# Alternative Routes to Certification of Technology Education Teachers

Marie Hoepfl

Virtually every state in the nation has provisions that allow school districts to hire nonlicensed individuals to teach if district authorities can demonstrate that no regularly licensed teachers are available. States are responding to this shortage through a variety of measures, including alternative routes to licensure. Begun as short-term measures to deal with immediate shortages, alternative paths are now becoming "institutionalized alternatives to college-based teacher education" programs (Stoddart & Floden, 1995, p. 1). Alternative routes are designed to reduce entrance requirements and preparation needed prior to paid employment as a teacher, and they emphasize on-the-job training (Zumwalt, 1996).

Defined simply, alternative certification (AC) is a process in which a state licenses a person who has not completed a university-based teacher preparation program (Wise, 1994). The term has been applied to a wide range of alternative models. The National Council for Education Information (NCEI) distinguishes "true" AC programs as those that "include formal instruction and mentoring while teaching, and are not driven by discipline shortages" (Ludwig, Stapleton, & Goodrich, 1995, p. 6). In spite of this, the AC programs in most states do not represent "true" models, since many have been implemented to address shortages, do not require formal mentoring, and may not require any formal instruction.

Alternative licensure routes typically focus on the more pragmatic issues of teaching– the survival skills –more than they emphasize the theoretical foundations of education. The pedagogical skills addressed are designed to help the teacher assume full-time responsibility for teaching with a measure of success (McKibbin & Ray, 1994).

Emergency teaching certificates have been used in K-12 education for a long time. These are typically temporary certificates awarded on an annual basis to fill a pressing need. In fact, the number of individuals teaching "out of field" or on an emergency basis is relatively high in some states and some districts. Certification through other than traditional routes has also been used in vocational education for the better part of this century (Walker, Gregson, & Frantz, 1996).

The nationwide shortage of teachers is being felt in technology education as it is in most other teaching fields (Weston, 1997). States appear to be responding to this shortage through a variety of measures, including alternative routes to licensure. Due to the continuing and apparently rapid decline in graduates from traditional technology teacher preparation programs (Volk, 1997, 2000), this study was conducted to examine the extent to which alternative routes to licensure in technology education is being used on a national level.

## Alternative Certification: Background and Issues

According to Stoddart and Floden (1995), the first step toward widespread development of alternative routes to certification was the adoption of standardized tests for teachers as a means of ensuring their academic competence. This shifted the emphasis away from pedagogical skills toward content knowledge.

Growth in the use of alternative routes occurred at a time when the military services were downsizing, businesses were displacing workers, and universities were attempting to market their teacher education programs (Ludwig et al., 1995). At the same time, politicians and the public were criticizing the quality of education and the inability of universities to produce teachers to meet expected demands for teachers. The Department of Defense has acted as an important promoter of moving retired or nonactive military personnel into the classroom. Programs such as Troops to Teachers and Servicemembers Opportunity Colleges Education (SOCED) offer incentives and financial support to retired military personnel who enter teaching (Keltner, 1994).

The underlying assumption behind most alternative routes to certification is that traditional teacher preparation (i.e., pedagogical knowledge) is unnecessary for success in the classroom (Knight, Owens, & Waxman, 1990-1991). The following statement, issued as part of an "education manifesto" by a group of educators and policy makers, is representative of the rhetoric that

often accompanies calls for alternatives:

Today, Albert Einstein would not be able to teach physics in America's public school classrooms. That is ridiculous. Alternative certification in all its variety should be welcomed, and for schools that are truly held accountable for results, certification should be abolished altogether. Colleges of education must lose their monopoly and compete in the marketplace; if what they offer is valuable, they will thrive. (Thomas B. Fordham Foundation, 1998, p. 5)

Characteristics of the particular AC program and of the teaching context have been found to be critically important in evaluating program success (Zumwalt, 1996). In their examination of AC of trade and industry teachers, for example, Walker et al. (1996) found that requirements for certification across different states were so dissimilar that reciprocity agreements did not seem to apply.

According to the National Education Association (NEA), the primary reasons for using alternative routes are to boost the pool of minority teachers and to provide opportunities for midcareer professionals from other fields to more readily apply their talents to teaching (Ludwig et al., 1995). By streamlining certification requirements, talented people may be attracted from industry or government who would otherwise not be able or willing to serve (Litowitz, 1998).

