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Practice Report

Morton Sternheim
University of Massachusetts - Amherst, mmsternheim@gmail.com

Yijie Zhao
University of Massachusetts - Amherst, yijiezhao@yahoo.co.uk

TOMORROW'S SCIENCE TEACHERS

STEM ACT Conference Report: Practice Section

A report on a working conference on
Alternative Certification for Science Teachers
held May 5-7, 2006 in Arlington, VA.

Authors

Morton M. Sternheim	*University of Massachusetts Amherst*
Yijie Zhao	*University of Massachusetts Amherst*
Barbara Austin	*New Mexico Institute of Mining & Technology*
Wendy Frazier	*George Mason University*
Anita Greenwood	*University of Massachusetts Lowell*
Judith Hayes	*Wichita State University*
Charmaine Hickey	*University of Massachusetts Lowell*
Kathy Shea	*University of Massachusetts Lowell*

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Photographs by Morton M. Sternheim.

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EXECUTIVE SUMMARY

The University of Massachusetts (UMass) STEM Education Institute and the UMass School of Education hosted a National Science Foundation funded conference entitled "Science, Technology, Engineering and Math—Alternative Certification for Teachers" (STEM-ACT) in Arlington, Virginia on May 5-7, 2006. This "practice" white paper summarizes issues presented at the conference that are of importance for providers of alternative certification (AC) for science teachers, highlights what we know so far about effective alternative certification programs, and discusses what we still need to know through future rigorous research on AC programs for science teachers. This paper also provides guidelines for assessment of alternative certification programs for science teachers. Two similar papers have been prepared for academic researchers and policy makers.

"Alternative certification" is, at best, a poorly defined concept. For some, they refer to programs designed to respond to teacher shortages by putting career-changers and others into classrooms more quickly than "traditional" teacher education programs. Others use this designation for anything other than a four-year undergraduate certification program. A myriad of alternative teacher certification programs exist at national, state, and local levels. They are designed for substantially different populations of teacher candidates, and with various programmatic features. The consensus at the conference was that there needs to be a continuum of teacher preparation and support programs to serve the varied needs of schools and of pre-service and in-service science teachers. Regarding the quality of AC programs, Antoinette Mitchell, representing the National Council for Accreditation of Teacher Education (NCATE), notes that NCATE holds alternative certification programs to the same standards required of all programs in NCATE-accredited institutions as a way of making institutions programs accountable for the quality of their programs and for the quality of the educators they prepare.

The participants in the conference agreed that effective AC programs emphasize these characteristics:

- solid partnerships involving the state licensing authority, institutions of higher education and local school districts in the preparation process of AC science teachers.
- the selection and recruitment of the right candidates for admission to a particular program
- needs responsive program design and delivery, and
- training for AC teacher mentors that addresses the specific needs of **science** teachers.

These features reflect what the existing literature reports about the characteristics of effective AC programs.

Nonetheless, the conference presenters shared the point of view that research on AC programs to date is very weak. Keynote speaker Kenneth Zeichner, from the University of Wisconsin-Madison, opened the conference with a critical overview of the relevant teacher education research. He noted that much of what is believed about teacher education program excellence in general cannot currently be supported by evidence due to flaws in research design and methodology. Based on the review of research on the practice of AC science teacher training, future research needs to focus on AC teacher training efficacy in terms of AC teacher quality, retention, and performance with reference to student achievement.

Given the variations among routes to AC teacher licensure, guidelines about AC teacher knowledge and skill performance are provided as a reference to assessing AC programs for science teacher preparation.

STEM ACT Conference Report

Practice section

Introduction

The University of Massachusetts (UMass) STEM Education Institute and the UMass School of Education hosted a National Science Foundation funded conference called STEM ACT in Arlington, VA on May 5-7, 2006. The focus was on what we know and what we need to know about alternative certification programs for science teachers. By limiting the discussion to science teachers, we could explore the issues that are specific to this subject area. The goal was to frame a research agenda while providing useful advice in the form of relatively short "white papers" to the academic research, policy maker, and provider communities; the last of these is the audience addressed in this document.

This white paper starts with a summary of issues presented at the conference with reference to practice in alternative certification for science teachers. This is followed by what we know so far about effective alternative certification programs, and what we still need to know through future rigorous research on alternative certification for science teachers. This paper also provides guidelines for assessment of alternative certification programs for science teachers.

A list of all the papers presented in the practice thread appears in the Appendix.

