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Identifying Personal and Contextual Factors that Contribute to Attrition Rates for Texas Public School Teachers

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Abstract: Teacher attrition is a significant problem facing schools, with a large percentage of teachers leaving the profession within their first few years. Given the need to retain high-quality teachers, research is needed to identify those teachers with higher retention rates. Using survival analyses and a large state dataset, researchers examined teacher data to identify those teacher and school variables associated with attrition. Unique to this study was the investigation of testing era (basic competency vs. higher standards based), school districts' yearly ratings based on state-mandated testing, and charter school status. Analyses revealed that teacher attrition was greater during the high stakes-testing era, at low-performing schools, and for charter schools; however, beginning teacher age, gender, and school level moderated several attrition rates. Implications for public policy are discussed.

Key words: Teacher attrition; teacher characteristics; school context; survival analysis; charter schools; school accountability.

La identificación de factores contextuales y personales que contribuyen a las tasas de deserción docentes en las escuelas públicas en Texas

Resumen: El abandono de la docencia es un problema importante que enfrentan las escuelas con un alto porcentaje de maestros que abandonan la profesión todavía en los primeros años. Dada la necesidad de retener a los profesores de alta calidad, es necesario investigar para identificar los docentes con mayores tasas de retención. Utilizando el análisis de supervivencia y un gran conjunto

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de datos del estado de Texas, los investigadores examinaron los datos de los docentes para identificar las variables escolares y profesionales asociadas con abandonar la profesión. La particularidad de este estudio fue investigar el tipo de prueba (competencias básicas en comparación con la competencia basada en estándares más altos), los rankings anuales de los distritos escolares con base en los exámenes estatales requeridos y el estado de las escuelas charter. Los análisis muestran que el abandono de los docentes fue mayor durante el periodo de exámenes con consecuencias graves, en escuelas de bajo rendimiento y en escuelas charter. Sin embargo, los primeros años de carrera, el género y nivel educativo de moderaban la deserción profesionales. En las conclusiones se discuten varias implicaciones para las políticas públicas.
Palabras clave: deserción docentes; características docentes; contexto escolar; análisis de supervivencia; las escuelas chárter.

Identificando fatores pessoais e contextuais que contribuem para as taxas de abandono nos docentes das escolas públicas do Texas

Resumo: O abandono do magistério é um problema significativo nas escolas, com uma grande percentagem de professores que abandonam a profissão ainda nos primeiros anos. Dada a necessidade de reter professores de elevada qualidade, é necessário investigar para identificar os professores com maiores taxas de retenção. Usando análises de sobrevivência e um grande conjunto de dados do Estado de Texas, pesquisadores examinaram dados dos professores para identificar as variáveis escolares e dos professores associadas com o abandono. Exclusivo para este estudo foi a investigação da tipo de testes (competência básica versus competência baseadas em padrões mais elevados), as classificações anuais dos distritos escolares, baseados em testes estaduais obrigatórios e o status das escolas charter. Análises revelam que o abandono dos professores foi maior durante o período de exames com consequências severas, nas escolas de baixo desempenho e para as escolas charter. No entanto, professores no início de carreira, gênero e nível de ensino das escolas as taxas moderam as taxas de abandono. Várias implicações para as políticas públicas são discutidas.
Palavras-chave: Taxas de abandono docente; características de professores; contexto escolar; análise de sobrevivência; escolas charter.

Introduction

Attracting and retaining high-quality teachers has been a national challenge, especially in high minority, low-income schools (Allen, 2005). With the current emphasis on academic standards and accountability, researchers are seeking ways to identify factors that contribute to the school system's effectiveness. The increasing numbers of diverse students, along with alarming teacher attrition rates, raise concerns regarding the staffing of classrooms with competent, qualified educators, especially given the correlations, although modest, between teacher qualifications and student's academic success (Darling-Hammond, 2000). Many teachers who leave the profession are highly capable and competent individuals; thus, the question is how to retain these teachers. From a policy standpoint, retaining teachers is critical as the No Child Left Behind Act (NCLB) mandates that all classrooms possess a "highly qualified teacher" (Darling-Hammond & Sykes, 2003).

To gain insight into these issues, researchers have focused their attention on identifying factors that contribute to teacher shortages, retention, and attrition (Tye & O'Brien, 2002). Research suggests that teacher attrition is the single largest factor contributing to high rates of teacher shortages, especially in mathematics, science, and special education (Brown & Wynn, 2007). Based on the increased public scrutiny of our nation's school system, an investigation into factors affecting

teacher attrition is warranted and justifiable. In fact, some researchers have labeled teacher attrition as "a significant factor undermining program stability and quality" (Boe, Bobbitt, & Cook, 1997, p. 371). If society seeks to strengthen school systems, they must begin by examining the issues that influence educators, as student outcomes are directly linked to teacher retention (Darling-Hammond, 2000; Kersaint, Lewis, Potter, & Meisels, 2007).

Even with a racially diverse United States population, the teaching force has remained largely White non-Hispanic (hereafter referred to as White). This persists despite the fact that minority teachers exhibit a lower retention rate than White teachers (Ingersoll, 2001; Kirby, Berends, & Naftel, 1999); however, this trend does appear to be changing as the attrition rate for minority teachers is on the rise (Ingersoll & May, 2011). Regardless, it is critical to understand how teacher and school variables influence teacher attrition (Kirby et al., 1999). Moreover, higher rates of teacher attrition are associated with additional financial costs and concerns related to school stability and teacher trust (Guin, 2004). The purpose of this study is twofold. First, this study sought to determine whether common trends associated with teacher and school variables continue to predict teacher attrition, while also testing moderating effects. Second, this study built on previous research by exploring the impact of accountability and high-stakes testing on teacher attrition. Examining these trends in light of teacher characteristics and school context over a twenty-year span (1998 to 2010) may offer additional insight and policy implications about teacher attrition.

Review of Literature

Attrition Rates and Cost of Teacher Loss

As early as the 1970's, teacher attrition was recognized as a major problem affecting the educational system. It is estimated that during a given year, 33% of all beginning teachers leave the field for a variety of reasons (Brown &Wynn, 2009; Ingersoll, 2001; McLauren, Smith, & Smillie, 2009). Nationally, nearly $2.2 billion is the annual projected cost of teacher attrition within the United States, with an upward estimate of $4.9 billion when including teacher transfer (Alliance for Excellent Education, 2005). Moreover, research indicates that even a 25% turnover negatively affects organizational performance and effectiveness (Ingersoll, 2001). It is clear that teacher attrition, whether due to career changes within or outside of the field, has negative consequences on the school system and is detrimental to learning, hence meriting further exploration (Guarino, Santibañez,, & Daley, 2006; Ingersoll, 2003, Quartz et al., 2008).

Factors Influencing Teacher Attrition

While a variety of factors contribute to teacher attrition, our study is focused on teacher personal characteristics and school context variables. The review begins with an examination of personal characteristics (e.g., age, gender, ethnicity, and assignment) to understand the impact of these factors on teacher attrition. After exploring these factors, literature associated with school context (e.g., population served, class assignment, school accountability rating, high-stakes testing mandates, school level, and school type) are reviewed.

Teacher Personal Characteristics

Age. Research suggests that age is a reliable predictor of teacher attrition, with higher rates reported for both younger and older teachers (Billingsley, 1993; Boe, Bobbitt, Cook, Whitener, & Weber, 1997; Murnane & Olsen, 1990). While older teachers presumably leave at higher rates due to retirement (Billingsley, 1993; Brown & Wynn, 2007), a plethora of variables likely contribute to higher attrition rates among younger teachers. Importantly, retirement is among the least significant

factors for teacher attrition, with teacher attrition rates disproportionately higher among novice teachers (Ingersoll, 2001). In fact, retirement accounts for only about 12% of the total attrition rate (Ingersoll, 2001), with the hazard function of younger teachers (defined as < 40) being about 37% greater than older teachers.

Gender. Research indicates that successful transition of teacher candidates into certified, full-time teachers is linked to gender. With female teachers already outnumbering their male counterparts, research has shown that attrition rates are higher for males (Marso & Pigge, 1997; et al., 2008). This finding does not appear universal, as Adams (1996) found that females were about 37% more likely to leave the profession than males. Regardless, males appear more likely to change roles within education and move up the career ladder (Quartz et al., 2008), which may be associated with greater teaching dissatisfaction by males (Ma & Macmillan, 1999).