Opponents of streamlined approaches claim that this results in teachers who are less prepared to fulfill their professional responsibilities. Instead, they believe, teaching should be modeled after other professional fields such as engineering or medicine, and licensure should be treated rigorously. Stoddart and Floden (1995) likened shortened alternative models to the trades, such as carpentry, plumbing, and the like, "where on-the-job training in the form of apprenticeships is the norm" (p. 3). Presumably, this is meant to suggest a less rigorous form of training.

A large-scale study conducted by Shen (1997) supports the claim that alternative routes lead to greater diversity in terms of gender and race (Zumwalt, 1996). The alternatively certified group did have a significantly higher percentage of minority teachers and a higher percentage of males than the traditionally certified group. The surprising finding was that over 50% of the alternatively certified teachers were recent college graduates, not older individuals seeking midcareer changes. An additional 24% of the teachers in Shen's study were seeking certification in a different field. An important implication of these findings is that AC routes allow new college graduates to circumvent the traditional teacher preparation process.

Proponents of AC claim that it is an effective way to meet the growing teacher shortages in many fields. While this may be true for some teaching fields and in some geographical areas, it is clearly not always the case (Ludwig et al., 1995). However, data from Shen's (1997) national study suggest that shortages in specific subject areas – namely, math, science, and technology – are being addressed (if not met) through alternative programs. In other words, a greater percentage of alternatively certified teachers held degrees in math, science, or engineering than the traditionally certified teachers (Shen, 1997).

Another claim made for AC programs is that they will help to meet the need for teachers in urban schools. According to Shen (1998), these programs have addressed the need in urban schools, where minority students are concentrated. AC programs do not, however, appear to have addressed the need for teachers in rural areas (Shen, 1998).

The great irony of many AC programs is that at the same time that policy makers have made it easier for noncredentialed individuals to enter the classroom, they are decrying the perceived lack of quality among graduates of traditional programs and implementing more stringent guidelines for the preparation of these teachers. The added hurdles make it even more difficult to attract people into the teaching profession via traditional routes. Stoddart and Floden (1995) called this the "two worlds of teacher education" (p. 2).

The argument for using alternative routes to find people with content-area expertise is challenged by two findings. Ludwig et al. (1995) found that participants in several AC programs studied felt they needed more content area training. And the widely held perception that knowing a subject does not guarantee you can teach it effectively has been supported by research (Ludwig et al., 1995). Young-Hawkins (1996) noted "subject-matter competence alone is inadequate for instruction because teaching requires the transformation of knowledge content into representations that enhance students' understanding and learning" (p. 27).

Finally, there is a notable absence of discussion about the pedagogical skills of alternatively certified teachers; proponents instead focus on claims about their greater content expertise. One study compared the classroom learning environments of alternatively and traditionally prepared elementary and middle school teachers. Significant differences were found in five aspects of the classroom environment: friction, cohesiveness, use of higher-thought processes, cooperation, and pacing. That is, students in traditionally certified teachers' classrooms perceived greater use of higher-thought processes, a more appropriate pace for coverage of material, more group cooperation and cohesiveness, and less friction than did students in the alternatively certified teachers' classrooms. These dimensions of the learning environment have been identified as predictors of levels of student achievement (Knight et al., 1990-1991). This would certainly be an avenue for further research.

## Alternative Certification in Technology Education

The decline in graduates from traditional technology teacher education programs is well documented (Volk, 1997, 2000). Less well documented is the number of technology teachers being certified through alternative routes (Volk, 2000). In an attempt to gain a better sense of the extent to which alternative licensure is being used on a national scale, a survey was sent to all state supervisors for technology education. Specifically, this study sought to address the following questions:

1. What is the extent of technology teacher shortages being experienced?
2. How are states responding to technology teacher shortages, if shortages exist?
3. What types of alternative licensure models for technology education are currently in place?
4. What effect(s) is the existence of alternative licensure models in technology education having on teacher shortages and on existing traditional technology teacher education programs?

### *How the Information Was Gathered and What It Yielded*

A survey was sent to the designated technology education supervisors in each of the 50 states and the District of Columbia during the fall of 1999. A second-round mailing, follow-up telephone calls, and email reminders netted a total of 36 returns, for a response rate of 70%. At least four states, it was found, have either no person designated at the state level to work with technology education programs or the position was unfilled. These states were counted as nonrespondents.