1. Summary of issues presented

The presenters at the conference discussed extensively issues related to 1) the definition of alternative certification (AC) programs, 2) the partnership characteristic of AC programs, and 3) AC teacher training practices. All these issues relate to AC teacher preparation in general and to AC science teacher preparation in particular. They are discussed respectively in the following sections.

1.1 Definition of alternative certification

One theme that came up repeatedly in the conference is that "alternative certification" is, at best, a poorly defined concept. To some, AC programs refer to those designed to respond to teacher shortages by putting career-changers and others into classrooms more quickly than "traditional" teacher education programs. Others use this designation for anything other than a four year undergraduate certification program. Antoinette Mitchell, of the National Council for Accreditation of Teacher Education (NCATE) (2006, p. 1) states:

> These programs range from 5th year programs for students without education backgrounds, to programs especially designed for career-switchers, to programs designed for specific sectors of the community such as military personnel and para-professionals.

The participants at the conference acknowledge that the "range" of the AC programs in existence is in response to the diverse training needs of prospective teachers. For example, Hayes (2006, p.9) posits:

> There's been a dramatic shift in the profile of people studying to be teachers through alternative routes. There are greater numbers of older, life-experienced people wanting to enter the teacher profession when compared with traditional preparation models. A higher percentage of these mid-career switchers are male

and/or are minorities interested in teaching in high-demand areas of the country in positions generally not sought by young, white females coming out of traditional schools of education.

… every alternative route to teacher certification is, in fact, a collaboration among the state licensing authority, institutions of higher education and local school districts.

Hence, the consensus at the conference was that there needs to be a continuum of teacher preparation and support programs to serve the varied needs of schools and of pre-service and in-service science teachers. Although there are concerns about sacrificing teacher preparation quality for meeting the science teacher demand, Mitchell (2006) notes that NCATE holds alternative certification programs to the same standards required of all programs in NCATE-accredited institutions as a way of making institutions programs accountable for the quality of their programs and for the quality of the educators they prepare.

Despite the proliferation of various AC programs to meet the challenge of science teacher shortages, partnership of AC programs, as a unifying organizational feature, was an issue addressed at the conference.

1.2 Partnership characteristic of AC programs

Alternative certification programs exist in a range of circumstances with various designs, admission criteria, program duration, amount of supervision, type of license or certification, course preparation, field experience and support. However, in spite of these differences, a unifying thread among alternative delivery models is that every alternative route to teacher certification is, in fact, a collaboration among the state licensing authority, institutions of higher education and local school districts.

There are primary and ancillary participants in a partnership for AC teacher preparation. Primary participants include the hiring school district or districts and the agent responsible for recommendation for certification. This recommending agent may be a university, a service center, or a district working directly with the state. Ancillary partners may include special interest groups such as industry or corporations, as with the Raytheon Teaching Fellows program (Hayes, 2006); military, as with Troops to Teachers; or organizations such as the National Science Foundation (NSF) or Department of Education (DOE) that provide grant funding with prescribed outcomes. With the increased demand for teachers to satisfy specific needs, innovation and collaboration have led to the development of creative partnerships.

Most of the AC programs presented at the conference are built upon solid partnerships as an integral support component in the preparation process. Indeed, research indicates that teacher candidates working in alternative licensure programs with strong district – university partnerships perform better and stay in the profession longer (retrieved from http://www.teach-now.org/overview.cfm). Thus, the establishment of strong partnerships seems to be a critical element of an effective alternative program. After all, a partnership provides the structure for science teacher preparation. The training process of prospective teachers determines not only the quality of AC programs but also the retention of the teachers trained.

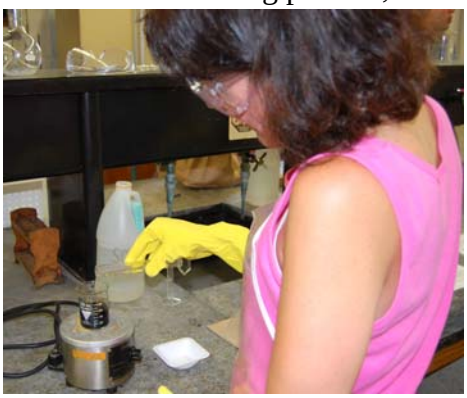
1.3 AC teacher training practices

The variety of AC programs is associated with the plethora of AC teacher training practices that were presented at the conference. From selection and recruiting of AC teacher candidates, to meeting their diverse needs through AC course design, to providing mentoring support during the training process and/or as part of new AC teacher induction, a wide range

of approaches have been adopted to attain the goals of the respective AC science teacher training programs.

