

U.S. Every Student Succeeds Act: Negative Impacts on Teaching Out-of-Field

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ABSTRACT

Every Student Succeeds Act (ESSA) requires states to ensure the equitable distribution of out-of-field teachers. Using over 180 million student-course-teacher records from Texas between 2011-12 and 2017-18, we found out-of-field teaching rates have increased dramatically since ESSA became law. We also found vast inequities in which teachers are assigned to teach out-of-field and dramatic differences in student out-of-field course-taking rates across demographic characteristics. The strongest predictors of teachers teaching out-of-field is that they work in a charter school or completed alternative certification programs. Black teachers and students are most likely to teach and take courses out-of-field, and Latinx teachers and students are least likely. Policy implications are considered given negative impacts of out-of-field teaching on student academic achievement.

KEYWORDS

Every Student Succeeds Act (ESSA); United States; teacher training; student performance.

INTRODUCTION

When teachers teach classes for which they are not certified, they are teaching out-of-field (du Plessis, 2005; 2015; Ingersoll, 2000; 2019; Monk, 1994). Out-of-field teaching is not a characteristic of the teacher, but a description of the misalignment of a teacher's qualifications and a class subject being taught. For example, a teacher certified to teach Chemistry and assigned to teach a Chemistry class is teaching this class in-field, whereas this same teacher assigned to teach Algebra II would be teaching this class out-of-field. Ingersoll (1999) argued that assigning teachers to teach out-of-field was equivalent to requiring "cardiologists to deliver babies, real estate lawyers to defend criminal cases, chemical engineers to design bridges, or sociology professors to teach English" (pg. 34).

In the USA, the issue of out-of-field teaching has been recognized as a problem for more than half a century (National Commission on Teacher Education and Professional Standards, 1965) and the topic is a subject of much current domestic and international research (e.g., du Plessis, 2018; Hobbs & Törner, 2019; Ingersoll, 2019; Weldon, 2016; Zhou, 2014).

Out-of-field teaching is a problem for several reasons. When teachers lack the requisite knowledge and skills to teach a particular subject they generally engage in lower-quality instructional practices (du Plessis, 2015). When this happens, students experience less academic growth (Clotfelter et al., 2010). Out-of-field teaching is more difficult and stressful on teachers and they are, therefore, more likely to leave the profession (Donaldson & Johnson, 2010).

One of the major pieces of U.S. federal legislation to substantially address the problem of out-of-field teaching was the No Child Left Behind Act of 2001 (NCLB). NCLB attempted to reduce the number of teachers assigned to teach out-of-field by increasing the statutory requirements for what constitutes a qualified teacher. Under NCLB, teachers were considered highly qualified if, and only if, they had at least a bachelor's degree, full state certification, and demonstrated competency in the course subject being taught (NCLB, Sec 7801[23][b][ii]). A teacher certified to teach Chemistry and teaching a Chemistry class was considered highly qualified under NCLB, whereas that same teacher teaching an Algebra II class was considered not qualified or underqualified.

In 2015, the Every Student Succeeds Act (ESSA) replaced NCLB. One of its main goals was to increase local control by states and school districts under the assumption that this freedom from federal legislative mandates would increase student achievement, improve teacher quality, and provide previously underserved students with more effective teachers (ESSA, Sec 2001). Instead of requiring highly qualified teachers like NCLB, ESSA requires the distribution of ineffective or out-of-field teachers to be equitable between low- and higher-income children and between White and minority children (Sec. 1111[g][1][B]). In other words, it is acceptable to have ineffective teachers or teachers teaching out-of-field provided the distributed across student groups is equal. ESSA also requires state education agencies to

define effective teaching (Sec. 1111[e][1][B][iii][X]) and to report annually on the distribution of effective teachers to ensure equity (Sec. 1111[g][1][B]; Robinson, 2018).

To determine whether ESSA resulted in the equitable distribution of teachers teaching out-of-field to different student groups, we analyzed over 180,000,000 student-teacher-course records from 2011 to 2018 from the Texas Education Research Center (ERC). The longitudinal nature of these data allowed us to examine changes in out-of-field teaching rates during the last four years of NCLB and the first four years of ESSA. As we document below, the rate of out-of-field teaching was relatively stable under NCLB but has increased significantly since the passage of ESSA.