Race/Ethnicity. Understanding the influence of gender and teacher starting age on attrition in isolation is ill-advised, as attrition rates may be moderated by other variables. Kirby et al. (1999) indicated relatively few differences in attrition rates based on ethnicity or gender during the first couple of years. However, after 17 years in the profession, White females and African-American males were at the highest risk of leaving the profession, followed by White males. These results confirm that the simple direct effects of these variables may not paint an accurate picture related to teacher personal characteristics and attrition.

Other research using race/ethnicity as a possible factor influencing attrition is conflicting (Boe, Bobbit, Cook et al., 1997; Ingersoll, 2001; Kirby et al., 1999; Quartz et al., 2008). Studies have found that African-American teachers have lower attrition rates than White teachers do (Adams, 1996; Ingersoll, 2001; Kirby et al., 1999; Quartz et al., 2008; Shen, 1997). Other studies showed that Latino teachers had lower attrition rates when compared to White teachers (Kirby et al. 1999), although no difference emerged when examining role-changers (Quartz et al., 2008; Quartz et al., 2008). Regardless, it appears that White teachers are at the greatest risk of leaving the profession, which is consistent with previous survival analysis research (Adams, 1996). However, recent research suggests these trends may be changing, as the percent of minority teachers who leave the profession is rising faster than for White teachers (Ingersoll & May, 2011). In fact, their results suggest that currently minority teachers are leaving the profession at higher rates than White teachers. Although more research is needed to understand attrition rate differences, Kane and Orsini (1999) noted that minority teachers reported the lack of diversity among teacher and student populations, along with feelings of isolation, as the top reasons for leaving the profession.

Teacher assignment. Mathematics, science, and special education teachers appear more likely to leave the education field than other teachers (Brown & Wynn, 2007). In addition to these fields, bilingual (including English as a second language) education and foreign language are considered critical shortage areas (Flores & Claeys, 2011; Kersaint et al., 2007; U.S. Department of Education, 2011). Evidence also suggests that secondary level teachers with mathematics standard certificates were less likely to leave the field than those with probationary certification (Hampeden-Thompson, Herring & Kiening, 2008). Regardless, relatively little research has compared attrition between content areas.

Schooling Context

The impact of schooling context on teacher attrition has been inconclusive (Boe, Bobbitt, Cook et al., 1997). The schooling context can be characterized by the schools' state accountability rating (e.g., below expectations, acceptable, recognized, or exemplary), and testing era (from minimal basic skills to more rigorous standards), student/community socioeconomic status (SES [lower, middle, higher]), school level (elementary, middle, or high school) and/or school type (public,

private, charter, etc.). In examining school context literature, these factors may be contributors, in isolation or collectively, to teacher attrition.

Testing and accountability. Tye and O'Brien (2002) reported that the primary reason teachers left the profession was the increased levels of accountability and pressure associated with high-stakes testing. Specifically, in Texas, as the stakes increased from basic skills to more rigorous standards each testing era, teachers expressed concern about the role of testing (Flores & Clark, 2003). Also observed was that teacher candidates and teachers decisions regarding entering or remaining in the field were influenced by the ever-increasing high-stakes testing and accountability. Evidently, frustrations arise as teachers spend more time coaching students on test-taking skills and teaching curriculum that is based on high-stakes testing rather than on content they deem relevant (Kauffman, Johnson, Kardos, Liu, Peske, 2002; Johnson et al., 2004; Tye & O'Brien, 2002). There is also increased stress due to higher levels of accountability placed on teachers administering these tests and the pressures seem to diminish teacher satisfaction (Tye & O'Brien, 2002). No attrition research was found that examined the different testing eras (from basic competencies to higher standards) or school accountability ratings.

School level. Research examining the correlation between certification level and attrition has been inconclusive. Boe, Bobbit, Cook et al. (1997) found no significant differences in the attrition rates of elementary and secondary teachers. Murnane and Olsen (1990) noted that elementary teachers had the lowest hazard function, with high school mathematics and science teachers having larger hazard functions.

School type. When examining the correlation between certification level and attrition between charter and public schools, research shows that there are no age differences (Miron & Applegate, 2007). As in public schools, younger teachers tend to leave the field at greater rates than their experienced peers. Whereas attrition research has been inconclusive on ethnic differences among teachers in public schools (Adams, 1996; Ingersoll, 2001; Bobbit, Cook et al. 1997; Kirby et al.1999; Quartz, et al. 2008), for charter teachers, no significant differences in the attrition rates were found (Miron & Applegate, 2007). Yet, overall national data revealed higher attrition rates for charter schools as compared to public schools (Stuit & Smith, 2009).

The schooling context appears to be a contributing factor for leaving the profession or transferring out of a specific school (Ingersoll, 2001; Johnson & Birkeland, 2003; Johnson et al., 2004; Shen, 1997). Higher teacher attrition occurs in high minority schools as compared to counterparts (Fuller, 2003; Ingersoll, 2003). Poverty is also a contextual factor, since many high minority schools are located in low-income communities. As a result, teacher retention, especially in high-minority, low-income schools, is of great concern. Kirby et al. (1999) noted that in Texas, which has a large minority teacher pool and student population, minority teachers were disproportionately represented in high-poverty schools.

Summary and Research Questions

We suggest that high rates of teacher attrition are troublesome because attrition likely influences students' performance, lowers the quality of educational experiences, and disrupts the organizational capacity to sustain quality programs. While teacher personal characteristics and school contextual factors have been previously investigated in attrition studies, these findings are inconclusive. Moreover, relatively few teacher attrition studies have employed survival analyses and have rarely captured the life span of most teachers. To our knowledge, Kirby et al. (1999) provided the longest time interval (17 years), whereas most other studies were less than ten years and do not allow for accurate survival functions for longer career teachers. Moreover, very little research has

explored the impact of school type (charter vs. non-charter), testing era, Adequate Yearly Progress (AYP) status, along with the interaction of these and other teacher related variables, on attrition rates.

The goal of the current study is to fill these gaps using the following definition of teacher attrition: A teacher who left the teaching profession and never worked as an administrator. Therefore, this study focused on career teachers rather than including the confounding effects related to being an administrator. Our definition also did not consider teachers transferring to another school as attrition, but instead only those who permanently left the profession within the timeframe of this study.

As outlined above, it is imperative that researchers and administrators: 1) understand teacher and school factors that may lead to teacher attrition, 2) implement strategies that ameliorate teacher stressors and eventual attrition, and 3) create a teacher characteristic profile to predict successful (i.e., retained) teachers within their school. The literature indicates that various factor's impact teacher attrition, rather than one factor in isolation. To understand these factors, the following research questions were explored:

1) Do survival functions differ across teacher/personal characteristics (beginning teaching age, gender, ethnicity, subject area, and testing era)? Moreover, are these relationships moderated by other variables included in the model?

2) Do survival functions differ across school characteristics [teaching assignment, school type (charter vs. non-charter), school accountability rating, and population served] and do significant moderation effects exist in the model?

Methods

This study sought to identify those teacher and school characteristics that influence teacher attrition. To accomplish this goal, a database from public school teachers in Texas over a twenty-two year span (1988 to 2010) was obtained from the Texas Education Agency (TEA). From this dataset, only teachers who entered and left the profession between 1988 and 2010 were considered for analyses. Administrators were eliminated to uphold the emphasis on teacher retention and preserve analysis integrity. From the total sample of teachers (n = 481,718), who entered the profession between 1988 and 2010, the 266,236 who remained in the teaching profession in 2010 were removed rather than treated as right censored (Allison, 2010, pp. 9-15). For this study, right censored data refers to those teachers who remained in the profession at the end of data collection (i.e., 2010). Consequently, these results only generalize to those teachers who entered and left the profession and should not be used as an estimate of overall teacher attrition. This final teacher sample (n = 215,482) was used for Study 1. School characteristic data prior to 1995 were unavailable from the state, nor were 2010 data, so only those teachers (n = 128,127) who entered and left the profession during this period (1995 to 2009) were used for Study 2. Given the importance of understanding the testing era, this variable was used as a teacher rather than school variable to allow a larger time-period with more testing eras. Without this adjustment, only two testing eras could be compared.