The survey was designed to elicit information about the number of unfilled technology teaching positions in each state, the alternative models being used to certify technology teachers, and the perceived effectiveness of these alternative models in preparing teachers and in meeting the teacher deficits. Each of the specific findings are discussed and, in some cases, contrasted with the findings from other studies.

### *Number of Teachers*

The state with the largest overall number of technology teachers was New York, which reported 3,000 technology teachers. The state with the smallest number of technology teachers, excepting the District of Columbia (50 teachers), was Hawaii, reporting 40 technology teachers. The average number for the 36 states responding was 917 teachers, with about one half reporting over 500 teachers and one half reporting fewer than 500.

For some states, reporting on the number of technology teachers was complicated by the fact that there is not always a clear distinction between technology education, trade and industry, industrial arts, computer technology, and related areas of study. An attempt was made, through follow-up telephone communications, to limit these findings to those teachers designated technology education or industrial technology education. For example, data on licensure models that appear to apply only to trade and industry teachers are not reported here.

### *Unfilled Positions*

All but five states in this study reported having unfilled positions at the time the survey was conducted, with a maximum of 150 (Florida) and an average of 37 unfilled positions. A total of five states noted more than 100 vacancies. These figures may be misleading, however. As one state supervisor observed, "if you have four math teachers and lose one, the fraction becomes 3/4 and the administration moves quickly to fill the position. If you have four technology teachers and one leaves, the administration simply adjusts the fraction from 4/4 to 3/3 to fit."

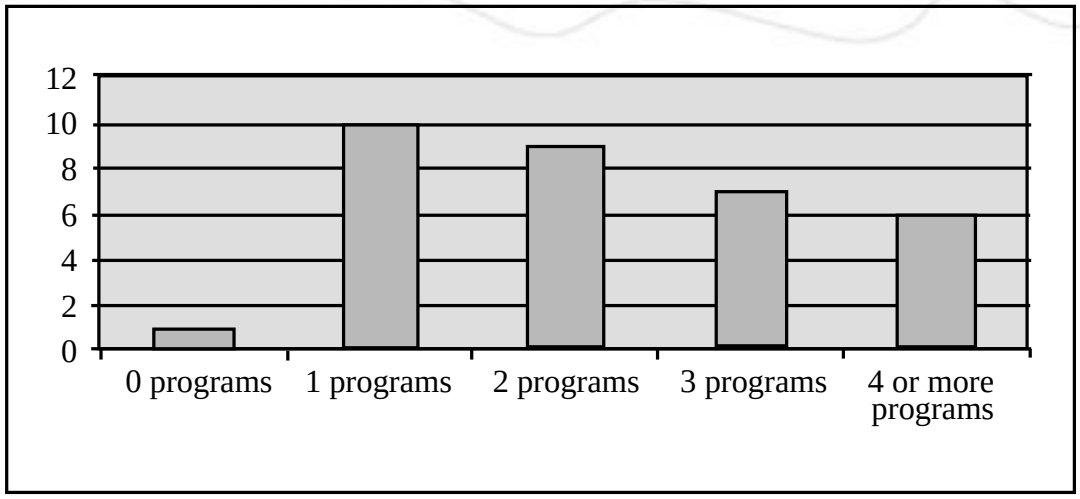


Figure 1. Number of traditional (university-based) programs (*n* = 33).

As a follow up, respondents were asked if they knew of any program closings as a result of districts not being able to fill a position. Seventy-four percent said yes, with an average number of nine closed programs per state. The maximum reported was 30 programs closed; however, one state indicated that 15 to 20 programs were being closed per year due to teacher shortages.

These findings can be compared to Litowitz's (1998) data showing that, nationwide, about 30% of states had an adequate supply of technology teachers. Litowitz found that 85% of state supervisors were aware of unfilled programs within their states, with a per state average of 19 unfilled positions.

*Traditional Certification Programs*

Figure 1 shows the number of university technology education programs in the responding states. One state had no university program, 10 had only 1 program, 9 states had 2 programs, 7 states had 3 programs, and 6 states had 4 or more certification programs. The maximum reported was 10 university programs (Texas).

