

## **Teacher Preparedness: A Comparison of Alternately and Traditionally Certified Technology and Engineering Education Teachers**

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### **Abstract**

There is a national conversation about a secondary teacher shortage and the lack of qualified teachers in the classroom. Over recent years, there has been a rise in the number of alternatively certified teachers to fill these positions. This is particularly true in the field of career and technical education. However, there is a debate on whether an alternatively certified teacher is as effective as a traditionally certified teacher. The level of preparedness has been identified as a critical factor in teacher effectiveness. This study looks at the differences in perceived preparedness of early career technology and engineering education teachers to determine if there is a difference between alternatively and traditionally certified teachers. The Schools and Staffing Survey Teacher Questionnaire was used as a generalizable national dataset. The results show that there is no statistically significant difference in the level of perceived preparedness of early career alternatively and traditionally certified technology and engineering education teachers. One construct within preparedness, behavior management, was statistically significant for traditionally certified teachers. By better understanding the nature of teachers in regard to preparedness and certification type, further research can be conducted to better prepare teachers in the field of technology and engineering education.

**Keywords:** Alternative certification, schools and staffing survey teacher questionnaire, technology education, teacher preparedness

Every child deserves the opportunity to have a quality education. Therefore, teachers need to have high levels of understanding in both content and pedagogical knowledge. Due to a teacher shortage in recent years, teachers have been placed into the classroom who may not be considered highly qualified as defined by the No Child Left Behind Act of 2001 (NCLB; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Koehler, Feldhaus, Fernandez, & Hundley, 2013; National Education Association [NEA], 2016). Now that NCLB has been revised to become the Every Student Succeeds Act, the qualifications for teacher preparedness now falls under state control but still holds teachers accountable for meeting state licensure requirements (NEA, 2016). The route that teachers take to earn their certification and obtain a teaching license has been a discussion of national importance. The two main pathways that secondary teachers can take to get a teaching license is the traditional route and an alternative certification route. Although originally used as a stopgap measure to

fill open positions (Hoepfl, 2001), alternative certification has become more commonly used to fill regular teaching positions (Cohen-Vogel & Smith, 2007; Gimbert, Cristol, Wallace, & Sene, 2005; Jacob, 2007). This is particularly true for the field of career and technical education (CTE; Litowitz, 1998), which includes technology and engineering education.

Many technology and engineering education teachers have come into teaching positions bringing in years of authentic work experience. However, these teachers may lack the pedagogical knowledge that they would gain from a traditional teacher preparation program. This has caused some concern about the quality of these teachers. There is mixed data on the effectiveness of alternatively certified teachers compared to traditionally certified teachers (Bowen, 2013; Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Bradshaw & Hawk, 1996; Hawley, 1992; Koehler et al., 2013). Research demonstrates that, overall, it is difficult to determine statistically significant differences between the two groups of teachers (Bowen, 2013; Bradshaw & Hawk, 1996; Darling-Hammond et al., 2005; Feiman-Nemser, 1989; Hoepfl, 2001; Litowitz, 1998; Reese, 2010; Sindelar, Daunic, & Rennells, 2004; Stoddart & Floden, 1995). In the field of technology and engineering education, there has been little research in regard to the teaching effectiveness of alternatively certified and traditionally certified teachers (Foster, 1996; Haynie, 1998; Hoepfl, 1997, 2001; Merrill, 2004; Pavlova, 2005). More research is needed to understand the level of preparedness that these teachers feel when beginning their teaching experience and if there are any differences in perceived preparedness between alternatively and traditionally certified teachers in technology and engineering education.

### **Traditional Versus Alternative Certification**

#### **Traditional Certification**

Most secondary education teachers earn their teaching license through a traditional teacher education program. The most common route is to attain a teaching license by attending a 4-year university. By obtaining a Bachelor's degree in a specific teaching content area, teachers gain content knowledge as well as educational pedagogical knowledge. Certification requirements can differ among universities and states in regard to the amount of coursework, quantity of field experiences, and length of time spent student teaching (Townsend & Bates, 2007).

