 19). In the present survey, time was mentioned (although not specifically tied to professional development) under all factors except student applications skills.

In 1998, we noted that, while many institutions were proud of their technology course offerings, there was little correlation between the courses and the reported levels of integration, student skills, or other factors. In 1999, the high-rating respondents held technology courses in high esteem as a way to build student skills, although they were rarely mentioned as contributing directly to integration or field experience.

When we looked at the original 1998 surveys for these respondents only, we found that a higher correlation did exist between required technology course work and three of the other factors (Table 14). It is interesting to note that student computer skills—which were linked to technology courses in the 1999 narrative responses—composed the one factor that did not correlate well with course work on the 1998 survey.

Table 14. Correlations Among Main Factors and Course Work, 1998 and 1999 Surveys

	Facilities		Integration		Applications		Field Experience		Technology Courses		Integrated Tech. Training	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Facilities	1.0	1.0										
Integration	.41	.39	1.0	1.0								
Applications	.44	.28	.62	.59	1.0	1.0						
Field Experience	.35	.53	.52	.38	.34	.27	1.0	1.0				
Technology Courses	.16	.35	.17	.24	.11	.52	.16	.28	1.0	1.0		
Integrated Tech. Training	.18	.43	.33	.35	.19	.05	.23	.49	.20	.15	1.0	1.0

It would seem that the role of technology course work is not primarily to boost student skills in word processing and other applications. As we noted in 1998, students gain technology skills from a variety of sources. Rather, the course work in these high-rating SCDEs probably is most valuable in supporting the integration of technology in the rest of the activities. Presumably, in these high-capacity SCDEs, there is more technology to teach, and more opportunity to apply what is taught.

The 22 high-rating respondents were no more likely than the rest of the original sample to have large numbers of course hours. (Three to four quarter hours was the median number of credits for both samples in both technology-specific course requirements and technology training integrated in to other course work.) However, the course hours seemed to be more related to the rest of the program.

Money, time, and course hours can all be quantified, budgeted, and scheduled. One of the important drivers of technology use mentioned by our respondents is harder to pin down—commitment. Our survey did not ask how SCDEs fostered commitment to technology innovations, but some of the respondents provided clues. One noted that commitment took the form of appointing a vice president of technology. Another reported the administration began requiring technology be included in faculty evaluation plans. In contrast to these top-down commitments, two sites reported that students voluntarily raised their own fees to support technology. Another respondent recounted how he and his colleagues made a presentation before their trustees to gain support for technology. The common thread in these comments seems to be the role of human initiative, facilitated by administrative actions and access to information. It suggests that supporting the innovation actually means supporting the innovators.

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Appendix:

Information Technology in Teacher Education
1999 Capacity Questions

1. We're interested in knowing more about how you achieved the high levels of capacity you reported in 1998. Please tell us what you consider to be the key elements that ....

   1.1.1 Helped your institution provide technology facilities for students and teachers.
   1.1.2 Hindered your institution in providing technology facilities.
   1.2.1 Helped faculty and students integrate technology into classroom practice.
   1.2.2 Hindered faculty and students from integrating technology into classroom practice.
   1.3.1 Helped your students achieve proficiency with word processing, e-mail, the World Wide Web, and electronic gradebooks.
   1.3.2 Hindered your students in achieving proficiency with word processing, e-mail, the World Wide Web, and electronic gradebooks.
   1.4.1 Helped your institution provide technology-related field experiences for students.
   1.4.2 Hindered your institution in providing technology-related field experiences.

2. In our 1998 survey, higher numbers of IT-specific course requirements did not correlate with higher reported capacity in other areas. In your opinion, what is the role of required computer courses in training new teachers?

3. Postsecondary students acquire their technology skills from a variety of sources. Please rate these sources of technology training as to how important each is for students in your program. Use the following scale:

1=Unimportant; rarely used	2=Moderately useful; used by some students	3=Important; used by many students	4=Essential; used by most students

Source of training	**1**	**2**	**3**	**4**
Technology courses within the education program.				
Technology courses from outside the education program.				
Technology training integrated into other education coursework.				
Technology training integrated into other non-education coursework.				
Prior training in high school or community college.				
Informal learning from peers or self-study.				
Other (describe):				

4.1 In your opinion, how essential is a formal technology plan to implementing information technology in teacher education?

___1: Not needed	___2: Not essential, but useful	___3: Very important	___4: Essential

4.2 In your opinion, what are the key characteristics of a useful technology plan?

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