When asked if the existing university programs were able to meet the demand for teachers in the state, all but two supervisors (94%) said no. The presence of multiple programs does not guarantee an adequate supply of teachers. Only one state with more than four programs reported an adequate supply of teachers and no unfilled positions. States reporting the greatest shortages had multiple traditional programs (see Table 1).

*Alternative Certification Programs*

Eighty percent of the states responding had AC programs in place for technology education. Of the eight states that did not, six were considering adopting alternative models. Thus, over 95% of the responding states either had, or were considering, alternative routes to licensure in technology education. This finding can be contrasted with data from the Litowitz

Table 1. Relationship Between Teacher Shortage and the Number of Traditional Technology Preparation Programs Within State.

| State | Unfilled Positions | Number of University Programs |
|---|---|---|
| Texas | 100 | 10 |
| New York | 100 | 2 |
| Pennsylvania | 110 | 2 |
| Missouri | 125 | 3 |
| Florida | 150 | 3 |
| Michigan | 0 | 5 |

(1998) study, which indicated that 72% of states were considering or were using alternative licensing criteria to meet the demand for teachers.

The earliest date of adoption of alternative models for technology education appears to be 1980 (Texas). At least six states adopted alternative models during the 1980s, and 15 have adopted alternative models since 1990. Data from the remaining states are not available. Only 5 out of the 27 reporting states had changed their requirements for AC since the models were first implemented. One state, Nevada, recently adopted more stringent requirements for technology certification via its alternative route. Although this appears to be part of a larger shift toward measurement of teacher performance and a strengthening of AC requirements (Ludwig et al., 1995), there was no indication that other states were considering such a move.

Estimates about the number of technology teachers pursuing certification via alternative routes at the time of this survey ranged from lows of zero (District of Columbia) and 2 (Missouri) to a high of 400 (Florida). The average for the 27 responding states that recognized alternative models was 65 teachers, although about one half of the states reported fewer than 50 alternatively certified teachers.

*Program Requirements*

Respondents were given a list of models from which to select to describe their alternative licensure requirements. The greatest number of respondents (13) indicated that they allow teachers certified in other fields to teach technology, with the requirement that they complete specified training after beginning teaching. However, all models were used on a fairly equal basis (see Figure 2). In this chart, *work* refers to coursework or other teacher training requirements, either prior to or after beginning teaching.

The following additional details will help to clarify this information. Only three states (Florida, New York, and Texas) made use of all the models listed. Of the states that listed "other" as an option, it most often referred to an emergency certification or special critical-need model. One state identified local (county-level) certification as an option under "other." At least three respondents were careful to note that the number of hours needed to satisfy certification requirements did not represent a shortened sequence of courses, but rather consisted of the same requirements that a traditionally certified teacher would have to meet.