Various teacher demographics, as well as teacher employment and responsibility data, were available from TEA. These variables include gender, ethnicity, age, tenure, base salary, teaching assignment, etc. These coded data were linked to school district characteristics, which included content area, school district, school type (charter vs. non-charter), testing era (e.g., basic

competency, standards based), AYP, etc. The AYP status was divided into four categories (exemplary, recognized, academically acceptable, and academically unacceptable), which was determined based on the school districts' performance on state-mandated tests and other academic factors (e.g. graduation requirements). Non-AYP rated school data were also used in this study, as several schools either filed for exemption status (often granted for only a year or two) or recently opened and did not yet have a school rating.

To classify schools, this study used the state classification of charter schools. According to TEA (www.tea.state.tx.us/charters.aspx), charter schools must meet the following criteria: 1) improve student learning, 2) increase the choice of learning opportunities within the public school system, 3) create professional opportunities that will attract new teachers to the public school system, 4) establish a new form of accountability for public schools, and 5) encourage different and innovative learning methods. Any school not under this state designation was considered a non-charter school.

Study 1 Sample

A sample of 215,482 teachers (77.24% female), with an average age of 39.54 years (*sd* = 11.90, median = 37 years) when they left the teaching profession, was evaluated to identify those teacher variables associated with teacher attrition. The average beginning teacher age was 34.93 (*sd* = 10.79). The majority of teachers were White (75.71%) or Hispanic (13.95%), with the other ethnicities as follows: Asian (1.18%), African American (7.97%), American Indian or Alaskan Native (0.26%), Native American (0.41%), Biracial (0.27%), and unknown or other (0.23%).

These teachers taught for an average of 4.61 (*sd* = 4.24) years, although the percentiles are statistically more appropriate (25th percentile = 1; 50th percentile or median = 3; 75th percentile = 6) given the distribution skew of 1.6. Most teachers left teaching during the Texas Assessment of Knowledge Skills (TAKS, 71.99%) or Texas Assessment of Academic Skills (TAAS, 26.19%) testing eras, with a small percentage leaving during the Texas Educational Assessment of Minimum Skills (TEAMS, 1.82%) testing era. It should not be interpreted that a greater number of teachers departed from the classroom as a result of the testing period, as these time intervals were unequal (TEAMS, 1988 to 1989; TAAS, 1990 to 1998; TAKS, 1999 to 2010). Instead, the testing period impact on attrition was addressed separately and more appropriately within Study 1. Most students (71.09%) taught were classified as "Regular," with "Special Education" representing the second largest group (10.80%). Other notable student populations were Bilingual (4.51%) and Compensatory/Remedial Education (3.75%) students. In terms of content taught, only the following groups were compared: ESL teachers (*n* = 2,006; 0.93%), foreign language teachers (*n* = 1,392; 0.65%), HS mathematics teachers (*n* = 10,398; 4.83%), HS science teachers (*n* = 8,346; 3.87%), middle school (MS) mathematics teachers (*n* = 8,134; 3.77%), MS science teachers (*n* = 11,350; 5.27%), and those labeled as "non-high risk areas" (*n* = 173,856; 80.68%). Teacher's average yearly salary was $35,309 (*sd* = $10,395), which was highly correlated with the year they taught (*r* = .67) and their tenure (*r* = .48).

Study 2 Sample

To evaluate school characteristics connected to teacher retention from 1995 to 2009, data from 128,127 teachers (77.23% female) were used. Only those teachers who entered and left the profession between 1995 and 2008 were considered in the analyses. The average teacher age was 37.97 years (*sd* = 11.44), with an average teacher starting age of 34.49 (*sd* = 11.08). Most teachers were White (73.1%), Hispanic (15.3%), or African American (9.0%), with the remaining classified as Other (4.6%). Teachers taught for an average for 3.47 (*sd* = 2.68), but the distribution skew (skew = 1.33) suggested that percentiles were more statistically appropriate (25th percentile = 1; 50th

percentile or median = 3; 75th percentile = 5). For these analyses, all teachers left during TAKS testing eras; therefore, testing era was not considered a school variable. Teacher's average yearly salary was $37,496 (*sd* = $8,943), which was highly correlated with the year they taught (*r* = .56) and their tenure or number of years of teaching (*r* = .39).

Most students taught were classified as Regular (71.81%), Special Education (10.18%), Bilingual (5.08%), and Compensatory/Remedial Education (3.01%). The breakdown by grade level taught was as follows: Elementary (Kindergarten through 5th grade; 51.38%), Middle (6th through 8th grade; 21.69%), and High (9th through 12th grade 26.92%) school. Teachers (3.0%), who taught in schools with a "non-traditional" breakdown of grade (e.g., 5th through 12th grade) levels, were not described here nor were they included in the statistical analyses due to the insufficient sample size.

Most teachers left teaching while working at non-charter schools (98.0%, *n* = 125,624) rather than charter schools (2.0%, *n* = 2,503). In terms of AYP status, the statistics were as follows: low performing (3.01%), acceptable (49.16%), recognized (30.87%), and exemplary (14.72%). The remainder of schools (2.24%) did not participate in the regular accountability rating system for unknown reasons (e.g., new schools that have not been rated, charter schools that are not required, etc.).

The percent of White teachers decreased as schools became higher risk based on AYP status (see Figure 1), whereas this percent increased for African-American teachers. In general, the percentage of Hispanic and other ethnic groups did not differ greatly based on AYP status; although, there appeared to be fewer Hispanic teachers in high performing (i.e., exemplary) schools. Overall, the data suggests that while White teachers gravitate toward higher performing schools, African-American teachers tend to work at lower performing schools. Hispanics and those labeled as Other seem less related to the school's AYP status. The percent of males increased as schools became higher-risk [non-participating (26.5%), low-performing (34.3%), acceptable (27.3%), recognized (18.3%), and exemplary (13.7%)].

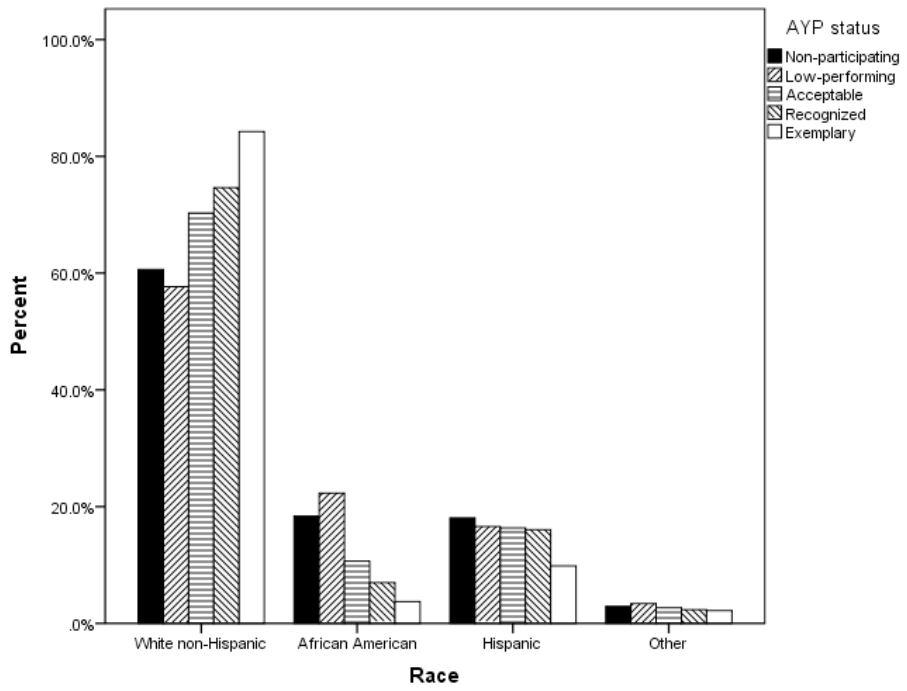

Figure 1. The percent of teachers within each AYP status group by ethnicity

Statistical Analyses

As denoted by Willett and Singer (1991), survival analysis is a "powerful and informative way" for investigating teacher retention. Essentially, survival analysis is designed to predict the time to an event, which in our case is the amount of time (measured in years) before a teacher leaves the profession. Our survival analyses estimated the probability of teachers (or subgroups of teachers) leaving the profession after a given number of years and identified those teacher and school variables that predict and/or moderate the amount of time before teacher attrition occurs. Consequently, this study sought to determine those teachers at the greatest (or lowest) risk of leaving the profession using time in the profession rather than teaching/not teaching as the outcome variable.