#### **Alternative Certification**

A shorter and sometimes less costly option for those that want to go into teaching after spending time in industry is an alternative certification program. Alternative certification programs prepare individuals to take the knowledge used in their previous jobs and apply it in a way that relates to students in the

classroom. “The term *alternative teacher certification* (AC) has historically been used to refer to every licensure avenue outside of traditional college-based programs” (Cohen-Vogel & Smith, 2007, p. 733). The structure and content of these programs can vary based on the content area and the state in which it is located. However, individuals are expected to be adequately prepared to teach after participating in an alternative certification program. Depending on the program, a bachelor’s degree may not even be required to be a classroom teacher when participating in an alternative certification program. The number of years of experience in the field can be equated to schooling experience, meaning that, in some cases, the education level of these teachers may not exceed an associate’s degree.

### Teaching Effectiveness

There is a debate in the educational community as to the effectiveness of alternatively certified teachers compared to traditionally certified teachers. Some educators believe that an alternatively certified teacher lacks understanding of pedagogical theories and practices that they would gain by completing a traditional education program (Boyd et al., 2009; Darling-Hammond et al., 2005; Gray & Taie, 2015; Hawk & Schmidt, 1989; Koehler et al., 2013; Stoddart & Floden, 1995). Darling-Hammond (1992) reports,

Studies of teachers admitted through quick-entry alternate routes frequently note that the candidates have difficulty with curriculum development, pedagogical content knowledge, attending to students’ differing learning styles and levels, classroom management, and student motivation (Feiman-Nemser & Parker, 1990; Grossman, 1989; Lenk, 1989; Mitchell, 1987). (p. 131)

Because of this lack of pedagogical knowledge, this teacher would not be able to develop and deliver lesson plans that effectively accommodate students’ educational needs. This, in turn, may result in lower student achievement. Several studies have found that students taught by alternatively certified teachers had lower achievement than students taught by traditionally certified teachers (Baines, 2006; Darling-Hammond, 2000). Allen (2003) reported that “overall, the research provides limited support for the conclusion that there are indeed alternative programs that produce cohorts of teachers who are ultimately as effective as traditionally trained teachers” (p. 3).

On the other side of this debate, some studies have shown that through practical work experience, alternatively certified teachers have gained content knowledge that is more in-depth than content knowledge gained through a traditional teacher education program (Darling-Hammond et al., 2005; Sindelar et al., 2004). Through corporate work experience, a teacher learns more authentic applications of the content and can provide students more relevant and

authentic real-world applications than a traditionally certified teacher (Bowen & Shume, 2018). Several studies show that students taught by alternatively certified teachers achieved just as much, and in some cases more, as the students taught by traditionally certified teachers (Bowen, 2013; Gimbert et al., 2005; Jacob, 2007; Tournaki, Lyublinskaya, & Carolan, 2009). These teachers are also shown to be as competent as traditionally certified teachers, as evidenced by having no difference in scores on the National Teachers Exam (Hawk & Schmidt, 1989).

### **Research Questions**

In recent years, the number of practicing teachers with alternative certifications has increased. Feistritz (2011) reported that between 2005 and 2010, as many as four out of every 10 public school teachers were hired through an alternative certification program. This emphasizes a strong need for understanding the differences in how teachers from both traditional and alternative certification routes perceive different aspects of their preparation. To fully understand the preparation needs of both alternatively and traditionally certified teachers, we need to better understand how these teachers perceive their initial preparedness. Therefore, the goal of this study is to inform the educational community about the perceived preparedness of alternatively and traditionally certified teacher in technology and engineering education as a means to inform future research. This study analyzes the differences between alternatively certified and traditionally certified technology and engineering education teachers in regard to their perceived preparedness during their early years of teaching.

This study was guided by two research questions specific to beginning technology and engineering education teachers' perceptions of school preparedness. The two questions posed by the researchers were:

1. To what extent are there differences in the overall perception of preparedness for beginning technology and engineering education teachers who entered the field through an alternative versus traditional certification program?
2. To what extent are there differences in perceptions of preparedness for elements of preparedness for beginning technology and engineering education teachers who entered the field through an alternative versus traditional certification program?

By understanding how these teachers perceive their preparedness, both alternative and traditional preparation programs can better align their methods to more effectively prepare technology and engineering education teachers. Also, by using a national dataset, better conclusions can be drawn than from previous research that primarily uses localized populations and relatively small sample sizes.