1.3.1 Selection and Recruiting

Selecting and recruiting candidates for AC programs varies greatly, reflecting the diversity of these programs. Most programs require at least a bachelor's degree, and have some sort of screening process, which may include components such as tests, interviews, evidence of content mastery, or a brief demonstration lesson. Many programs presented at the conference are highly selective, as is the case for the New York City Teaching Fellows Program (Boyd, Grossman, Lankford, Loeb & Wyckoff, 2005) and for the Wichita Area Teachers in Transition and Raytheon Teaching Fellows (Hayes, 2006). Humphrey, Wechsler and Hough (2006) have observed that "most alternative certification programs bet on education background, work experience, previous classroom experience, or some combination of the three" (p.4). There are, however, programs with relatively little selectivity. An example is the George Mason University effort to support provisionally licensed teachers already in Washington, D.C. area classrooms. (Sterling, Frazier, Logerwell & Kitsantas, 2006).



Recruiting practices also vary widely, depending on the character of the program. For instance, the large Texas A&M system (Harper & Edwards, 2006) reports that "recruitment practices which seem to be the most effective are scholarships, attending and hosting career fairs and recruiting in graduate programs" (p. 3).

At the University of Texas, which has a program designed for undergraduates, Marder notes (2006, p.5),

> **All students** in the College of Natural Sciences are **recruited** to join UTeach; they receive a letter about it upon admission, hear about it during orientation, and receive additional invitations during mailings each year, from presentations before students groups, and from newspaper and television reports.

Teach for America sends representatives to large numbers of campuses, focusing on students from selective institutions and selecting only a small fraction of the applicants. The NYC Teaching Fellows program targets mid-career professionals as well as recent college graduates. The Troops to Teachers program provides information and support to retiring military personnel, with offices in 32 states.

All of the teachers need practical knowledge about navigating the current school environment such as information about legal and ethical responsibilities, teaching to diverse populations, inclusion issues, and classroom management.

There was the consensus among the participants at the conference that selecting and recruiting the right candidates for admission to a particular program is important for the program's success, because "investing resources in candidates unlikely to succeed is a lose-lose situation for programs and districts" (Hayes, 2006, p.10). After the selection and recruitment of teacher candidates based on different selection criteria of different programs (Humphrey, Wechsler & Hough, 2006), the delivery of AC programs is another step to achieve a win-win situation for both the program partners and the teacher candidates themselves.

1.3.2 Responsiveness to AC participants' needs

The presenters at the 2006 STEM-ACT conference identified four types of students who participate in alternative certification.

- Group I candidates are undergraduate students attending a traditional university in which there is no traditional certification program, for example, at the University of Texas at Austin (Marder, 2006) and at New Mexico Tech (Austin, 2006).
- Group II candidates are recent graduates who have decided to become teachers.
- Group III candidates who seek alternative licensure are working professionals who decide to switch careers or retired military personnel.
- Group IV candidates are teaching out-of-field and need to take one or more courses in order to become highly qualified for their current appointment.

Candidates in each of these groups have different sets of needs and may have their needs met through different avenues. These needs can be grouped into five main categories.

Need 1: Practical teaching knowledge. All of the teachers need practical knowledge about navigating the current school environment such as information about legal and ethical responsibilities, teaching to diverse populations, inclusion issues, and classroom management. Groups I, II, and III participants have this need met through some form of coursework. Additional avenues for meeting this need for groups II and III are through induction programs that are associated with the alternative certification program or through identifying mentor teachers in the school system who are paid to work with these teachers. No mention was made of meeting this need for group IV teachers, perhaps because it is assumed these teachers received this knowledge from their initial certification or induction program.

Need 2: Content knowledge. Federal law mandates that teachers must have sufficient content knowledge as the major provision of being highly qualified. Content knowledge needs are not usually a consideration in design of AC programs for groups I, II, and III. Only Group IV primarily needs preparation in content knowledge.

Need 3: Pedagogical content knowledge. Best practices in the field of science and math education indicate that teachers not only need to understand math or science but teach in a manner that is consistent with what is known about how people learn math or science, and is based on significant insights from recent educational research. All four groups of teachers require instruction on content-specific pedagogical practices, and all the AC programs reported that they address this need through subject specific methods courses. Laboratory safety was cited as a priority issue that is specific to science teachers. They must be comfortable dealing with biological materials or chemicals, or they will do little or no hands on laboratory work with their students.