To understand the shape of the survival function (estimated proportion of teachers in the profession by year) for each group and visually evaluate whether the groups were proportional (i.e., approximately parallel survival functions), univariate Kaplan-Meier curves were estimated for each categorical variable prior to testing a model with multiple predictors. For these models, the significant difference between the survival functions was tested using the log-rank χ^2 test.

The univariate Cox proportional hazard regression, which is a semi-parametric model, was used next to estimate the individual hazard ratio (or incidence rate ratio) and regression coefficients (β or change in the logarithm of the hazard function when the variable changes by one unit). The hazard ratio was computed by taking the antilog of the parameter estimate $\exp(\beta)$, thus measuring the risk of one group (e.g., males) leaving the profession compared to another group (e.g., females). The hazard function represents the risk of a teacher leaving the profession at each year of data collection, whereas the cumulative hazard curve provides the cumulative probability of a teacher leaving the profession for each year. The Cox proportional hazard analyses also tests the individual parameter estimates and the overall model's statistical significance using the maximum likelihood and Wald χ^2 tests, respectively. Collectively, these analyses were conducted to establish the risk or relative risk of a teacher leaving the profession over the course of the study. This methodology also eliminates the limitations of previous research that only focused on retention at a single point in time.

Accompanying univariate analyses that tested the unique contribution of each variable, multivariate regression models were conducted to assess each variable's unique contribution after controlling for other covariates or interactions in the model. Only statistically significant interactions were evaluated to reduce model complexity, as these interaction terms more accurately portray the predictor variable's impact on attrition rates (Willett & Singer, 1991).

Results

Study 1: Univariate Effects for Teacher Variables

Beginning teaching age. To use the Kaplan-Meier test to compare survival functions, this variable was categorized as follows: Young adulthood (less than 25 years of age), mid-adulthood (25 to 30 years of age), and older adulthood (older than 30 years of age)[1]. The Kaplan-Meier test revealed a statistically significant effect of beginning teaching age, $\chi^2 = 4190.40$ (2), $p < .0001$, with

[1] While we recognized that a plethora of age group categories could be produced, we created our age categorizes based on previous research in the area of teacher attrition and used adult learning theory to guide the different developmental ages in adulthood. The percent of teachers in the young adulthood, mid-adulthood, and older adulthood was 18.26%, 27.60%1, and 54.13%, respectively.

younger beginning teachers possessing higher attrition rates. The survival functions were similar for teachers entering the profession during young and mid-adulthood, with a much lower attrition rate for older adults.

Using beginning teaching age as a continuous variable, the Cox proportional hazard regression produced a significant effect, $\chi^2 = 960.92$ (1), $\beta = -.007$, $p < .0001$, HR = 0.993. For this continuous variable, it is easier to interpret the hazard ratio statistic by subtracting one from the hazard ratio and multiplying it by 100 to compute the percent change. After this conversion, the hazard ratio of .993 [100(.993-1) = -0.70] indicated that for every 1-year increase in beginning teaching age the hazard of leaving the profession went down by 0.7 percent. Treating the beginning teaching age as a categorical variable with older adulthood as the reference group, the risk of leaving the profession was much greater for younger adults, $\chi^2 = 1568.68$ (1), $\beta = .23$, $p < .0001$, HR = 1.23, and mid-adulthood, $\chi^2 = 2606.79$ (1), $\beta = .26$, $p < .0001$, HR = 1.30, teachers. This indicates that younger adults and mid-adulthood teachers have hazard functions 23 and 30 percent larger than teachers who entered the profession during older adulthood.

Gender. The Kaplan-Meier test explored whether gender affected the survival or retention experience. Results revealed a statistically significant difference based on gender, $\chi^2 = 1137.30$ (1), $p < .0001$. Visual and follow-up analyses of the survival curves indicated that males leave the profession at a slightly higher rate early on (i.e., less than 10 years of experience), whereas these gender differences were minimized for teachers who remain in the profession for longer periods of time. The Cox proportional hazard regression revealed that β and HR were statistically significant, $\chi^2 = 881.43$ (1), $\beta = -.15$, $p < .0001$, HR = .86. The hazard ratio implied that the hazard (or risk that a teacher will leave the profession) for females was about 86% of the hazard for males, meaning that females stayed in the profession longer than males on average. Reversing the comparison (1/.86), the retention rate for females is about 16% higher than that of males on average.

Race/Ethnicity. The Kaplan-Meier test indicated a statistically significant effect of ethnicity, $\chi^2 = 958.90$ (8), $p < .0001$, which showed that the nine ethnic groups do not have the exact same survival function. Given the arduous nature and complexity of comparing the survival function across nine ethnic groups, and the fact that many of the groups had significantly smaller sample sizes than Whites, Hispanics, and African Americans, these other ethnicities were combined and classified as "Other." The revised Kaplan-Meier test still revealed a statistically significant difference in survival functions, $\chi^2 = 359.45$ (3), $p < .0001$.

The Cox proportional hazard regression found differences between these groups using the Wald χ^2 test, $\chi^2 = 269.33$ (3), $p < .0001$. Follow-up tests suggested that African Americans, $\chi^2 = 134.24$ (1), $\beta = .09$, $p < .0001$, HR = 1.10, and those labeled as Other, $\chi^2 = 133.89$ (1), $\beta = .17$, $p < .0001$, HR = 1.18, were at a greater risk of leaving the teaching profession when compared to the reference group, Whites. However, Hispanics were at a lower risk when compared to Whites, $\chi^2 = 7.89$ (1), $\beta = -.02$, $p = .005$, HR = 0.98. These results suggested that while African Americans and those labeled as "Other" possessed larger hazard functions (10% & 17% larger) than Whites, the hazard function for Hispanics was slightly smaller (2%) than Whites.

Teaching assignment. When evaluating teaching assignment (high-need areas vs. non-high-need areas), high-need course content areas (i.e., middle and high school mathematics and science, ESL, & foreign language) displayed higher attrition rates and steeper survival functions than teachers in non-high-need content areas. The Kaplan-Meier test revealed a statistically significant effect of teacher classification, $\chi^2 = 831.12$ (6), $p < .0001$; thereby, differences emerged between the survival functions based on teaching content area. These analyses also revealed that foreign language teachers possessed the greatest risk of attrition, with few teachers (n = 1,392; 0.65%) remaining in the

profession after ten years. In other words, of those foreign language teachers who entered the profession less than 1% stayed in the classroom after ten years.

The statistically significant Cox proportional hazard regression evaluated these group differences in more detail, $\chi^2 = 598.94$ (6), $p < .0001$. Using non-high-needs teaching areas as the reference group, analyses confirmed that foreign language teachers were at the highest risk of leaving the teaching profession (1.54 times more likely) and possessed the largest hazard ratio when compared to non-high-needs teachers, $\chi^2 = 254.90$ (1), $\beta = .42$, $p < .0001$, HR = 1.54. When considering the other high-needs teaching areas, the groups of next greatest risk were as follows: middle school mathematics teachers, $\chi^2 = 169.74$ (1), $\beta = .15$, $p < .0001$, HR = 1.16, high school science teachers, $\chi^2 = 148.44$ (1), $\beta = .14$, $p < .0001$, HR = 1.15, high school mathematics teachers, $\chi^2 = 123.44$ (1), $\beta = .11$, $p < .0001$, HR = 1.12, and middle school science teachers, $\chi^2 = 12.93$ (1), $\beta = .04$, $p = .0003$, HR = 1.04. No differences emerged between ESL teachers and non-high-needs teachers ($p = .1330$).