### Methodology

#### Participants

In this study, beginning teachers who had less than 3 years teaching experience in technology and engineering education were identified and separated by discipline. Participants had provided subject-matter codes relating to technology and engineering education for the Schools and Staffing Survey Teacher Questionnaire (SASS TQ) question: “This school year, what is your MAIN teaching assignment field at THIS school?” Table 1 shows the codes for placing teachers into the category of technology and engineering education. Next, data for the respondents were categorized by whether they entered teaching through an alternative certification program. This determination was made by teachers’ answer to the SASS TQ question: “Did you enter teaching through an alternative certification program? (An alternative program is a program that was designed to expedite the transition of non-teachers to a teaching career, for example, a state, district, or university alternative certification program).”

**Table 1**

*Technology and Engineering Educator SASS TQ Codes and Summary Descriptors Representing Main Teaching Assignment*

Code	Summary description
246	Construction technology (construction design and engineering, CADD and drafting)
249	Manufacturing technology (electronics, metalwork, precision production, etc.)
250	Communication technology (communication systems, electronic media, and related technologies)
255	General technology education (technological systems, industrial systems, and pre-engineering)

Data from the SASS TQ for teachers with alternative certification and traditional certification were analyzed using descriptive statistics. All data presented were weighted data as detailed in the procedures section. This resulted in 3,720 teachers within the weighted results for alternative certification and 5,660 teachers for traditional certification. Each state was represented with at least one teacher with an alternative certification. Basic demographic information for these teachers are reported in Table 2.

**Table 2**

*Descriptive Information for Alternately and Traditionally Certified Technology and Engineering Education Teachers*

Variable	Certification	
	Alternative	Traditional
Weighted sample	3,720	5,660
Mean age in years	40.22 (10.05)	34.28 (10.92)
Male	77.4%	74.4%
Female	22.6%	25.6%

*Note.* Standard deviation is in parentheses.

### **Instrumentation**

The Schools and Staffing Survey (SASS) consists of five questionnaires: a School District Questionnaire, Principal Questionnaire, School Questionnaire, Teacher Questionnaire (SASS TQ), and a School Library Media Center Questionnaire. According to Tourkin et al. (2010), the SASS

is conducted by the National Center for Education Statistics (NCES) on behalf of the U.S. Department of Education in order to collect extensive data on American public and private elementary and secondary schools. SASS provides data on the characteristics and qualifications of teachers and principals, teacher hiring practices, professional development, class size, and other conditions in schools across the nation. (p. 1)

The goal of the SASS is to collect data “for a comprehensive picture of elementary and secondary education in the United States” (p. 2). “The SASS was designed to produce national, regional, and state estimates for public elementary and secondary schools and related components” (p. 9) and is an excellent resource “for analysis and reporting on elementary and secondary educational issues” (p. 1).

### **Variables Analyzed**

**Gender and age.** The gender of technology and engineering education teachers was determined by SASS TQ Question 78: “Are you male or female?” The teachers’ ages were determined by their date of birth.

**Perceived preparedness.** Perceived preparedness was a composite variable that was created by summing eight questions on the SASS TQ that asked the participants to rate how prepared they were during their first year of teaching. For the purposes of this study, we labeled the composite variable as perceived

preparedness because it was a self-rating by the teachers. It was their perception of preparedness, not their actual ability or performance. The SASS TQ question for preparedness was Question 33: "In your FIRST year of teaching, how well prepared were you to –" (a) "handle a range of classroom management or discipline situations," (b) "use a variety of instructional methods," (c) "teach your subject matter," (d) "use computers in classroom instruction," (e) "assess students," (f) "differentiate instruction in the classroom," (g) "use data from student assessments to inform instruction," and (h) "meet state content standards?" The participants responded to each question on a four-point Likert scale: *not at all prepared, somewhat prepared, well prepared, or very well prepared.*

### Procedures

This ex-post-facto study analyzed data from the SASS TQ restricted-use dataset. The methodology included appropriate protocol, as required by the NCES and Institute of Education Sciences (IES). NCES specific reporting protocols required that the results intended for submission be sent to the NCES and IES for approval and authorization for release. The results were authorized for release. The NCES and IES require that all weighted  $n$ 's be rounded to the nearest 10 to assure participant anonymity and that all degrees of freedom in statistical tests be rounded to the nearest 10. Therefore, data in the tables and associated narrative may not add to the total  $N$  reported because of rounding requirements.