We also examined whether ESSA resulted in the equitable distribution of qualified teachers to students and of teachers to classes. We found that students of color, low socioeconomic students, students receiving special education services, and students in charter and rural schools are significantly more likely to take classes taught out-of-field. We also found that male teachers, Black teachers, teachers at charter and rural schools, and teachers who completed alternative certification programs (ACP) are significantly more likely to be assigned to teach out-of-field. These findings are in direct conflict with the stated purpose of ESSA. The student academic achievement and policy implications of these findings are explored.

BACKGROUND LITERATURE

Teaching out-of-field occurs when “teachers [are] assigned to teach subjects for which they have inadequate training and qualifications” (Ingersoll, 2019 p 21). This misassignment of teachers to classes is largely the responsibility of the school principal (Carey & Farris, 1994; Ingersoll, 1993, 2019). The states define the certifications that teachers must hold to be considered qualified to teach. Subject-specific degrees and subject-specific teaching certifications have been conventionally used in research studies of out-of-field teaching (Darling-Hammond & Youngs, 2002; Dee & Cohodes, 2008; Goldhaber & Brewer, 1997b; Goldhaber & Brewer, 2000; Hill, 2011; Porsch & Whanell, 2019). Like other states, Texas publishes rules for what certifications are required to teach each subject and/or grade level.

Why Teaching Out-of-Field Matters

Out-of-field teaching assignments matter for many important reasons and each will be in examined in more detail next. To summarize, teachers engage in lower quality instructional practices when teaching out-of-field, student experience less learning when taught out-of-field, and teachers experience more stress and are more likely to leave the profession.

Student success

First and most important, out-of-field teaching matters because when students take classes that are taught out-of-field, the students are generally less successful and show less academic growth (Chaney, 1995; Clotfelter, Ladd, & Vigdor, 2010; Dee & Cohodes, 2008; Goldhaber &

Brewer, 2000; Ingersoll, Perda, & May, forthcoming, as cited in Ingersoll, 2019; Raudenbush, Fotiu, & Cheong, 1999; Riordan, 2009).

Clotfelter and colleagues (Clotfelter et al., 2010) used rich, statewide, longitudinal data from North Carolina to compute value-added scores using end-of-course tests to examine student academic growth and found that high school students did significantly and substantially better when they took classes taught in-field compared to those taught out-of-field. In fact, the positive effect of in-field teaching on student achievement was stronger than most teacher qualifications variables including years of teaching experience, graduate degree attainment, competitiveness of undergraduate university, licensure test scores, and National Board Certification status (see Table 4, Clotfelter et al., 2010). They concluded that the inequitable distribution of qualified teacher to students contributes substantially to high school achievement gaps across student race and income levels.

Using a small national dataset from the National Education Longitudinal Study of 1988 (NELS:88), Dee and Cohodes (2008) examined Grade 8 student achievement in English, Math, Science, and Social Studies. They found that students who took Math and Social Studies classes taught in-field did significantly better academically than students who took them out-of-field, and the magnitude of the benefit of in-field teaching was greater for students in urban schools, low-income students, and male students. The positive benefits were also found for students at different academic levels. Specifically, in almost every case, lower- and higher-performing students benefitted equally from taking in-field classes; conversely, all students were negatively affected by out-of-field classes. They found no relationship between in-field class status and achievement for English and Science.

Goldhaber and Brewer (2000) used a subset of the NELS:88 data and found that Grade 12 students who took Math or Science in-field received significantly higher scores than students taught out-of-field. This pattern of results is similar to Goldhaber and Brewer (1997a, 1997b) and Monk and King (1994).

Ingersoll, Perda, and May (forthcoming; as cited in Ingersoll, 2019) examined National Assessment of Educational Progress (NAEP) scores in Reading, Math, Science, Geography, and History and found that students scored significantly higher on all tests when they took classes in-field compared to classes out-of-field.