Testing era. Although initially "testing era" was considered a school context variable, it was grouped with the other teacher variables to incorporate more testing eras as aforementioned. To test the effect of the testing era, a reduced dataset ($n = 70{,}997$) was used to lessen confounding effects (i.e., teachers who taught during both testing eras and different lengths of testing eras). Consequently, only teachers that started during the first five years of that testing era and quit within five years (thus ensuring that teachers did not enter the next testing era) were included in this analysis. Kaplan-Meier analyses suggested that teachers who taught during the TAKS era (or high-stakes testing era 1999 to 2010) left the profession at a higher rate than those in the TAAS era (1990 to 1998), $\chi^2 = 25.30$ (1), $p < .0001$. Cox proportional hazard regression analyses confirmed this conclusion, $\chi^2 = 850.80$ (1), $\beta = -.22$, $p < .0001$, HR = 1.24, with the hazard ratio indicating that the hazard for teachers during the TAKS era was 24% greater than during the TAAS era.

Multivariable Survival Model with Teacher Variables

To estimate the overall effect of gender, beginning teaching age, ethnicity, and teaching assignment, along with statistically significant interactions, two multivariate Cox proportional hazard regression analyses were conducted. These analyses were useful in investigating the unique contribution of each covariate (controlling for other covariates), while also testing the interaction effects between covariates. The first analysis included all two-way interaction terms, while the second analysis only incorporated those interactions that were statistically significant after the Bonferroni adjustment ($\alpha = .05/42 = .0012$). Of the 31 two-way interaction terms from the first analysis, eight interaction terms and all the main effects were included in the final model. The testing era variable was not included as it used a significantly smaller sample size after controlling for confounding effects due to changing testing eras.

The final multivariate Cox proportional hazard regression analysis (see Table 1) yielded an overall statistically significant model, $\chi^2 = 3324.56$ (19), $p < .0001$. From this model, 14 of the 19 parameter estimates were statistically significant after the Bonferroni adjustment ($\alpha = .05/19 = .0026$). Consistent with the univariate analyses, foreign language teachers, Hispanic status, and beginning teaching age were the best main effect predictors of teacher attrition after controlling for the other covariates. To prevent redundancy, these and other main effects were not interpreted, as they were consistent with the univariate results above. Overall, these results indicated that Hispanics, older starting teachers, and non-foreign language teachers stayed in the profession longer than most other groups considered in these analyses. Of course, those main effects, incorporated with a significant interaction term, should be interpreted with caution.

Table 1

Cox proportional hazard regression results with multiple main effects and interaction terms for the teacher variables.

Main effect/interactions	β	χ^2	HR
Beginning teacher age status	-0.01	***153.05	0.99
Gender status	-0.04	*4.71	0.96
African American status	-0.22	***56.85	0.80
Hispanic status	-0.38	***281.47	0.68
Other race status	-0.16	*9.59	0.85
ESL teacher status	0.06	*6.33	1.06
Foreign language teacher status	0.44	***266.52	1.55
HS mathematics teacher status	-0.11	*10.37	0.89
HS science teacher status	0.02	1.03	1.02
MS mathematics teacher status	0.20	***95.54	1.23
MS science teacher status	0.01	2.04	1.01
HS science teacher by Gender status	0.11	***25.54	1.12
Beginning teacher age by African American status	0.01	***114.46	1.01
Beginning teacher age by Hispanic status	0.01	***232.52	1.01
Beginning teacher age by Other race status	0.01	***35.73	1.01
Beginning teacher age by HS mathematics status	0.01	***34.47	1.01
Beginning teacher age by Gender status	-0.01	***127.26	0.99
MS mathematics teachers by Gender status	-0.10	***16.89	0.90
HS science teachers by Hispanic status	0.10	*8.60	1.11

Note. Gender status, ESL teacher status, HS science teacher status, MS science teacher status, and HS science teacher by Hispanic status predictors were not statistically significant after the Bonferroni adjustment (.05/19 = .0026). Similar to the univariate analyses, the reference groups were males, Whites, and non-high risk content areas.

* $p < .05$, ** $p < .001$, *** $p < .0001$

To understand the interaction effects, separable groups were created for each subgroup within the interaction and the survival function was estimated. For these interaction analyses, the beginning teacher age variable was dichotomized to ease interpretation (beginning age $\leq$ 30 equals younger, beginning age > 30 equals older). This was deemed appropriate given the small difference between young adulthood (less than 25 years of age) and mid-adulthood (25 to 30 years of age) teachers (HR = 1.03, with Young adulthood as the reference group). Although two interaction/moderation effects were described below for demonstration purposes, the remainder of the results was provided in Table 2 for readers to interpret.

Focusing on the two most significant interaction terms Table 1, the strongest interaction effect was the beginning teaching age by Hispanic status term (see Interaction 2 in Table 2). The Cox proportional hazard regression was statistically significant and revealed that younger beginning White teachers were at the greatest risk of leaving the profession, whereas the survival functions were smaller (i.e., lower risk) across the other three groups. This interaction suggests that while beginning teacher age plays a large role for White teachers (i.e., puts them at a higher risk), this finding does not generalize to Hispanic teachers or older White teachers. Interestingly, older White teachers were at a lower risk than both young and older Hispanics, with the difference in hazard ratios being much smaller between younger and older Hispanics.

The second most significant interaction term (see Interaction 5 in Table 2) was beginning teaching age by gender. The statistically significant Cox proportional hazard regression model revealed that older females were at a much lower risk of attrition than the other three subgroups, with younger males and females being 47% and 25%, respectively, more likely of leaving teaching than older females. Moreover, the risk of an older male leaving the profession is much higher (26%) than older

females. Collectively, these statistical analyses suggest that the effect of age is inconsistent across ethnicity and gender.

Table 2

Provides the estimated hazard ratios for each subgroup to interpret the interaction effects from the multivariate Cox proportional hazard regression model using teacher variables.

Interaction	Predictors	Moderators	
		Age	
		Younger	Older
Interaction 1	White	1.38	RG
	African American	1.34	1.20
Interaction 2	White	1.38	RG
	Hispanic	1.16	1.10
Interaction 3	White	1.38	RG
	Other	1.40	1.33
Interaction 4	Non-high-risk	1.31	RG
	HS mathematics	1.39	1.31
Interaction 5	Males	1.47	1.26
	Females	1.35	RG
		Gender	
		Male	Female
Interaction 6	Non-high-risk	1.16	RG
	Middle school mathematics	1.42	1.12
Interaction 7	Non-high-risk	1.16	RG
	High school science	1.19	1.17

Note. RG refers to the reference group. Younger was defined as teacher < 30, whereas older was defined as teachers ≥ 30. All hazard ratios were statistically significant at $\alpha = .0001$, with additional statistical results (e.g., χ^2, *p*-value, β coefficient) available from the corresponding author. Generally speaking, the hazard ratios provide sufficient information to interpret the interaction effects.

Study 2: Univariate Effects for School Context Variables

AYP status. The Kaplan-Meier test revealed that the survival functions were different across AYP status, $\chi^2 = 431.07$ (4), $p < .0001$. Omnibus test results from the Cox proportional hazard regression model confirmed the aforementioned conclusion, $\chi^2 = 303.11$ (4), $p < .0001$. Using teachers who worked in exemplary school as the reference group, these analyses indicated a small difference between exemplary and recognized schools, $\chi^2 = 4.47$ (1), $\beta = -.02$, $p = .0345$, HR = 0.98.

However, this gap increased (when looking at the hazard ratios) when compared to those schools classified as acceptable, $\chi^2 = 74.65$ (1), $\beta = .07$, $p < .0001$, HR = 1.07, low-performing, $\chi^2 = 42.15$ (1), $\beta = .11$, $p < .0001$, HR = 1.22, and non-participating, $\chi^2 = 79.19$ (1), $\beta = .18$, $p < .0001$, HR = 1.20. These results imply that teachers from lower performing schools, or those not participating in AYP, were more prone to attrition. In fact, teachers from non-participating or low-performing schools were 20 and 22 percent more likely to leave the teaching profession, respectively, when compared to teachers at exemplary schools, whereas the risk of leaving the profession was similar for exemplary, recognized, and acceptable schools.

