ALTERNATIVE CERTIFICATION AND RETENTION OF SECONDARY MATH AND SCIENCE TEACHERS: A STUDY BASED ON *SASS/TFS*

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In light of shortages of mathematics and science teachers, alternative certification was introduced in the mid-1980s. This study examined the effect of alternative certification among math and science teachers who moved to a different school or left the profession. This was accomplished using the national SASS and TFS databases. The results indicated that alternatively certified teachers were comparable in their commitment to their current school and the teaching profession when compared with their traditionally certified colleagues. Findings are discussed with respect to their relevance for education policy makers and school administrators.

Keywords**:** *Alternative Certificate, Teacher Retention, Math and Science Education*

Since the early twentieth century, teacher education has been the responsibility of teacher colleges, while school districts directed their efforts to teaching children and youth. Within the past few decades, many schools faced difficulties finding teachers, particularly in some specialized areas. Demographic changes and class-size reductions, among other factors, have increased the need for new teachers, and concerns about staffing schools with qualified teachers have been raised. In 2000, Murphy, DeArmond, & Guin (2003) estimated that 45,000 public-school teaching positions were unfilled when school began. However, the depth of the problem varies across subject area and region in the United States. For example, a study based on a national survey found ninety-five percent of urban school districts had an immediate demand for science, mathematics, and special education teachers, compared to only fifteen percent in social studies (Recruiting New Teachers Inc., 2000).

To alleviate the teacher shortage, alternative teacher certification programs have grown rapidly since their introduction in 1983. At that time, only eight states offered alternative routes for people who had not come through a traditional teacher education program. In 2003, 45 states and the District of Columbia have some type of alternative route for certifying elementary and secondary teachers, and an estimated 200,000 people have received alternative certifications since 1985 (Mikulecky, Shkodriani & Wilner, 2004). Approximately 18 percent of new hires in California, 24 percent in Texas, and 24 percent in New Jersey entered the teaching force through "alternative" routes (Feistritzer, 2003). A recent *New York Times* advertisement recruiting participants for the New York City Teaching Fellows programs provided an indication of the professional workforce being targeted by these programs, i.e. "mid-career professionals and recent graduates", in the high-need disciplines of mathematics and science. ("Become a NYC Teaching Fellow", 2006).

Due to the nature of these programs, alternatively certified teachers have typically taken fewer education courses and undergone training programs of shorter duration than

traditionally certified teachers. In 1990, Darling-Hammond pointed out the inconsistency in existing definitions of alternative certification and the often-ignored difference between "alternative certification" and "alternative paths to certification." Shen (1997, 1999) used the working definition from *Schools and Staffing Survey (SASS)*, which is, simply put, "what the state calls an 'alternative certificate program'" (1997, p. 277).[1] Laczko-Kerr and Berliner (2002) defined "under-certified teachers" as those who had emergency, temporary, and provisional certificates, while Qu and Becker (2003) pointed out that traditional standard teacher certification and traditional provisional teacher certification appears to differ only in their levels of teaching experience. McKibbin (1999) mentioned that, in 1998, some states merely considered alternative certification as synonymous with emergency certification or a way to test out of normal requirements. Compared with teachers who obtained a teaching certificate through traditional routes, alternative certificate holders usually took their educational coursework during an on-the-job internship, though most alternative certification programs require completion of a Bachelor's degree in some subject-matter field. While alternative certification programs have addressed some critical shortage areas and brought more minority teachers into classrooms, concern in the educational establishment remains over the quality of alternatively certified teachers. Some researchers have suggested that these teachers have more difficulties learning to teach than traditionally certified teachers (Darling-Hammond, 1990; Salyer, 2003).[2] On the other hand, others have argued that good teaching is based on subject matter knowledge and an enthusiasm for teaching (Moore, 1994).

An important issue ignored by most researchers on this topic is the attrition/retention rate of alternatively certified teachers compared with traditionally certified teachers. The teaching occupation suffers from chronic and relatively high annual turnover compared with other professions. As reported by the National Commission on Mathematics and Science Teaching for the 21st Century (2000), close to 10% of beginning teachers do not survive their first year of teaching and 30% leave teaching within the first three years. Data on cumulative attrition suggested that after just five years, between 40 and 50 percent of all beginning teachers have left the profession (Ingersoll, 2003). In addition, contrary to the presumption that alternative certification is a route for committed and experienced people to enter teaching, a high proportion of alternatively certified teachers have been recent college graduates or those who did not consider teaching as a lifelong career (Shen, 1997). Some have worried that this "revolving door" phenomenon (Ingersoll, 2001) – teachers leaving for reasons other than retirement – would hurt students in urban schools, where many viewed the teacher shortage as the most severe.