Riordan (2009) used a small, nationally representative sample of data about a cohort of kindergartners from the Early Childhood Longitudinal Study of Kindergartners (ECLS-K) and found that students showed higher academic achievement in both Reading and Math when they were taught by in-field teachers compared to those taught by out-of-field teachers. This positive benefit was cumulative from kindergarten to Grade 3 with each year of in-field classes positively contributing to the students' academic achievement. Conversely, students were negatively impacted by taking classes taught out-of-field and the negative impact accumulated thereby contributing to achievement gaps.

In summary, when students take classes taught in-field they learn more than when classes are taught out-of-field, and the positive effect of in-field classes is cumulative. In most studies, the benefit exists across all class subjects.

Lower quality instruction

When teachers lack sufficient training and certification in the subjects they are teaching (i.e., teaching out-of-field), they often lack the requisite pedagogical content knowledge (PCK) and engage in lower quality instruction (Baumert et al., 2010; Hashweh, 1987; Hobbs, 2013; Ingersoll, 1999; Jones & Carter, 2007; Sanders et al., 1993). Researchers have found that teachers, when teaching out-of-field, were more likely to rely on textbooks and workbooks for their lesson plans and they engaged in superficial instructional practices. Those with higher content knowledge created their own lesson plan, scaffolded the current material with prior content, and supplemented the textbook material with creative classroom activities and materials. By connecting different topics and engaging in creative activities, the teachers teaching in-field gave their students the chance to learn subjects in a dynamic way that was able to keep students' interest in the topic for a longer period of time.

Several studies have directly shown that teaching out-of-field is a characteristic of the alignment of teacher to class and not a characteristic of the teacher. For example, Sanders et al. (1993) studied teachers who taught both in-field classes and out-of-field classes. When the teachers were teaching in-field, they had well-rehearsed, finely tuned lessons, presented concepts in multiple ways, and responded to student questions in richer, more effective ways. These same teachers, when teaching out-of-field spent more time trying to explain the content and concepts, were more likely to recite definitions, and struggled to respond to student questions. Similarly, Hashweh (1987) conducted a study involving teachers of Chemistry and Physics classes where one subject was taught in-field and the other was taught out-of-field. When the teachers taught in-field they were better able to scaffold the material and build on students' prior knowledge. When teaching out-of-field, they tended to simply follow textbook material and use textbook activities regardless of student ability. The quality of the questions that teachers asked their students also varied. When teaching in-field, the teacher asked questions that required students to synthesize concepts, whereas when these same teachers were teaching out-of-field they asked more surface-level, recall-type questions.

Student Learning Environment

Out-of-field teaching assignments can result in less effective learning environments (e.g., du Plessis, 2015; 2016). First, PCK (how to teach a particular subject) is important for successfully engaging students (Hobbs, 2013) and teachers teaching out-of-field are less likely to have the requisite PCK (du Plessis, 2015). Second, teachers who are insecure about their own subject-matter knowledge are more likely to act defensively in class, which causes tension between them and their students (du Plessis, 2016). As tensions rise, emotional support for students decreases and these changes can negatively affect students' self-efficacy, happiness, motivation, and self-reliance (Blazar & Kraft, 2017; Pianta & Hamre, 2009).

Students' attitude toward and enjoyment of a subject can be negatively affected by out-of-field teaching (Blazar & Kraft, 2017; du Plessis, 2016; cf., Clotfelter et al., 2010). A positive attitude toward a class subject helps students learn better and they have higher test scores as a result (Chaney, 1995). When a teacher has insufficient PCK, it is often difficult for them to make the material relevant to students because they lack the knowledge necessary to connect the lesson to the outside world (du Plessis, 2016). Instead, teachers are more likely to rely on textbook materials and activities. As students realize that their teacher is not confident in their subject knowledge, students become less confident or interested in the class (du Plessis, 2016).

Teacher Attrition

Teachers who are assigned out-of-field classes are more likely to leave the profession than teachers who are assigned in-field classes (e.g., Donaldson & Johnson, 2010). This higher attrition rate is partially due to the stigmas and frustrations teachers experience by being assigned to teach classes for which they were not trained. Teachers with out-of-field assignments are more likely to report a lower quality of work life, stronger feelings of professional alienation, lower professional status, and limited chances to use their professional training (Sharplin, 2014). Even when teachers reported some benefits from teaching out-of-field (e.g., learning a new subject), they still report experiencing more satisfaction from in-field assignments than out-of-field assignments (Sharplin, 2014). Steyn and du Plessis (2007) found that experienced teachers who were given out-of-field assignments perceived themselves to be not effective and therefore unsuccessful. For teachers who are struggling with their out-of-field class assignment, an unsupportive principal exacerbates their dissatisfaction (du Plessis, 2016; Steyn & du Plessis, 2007). Sharplin (2014) found that a lack of support from colleagues also exacerbated the teachers' negative feelings about their out-of-field assignments.