The perceived extent of influence of certification route over perceived preparedness and the eight components of preparedness were analyzed using AM Statistical Software. Independent samples  $t$ -tests were used to identify statistically significant differences between the self-ratings of those who entered teaching through an alternative certification program and those who entered through a traditional certification program. Probability levels of .05 or less were deemed to be statistically significant. Data were weighted using the Teacher Final Sampling Weight (TFNLWGT) variable, and the SASS TQ supplied 88 replicate weight variables, as required by IES, to approximate the population of teachers under investigation in this study. A balanced repeated replication procedure was utilized, as required by the IES, to adjust standard errors. Tourkin et al. (2010) provides a detailed explanation of SASS sampling, weighting, and replication procedures.

### Results

Descriptive statistics and independent samples  $t$ -tests were used to investigate teacher perceptions of preparedness. A descriptive account of composite scores and item scores for perceived preparedness is presented in Table 3.

**Table 3**  
*Composite and Item Descriptive Statistics*

Variable	Mean	SE	SD	Min	Max
Traditional certification					
Perceived preparedness	22.711	0.746	4.828	8	32
Behavior management	2.788	0.115	0.786	1	4
Instructional methods	2.850	0.169	0.917	1	4
Subject matter	3.179	0.105	0.793	1	4
Computers	3.138	0.188	0.89	1	4
Assessment	2.757	0.106	0.764	1	4
Differentiate instruction	2.640	0.121	0.805	1	4
Student assessment for instruction	2.427	0.100	0.712	1	4
Content standards	2.932	0.125	0.777	1	4
Alternative certification					
Perceived preparedness	22.294	1.366	5.129	10	32
Behavior management	2.326	0.162	0.822	1	4
Instructional methods	2.615	0.226	0.883	1	4
Subject matter	3.422	0.136	0.7	1	4
Computers	3.231	0.166	0.923	1	4
Assessment	2.751	0.224	0.857	1	4
Differentiate instruction	2.480	0.233	0.812	1	4
Student assessment for instruction	2.490	0.23	0.860	1	4
Content standards	2.980	0.189	0.761	1	4

*Note.* *SE* is standard error; *SD* is standard deviation; Min is minimum score; Max is maximum score.

### T-Tests

The first research question was analyzed using independent samples *t*-tests, and the results are reported in Table 4. The results showed that there were no statistically significant differences between traditionally and alternatively certified technology and engineering education teachers on their overall perceived preparedness.



**Table 4**

*Results From t-Tests for Perceived Preparedness and Preparation Variables for Technology and Engineering Education Teachers*

Variable	Alt. mean score	Trad. mean score	Mean score diff.	<i>df</i>	<i>t</i>	<i>p</i>
Perceived preparedness	22.294	22.711	-0.417	90	-0.269	0.789
Behavior management	2.326	2.788	-0.462	90	-2.354	0.021
Instructional methods	2.615	2.850	-0.235	90	-0.848	0.399
Differentiate instruction	2.480	2.640	-0.160	90	-0.613	0.541
Student assessment for instruction	2.490	2.427	0.063	90	0.240	0.811
Assessment	2.751	2.757	-0.007	90	0.027	0.979
Computers	3.231	3.138	0.093	90	0.399	0.691
Subject matter	3.422	3.179	0.243	90	1.433	0.155
Content standards	2.980	2.932	0.048	90	0.211	0.834

*Note.* *df* is degrees of freedom; *t* is *t*-test value; *p* is probability level.

The second research question was analyzed using independent samples *t*-tests, and the results are reported in Table 3. The question concerning how prepared the teacher was to “handle a range of classroom management or discipline situations” was the only statistically significant finding. Traditionally certified teachers ( $M = 2.788$ ,  $SD = 0.786$ ) perceived themselves to be better prepared to handle classroom management and discipline issues when compared to those who received an alternative certification ( $M = 2.326$ ,  $SD = 0.822$ ;  $t(90) = -2.354$ ,  $p = 0.021$ ). However, the effect size for this difference was small (Cohen’s  $d = .08$ ).