Need 4: Income during program. Many teacher candidates have specific needs with regard to financial support and the method and timing of course delivery. Based on presentations given by teachers trained through AC programs, fulfilling these needs is critical in determining whether members of groups II and III enter the field of teaching.

Need 5: Non-traditional course delivery. Programs designed for groups II, III, and IV consist almost entirely of non-traditional course delivery, such as a summer immersion component prior to placement of candidates, multiple summers of course work, evening courses, and online, self-paced course delivery.

Although both the types of candidates and their educational needs can be categorized and summarized fairly succinctly, a shared understanding among the conference participants is that there is no easily identified one-to-one correspondence between candidate and needs. Therefore, a challenge to AC program designers is characterizing the potential population of teacher candidates with regard to their needs, and designing the program that is responsive to these needs. A related issue to meeting teacher candidate needs is mentoring support from the school district as an AC program partner.

1.3.3 Mentoring support

In addition to mentoring support provided to AC teacher candidates while they are in training (e.g., Gagne, 2006), it is also becoming a key component of new teacher induction (Feiman-Nemser, 1996), depending on the design of the AC programs. Given that most AC teacher candidates, i.e., Groups II, III and IV candidates, and new AC teachers generally lack education course work and need assistance not only with general pedagogy, but with content and science specific pedagogical content knowledge, the presenters (e.g., Britton, 2006; Greenwood, Shea & Hickey, 2006) at the conference agreed that mentors involved in AC programs need differentiated training from those on traditional certification programs so that the mentors are able to address the subject specific needs of these individuals on AC programs. Differentiated mentoring training is also important for AC science teacher professional socialization when they start to work as full-time teachers, taking into account that some AC teachers are career changers. They are "novices in a new and entirely different position", despite their "previous career experience" (Mayotte, 2003, p. 691) which will often have included teaching in some context other than K12 schools. There is research evidence that career changers' prior career experiences influence their conceptions and expectations of mentoring. When there is consistency between mentor and mentee in the conception of the mentor's role, the mentoring relationship is productive (Koballa, Bradbury, Deaton & Glynn, 2006).

In addition to the traditional one year mentoring support, there has been some experience with providing mentoring as part of AC teacher on-going professional development spanning several years (e.g., Hayes, 2006). Such a structure reportedly not only enhances new teachers' perceived self-efficacy, but also provides a continuum of professional development for all participants (Hayes, 2006).

He (Zeichner) cautioned against oversimplified views of excellence, specifically against attempting to connect the surface features of teacher education programs (e.g., their length) to various teacher and student outcomes without accounting for the characteristics that candidates bring to their preparation.

An overview of the conference presentations on practices in alternative science teacher training indicates that an AC program is a synergetic endeavor to meet the demand for qualified science teachers involving the hiring school district, the agent responsible for recommendation for certification, and some special interest groups. The process of AC teacher training, from selection and recruitment to program delivery and mentoring support, has implications for the quality of the AC programs as well as the cost-effectiveness of the alternative routes to teacher licensure. With reference to the presentations at the conference and existing literature on AC programs, the following section presents what we know so far about the characteristics of effective alternative science teacher certification programs, thus providing insights into what we still need to know.

2. What we know: Characteristics of effective alternative science teacher certification programs

As noted above, keynote speaker Ken Zeichner (Zeichner, 2006) stressed the limitations of the existing research on teacher preparation programs of all kinds, noting that "teaching and teacher education are inherently complex and are not reducible to simple prescriptions for practice". He cautioned against oversimplified views of excellence, specifically against:

> Attempting to connect the surface features of teacher education programs (e.g., their length) to various teacher and student outcomes without accounting for the characteristics that candidates bring to their preparation. …. Attempting to define the characteristics of good teacher education programs by the mere presence or absence of certain program elements without addressing how these elements are defined and used and for what purposes.

In 2006, 48 states and the District of Columbia reported to the National Center for Educational Information (NCEI) that they were implementing alternative routes to teacher certification, with the most rapid growth occurring since 2000 (retrieved from http://www.teach-now.org/overview.cfm). As alternative routes have gained in prominence, there has been increased interest in academic research to ascertain the best practices of alternative science teacher certification, or the effective program components that contribute to the supply and retention of successful AC science teachers.