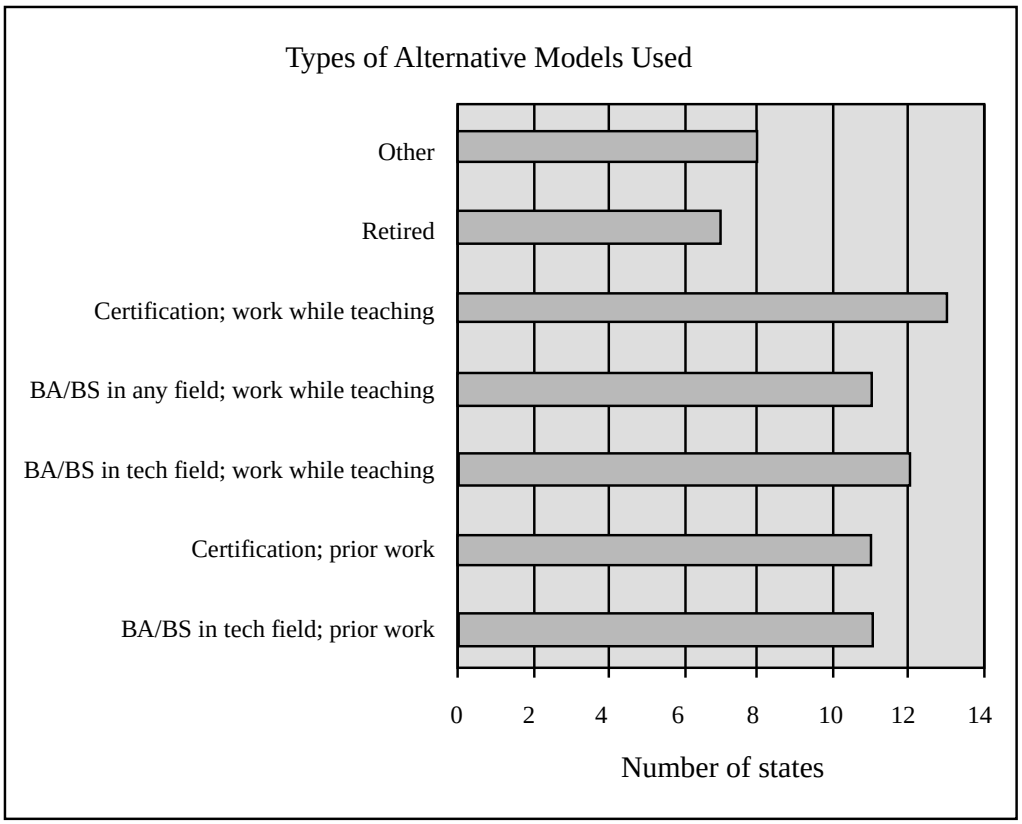


Figure 2. Frequency of use and types of alternative models adopted by states ($n$ = 27).

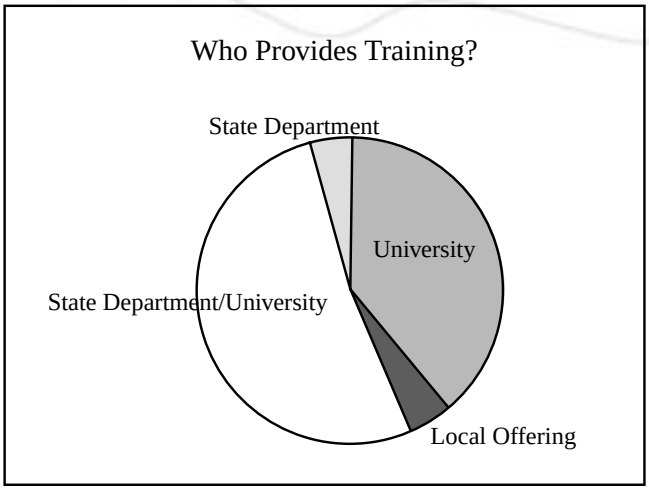


Figure 3. Source of training experiences.

Respondents were asked to describe in more detail the specific requirements for their various models. Without exception, candidates were required to hold a bachelor's degree to qualify for participation in alternative routes. Beyond that, models varied significantly from state to state. Even within states, requirements differed depending on the route taken. In some states, based on a transcript review by the state department or a university representative, an alternatively certified teacher may not have to pursue any additional training. For example, in Georgia, individuals certified in middle level education could teach any subject within the middle school setting. In other states, if students completed some type of technical degree and could pass a written test of technical content knowledge, they may not have required additional training.

Requirements, therefore, were typically decided on a case-by-case basis in relation to established standards. In one example, New Hampshire offered an alternative route that involved a portfolio review and interview process in which candidates documented their work, then met with an evaluation team consisting of a state department representative and other technology teachers. If successful, no additional training was required. The cost to candidates for applying was $100.

Some states had much more streamlined processes than others. For example, Mississippi required only a four-week training session prior to employment as a technology teacher. This option was available to teachers certified in another teaching field. The supervisor for that state believed that the four-week session was adequate preparation for teaching in the modular labs common there. By contrast, several state supervisors noted that teachers must satisfy the same requirements, both technical and pedagogical, that traditionally certified teachers do. The greatest number of requirements noted consisted of some 60 hours of coursework, plus a directed teaching experience. In some cases, candidates had a great deal of leeway in determining where and how they would satisfy requirements. For example, teachers might take technical coursework at a community college or select coursework based on the convenience of when, how, and where it was offered.

This information can be compared with that contained in the Litowitz (1998) study. He reported a minimum requirement of 6 credit hours and a maximum requirement of 64 credit hours, with a state average of 33 credit hours for nonteaching degree holders and 24 credit hours for individuals with an existing teaching degree. The findings from the current study support Young-Hawkins' (1996) observation that most alternative models do not require any formal internship or period of supervised teaching.