Subject and School Differences

The extant literature shows that the rate of out-of-field teaching varies across a host of variables including class subject, school characteristics, teacher characteristics, and student characteristics. Several studies have found out-of-field teaching rates were higher in Math (Hill, 2011; Hill & Dalton, 2013) and Science (Nixon, Luft, & Ross, 2017) than in English and Social Studies. For example, using national survey data from the School and Staffing Survey (SASS: 2007-08), Hill (2011) found that 37% of teachers of high school Math classes were teaching out-of-field, whereas 29% of teachers of English, and 26% of teachers of Science and of Social Studies were teaching out-of-field. Hill and Dalton (2013) found that Grade 9 students who were low-achieving in Math were significantly more likely to be assigned teachers teaching out-of-field than higher-achieving students. Nixon et al. (2017; see also Ingersoll, 1999; Lock, Salt, & Soares, 2011) examined data on 128 new middle- or high-school science teachers during their first five years teaching and found 64% of these teachers teaching at least one class out-of-field. They also found that teachers in urban schools and in high schools

taught higher percentages of class out-of-field, compared to suburban schools and middle schools, respectively.

Out-of-field teaching rates have varied across student characteristics. Students who were English language learners or who received special education services were more likely to take classes out-of-field (Lankford, Loeb, & Wyckoff, 2002; Nixon et al., 2017; Seastrom et al., 2004; Ramsay, 2018). Students' ethnicity is also correlated with out-of-field teaching. Ingersoll (2008) found 30% of Math classes in secondary schools were taught out-of-field if the school had a majority of students of color, whereas only 16% of Math classes were taught out-of-field if the school was majority White.

Particular types of schools are also more likely to have a higher percentage of out-of-field classes, and the rates vary by school location and the demographic characteristics of the students in the schools. Out-of-field teaching rates were higher in rural and urban settings than in suburban settings (Ee-gyeong, 2011; Ingersoll & Curran, 2004; Jimerson, 2003; Nixon et al., 2017; Sharplin, 2014; Zhou, 2014) and higher in schools with large percentages of low-income students or students of color than wealthier schools or schools with large percentages of White students (Boyd et al., 2013; Ingersoll, 2008; Ingersoll, Gruber, & American Institutes for Research in the Behavioral Sciences, 1996; Jerald & Education Trust, 2002; Lankford, Loeb, & Wyckoff, 2002). For example, Ingersoll (2008) found that 27% of class in core subjects in high-poverty schools were taught out-of-field, compared to 14% in low-poverty schools. In addition, schools with majority students of color were 40% more likely classes taught out-of-field compared to majority White schools.

Teachers also face different rates of out-of-field teaching assignments. Out-of-field teaching is more common among male teachers than female teachers (Butler, 2013) and higher for younger/less experienced teachers than older/more experienced teachers (Ni Riordain, & Hannigan, 2011). Butler (2013) found that 12% of male teachers were teaching out-of-field compared to 6% for female teachers. Ingersoll (1999) found that teachers with fewer than 5 years of experience were teaching out-of-field at higher rates than teachers with 25 or more years of experience.

Federal Regulations

The two most recent federal omnibus education bills (NCLB and ESSA) have attempted to address the problem of out-of-field teaching. NCLB did so by federally mandating teacher qualifications for teaching courses and ESSA did so by giving states unlimited control over defining teacher qualifications for each course. These changes created a natural experiment to enable us to examine the impact of federal mandates versus state autonomy on the equitable distribution of certified teachers to different student groups.