With reference to the presentations at the conference and existing literature (e.g., Berry, 2004; Duhon-Haynes, Augustus, Duhon-Sells, Duhon-Ross and Mitchell, 1996; Feistritzer & Chester, 2000; Littleton and Larmer, 1998; Lutz and Hutton, 1989; McKibbon and Ray, 1994; NCATE, 2002; Wilson, Floden and Ferrini-Mundy, 2001), common themes that emerge as effective alternative certification program characteristics include seven dimensions: 1) needs-based design of the program; 2) high entrance standards; 3) intensive training focusing on professional expertise; 4) on-site support during training; 5) frequent program evaluation; 6) high exit standards; and 7) ongoing support of graduates after the program. They are elaborated on as follows.

1) Needs-based design:

- The program is designed specifically to meet the needs of particular regions, e.g., urban and rural areas, and/or subject areas, such as math and science.
- The program is tailored to meet the specific needs of the participants, e.g., taking into account the educational backgrounds and learning styles of older teacher candidates.

2) High entrance standards:

- The teacher candidates are screened through a comprehensive process to ensure that high quality candidates are accepted to the program, such as passing tests, interviews, and demonstrated mastery of content.
- Candidates with appropriate science or science-related backgrounds are recruited.

3) Intensive training in professional expertise:

- The program content includes instructional strategies, classroom management, curriculum, student assessment and how to work with the specific age group and diverse student population.

- The program provides the teacher candidates with sufficient subject content, pedagogical knowledge and skill training, and pedagogical content knowledge.
- The program provides multicultural and special education curricula and experiences related to developing and increasing candidate abilities to work with students, families, and communities from different racial/ethnic and socio-economic backgrounds, as well as with students with exceptionalities.

4) Field-based training

- An organized and comprehensive system of support is available from experienced, trained mentors once the candidate begins working in a school.
- Prospective teachers go through their training in cohorts at school so that they have sufficient peer support.
- Teacher candidates have the opportunity of guided practice in lesson planning and teaching prior to taking full responsibility as a teacher.

5) Frequent and substantial evaluation: A system is in place for continuous monitoring, evaluation, and feedback of individual and group performance to allow for program adjustment and improvement.

- All teacher candidates receive frequent and substantial formal and informal evaluation of their teaching from well-trained mentors and faculty with strong science education backgrounds;
- Faculty receives continual formal and informal evaluation of their instruction from the teacher candidates.

6) High exit standards tied to state standards for teaching: At the end of the program, teacher candidates demonstrate that they have mastered the knowledge, skills, and dispositions identified in state standards and can have a positive impact on P-12 student learning.

7) Ongoing support of graduates after the program.

- There is a structured, well-supervised induction period when the novice receives observation and assistance in the classroom by an experienced teacher.
- Ongoing professional development and reflection is supported and provided by the school and/or the university through seminars and workshops.

In the case of collaboration of colleges, which historically have been responsible for training teachers, with school districts on alternative certification programs, coordination of the schools and the colleges is needed to support candidates.

- Colleges, schools and the teacher candidates have constant communication to ensure that teaching theory and practice are effectively integrated to address classroom and pedagogical issues.
- School districts provide the teacher candidates in alternative certification programs with a supportive school environment to help them with effective transition to teaching.

- The program prepares individuals for specific positions in specific schools, and should place participants in those positions early in the training.

An AC program encompassing all these components may be an ideal, but these benchmarks provide a frame of reference for an effective AC program. These components are not meant to be an oversimplified checklist to measure the excellence of an AC program, but rather, to serve as research directions for in-depth inquiry into the implementation and efficacy of these elements to achieve excellence in AC teacher preparation.

3. What we need to know: Research agenda

It is clear from the presentations that research on alternative certification programs to date is very weak. Keynote speaker Kenneth Zeichner, from the University of Wisconsin-Madison, opened the conference with an excellent, critical overview of the relevant teacher education research. He notes that much of what is believed about teacher education program excellence in general cannot currently be supported by the evidence. It is oversimplified to judge the quality of an AC program by a simple criterion such as its length without, for example, taking into account the characteristics of the participants. Another example is that everyone agrees that mentoring of new teachers is important, but in practice the quality and extent of the mentoring offered varies enormously. Humphrey, Wechsler and Hough (2006) similarly note, “Ironically, both the endorsement and criticism of alternative certification are based on a very thin research base” (p. 4).

Based on the review of research on practice of AC science teacher training, future research needs to focus on the following areas.