Since alternative certification is a relatively recent development, the studies available on teacher retention in this area mostly focus on local or small samples. While important, local studies lack the scope of a national analysis that may offer a wider perspective on alternative certification. For this reason, we have chosen to base our analysis on the combination of the *Schools and Staffing Survey (SASS)* and the *Teacher Follow-up Survey (TFS)*. *SASS* was designed to collect information on tens of thousands of in-service teachers, while *TFS* surveyed a sub-sample of the *SASS* teachers to gather longitudinal information. Designed specifically to provide teacher retention data in a nationally representative sample (Haggstrom, Darling-Hammond, & Grisser, 1988; Ingersoll, 1995), *TFS* obtained exit questionnaires of all teachers who left the profession or left for another school. Linking *SASS* and *TFS* provides an

[1] Twenty-nine percent of alternatively certified teachers taught math, 24% taught in the sciences, 11% taught special education, and 25% taught in urban schools (Mikulecky, Shkodriani, & Wilner, 2004).

[2] The term "urban" pertains to the central city as used by the U.S. Census. Its definition is taken from the Federal Information Processing Standards.

opportunity to study math/science teacher attrition longitudinally in a comprehensive manner.

METHODS

Data Source

Our study used the 1999-2000 *Schools and Staffing Survey (SASS)* and 2000-01 *Teacher Follow-up Survey (TFS)*, which are the largest and most comprehensive and recent data sources on staffing, and the occupational and organizational aspects of US schools. *SASS* obtained extensive information from teachers, schools, and districts in a nationally representative sample. The survey included over 50,000 teachers in both public and private schools. *TFS* was carried out one year after *SASS* and followed all the teachers who left the profession as well as a random sample of current teachers in the cohort. Like its three predecessors, the fourth cycle of *SASS-TFS* included separate, but linked, questionnaires from a random sample of teachers in each school. The national teacher sample of 2000-01 *TFS* included 5,788 teachers, with information on 2149 teachers who left the profession (*leavers*") and 3639 who remained in the teaching force. Of those who remained, the sample included 1324 teachers who transferred to another school ("*movers*") and 2315 teachers who stayed at the same school ("*stayers*"). Since we limited our focus to mathematics and science, this large initial data base offered an opportunity to cull a large enough final sample to perform our analysis.

Analysis

Initially, the sample included 900 regular math/science teachers. Of this number, 92 were deleted from the sample because of missing information and 137 teachers were deleted because of retirement. Of the final sample of 671 math and science teachers, 270 of them remained at the same school, 203 moved to a different school, and 198 were no longer teachers. By gender, the final sample included 301 males and 370 females. By discipline, the final sample included 346 mathematics and 325 science teachers.

The independent variables used in this analysis came from the 1999-2000 *SASS* teacher questionnaires and included both continuous and categorical variables. The dependent variable was by nature categorical with three options: stayers, movers, and leavers. An inferential statistical technique specifically designed for this form of analysis is multinomial logistic regression. This analysis technique allows us to assess the degree to which an independent variable was associated with the categorical outcomes. It does so by producing a series of estimated probabilities that allows for the comparison of the estimated likelihoods of selected outcomes for prototypical cases. Independent variables were included to control for teachers' backgrounds and school-related differences. Major independent variables included school demographics (urbanicity – a categorical variable indicating whether a school was located in an area considered to be rural, suburban, or urban; school sector – public versus private), teacher demographics (gender, race, age, salary, years at school, and 'new teacher' – fewer than 3 years of experience), satisfaction variables (job satisfaction and satisfaction with salary), and teacher certification (traditional versus alternative).

The dichotomous teacher certification independent variable was specifically included to account for any significant difference between traditional versus alternative teaching certificate holders. We defined traditional certificate holders as those who held regular, standard, or provisional teaching certificates as a part of a Bachelor's, 5^{th} year, or Master's degree program. Alternative certificate holders were those who (i) obtained a regular or standard teaching certificate through an alternative program or continuing professional development, (ii) obtained a teaching certificate through their school or school district, or (iii) taught with a probationary, temporary, or emergency certificate. As a result, the process to categorize the participants into these two

certification groups was fairly complex and involved the use of several variables which are listed in Table 1. Our inferential analysis offers two comparisons: 1) leavers versus stayers and 2) movers versus stayers.