No Child Left Behind Act of 2001

NCLB was a major overhaul to the Elementary and Secondary Education Act (ESEA, 1965) that federally regulates P-12 education in the United States. One of NCLB's primary goals was to

“ensure that all children have a fair, equal, and significant opportunity to obtain a high-quality education and reach, at a minimum, proficiency on challenging State academic achievement standards and state academic assessments” (Sec. 1001). Under NCLB, every teacher hired after 2002 had to be highly qualified and by the end of the 2005-06 school year, 100% of teachers in core academic subjects had to be highly qualified. Highly qualified teachers in middle or secondary grade levels must hold at least a bachelor’s degree and demonstrate a high-level of competence on rigorous state subject-specific licensure tests in each academic subject the teacher teaches (Sec. 9101[23]). The core academic subjects were codified as English, reading, language arts, mathematics, science, foreign languages, civics and government, economics, arts, history, and geography. A teacher was considered teaching out-of-field if assigned to teach a class for which the teacher was not highly qualified – certified to teach that class.

Requiring schools to only hire highly qualified teachers increased competition for teachers in core subjects and some labor markets (e.g., rural or poor communities). Highly qualified teachers could then be more selective of the types of schools in which they worked; they could select schools with greater resources and easier teaching assignments. This increased competition forced schools to compete more to hire teachers from the now-limited pool of highly qualified teachers, but poor schools had fewer resources to compete and every school had the same timeline to produce results (Riordan, 2009). Once schools realized that they could not guarantee that all their teachers would be highly qualified by the deadline, states began requesting waivers from the federal government. Although 33 states reported that the percentage of highly qualified teachers had increased to over 90% by the 2004-05 school year, high-poverty schools and schools with large non-White populations had persistently greater percentages of unqualified teachers compared to wealthier or White schools (Birman et al., 2007).

Every Student Succeeds Act

ESSA was introduced in April 2015 and replaced NCLB in December 2015. Similar to NCLB, its main purpose is to “provide all children significant opportunity to receive a fair, equitable, and high-quality education and to close educational achievement gaps” (Sec 1001). However, ESSA removed the requirement that teachers be highly qualified and instead it had the goal of increasing the number of teachers “who are effective in improving student academic achievement in schools” (Sec. 2001). Given the extant literature on the negative impacts of out-of-field teaching on student academic achievement and achievement gaps, an out-of-field teaching assignment would not meet these criteria. The ESSA authors seem to agree because states are required to submit plans that describe “how low-income and minority children” ... “are not served at disproportionate rates by ineffective, out-of-field, or inexperienced teachers” (Sec. 1111). Any inequity identified in the distribution of out-of-field teachers must be addressed in a state’s plan. In addition, school districts must provide parents with “timely notice that the student has been assigned, or has been taught for 4 or more consecutive weeks by, a teacher who does not meet applicable state certification or licensure

requirements at the grade level and subject area in which the teacher has been assigned” Sec. 1112[e][1][B]). ESSA defined the core academic subjects in the exact same way as NCLB.

Research Questions

This present study addresses many of the critiques of prior out-of-field studies (Ingersoll, 2019) because it involves real-world, student-teacher-class assignment data, teaching certification/licensure records for each teacher, and an explicit state map between teaching certifications and class assignments. Using a statewide dataset from the second largest state in the USA, the primary purpose of this study is to longitudinally examine in-field versus out-of-field teaching rates across subjects, secondary grade levels, teacher characteristics, and student characteristics. We examine these rates during the last four years of NCLB and the first four years of ESSA to see if the rates changed in response to changes in the federal legislation. The specific research questions (RQ) being answered are as follows:

1. What percentage of classes in Grades 7 to Grade 12 are taught out-of-field, by subject from 2011 to 2018?
2. Is there an equitable assignment of teachers to out-of-field classes?
3. Is there an equitable distribution of students to out-of-field classes?

METHODOLOGY

Data

Data for this study were obtained from the Texas P-20 education and workforce data warehouse housed in the Education Research Center (ERC) at the University of Houston. The ERC holds 27+ years of person-level but de-identified and longitudinally linkable education and workforce records from the two state education agencies and the state’s workforce agency. Since fall of 2011, the state has collected detailed, class-level data for all 5+ million P-12 students and these records can be linked to a particular teacher, in a particular classroom, subject, and during a particular period of the day/week. Permission to access these confidential student- and teacher-level data was granted by the ERC Advisory Board.