- Given that “different programs have different selection criteria” (Humphrey, Wechsler & Hough, 2006, p. 8), we need to test the assumptions about the most desirable qualities of an effective teacher, and about which qualities are generic and which are specific to science teachers.
- Given that the strong interaction among AC program partners has impact on recruiting, selection and initial placement and the training processes (Daly, 2006; Harper & Edwards, 2006), we need to know the impact of such collaborative innovations on AC teacher retention.
- Research shows that field-based experiences through alternative certification routes have the potential to: 1) engage interns in the exploration of different instructional methods; 2) increase intern self-efficacy; 3) connect university coursework to classroom decision making (Bullough, Young, Erickson, Birrell, Clark, Egan, Berrie, Hales & Smith, 2002); and 4) create the “transformative pathway” (Abell, 2006) for teacher candidates to interact with veteran teachers for understanding and experiencing the teaching profession. What we need to know is through what structural, organizational, and systemic elements in the partnerships AC candidates benefit most from the field-based experiences.
- In the area of mentor training, we need to know
    - The type of assistance that is most needed by first year, alternative certification science teachers.
    - The type of mentor training that enables mentors to effectively develop the pedagogical content knowledge in alternative certification science teachers.
- Regarding mentoring relationships that best support AC science teachers, we need to know

  - The process of selection of mentors in order to ensure that productive partnerships with AC science teachers develop.
  - The expectations for mentoring that are held by both mentors and mentees.
  - The types of partnerships between mentors and mentees that most effectively develop AC science teachers' classroom skills.
  - The support of the partnerships from the school systems with release time or other means of facilitating meetings.

- In order to examine the efficacy of AC induction programs, we need to know
  - The structure of long-term professional development programs and the role of mentoring in these programs.
  - The benefits to the AC teachers who are participating in mentoring programs as a part of long-term professional development.
- Research indicates that AC science teacher training efficacy appears to be a function of the interaction between the program as implemented, the school context, and individuals' backgrounds (Humphrey & Wechsler, 2005). What we need to know is how the interaction influences novice AC teachers' performance with reference to student achievement, and their retention not only in the teaching profession but also in hard-to-staff schools.
- For comparative studies of certification programs, Humphrey and Wechsler (2005) theorize that rather than comparing different AC programs "a better unit of analysis would be a subgroup of individuals from different programs with similar backgrounds and experience, who work in the same or similar school settings"(p. 30).

The quality of an AC science teacher is a direct reflection of the quality of the AC program that he/she went through. The following section recommends guidelines for assessment of AC programs through the evaluation of the AC science teachers' mastery of teacher knowledge and their skill performance.

4. Guidelines for assessment of AC programs for science teachers

Though variation exists among routes to licensure according to state regulations and the alternative pathways that teachers can utilize to become certified, guidelines must be established to assess the alternative certification programs existing today. Included here are guidelines for states, school districts, and higher education institutions to use in order to determine the effectiveness of their alternative certification programs and for programs to use to better prepare its science teachers. The guidelines address both teacher knowledge and teacher skill performance.

4.1 Teacher Knowledge

Teacher knowledge includes teacher content knowledge and teacher knowledge of educational foundations and strategies.

Content knowledge

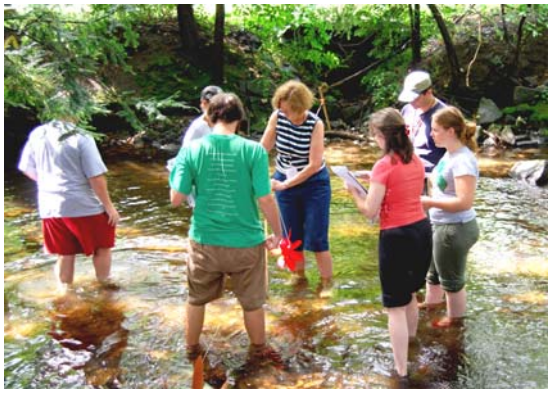
The STEM areas are a growing body of content knowledge. This requires a periodic examination of the content that science teachers are required to know. Science teacher preparation is particularly precarious since there are distinct, yet related, disciplines within science that no one teacher can truly be expected to master completely. While several states,

such as Texas, offer "composite science" certification so that teachers are certified to teach in all science content areas, such encompassing certificates in science should be used with caution. A teacher with a degree in the life sciences may not be equipped to teach the physical sciences, and vice-versa. In order to assess the extent to which alternative certification programs effectively prepare teachers who have the appropriate content knowledge set, some guiding questions are:

- To what extent do the alternative certification program's requirements for content knowledge meet local, state, and national guidelines for content?
- What evidence does the program provide regarding the teacher's working knowledge of the range of content that they will possibly teach?
- To what extent does the program identify deficiencies in content knowledge and require content preparation to meet deficiencies?
- To what extent does the program include instruction in the range of content that the teacher will likely teach?
- To what extent does the program extend teachers' knowledge beyond the range of content they will likely teach?