School type. Teachers from charter schools possessed a very different survival function than non-charter schools based on the Kaplan-Meier, $\chi^2 = 838.38$ (1), $p < .0001$, analyses. Compared to the other covariates, charter schools produced the largest hazard function difference and appeared to be the best predictor of teacher attrition when using the Cox proportional hazard regression analysis, $\chi^2 = 1020.56$ (1), $\beta = .67$, $p < .0001$, HR = 1.91. The hazard ratio indicated that charter school teachers were almost twice (1.91) as likely to leave teaching when compared to non-charter school teachers. To provide a greater appreciation for this difference, the average attrition rate for charter and non-charter school teachers was 1.89 (*Mdn* = 1) and 3.51 (*Mdn* = 3) years, respectively.

School level. When contrasting the school level (Elementary, Middle, & High school), the Kaplan-Meier log-rank χ^2 test, $\chi^2 = 397.40$ (2), $p < .0001$, and Cox proportional hazard regression Wald χ^2 test, $\chi^2 = 280.52$ (2), $p < .0001$, results suggested that the survival curves were significantly different between school levels. Survival function curve analyses revealed that elementary school teachers were the least likely to leave the profession, with little difference between middle and high school teachers. Using high school teachers as the reference group, analyses confirmed this conclusion with no significant difference emerging between middle and high school teachers ($p = .5186$). However, variation in hazard rates existed between elementary and high school teachers, $\chi^2 = 209.55$ (1), $\beta = -.10$, $p < .0001$, HR = 0.91, with middle school teachers at a slightly lower risk (about 10%) than high school teachers.

Multivariable Survival Model with School Variables

To evaluate the cumulative effect of AYP status, school type, and school level, along with the statistically significant interaction effects, two multivariate Cox proportional hazard regression analyses were conducted. Like the teacher model, the first analysis employed all two-way interactions and main effects, with the second only including the main effects and statistically significant interaction terms from the first model. Of the 11 2-way interactions, six interactions were statistically significant after the Bonferroni adjustment ($\alpha = .05/18 = .0028$) and included in the final model. The final multivariate Cox proportional hazard regression analyses revealed an overall significant model, $\chi^2 = 1456.11$ (12), $p < .0001$, with most (10 out of 12) parameter estimates being statistically significant after the Bonferroni adjustment (see Table 3). The interpretation of the multivariate results was similar (difference being the effect of that variable or interaction term controlled for other variables or interaction terms in the model) to those of the univariate, with the follow-up interaction/moderation results displayed in Table 4. The most interesting interaction effect (Charter Status by School Level) was described below, whereas the interpretation of the other interaction terms are relatively straight forward based on the hazard ratio comparisons. Collectively, the results consistently demonstrated that the school level interacts with the school's accountability rating. It is worth mentioning that higher performing high schools experienced, on average, higher attrition rates. Therefore, our results reliably counter the common assumption that teachers leave low performing schools at higher rates. Instead, this is likely only true for elementary schools, as these findings were not replicated with middle or high school teachers. Exit interview data would be

extremely useful to ascertain whether teachers leave high performing schools for different reasons than low performing schools and why these differences are school level dependent.

Table 3
Cox proportional hazard regression results with multiple main effects and interaction terms for the school variables.

Main effect/interactions	β	χ^2	HR
Non-participating school status	0.07	*7.11	1.08
Low performing school status	-0.01	0.20	0.99
Acceptable school status	0.10	***96.46	1.10
Recognized school status	-0.03	**10.09	0.97
Charter status	0.71	***881.36	2.03
Middle school status	0.16	***68.35	1.17
High school status	0.19	***313.46	1.21
High school by Charter status	-0.17	**10.24	0.84
High school by Non-participating school status	-0.20	***22.39	0.82
High school by Acceptable school status	-0.18	***164.37	0.83
Middle school by Acceptable school status	-0.12	***30.76	0.89
Middle school by Recognized schools status	-0.06	*5.86	0.95

Note. Only the Low performing school covariate and the Middle school by Recognized schools interaction term was not statistically significant after the Bonferroni adjustment (.05/12 = .0042). Similar to the univariate analyses, the reference groups were exemplary schools, non-charter schools, and elementary schools.
* $p < .05$, ** $p < .001$, *** $p < .0001$

The univariate Cox proportional hazard regression analysis revealed that the hazard functions were consistently greater for charter than non-charter schools (see Table 4). However, the interaction emerged due to the significantly lower hazard function for non-charter elementary school teachers compared to the other three groups. These disparities were always statistically significant at $p < .0001$, as the hazard ratios indicated the largest difference emerged between charter and non-charter elementary schools. While a statistically significant difference between charter and non-charter schools remained at the high school level, practically speaking it was less than at the elementary level. While previous empirical or theoretical research has not considered these variations, given the large differences in hazard ratios, it would be useful to determine the fundamental differences between these teachers and the schools in which they work.

Table 4
Provides the estimated hazard ratios for each subgroup to interpret the interaction effects from the multivariate Cox proportional hazard regression model using school variables.

Interaction	Predictors	Moderator	
		School Level	
		Elementary school	High school
Interaction 8	Non-charter	RG	1.11
	Charter	2.10	1.81
Interaction 9	Non-participating	1.23	1.29
	Exemplary	RG	1.44
Interaction 10	Acceptable	1.15	1.14
	Exemplary	RG	1.43
		School Level	
		Middle school	High school
Interaction 11	Acceptable	*1.03	RG
	Exemplary	*1.09	1.24
Interaction 12	Recognized	RG	*1.05
	Exemplary	1.13	1.28

Note. RG refers to the reference group. All hazard ratios were statistically significant at $\alpha = .0001$, with the exception of those marked with an * that were statistically significant after the Bonferroni adjustment ($\alpha = .05/15=.003$). Additional statistical results (e.g., χ^2, *p*-value, β coefficient) are available from the corresponding author. The hazard ratios provide sufficient information to interpret the interaction effects.

Discussion

Concerns associated with teacher attrition have prompted researchers to identify factors that contribute to teacher retention. One imperfection of most past research is the limited number of years data were collected, which prohibits the use of survival analyses and other robust models for longitudinal data. Thus, these studies may produce invalid, and therefore unreliable, estimates of teacher retention overall or at the subpopulation level. By using a large longitudinal state dataset, this study overcame this limitation and demonstrated that the risk of leaving the teaching profession varies as a function of both teacher and school variables. More importantly, this study suggests these variables interact to influence attrition. Unique to this study, the results designate teachers working at charter schools, younger beginning teachers, high school teachers working at better performing schools, and foreign language teachers as possessing higher attrition rates. Perhaps more importantly, our results provide evidence that many variables interact to influence teacher attrition.

Teacher Variables

Not only are there more female teachers in the profession, but females appear to remain in the profession longer than males. This main effect conclusion supports the findings of Heynes

(1998) and Kirby et al. (1999), while countering those of Marso and Pigge (1997). However, our multivariate analyses suggest that this effect is conditional on beginning teacher age, as older beginning female teachers are at a lower risk of leaving the teaching profession compared to males (regardless of beginning teacher age) and younger female beginning teachers. Prior research does not provide evidence as to why gender and beginning teacher age interact to influence attrition. However, past research does suggest that males, on average, are less satisfied with the teaching profession than females (Ma & Macmillan, 1999) and are more likely to move up the career ladder as administrators (Quartz et al., 2008). From an administration standpoint, it is important to recognize that greater effort might be required to retain all younger starting teachers, as well as older male starting teachers. It would also be useful to determine those unique characteristics of older female beginning teachers, as they appear more prone to remain in the classroom. While administrators cannot discriminate based on age, if all other things are equal, it is important to consider older applicants, who likely have a lower chance of attrition.

Consistent with previous research (Boe, Bobbitt, Cook et al., 1997), a teacher's starting age was a significant predictor of teacher retention. However, these results are not consistent across all teacher demographics, in particular gender and ethnicity. This conclusion is especially true for younger White teachers (see Table 2), as their risk of leaving the profession was higher than that of Hispanics, African Americans, and those labeled as Other regardless of beginning teaching age. Although it is not entirely clear without more research, culture (or some associated variables) likely play a significant role in teacher retention. Thus, while earlier studies suggest ethnicity to be unrelated to teacher attrition (Boe, Bobbit, Cook et al, 1997), Quartz et al. (2008) found attrition differences based on ethnicity, with Hispanics being retained over longer time-periods. The only caveat to this previous research is that older starting White teachers remained in the profession longer than any other ethnic group regardless of beginning teaching age.