*Who Provides Training?*

Fourteen states reported offering some form of state level support for alternatively certified teachers. Eight provided financial support, with three states reporting substantial financial support for individuals pursuing certification. For example, Florida's loan forgiveness program provided up to $10,000 in loan forgiveness to some participants. Six states sponsored or offered workshops for alternatively certified technology teachers, although these were frequently available to any

technology teacher who wanted to participate. Two states reported state-level support in the form of mentoring programs. For the most part, training programs were provided through collaborative efforts between the state department and university-approved programs (see Figure 3).

*What Backgrounds Are Teachers Coming From?*

The most frequently identified background for alternatively certified technology teachers was another teaching field. Some states appeared to specifically target this population. The next most frequently identified background was nonteaching technical bachelor's degree programs. Business and industry ranked third as a source for teachers, with the military ranking last.

*How Well Prepared Are Alternatively Certified Teachers?*

Fifteen (71%) of the 21 people responding to this question felt that teachers are being adequately prepared through AC programs. In this regard the wide variety of requirements across states should be kept in mind. Four respondents (19%) felt that the alternatively certified teachers are not adequately prepared, while two (9%) were "uncertain" with regard to this question.

In the study conducted by Ludwig et al. (1995) for the National Science Foundation, up to 40% of participants reported feeling underprepared for tasks such as classroom management, working with at-risk students, "survival skills," and administrative duties. Surprisingly, 11% felt inadequately prepared to cover course content, and subject area coursework was perceived to be as valuable as education coursework, even though participants were selected on the strength of their subject area knowledge. An interesting follow-up study could involve asking alternatively certified technology teachers whether they perceive the required training to be adequate.

When asked how they might improve the training required, seven (33%) supervisors indicated that they would like to include formal mentoring components. Four (19%) indicated that they would require more education courses, with an equal number stating that they would require additional technology courses. Two respondents specifically expressed a desire for more training regarding the philosophy of technology education.

*Are Alternative Programs Meeting the Need for Teachers?*

Eleven out of 23 respondents (48%) to this question said that alternative routes are meeting the need for technology teachers that would not otherwise be met by traditional routes. Twelve (52%) responded negatively to this question, saying that typically there is still a need for teachers. Others expressed the belief that although this approach is not the most desirable, it is better than having no teachers (i.e., unfilled programs).

When asked whether the presence of alternative routes is affecting existing traditional programs, 16 respondents (70%) indicated that they did not believe it is. Five (22%) believed that it is affecting university programs, but at least two noted that it is affecting them in positive ways. That is, traditional programs have been upgraded or, in one case, begun as a result of this influence. One respondent was uncertain whether there is any impact on traditional programs.

*Turnover Rates*

None of the respondents to this study could provide data on turnover rates for alternatively certified teachers, although two indicated that they had begun to track this information. According to Shen (1997), there is a higher attrition rate among alternatively certified teachers than among traditionally certified teachers. This data is not specific to technology education, however, and may not be representative of the field.

## Promising Models

This study collected details regarding the requirements for alternative routes to certification in technology education, but no assessment was made regarding the advantages of one model over another, other than to consider suggestions from respondents regarding how they would like to see their models strengthened. The Council on Technology Teacher Education (CTTE) has issued a monograph that outlines the recommended components of an alternative licensure model for technology education (Litowitz & Sanders, 1999).

Ludwig et al. (1995) found agreement among the various program partners in their study of university-based alternative models that the school-based portion of these models should attempt to improve instruction, prevent attrition, develop knowledge of school culture,

and develop an understanding about student needs on the part of the alternatively certified teacher. An AC program examined by Miller, McKenna, and McKenna (1998) included condensed coursework to meet certification standards, a new-teacher mentoring program, and ongoing coursework to satisfy state requirements for middle level education. The study compared the characteristics and abilities of alternatively certified and traditionally certified teachers with results that support this type of model. Alternatively certified and traditionally certified teachers were found to be equally confident, to share the same problems, and to have no observable teaching behavior difference. The critical feature of the model program described in the study is its extensive mentoring component.

Numerous sources have supported the need for mentoring new teachers, whether certified through alternative or traditional routes (Associated Press, 1999; Kopp, 1994; Litowitz & Sanders, 1999; McKibbin & Ray, 1994; Talbert, Camp, & Heath-Camp, 1992). Whenever possible, the program should include some initial field experiences *before* a candidate assumes responsibility for the classroom. In addition to the continued support provided by the mentor teacher, ongoing feedback on performance that targets the specific needs of each teacher would, ideally, be provided. When all of these elements are in place, the candidate is more likely to experience success, and therefore satisfaction, with the teaching role (McKibbin & Ray, 1994).