Educational foundations and strategies

Being a good teacher is more than knowing content (Darling-Hammond, 1999, 2000, 2002, 2003). Included in alternative certification programs are usually training in educational foundations and strategies. While an individual in an alternative certification program may have a degree in their certification area and have practiced as a professional in that area, further preparation is still needed, such as opportunities for teachers to experience first-hand the environment in which they will be working prior to their employment. Once the teacher is employed full-time, training in effective teaching strategies should continue with the support of a mentor teacher in the same content area and grade level, and mentors should receive adequate training in research-based strategies in order to meet the changing needs of the teachers (Evertson & Smithy, 2000; Hawkey, 1998). Thus, assessment of alternative certification programs must include an assessment of the training that mentors receive as well. In order to assess the extent to which alternative certification programs effectively prepare teachers who possess an appropriate knowledge of appropriate educational foundations and strategies, some guiding questions are:



- To what extent do the alternative certification program's requirements for knowledge of educational foundations and strategies meet local, state, and national guidelines for beginning teachers?
- What evidence does the program provide indicating that the teacher has a working knowledge of educational foundations and strategies necessary for the range of grade levels they will possibly teach?
- To what extent does the program identify deficiencies in this area and require preparation to meet deficiencies?

- To what extent does the program include preparation in the range of educational foundations and strategies necessary for the grade levels that the teacher will possibly teach?
- What field experiences are provided so that teachers have the opportunity to become familiar with the school environment, observe effective teaching, and interact with students within their particular certification area and for the range of grade levels they will possibly teach?
- What evidence is there indicating that each mentor has expertise in their assigned teacher's content area and grade level?
- What type of training does each mentor receive in research-based mentoring strategies?

4.2 Teacher skill performance assessment

In addition to assessing the extent to which alternative certification programs prepare teachers in terms of their content knowledge and their knowledge of educational foundations and strategies, programs must be held accountable for ensuring that the graduates are capable of using effective teaching practices through direct observation both during and after the program and with reference to student outcomes.

Direct observation

In order to assess the extent to which alternative certification programs effectively prepare teachers who are able to demonstrate effective teaching practices, some guiding questions are:

- To what extent do the alternative certification program's requirements for teacher performance meet local, state, and national guidelines for beginning teachers?
- What evidence does the program have indicating that the teacher is capable of employing the teaching skills necessary for the range of grade levels they will possibly teach?
- What deficiencies does the program identify in this area prior to the full-time employment of the teacher and require preparation to meet the deficiencies?
- What opportunities does the program provide for teachers to demonstrate effective teaching practices during their training for the range of grade levels that the teacher will possibly teach?
- What field experiences are provided prior to their employment as a full-time teacher so that teachers have the opportunity to demonstrate effective teaching practices within their particular certification area and for the range of grade levels they will possibly teach?
- What specific feedback do teachers receive on their teaching once hired as full-time teachers?
- What deficiencies does the program identify in this area that require remediation and sustained support to meet the deficiencies?
- What are the evaluation results of the teachers by multiple individuals over multiple observation visits that include both planned and unplanned observations?

Student outcomes

Another means of determining the extent to which teachers are able to utilize effective teaching practices is their influence on student performance as measured by students' course grades and standardized test scores. Research indicates that better prepared teachers have a more positive impact on student performance as compared to less prepared teachers (Darling-Hammond, 1999, 2000, 2003; Marzano, 2003; Reeves, 2002; Sanders, 1998).

Alternatively licensed teachers should have students performing at comparable levels to the students of traditionally prepared teachers with similar school placements, teaching assignments, students, and years of experience. Due to the potential subjective nature of students' course grades (Adelman, 1983; Bracey, 1994; Marzano, 2000; USDOE, 1994), student performance on standardized tests should be weighted heavily in this comparison. In order to assess the extent to which alternative certification programs effectively prepare teachers who utilize effective teaching practices, some guiding questions are:

- To what extent do the alternative certification program's requirements for teacher performance, as measured by student outcomes, meet local, state, and national guidelines for the students of beginning teachers?
- To what extent does the alternative certification program have access to, and make use of, student data to ensure that the teacher is capable of employing the teaching skills necessary for their particular teaching assignment?