Though purely speculation, it is feasible that African Americans, Hispanics, and other minority groups entered the teaching profession for different reasons. Perhaps, they encompass a more collective culture, greater sense of community, and greater commitment to social justice (Flores, Ek, & Sánchez, 2011; Villegas & Irvine, 2010) than younger White teachers. These results also may relate to school diversity, as teachers frequently report a stronger desire to work in schools with greater student and teacher diversity (Kane & Orsini, 1999). Of course, these results should not be considered in isolation, as it would be interesting to determine whether highly-qualified, minority teachers with a larger minority student population remain in the profession longer than non-minority teachers and vice-versa.

Teacher assignment was envisaged to be a strong predictor of teacher retention, as teachers in high-demand areas were thought to be more employable elsewhere for greater financial compensation. Our analyses indicated that foreign language teachers experienced the greatest attrition, with a hazard rate of 1.54 times that of teachers in non-high-risk areas. This was a concerning finding given that in Texas the minimum high school graduation requirements have changed mandating at least two credits in the same foreign language. With this policy, the demand for foreign language teachers has increased and the prototypical student population has changed. Consequently, foreign language teachers are now faced with teaching diverse learners, rather than only those students with high interest and motivation to learn a second language and/or pursue a college degree path. Many schools in Texas offer additional stipends and mentoring support for mathematics and science teachers to increase retention. These benefits might be extended to foreign language teachers given that they appear at the greatest risk of attrition or, perhaps, greater curricular guidance is required for these teachers.

Johnson et al. (2004) demonstrated that teacher attrition is directly linked to curricular guidance, with mathematics teachers receiving more (80%) curricular guidance than science (44%), social studies (31%), and language arts (68%) teachers. Based on this notion, previous research (Murnane & Olsen, 1990) indicating that high school mathematics teachers have lower attrition rates than high school social studies, English, and the science teachers might be expected. However, our study revealed that mathematics and science teachers display higher attrition rates than non-high-risk areas regardless of school level. Given the contradictory findings, it appears that more research is needed to determine causality. One simple explanation is that the demand for mathematics and science majors outside of education has changed in the last twenty years.

One interesting variable that has received little attention is the testing standards imposed on students and the influence on teacher attrition. Although the TAAS testing era required higher student standards than the previous TEAMS test, while also providing greater consequences to students, schools, and districts for poor test performance, the TAKS era imposed even higher standards and consequences for these groups. Our results suggest that these higher standards had a significant negative impact on teacher retention, as the risk of leaving the teaching profession during the TAKS era was 24% higher than during the TEAMS era.

These results support previous research (Tye & O'Brien, 2002) that a primary reason teachers leave the profession is the increased level of accountability associated with high-stakes testing, along with the frustrations of spending more time on test-taking skills and teaching curriculum for these high-stakes tests (Kauffman et al., 2002; Tye & O'Brien, 2002). Our results also coincide with the notion that high-stakes testing increases teacher stress and workload (Tye & O'Brien, 2002), thus purportedly contributing to greater attrition rates. Given that educational policies are unlikely to change in the near future, perhaps administrators and policymakers could put in place policies to better help teachers cope with these stressors. It is also recommended that schools use technology (e.g., webinars, vodcasts) to help prepare students for these tests, rather than devoting a significant amount of class time. For example, students could be required to watch vodcast and participate in webinars that teach them study habits and prepare them for the state-mandated tests. To ensure completion, students could then be required to take a short on-line test to measure their mastery of these newly acquired skills. This certainly would reduce teacher stress related to state testing.

School Variables

Results from this study provide strong evidence that attrition rates are not only linked to teacher factors, but also school factors. One interesting finding was that teachers who taught at lower risk schools (based on AYP status) were not always at a greater risk of leaving the profession. In fact, high school teachers at higher performing schools often left the profession at greater rates than lower performing schools. It is often argued that teachers working at higher risk schools experience greater workload stressors, lack sufficient resources, and work with high-risk student populations, thus putting them at greater risk for attrition. While these assertions may be true, and are actually supported by our univariate analyses, it is important to recognize that this is not universal. As seen in Table 4, our analyses indicate that high school teachers working at higher performing schools consistently leave the profession at higher rates.

One theory is that these high school teachers were highly qualified and therefore provided employment opportunities elsewhere, whereas elementary teachers at better performing schools may enjoy their low-need students and experience fewer opportunities for advancement. For example, a highly qualified high school mathematics or science teacher could likely find higher pay for conducting professional development, developing curriculum, working at central office, or obtaining

outside employment. Quartz et al. (2008) provided support for the above assumption, as teachers often leave the classroom seeking higher pay and leadership opportunities that result in career advancement and increased status. However, a counter theory is that there are other stressors in exemplary high schools located in more affluent areas, such as parental demands and teacher status (Fives & Alexander, 2004). In the case of acceptable schools, there exists continued pressure from administrators to raise school ratings (Flores & Clark, 2003). Regardless, the interaction between school level and AYP status appears to be a consistent trend.

Previous research has indicated that secondary teachers leave the profession at greater rates than elementary teachers (Guarino et al., 2006), while other studies show the opposite (Boe, Bobbitt, Cook et al., 1997). Although some secondary teachers leave the field altogether, Quartz et al. (2008) noted that secondary teachers, specifically in years 3 to 8, are more likely to leave the classroom for other positions (e.g., administration) within the profession. Our results suggest that attrition rate differences do exist between elementary and both middle and high school teachers and shed some light on previous research. For example, it is feasible that these higher attrition rates for secondary teachers could be a consequence of teaching accountability courses tested by the state, thus resulting in elevated stress. As this study revealed, school level often moderates the effect between AYP status and attrition rates and may partially explain some of the contradictory findings of previous research.

Limitations and Future Research

Despite the valuable and comprehensive analysis of teacher and school data, several limitations remain. Foremost, these data consist primarily of teacher and school demographic variables and omit other variables likely to be associated with teacher retention (e.g., administrator support, and teacher stress and workload.). Although extremely labor and time intensive, it would be beneficial to conduct similar statistical analyses using those explanatory variables thought to predict teacher retention and likely to vary more between teachers. Of course, one difficulty with such a study is all the predictors are time-dependent variables. In addition to those aforementioned teacher related variables, it would be interesting to evaluate teacher preparation and education variables (e.g., degree obtained, certificates earned, and continuing education) associated with attrition.

One methodological/statistical limitation of this study is the inability to control or appropriately model time-dependent variables. Take for example charter school status, the best predictor of teacher attrition. This study only considered teachers' charter school status the year they left the profession; therefore, it is feasible that previous teaching experiences and school context variables influenced their decision to resign. One could certainly argue that the teachers' current school context plays the largest role, as a teacher satisfied with her or his current working environment would be less likely to leave the teaching profession.

Another limitation and area of future research is evaluating teachers who transfer into administration, as this study only considered teachers who remained in the classroom their entire career. It is possible that the retention profile differs for administrators and a unique type of individual is more prone to gravitate toward administration. Another source of bias is that teachers who left the state of Texas were counted in the attrition rates, as the state had no way to track these teachers thereafter. While the effect on between group differences is purportedly random given there is no reason to believe that certain demographic groups are more likely to leave the state than others, this may slightly overestimate attrition rates. Lastly, our analyses focused on teachers who entered and left the profession within the designated timeframe; thus, results may not generalize to teachers who remained in the profession.

Policy Implications

Interest in the construction of retention policies has soared due to the relationship between student achievement and teacher retention (Boe et al., 1997; Finch, Lapsley, & Baker-Boudissa, 2009; Kersaint et al., 2007). The growing literature base and our findings provide insight into the factors associated with teacher retention. Regardless of the educational setting (charter vs. non-charter, high performing vs. low performing schools, etc.) and policy (e.g., testing policy), it is critical that teacher preparation programs, school district administrators, and policymakers are cognizant of how these factors influence teacher attrition. Most policy efforts have focused on increasing the number of teachers in the profession, with less attention given to the required support to retain highly-qualified teachers. Below are our policy recommendations.

Develop Strategies for Retaining Teachers.