TABLE 1 *SASS* Survey Items Used to Create Variable "Traditional/Alternative Certificate"

Item Number	Question	Answer	Coding
T0103	Do you have a teaching certificate in this state in your MAIN teaching assignment field?	Yes No	Go to **T0104** Go to **T0107**
T0104	What type of certificate do you hold in your field?	Regular/Standard Probational Provisional Temporary Emergency	Go to **T0106** Alternative Traditional Alternative Alternative
T0106	How did you earn your regular or standard certificate or advanced certificate in your MAIN teaching assignment field?	Part of a Bachelor's degree program Part of a "5th year" program Part of a Master's degree program After/before I began teaching, as part of an alternative program Through continuing professional development Other	Traditional Traditional Traditional Alternative Alternative Alternative
T0107	Are you currently in a program to obtain state certification in your MAIN teaching assignment field?	Yes No	Go to **T0108** Go to **T0109**
T0108	Which of the following describes this program?	University or college program Program offered by your school or school district Other	8 (Missing) Alternative Alternative
T0109	This school year, are you assigned to teach classes in OTHER fields at this school, in addition to your MAIN teaching assignment field?	Yes No	Go to **T0111** Go to **T0113**
T0111	Do you have a teaching certificate in this state in your OTHER teaching assignment field at this school?	Yes No	Go to **T0112** Go to **T0113**
T0112	What type of teaching certificate do you hold in this field?	Regular/Standard Probational Provisional Temporary Emergency	Traditional Alternative Traditional Alternative Alternative
T0113	Do you currently hold ANY ADDITIONAL regular or standard state certificate or advanced professional teaching certificate in this state or any other state?	Yes No	Traditional Alternative

RESULTS AND DISCUSSION

The descriptive data showed that alternatively certified teachers were more likely to be male and belong to a minority group, compared with traditionally certified teachers. See Table 2. A further analysis indicated that alternatively certified teachers appeared to be about the same in terms of leaving the teaching profession but more likely to move to another school. Also, the descriptive statistics indicated that alternatively certified teachers were more likely to work in urban schools. However, these conclusions are based on analyses that lack controls. The inferential analysis that follows includes controls for a number of potentially important factors.

TABLE 2 Comparisons of Alternative and Traditional Certificate Teachers on Gender, Ethnicity, Urbanicity, and Teaching Status in Percentage

Variables	Traditionally Certified	Alternatively Certified
Gender		
Male	232 (44.4%)	69 (46.3%)
Female	290 (55.6%)	80 (53.7%)
Ethnicity		
White	479 (91.8%)	129 (86.6%)
African-American	17 (3.3%)	10 (6.7%)
Asian/Pacific Islander	17 (3.3%)	8 (5.4%)
Native American	9 (1.7%)	2 (1.3%)
Urbanicity		
Large or mid-size central city	141 (27.0%)	45 (30.2%)
Suburban	246 (47.1%)	64 (43.0%)
Small town/Rural	135 (25.9%)	40 (26.8%)
Teaching Status		
Stayers	224 (42.9%)	46 (29.5%)
Movers	144 (27.6%)	59 (39.6%)
Leavers	154 (29.5%)	46 (30.9%)
Sample size	522	149

In our approach to the multinomial logistic regression analysis, we chose to use a series of nested models. We first established baseline models to account for background and contextual factors (Models 1 and 2). We then created our final statistical model (Model 3) by entering the

primary predictor of traditional vs. alternative certification. The two groups of control variables were (i) school demographics and (ii) teacher demographics and experience. School demographics included school sector and urbanicity. Albeit statistically significant at an α–level of 0.05, these variables played a very small role in teachers' decisions, accounting for only 1.3% of the total variance (see Model 1).[3]

Teacher demographics and experience included gender, ethnicity, number of years at the current school, whether they have been new teachers with less than 3 years of teaching experience, salary, satisfaction in general, and satisfaction with salary. Inclusion of these variables increased the pseudo R^2 to 18.6%, a large improvement over Model 1 ($p<0.01$). Gender and ethnicity information, however, were not significant in predicting a teacher's decision to leave or move.

Finally, we included the primary independent variable of traditional versus alternative certification and found that this variable was not statistically significant ($p>0.05$) in predicting the outcome variables (mover vs. stayer, leaver vs. stayer) in Model 3. This result indicated that, after the control variables had been accounted for, alternatively certified math and science teachers were not more likely to move to a different school or leave the teaching profession compared to traditionally certified teachers. Model 3 accounted for about 19% of the variance in teachers' decisions to leave the teaching profession or to move to another school. The two most prevalent factors that related to teachers' decisions to leave or to move to another school are general satisfaction and number of years at current school ($p < 0.01$), both inversely proportional to the outcome. Lower earnings were also a significant predictor for teachers leaving the profession ($p < 0.01$). Finally, new teachers were more likely to leave teaching compared to those who had been teaching for more than three years ($p < 0.01$), reiterating Ingersoll's (2001) earlier call for teacher induction programs.