Teacher Certification

Before in-field or out-of-field teaching assignments could be determined, the specific teaching certificates appropriate for each class were identified using the state’s published assignment standards (Texas Administrative Code [TAC], §231). The Texas Education Agency (TEA) created an explicit teacher-qualification map between the teacher certifications required to teach each subject. In Texas, teacher certifications overlap at different grade levels. For example, the elementary teaching certificates are early childhood (EC) through Grade 6, whereas the middle-grade teaching certificates are Grades 4-8. The secondary teaching certificates can be Grades 6-12, 7-12, or 8-12 depending on the subject matter. These TAC rules were used to determine whether a teacher was teaching in-field or out-of-field for students enrolled in

Grades 7-12 from Fall of 2011 to Spring 2018¹. We also added information from the teacher certification data about the type of teacher preparation program that the person completed.

Apparently in response to ESSA, the Texas Legislature passed a bill in June 2015 (House Bill 1842; see also, Texas Education Code, Chapter 12A) that enabled districts to become “districts of innovation.” This legislation gave districts the authority to not comply with TAC 231 – the certification-class requirements for teachers (see Sec. 12A.003 and 12A.004).

Participants

Three different datasets were created to answer the different research questions. The method used to create each dataset is described in detail next.

Class Dataset

To answer the first research question, a class-level dataset was built. From a master dataset of over 400 million unique student-class-school-year records for all Texas students enrolled between fall 2011 and spring 2018, we extracted 180,273,585 records for students only in Grades 7-12. A year-long course like English I is two semesters long and one record exists for each semester. By contrast, English classes in Grades 7 and 8 were often listed as a single course for the entire school year and therefore only one course record existed. From this student-class sample, we identified 14,919,527 unique classes². We matched teacher employment data for 13,407,237 of these class records (90%) for 271,330 unique teachers. We matched teacher demographic information for 13,282,833 (89%) class records. Using the state’s educator certification licensure data, we then matched all valid, non-expired teaching certifications to each teacher of each classes using the state’s publish licensure course/subject/grade standards (TAC 231). For brevity and for consistency with NCLB and ESSA, this was done only for the core subjects and any other subjects that were in the top 25 most frequently taken class subjects (see Table 1; minimum class count was at least 24,000).

Teacher Dataset

To answer RQ2, a teacher-level dataset was built. From the Class Dataset, we extracted each unique combination of teacher and school year and computed the number of classes taught and the percentage of classes taught out-of-field for the core or frequent subjects.

Student Dataset

To answer RQ3, a student-level dataset was built. From the master dataset, we extracted each unique combination of student ID and school year, again only for students in Grades 7-12. This resulted in 15,394,115 unique student-school year combinations. We then calculated for each student the number of classes taken and the percentage of these courses taken out-of-field, for the core or frequent subjects.

Table 1: Number of Classes Taught by Subject and Percentage Taught Out-of-Field

Rank	Subject	Number of Classes	Percentage Taught Out-of-Field
1	Music	634,204	5.0%
2	Agriculture	194,968	9.4%
3	Theater	236,273	10.2%
4	Dance	103,726	11.1%
5	Art	499,964	14.7%
6	French	73,150	16.2%
7	Science	569,907	19.3%
8	Physics	278,346	23.0%
9	Biology	445,755	24.4%
9	Math	2,058,826	24.4%
9	Chemistry	360,069	24.4%
12	Reading	319,986	26.2%
13	English	2,121,281	26.7%
14	Geography	380,817	30.9%
15	History	1,166,007	31.3%
16	Health	155,198	33.2%
17	Spanish	765,989	34.6%
17	Physical Education	1,295,166	34.6%
19	Speech	123,956	37.2%
20	Government	168,767	38.4%
21	Psychology	39,431	41.3%
22	Social Studies	32,012	41.7%
23	Sociology	24,169	45.6%
24	Physics/Chemistry	150,120	47.0%
25	Earth Science	28,924	53.5%

Analyses

To answer Research Question 1, we conducted descriptive analyses. To answer RQ2, we conducted an OLS regression using the percentage of classes teachers assigned to teach out-of-field as the DV and with the following independent variables (IVs) about teachers: Female (1=Yes); ethnicity variables for Black, Latinx, and Other-ethnicities (1=Yes; White was reference); degree level; years of teaching experience; age as of September 1 of that school year; number of classes taught; type of teacher preparation program completed; and pedagogy licensure test score. It also contained IVs for each school year from 2011-12 to 2017-

18 (2014-15 was reference), nine variables for district type (suburban was reference), and two variables for school type (middle, combined; high school was reference).