Administrators should be aware that retention rates differ as a function of teachers themselves and that these effects are not always consistent, as beginning teacher age and gender moderated several predictions. As a result, younger adults might be developmentally distinct when compared to older adults in the areas of commitment, self-evaluation, and problem-solving, with these factors presumably varying based on teacher content area, gender, and ethnicity. These skills must be taught to ensure that younger teachers acquire resiliency (Guerra, Flores, & Claeys, 2009) and receive the preparation and induction support throughout the novice years to work with diverse student populations (Flores et al., 2011). Associated with retaining teachers, administrators are encouraged to identify other teacher characteristics (e.g., commitment to teaching and coping skills) that could be used to predict retention. By administering an assessment battery prior to hiring teachers, administrators could use these data to predict whether they will be successful (i.e., effective teachers that remains in the profession).

Ameliorate Hiring Practices and Restructure Professional Development for New Hires.

While the results from this study identify teacher characteristics more prone to attrition, these factors cannot be used to discriminate when recruiting and hiring teachers. To ensure equal employment opportunities and increase retention rates, administrators, human resources personnel, and policymakers must be trained to identify prospective new teachers' strengths-based problem solving skills, teaching efficacy, and commitment to the profession. Again, an assessment battery for applicants to complete that measures these factors may be very useful. Regardless, at the onset of employment, the school district must develop professional support for all new beginning teachers regardless of age, gender, and ethnicity to improve retention. Teacher trainers should be well-versed in identifying strengths and weaknesses of teachers, while at the same time being able to scaffold their learning, which should increase the likelihood of retention. Lastly, state and/or federal monies should only be provided to those teacher preparation programs that empirically demonstrate consistent significant improvements associated with academics and teacher retention.

Increase Minority Teacher Representation.

It is noteworthy that minority teachers, specifically Hispanic teachers, have greater retention rate than White teachers; hence, it is important to continue recruiting minorities into the teaching profession and creating strategies that ensure their retention (Flores & Claeys, 2011). Teacher preparation programs must work collaboratively with school districts to improve teacher retention by preparing all teachers to work with diverse student populations through coursework, field experiences, service learning, and professional development (Flores & Claeys, 2011).

Reduce the Cost of Attrition.

Given the extreme cost of teacher turnover (Alliance for Excellent Education, 2005), it appears critical that districts provide cost-effective methods to increase teacher effectiveness and retention. While various approaches may exist to meet these needs (e.g., teacher mentor), administrators should proactively consider empirically supported training, such as strengths-based problem solving (Guerra, 2006), that assist teachers with the daily stressors (e.g., student behaviors, classroom, and administrative barriers) rather than only academic related activities. Specifically, another recommendation for the school districts and teacher preparation programs is to work collaboratively to establish hybrid professional learning communities where novice teachers continue to learn about the latest research-based practices, attain strengths-based problem solving skills, renew their commitment to teaching, and network with experienced teachers. A third recommendation is to implement a year-long residency for new teachers to ensure mastery learning and teaching efficacy before working in the schools. Finally, perhaps there should be financial repercussions for schools with poor teacher retention. Schools in Texas are currently financially penalized for poor student performance and graduation rates, while little consideration is given to high teacher attrition that ultimately influences student success. Perhaps greater financial rewards should be provided to those schools with effective hiring practices and teacher preparation programs that result in greater teacher retention. This could easily be justified given the large of amount of state monies currently allocated to improve teacher retention.

Before implementing any policy changes, it is critical to assess whether they are cost-effective and functional. For example, while it may be cost-effective to administer measures shown to predict teacher retention during the application process and work with teacher preparation programs to better prepare teachers, it may not be cost-effective to implement teacher residency programs. The latter is especially true if it is a year-long paid residency. Therefore, additional research is needed to conduct cost-benefit analyses for programs and procedures thought to increase teacher retention and, perhaps more importantly, increase teacher effectiveness.

Curtail High-stakes Testing and Accountability Stressors.

With high-stakes testing and accountability influencing teacher attrition, professional development should also assist teachers in dealing with such stressors. As delineated by Lambert and McCarthy (2006), several approaches can be conducted to help teachers cope with these associated stressors. To date, most research focuses solely on teacher perceptions related to high-stakes testing (Flores & Claeys, 2011; Kauffman et al., 2002; Johnson et al., 2004; Tye & O'Brien, 2002) and no research has quantitatively demonstrated the actual impact on teacher retention rates. Consequently, our study provides a significant contribution to the literature by quantitatively confirming the influence of state and federal policy on teachers. Interestingly, while NCLB was put in place to increase student academic success, this same policy appears to decrease teacher retention (thus reducing teacher experience), which directly influences student success (Darling-Hammond, 2000). The limiting inference from these results is the uncertainty with which teachers are leaving the profession, as the policy may be driving out some less qualified teachers. Along a similar vein, it would be valuable to ascertain whether the number of "qualified teachers" who left the profession differed as a function of teacher content area.

From a policy perspective, we suggest that new teachers should not be held accountable for past school performance, whether positive or negative, given that they have not contributed significantly to this rating. Doing so may deter them from staying at a low-performing school where there is significant pressure for increasing student scores. At high performing schools, administrator and parental demands contribute to the pressure to maintain or to increase the scores. A specific

recommendation is that accountability ratings should not be included as part of a new teacher's evaluation at least for the first year; rather, teachers' effectiveness and accountability should be rated based on their own students' demonstrated academic growth. In addition, effective teachers who remain in high-need schools should be provided with monetary incentives for each year remaining at the school. Clearly based on retention rates of teachers, teaching is a difficult and stressful profession. Therefore, highly effective teachers who are dedicated to the profession should be rewarded.

Equalize Educational Opportunity.

Charter schools are touted as giving parents choice and allowing for innovation, while also often having the option of being exempt from high-stakes testing and other state regulations in Texas. At the surface, this seems to be an ideal working condition for teachers. Yet, teachers within these schools appear at a much higher risk of attrition (about twice that of non-charter school teachers). To date, no research has provided this comparison and the notion that teachers prefer charter schools due to the flexible, innovative approach to instruction (along with reduced state regulations) appears seriously in question based on our results.

Given the evidence that a stable teaching force increases student achievement and enhances the education system for non-charter (Boe et al., 1997; Kersaint et al., 2007) and charter schools (Finch et al., 2009), our finding that charter schools have extremely high attrition rates is concerning. This result seriously calls into question the strong political drive to increase the number of charter schools and to privatize education (Ausbrooks, Barrett, & Daniel, 2005). Policymakers need to consider whether charter and non-charter schools with extremely high teacher attrition should continue to receive equal support as other schools. Regardless, these results suggest that the working environment likely differs considerably based on school classification, which contributes to differences in attrition rates. Therefore, we recommend that policymakers not only consider student academic success when deciding to fund schools, but also the working environment and those factors associated with teacher attrition.

Our results also might be associated with the inconsistent conclusions related to student academic achievement when comparing charter and non-charter schools (Booker, Sass, Gill, & Zimmer, 2010; Hoxby, Muraka, & Kang, 2009; Winters, 2009), as schools dedicated to meticulously hiring teachers and mentoring their development purportedly produce greater academic success. Schools, regardless of classification, that are unable to retain high-quality teachers may display lower test scores and graduation rates. Again, our analyses call into question the functionality of charter schools if they are unable to retain and nourish teachers. To examine charter schools' attrition and retention trends, we recommend that empirical research be conducted to investigate this phenomenon and to ensure educational opportunity.

In summary, our results suggest that numerous factors contribute to whether a teacher remains in the profession. While several of these variables are unchangeable (e.g., gender, age, race, etc.), others could be influenced by policy and administrative decisions to increase retention rates. For example, it is illegal and unethical to discriminate against an applicant based on their ethnicity, age, and gender, but policymakers and administrators could require that certain teachers (e.g., younger starting teachers) receive additional support, mentoring, and training before entering the classroom. Policymakers also have considerable power related to how student test scores influence teacher's job security and stress, not to mention what type of schools (charter vs. non-charter) receive state funding. For example, policymakers can increase the funding available for outside resources (e.g., webinars, vodcasts) that help students prepare for state-mandated tests, thus allowing teachers more time for teaching in the classroom. In the end, these results aid administrators in

estimating the probability of a specific teacher remaining in the teaching profession. At the same time, this manuscript also provides some suggestions for policy reform.

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