### Implications for Technology Teacher Educators

In 1999, the president of the University of North Carolina General Administration laid down this challenge to universities across the state:

> The growing teacher shortage [North Carolina had an estimated deficit of 8,000 teachers] has presented all of us with a dilemma. The need for teachers is *now*, adding impetus to solutions that simply place 'warm bodies' in classrooms. Universities are increasingly seen as part of the problem rather than part of the solution to teacher shortages as we seem unable or unwilling to develop more accessible, high-quality, flexible preparation programs for working adults. (M. C. Broad, personal communication, January 27, 1999)

An important implication for technology teacher education programs is that a university-based alternative program may represent a distinct opportunity to design a more effective program overall. At the very least, increased collaboration between school districts, university faculty, and state departments can be seen as beneficial. Ideally, there will be chances to combine the "best of practice and theory" (Ludwig et al., 1995, p. 107).

When designing an AC program, some questions that must be asked include:

- How much of the program should focus on career transition issues? Individuals entering the classroom are often surprised and overwhelmed by the discipline problems, workload, lack of parental support, and lack of student respect for teachers.
- What kind of incentives can be offered to cooperating teacher-mentors? It seems clear that for substantive mentoring to occur, there must be something in the relationship to benefit both parties.
- How much interaction between traditionally certified and alternatively certified students is desirable? For example, TC route students may resent the streamlined certification requirements of the alternative program. They may also become disenchanted by the "war stories" shared by practicing teachers.
- To what extent should program participants be encouraged to act as change agents in the schools where they work? Individuals who have made the transition from a business or industry setting are often not in tune with the pace and culture of the school setting (Ludwig et al., 1995).

There must be a realization on the part of those designing AC programs that nontraditional teacher candidates have different expectations and needs. For example, Ludwig et al. (1995) found that the location of the program (i.e., proximity to home) was a dominant factor in participation. Reputation of a program was another desirable factor for participants. Participants tended to be older, to have families, and to have taken significant pay cuts by making the transition to classroom teaching.

According to Young-Hawkins (1996), few programs are designed to accommodate the needs of nontraditional students, who may require more flexible scheduling, different modes of delivery, and more focused and

pragmatic content than students in traditional programs. In her view, "the emergence of alternatives should provide us with new lenses for viewing the recruitment and preparation of technology education teachers" (p. 30).

One concern for university program coordinators is ensuring that involvement with AC programs does not detract from the reputation or quality of their traditional programs. At Appalachian State University, this author regularly works with classroom teachers pursuing certification through North Carolina's provisional route. These individuals are nondegree seeking and take relatively few courses, yet consume a significant portion of my time due to their specialized advisement needs. The attempt to accommodate these individuals through flexible scheduling means that the traditional, full-time students must compromise by taking courses at less convenient times, or on a more compressed basis than would otherwise be desirable. These accommodations are made primarily as a service to the state and to the profession.

### Suggestions for Further Research

The data collected in this study should by no means be considered definitive. Rather, they document the status of alternative licensure in technology education in the United States at a particular point in time. What these data do indicate is that the licensure landscape is a moving target, that AC programs for technology education are being increasingly relied upon to address teacher shortages, and that considerable research is needed to determine the effectiveness of AC program models.

Ludwig et al. (1995) posed three questions about AC that are important for all disciplines to address. First, what aspects of AC programs equal success in the classroom? What long-term impacts will alternatively certified teachers have on students in the classroom? Finally, how will AC programs affect the teaching population?

It is shocking and surprising how many initiatives are adopted in education without any formal evaluation to determine their effects. AC is no exception. To get a clear picture of the effectiveness of alternative approaches, multiyear follow-ups of candidates should be made (McKibbin & Ray, 1994). Compounding the lack of follow-up data on alternatively certified teachers is the lack of longitudinal data on the effectiveness of traditionally certified teachers, information that would be needed for a meaningful comparison of the two approaches (Sandlin, Young, & Karge, 1992). Zumwalt (1996) suggested that neither alternatively nor traditionally certified teachers are adequately prepared to meet the challenges in the nation's most needy schools.