CONCLUSIONS

Based on our analysis of background and contextual factors, school demographics played only a small role in teachers' decisions to move to other schools or to leave the profession. On the other hand, it appears that low salary was an important predictor of teacher attrition, while salary satisfaction was an important predictor of teacher movement to another school.

Apart from these ancillary findings, we originally set out to assess the role that certification routes may have played in mathematics and science teachers' decision to leave or stay in teaching careers. A simple descriptive analysis seemed to indicate that alternative certificate holders were about the same in terms of percentage to leave the teaching profession but were more likely to move to another school. However, after factors such as earnings, job satisfaction, salary satisfaction, and years at current school had been accounted for, teachers with alternative certification were not found to be more likely than teachers with traditional certification to either leave teaching or move to another school.

Our findings should be considered in light of the limitations of the data. Since only one year had elapsed between the *SASS* and *TFS* surveys, longer-term evaluation of these factors lie outside the scope of this analysis and, indeed, suggest an area for much needed further research. In addition, further examinations of large-scale studies that consider the issues brought forth in more highly detailed studies, e.g., ethnographies and interviews, appear to be in order. However, this analysis does offer some evidence suggesting that the goal of alternative certification programs to provide teachers for urban schools and in

[3] To take into account co-linearity between variables in the data set, Variance Inflation Factor (VIF) analysis was performed on the variables selected to eliminate some of the highly correlated variables from the models. Nevertheless, there are still some variables in the model that are inevitably correlated, such as the number of years the teacher had been at the current school and the earning from school.

difficult-to-staff subject areas and to diversify the teaching force have been successful. While alternative certification programs may draw some potential pre-service teachers away from traditional programs given the low cost and typically shorter duration of formal training, the introduction of alternative certification programs has not contributed to the "revolving door" phenomenon, based on this analysis. It appears that alternatively certified teachers fill a needed gap in the teaching force that traditionally certified teachers do not fill. We hope these results will offer some evidence to critics of alternative certification programs regarding teacher commitment. It appears that the teacher workforce may be strengthened through the diversification of certification options.

TABLE 3: Nested Multinomial Logistic Models for Predicting Math/Science Teachers' Likelihood of Leaving Teaching Profession or Moving to a Different School

		Nested Multinomial Models			Odds Ratios from Multinomial Model 3	
					"Leavers" vs. "Stayers"	"Movers" vs. "Stayers"
Independent Variables		Model 1	Model 2	Model 3	Total [d] Sample	Total Sample
School Demographic Predictors [a]	School sector	+	+	+	1.27	1.06
	Urbanicity				0.87	0.92
Teacher Demographic Background and Teaching Experience [b]	Gender				1.15	0.88
	Ethnicity				0.89	0.69
	Years at school				0.95 **	0.93 **
	New teacher flag (<3 years)		+	+	2.00 **	0.86
	Salary				0.68 **	0.96
	Satisfaction with salary				0.82	0.81 *
	Satisfaction in general				0.58 **	0.52 **
Teaching Certificate [c]	Regular/Alternative Certificate			+	1.24	1.57
χ^2		7.93	120.83	124.35		
$\Delta\chi^2$			112.90**	3.52		
df		2	9	10		
Δdf			7	1		
pseudo R^2		0.013	0.186	0.191		
Δ pseudo R^2			0.173**	0.005		

a: School demographic predictors included school sector and urbanicity variables. School sector is a dichotomous variable with private school = 1 and public school = 0. Urbanicity is an ordinal variable with higher values indicate more urban areas.

b: Teacher demographic background variables included gender (male = 1 and female = 0), ethnicity (white = 1 and other = 0), year at the current school, whether they are new teachers with less than 3 year experience (yes = 1), teacher earning from school (an ordinal variable with higher values indicate higher salary), satisfaction in the salary (higher value indicates higher satisfaction), and satisfaction in general (higher value indicates higher satisfaction).

c: Teaching certificate variables included the type of certification they have (regular certificate = 1 and alternative certificate= 0).

d: The analysis for the total sample has sample size of 671.

+ indicates that these variables were added to the model.

**: $p < 0.01$; *: $p < 0.05$.

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