### Discussion

This study deals specifically with technology and engineering education teachers. Of the weighted total of 9,380 teachers, approximately 40% (3,720) were certified through an alternative program. The results show that, based on this national sample of technology and engineering education teachers, there are no overall statistically significant differences in the perceived preparedness of beginning teachers when comparing alternatively and traditionally certified teachers. Within the constructs of preparedness, the only individual component that was statistically significant is behavior management. This is a very interesting finding when comparing it to the existing research on the two types of routes to teaching. Previous research claims that alternatively certified teachers have difficulty with curriculum development, pedagogical practices,

and differentiated instruction (Darling-Hammond, 1992). However, according to the results of the current study, alternatively certified teachers did not feel differently than traditionally certified teachers in their ability to complete these types of activities. When reviewing the results of the eight individual constructs, the alternatively certified group had a higher mean in four of the constructs, and the traditionally certified group had a higher mean in the other four constructs. This supports the literature that there does not seem to be any statistically significant or distinguishable differences in the two groups of teachers. Research does support that, generally speaking, behavior management is one of the issues that many teachers struggle with (Evertson & Weinstein, 2006; Flower, McKenna, & Haring, 2017; Melnick & Meister, 2008; Piwowar, Thiel, & Ophardt, 2013). These findings indicate that alternatively certified teachers felt less prepared to handle classroom management and behavioral issues than did traditionally certified teachers, although the effect was small.

#### **Conclusions and Recommendations**

As previously mentioned, current research shows that there are mixed data when comparing the effectiveness and performance of alternatively and traditionally certified teachers. This study was designed to target technology and engineering education teachers within a national sample in order to contribute to the literature in a way that has not been previously reported. According to Kee (2012), traditionally certified teachers felt slightly more prepared in regard to early career preparation when accounting for teachers of all subject areas. However, the study only considered preparedness as a whole and did not analyze each individual construct. Studies by Darling-Hammond, Chung, and Frelow (2002) reported that teacher ratings of traditionally certified teachers were significantly higher than those of alternatively certified teachers. Both of these studies had different sample sizes and different disciplines than the current study, which uses a national dataset specific to technology and engineering education. By analyzing the perceived preparedness of early career technology and engineering education teachers, we are able to see that alternatively and traditionally certified teachers do not perceive their overall preparedness to be different. The only item with a statistically significant difference was behavior management.

The results of the current study would suggest that the population of teachers of technology and engineering education may not follow the national trend in regard to their perceived preparedness during their early career years. This study, however, did not measure any specific differences in teacher behavior, content or pedagogical knowledge, or student test scores. This study only analyzed the perceived preparedness of the teacher. Further research is needed to further investigate how technology and engineering education teachers compare to the general teaching population and investigate any specific differences that could be measured at the classroom level.

Supporters of each certification type can make a case that teachers from both teacher certification routes produce educators with different expertise and skill sets (Bowen, 2013; Feiman-Nemser, 1989; Stoddart & Flodon, 1995). Technology and engineering education is a field that has content ranging from trade-based activities to engineering design. The content required by the teacher to accommodate this range of knowledge lends itself to incorporating skills obtained by teachers of both certification types (Bradshaw & Hawk, 1996; Darling-Hammond et al., 2005; Reese, 2010). Therefore, more empirical research is needed to distinguish these differences. We believe that teachers from both types of certification provide value to the classroom. If the characteristics of teachers from both types of certification are better understood, then alternatively certified teachers can be better supported, traditional preparation programs could be improved, and targeted professional development could help early career educators. By better understanding the differences and similarities in the teacher behaviors produced by these two types of certification programs, more effective teacher preparation can be designed to create more high quality student learning environments.

#### **Limitations and Future Research**

Although this study has limitations, this data collected by the IES was weighted to approximate the total population of teachers and provides insight into beginning teachers' perceptions of their abilities. A major limitation is that it is possible that the SASS TQ items might not be able to adequately discriminate between the two groups because the questions measure perceived preparedness. It is plausible that beginning teachers, both traditionally and alternatively certified, do not have a realistic idea of what knowledge and skills are necessary to be an effective teacher. In essence, they might not realize how much they do not know or need to know, and they might underestimate or overestimate their ability. We have no way to actually verify their performance or abilities. This presents some interesting areas for future research such as comparing teachers' self-ratings of preparedness to actual classroom performance and examining the effect of teacher in-service training, the amount of in-service, and the areas of in-service training on perceptions of preparedness.