The ultimate challenge facing technology educators is to determine how best to satisfy the continuing demand for technology teachers. There are many good reasons for adopting alternative models, ones that take advantage of the strengths of this approach, rather than focusing on expediency. As Miller et al. (1998) stated, "alternative certification is here to stay; researchers should investigate not whether such programs work, but which ones work best" (p. 166).

*Dr. Marie Hoepfl is an Associate Professor and Coordinator of the Technology Education Program, Department of Technology, Appalachian State University. She is a Member-at-Large of Epsilon Pi Tau.*

## References

Associated Press. (1999, September 15). Plan speeds career-change process for prospective teachers. *Winston-Salem Journal*, p. B-5.

Keltner, D. (1994). Troops to teachers: Alternative certification and the military. *The Educational Forum*, 58(2), 182-186.

Knight, S., Owens, E., & Waxman, H. (1990-1991). Comparing the classroom learning environments of traditionally and alternatively certified teachers. *Action in Teacher Education*, 12(4), 29-34.

Kopp, W. (1994). Teach for America: Moving beyond the debate. *The Educational Forum*, 58(2), 187-192.

Litowitz, L. (1998). Technology ed teacher demand and alternative route licensure. *The Technology Teacher*, 57(5), 23-28.

Litowitz, L., & Sanders, M. (1999). *Alternative licensure models for technology education.* Reston, VA: Council on Technology Teacher Education.

Ludwig, M., Stapleton, L., & Goodrich, B. (1995). *Sustaining the supply of math and science teachers: Assessing the long-term effects of nontraditional and mid-career teacher preparation programs.* Washington, DC: American Association of State Colleges and Universities. (ERIC Document Reproduction Service No. ED 381 487)

McKibbin, M., & Ray, L. (1994). A guide for alternative certification program improvement. *The Educational Forum,* 58(2), 201-208.

Miller, J., McKenna, M., & McKenna, B. (1998). A comparison of alternatively and traditionally prepared teachers. *Journal of Teacher Education,* 49(3), 165-176.

Sandlin, R., Young, B., & Karge, B. (1992). Regularly and alternatively credentialed beginning teachers: Comparison and contrast of their development. *Action in Teacher Education,* 14(4), 16-23.

Shen, J. (1997). Has the alternative certification policy materialized its promise? A comparison between traditionally and alternatively certified teachers in public schools. *Educational Evaluation and Policy Analysis,* 19(3), 276-283.

Shen, J. (1998). The impact of alternative certification on the elementary and secondary public teaching force. *Journal of Research and Development in Education,* 32(1), 9-16.

Stoddardt, T., & Floden, R. (1995). *Traditional and alternate routes to teacher certification: Issues, assumptions, and misconceptions.* Washington, DC: Office of Educational Research and Improvement. (ERIC Document Reproduction Service No. ED 383 487)

Talbert, B., Camp, W., & Heath-Camp, B. (1992). A review and synthesis of the literature on teacher induction: The vocational education perspective. *Journal of Industrial Teacher Education,* 29(2), 35-48.

Thomas B. Fordham Foundation. (1998). *A nation "still" at risk: An education manifesto.* Washington, DC: Author. (ERIC Document Reproduction Service No. ED 422 455)

Volk, K. (1997). Going, going, gone? Recent trends in technology teacher education programs. *Journal of Technology Education,* (8)2, 67-71.

Volk, K. (2000). Trends in U.S. technology teacher education programs: Home thoughts from abroad. *Journal of Industrial Teacher Education,* 37(3), 115-126.

Walker, T., Gregson, J., & Frantz, N. (1996). Standards of quality for programs that certify trade and industrial (T&I) education teachers: The need and key issues. *Journal of Industrial Teacher Education,* 34(1), 19-30.

Weston, S. (1997). Teacher shortage: Supply and demand. *The Technology Teacher,* 57(1), 6-9.

Wise, A. E. (1994). Choosing between professionalism and amateurism. *The Educational Forum,* 58(2), 139-145.

Young-Hawkins, L. (1996). Recruiting technology education teachers. *The Technology Teacher,* 56(2), 26-30.

Zumwalt, K. (1996). Simple answers: Alternative teacher certification. *Educational Researcher,* 25(8), 40-42.