Conclusion

Alternative teacher certification (AC) is a complex phenomenon. It has a significant impact on how teachers are educated and brought into the profession (Feistritzer & Chester, 2002), and it has become a catalyst for debates centering upon interpretations of teacher shortages, on the definition of "highly qualified" teachers, and on the nature of teaching and teacher education. However, research on the effect of alternative teacher certification programs is "limited" and research findings are very often "mixed" (Wilson, Floden & Ferrini-Mundy, 2002, p. 198) because of flaws in AC research (Hawley, 1990; Zeichner, 2006). The presentations at the conference help to define what we know about current effective practices of AC programs in preparing science teachers and to clarify what we still need to know through future research in this area.

Appendix: Practice Presentations

The research and policy presentations are listed in the respective reports. Abstracts and papers for most of these presentations are available at www.stemtec.org/act.

Keynote: *Ken Zeichner, University of Wisconsin-Madison*
Title: WHAT DO WE KNOW ABOUT THE CHARACTERISTICS OF GOOD TEACHER EDUCATION PROGRAMS?

Michael Marder, University of Texas at Austin
Title: UTEACH

Dan MacIsaac, (SUNY) Buffalo State College
Title: THE SUNY-BUFFALO STATE COLLEGE ALTERNATIVE CERTIFICATION PROGRAM FOR HS PHYSICS TEACHERS

Bruce E. Herbert, Texas A&M University
Bonnie Longnion, North Harris Montgomery Community College District
Guy Sconzo, Humble Independent School District
Title: BRIDGING COMMUNITIES: THE ROLES AND IMPACT OF STEM FACULTY IN BUILDING A PROFESSIONAL LEARNING COMMUNITY SUPPORTING INTERN TEACHERS SEEKING ALTERNATIVE CERTIFICATION

Posters

Barbara Austin, New Mexico Institute of Mining and Technology
Title: ALTERNATIVE LICENSURE AT NEW MEXICO TECH

Craig A. Berg, University of Wisconsin-Milwaukee
Michael P. Clough, Iowa State University
Title: “ALTERNATIVE” STILL REQUIRES REACHING YOUR DESTINATION: A VISUAL FRAMEWORK FOR TEACHER DECISION-MAKING

Kathleen D. Gagne, University of Massachusetts
Title: 180 Days IN SPRINGFIELD: CULTIVATING SCHOOL-UNIVERSITY PARTNERSHIPS TO ENHANCE URBAN TEACHING

John R. Gantz, Troops to Teachers
Title: TROOPS TO TEACHERS – A SOURCE OF QUALITY MATH AND SCIENCE TEACHERS

Judith L. Hayes, Wichita State University
Title: AN INQUIRY INTO BEST PRACTICES FOR PREPARING AND RETAINING ALTERNATIVE CERTIFICATION CANDIDATES IN THE SCIENCES

Grant L. Holley and John Penick, NC State University
Title: DO YOU HEAR WHAT I HEAR? BUILDING A MODEL BASED ON RESEARCH AND EXPERIENCE-NC STATE UNIVERSITY

Richard Iuli, Robin Voetterl and Tina Wagle, SUNY Empire State College
Title: SUNY EMPIRE STATE COLLEGE'S MAT PROGRAM: AN ALTERNATIVE ALTERNATIVE STEM TEACHER PREPARATION PATHWAY

Bobby Jeanpierre, University of Central Florida
Title: WHAT DOES IT TAKE TO BECOME A SUCCESSFUL URBAN MIDDLE-LEVEL SCIENCE TEACHER

Vicki H. Metzgar and Alene H. Harris, Vanderbilt University
Title: HELPING ALTERNATIVELY CERTIFIED SCIENCE TEACHERS MAXIMIZE THEIR TEACHING POTENTIAL THROUGH RESEARCH-BASED CLASSROOM MANAGEMENT STRATEGIES IN SCIENCE LABS

Chris Olszewski, SUNY-Buffalo State College
Title: THE ROAD LESS TRAVELLED: A PH.D. PHYSICIST BECOMES A HS PHYSICS TEACHER

William Veal, College of Charleston
Dorothy Mebane, University of North Carolina
Keri Randoph, Northwood High School,Chatham County, NC.
Title: ONLINE SCIENCE METHODS FOR LATERAL ENTRY SCIENCE TEACHERS

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