## References

- Allen, M. (2003). *Eight questions on teacher preparation: What does the research say? A summary of the findings*. Denver, CO: Education Commission of the States.
- Baines, L. A. (2006). Deconstructing teacher certification. *Phi Delta Kappan*, 88(4), 326–328. doi:10.1177/003172170608800417
- Bowen, B. (2013). Measuring teacher effectiveness when comparing alternatively and traditionally licensed high school technology education teachers in North Carolina. *Journal of Technology Education*, 25(1), 82–100. doi:10.21061/jte.v25i1.a.6
- Bowen, B., & Shume, T. (2018). Educators in industry: An exploratory study to determine how teacher externships influence K-12 classroom practices. *Journal of STEM Education: Innovations and Research*, 19(1), 57–62. Retrieved from <https://www.jstem.org/jstem/index.php/JSTEM/article/view/2266>
- Boyd, D. J., Grossman, P. L., Lankford, H., Loeb, S., & Wyckoff, J. (2009). Teacher preparation and student achievement. *Educational Evaluation and Policy Analysis*, 31(4), 416–440. doi:10.3102/0162373709353129
- Bradshaw, L., & Hawk, P. (1996). *Teacher certification: Does it really make a difference in student achievement?* Greenville, NC: ENCCARE.
- Cohen-Vogel, L. & Smith, T. M. (2007). Qualifications and assignments of alternatively certified teachers: Testing core assumptions. *American Educational Research Journal*, 44(3), 732–753. doi:10.3102/0002831207306752
- Darling-Hammond, L. (1992). Teaching and knowledge: Policy issues posed by alternate certification for teachers. In W. D. Hawley (Ed.), *The alternative certification of teachers* (ERIC Teacher Education Monograph No. 14, pp. 123–154). Washington, DC: ERIC Clearinghouse on Teacher Education.
- Darling-Hammond, L. (2000). *Solving the dilemmas of teacher supply, demand, and standards: How we can ensure a competent, caring, and qualified teacher for every child*. New York, NY: National Commission on Teaching and America's Future.
- Darling-Hammond, L., Chung, R., & Frelow, F. (2002). Variation in teacher preparation: How well do different pathways prepare teachers to teach. *Journal of Teacher Education*, 53(4), 286–302. doi:10.1177/0022487102053004002
- Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). Does teacher preparation matter? Evidence about teacher certification, teach for America, and teacher effectiveness. *Education Policy Analysis Archives*, 13, Article No. 42.
- Evertson, C. M., & Weinstein, C. S. (2006). Classroom management as a field of inquiry. In C. M. Evertson & C. S. Weinstein (Eds.), *Handbook of classroom management: Research, practice, and contemporary issues* (pp.

- 3–15). Mahwah, NJ: Erlbaum.
- Every Student Succeeds Act of 2015, Pub. L. No. 114-95, § 114 Stat. 1177 (2015–2016). Retrieved from <http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf>
- Feiman-Nemser, S. (1989). *Teacher preparation: Structural and conceptual alternatives* (Issue Paper No. 89-5). East Lansing, MI: National Center for Research on Teacher Education.
- Feistritzer, C. E. (2011). *Profile of teachers in the U.S. 2011*. Washington DC: National Center for Education Information.
- Flower, A., McKenna, J. W., & Haring, C. D. (2017). Behavior and classroom management: Are teacher preparation programs really preparing our teachers? *Preventing School Failure: Alternative Education for Children and Youth*, 61(2), 163–169. doi:10.1080/1045988X.2016.1231109
- Foster, W. T. (1996). A research agenda for technology education. *The Technology Teacher*, 56(1), 31–33.
- Gimbert, B., Cristol, D., Wallace, D., & Sene, A. M. (2005). A case study of a competency-driven alternative route to teacher licensure in an urban “hard to staff” school system. *Action in Teacher Education*, 27(1), 53–71. doi:10.1080/01626620.2005.10463374
- Gray, L., & Taie, S. (2015). *Public school teacher attrition and mobility in the first five years: Results from the first through fifth waves of the 2007–08 Beginning Teacher Longitudinal Study* (NCES Report No. 2015-337). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- Hawk, P. P., & Schmidt, M. W. (1989). Teacher preparation: A comparison of traditional and alternative programs. *Journal of Teacher Education*, 40(5), 53–58. doi:10.1177/002248718904000508
- Hawley, W. D. (1992). *The alternative certification of teachers* (ERIC Teacher Education Monograph No. 14). Washington, DC: Office of Educational Research and Improvement.
- Haynie, W. J., III. (1998). Experimental research in technology education: Where is it? *Journal of Technology Education*, 9(2), 78–83. doi:10.21061/jte.v9i2.a.6
- Hoepfl, M. C. (1997). Choosing qualitative research: A primer for technology education researchers. *Journal of Technology Education*, 9(1), 47–63. doi:10.21061/jte.v9i1.a.4
- Hoepfl, M. (2001). Alternative routes to certification of technology education teachers. *Journal of Technology Studies*, 27(2), 74–83. doi:10.21061/jots.v27i2.a.2
- Jacob, B. A. (2007). The challenges of staffing urban schools with effective teachers. *Future of Children*, 17(1), 129–153. doi:10.1353/foc.2007.0005
- Kee, A. N. (2012). Feelings of preparedness among alternatively certified teachers: What is the role of program features? *Journal of Teacher*

- Education*, 63(1), 23–38. doi:10.1177/0022487111421933
- Koehler, A., Feldhaus, C. R., Fernandez, E., & Hundley, S. P. (2013). Alternative certification programs & pre-service teacher preparedness. *Journal of STEM Education: Innovations and Research*, 14(4), 45–55. Retrieved from <https://www.jstem.org/jstem/index.php/JSTEM/article/view/1680/>
- Litowitz, L. S. (1998). Technology education teacher demand and alternative route licensure. *The Technology Teacher*, 57(5), 23–28.
- Melnick, S. A., & Meister, D. G. (2008). A comparison of beginning and experienced teachers' concerns. *Educational Research Quarterly*, 31(3), 39–56.
- Merrill, C. (2004). Action research and technology education. *The Technology Teacher*, 63(8), 6–8.
- National Education Association. (2016). *Proposed alternative to Highly Qualified Teachers (HQT)*. Washington, DC: Author. Retrieved from <https://www.nea.org/assets/docs/Backgrounder-HighlyQualifiedTeachers.pdf>
- No Child Left Behind Act of 2001, Pub. L. No. 107-110, § 115, Stat. 1425 (2002). Retrieved from <http://www2.ed.gov/policy/elsec/leg/esea02/107-110.pdf>
- Pavlova, M. (2005). Knowledge and values in technology education. *International Journal of Technology and Design Education*, 15(2), 127–147. doi:10.1007/s10798-005-8280-6
- Piowar, V., Thiel, F., & Ophardt, D. (2013). Training inservice teachers' competencies in classroom management: A quasi-experimental study with teachers of secondary schools. *Teaching and Teacher Education*, 30, 1–12. doi:10.1016/j.tate.2012.09.007
- Reese, S. (2010). Traditional or alternative—Finding new teachers along different pathways. *Techniques*, 85(1), 16–21.
- Sindelar, P. T., Daunic, A., & Rennells, M. S. (2004). Comparisons of traditionally and alternatively trained teachers. *Exceptionality*, 12(4), 209–223. doi:10.1207/s15327035ex1204\_3
- Stoddart, T., & Floden, R. E. (1995). *Traditional and alternate routes to teacher certification: Issues, assumptions, and misconceptions* (Issue Paper No. 95-2). East Lansing, MI: National Center for Research on Teacher Learning.
- Tourkin, S., Thomas, T., Swaim, N., Cox, S., Parmer, R., Jackson, B., . . . Zhang, B. (2010). *Documentation for the 2007–08 Schools and Staffing Survey* (NCES Report No. 2010-332). Washington, DC: U.S. Department of Education, National Center for Education Statistics. Retrieved from [https://nces.ed.gov/pubs2010/2010332\\_1.pdf](https://nces.ed.gov/pubs2010/2010332_1.pdf)
- Tournaki, N., Lyublinskaya, I., & Carolan, B. V. (2009). Pathways to teacher certification: Does it really matter when it comes to efficacy and effectiveness? *Action in Teacher Education*, 30(4), 96–109.

doi:10.1080/01626620.2009.10734455

Townsend, T., & Bates, R. (Eds.). (2007). *Handbook of teacher education: Globalization, standards and professionalism in times of change*. Dordrecht, the Netherlands: Springer. doi:10.1007/1-4020-4773-8

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