For RQ3, we again used an OLS regression model with the percentage of courses taken out-of-field as the DV and the following student IVs: Female (1=Yes); ethnicity variables for Black, Latinx, and Other-ethnicity (1=Yes); economic disadvantaged status (1=Yes); English language learner status (1=Yes); special education services status (1=Yes); number of classes taken. The same school year and district type variables from RQ2 were included.

RESULTS

Research Question 1

The results for Research Question 1 about subject-specific out-of-field teaching rates are presented in Table 1 and the subjects are listed in order from the lowest out-of-field teaching rates to the highest. As can be seen, Music has the lowest level of out-of-field teaching (Rank=1) followed by Agriculture (Rank=2), and then followed by Theater, Dance, and Arts (Ranks=3-5). Only 5.0% of the 634,204 Music classes were taught out-of-field. Following French (Rank=6) are the STEM subjects of Science (Rank=7), Physics (Rank=8), and Biology, Math, and Chemistry tied (Rank=9). Given the over 2 million Math classes in this dataset, this means that over 500,000 classes were taught out-of-field. Over 19% of Science classes were taught out-of-field, and almost 25% of Biology, Math, and Chemistry. Reading and English came in at 12 and 13 with 26-27% of classes being taught out-of-field. Physical education comes in at 17 with 35% of the 1.3 million classes taught out-of-field (~445,000 classes). The highest rates of out-of-field teaching occurs with Earth Science classes where a majority of courses (53%) are taught out-of-field.

Research Question 2

The results of the OLS regression to answer Research Question 2 are shown in Table 2. The overall model was highly significant $F(28,511984) = 927.22$, $r^2 = 0.05$. Overall, the distribution of out-of-field teaching assignments is not equitable and varies substantially and significantly by teacher characteristics. We present the results in the order of strongest to weakest predictor of the rate of teaching out-of-field.

Teachers employed by charter schools are assigned the highest percentage of classes out-of-field – 17% more classes were taught out-of-field compared to a teacher employed by a suburban, non-charter school ($B = 17.07$, $t = 60.93$, $p < 0.001$). Teachers who were alternatively prepared were significantly more likely to be assigned to teach out-of-field ($B = 6.72$, $t = 58.37$, $p < 0.001$). Teachers in rural schools were assigned out-of-field classes at higher rates than teachers in suburban school ($B = 11.43$, $t = 47.20$, $p < 0.001$). Black teachers were assigned to teach out-of-field at higher rates than White teachers ($B = 7.08$, $t = 43.89$, $p < 0.001$), whereas Latinx teachers ($B = -1.99$, $t = -16.31$, $p < 0.001$) and Other-ethnicity teachers ($B = -2.76$, $t = 10.89$, $p < 0.001$) taught more classes in-field than White teachers. Older teachers taught more

classes out-of-field than younger teachers ($B = 0.27$, $t = 43.11$, $p < 0.001$). Teachers who have higher scores on the state's pedagogy and professional responsibility licensure test taught higher percentages of classes in-field ($B = -0.11$, $t = -37.56$, $p < 0.001$). The rate of out-of-field teaching was not significantly different between 2015 and the other school years from 2011-12 through 2016-17. However, teachers working in 2017-18 were assigned to teach out-of-field at a significantly higher rate ($B = 0.41$, $t = 2.29$, $p = 0.02$).

Table 2: Regression Results for Percentage of Classes Taught Out-of-Field by Teacher and Campus Characteristics.

DV=Percentage Out-of-Field	Coef.	Std. Err.	t	P> t
Female	-1.34	0.099	-13.54	0.000
Black	7.08	0.161	43.89	0.000
Latinx	-1.99	0.122	-16.31	0.000
Other	-2.76	0.253	-10.89	0.000
Degree	-1.76	0.109	-16.06	0.000
Teaching Experience	-0.29	0.013	-21.54	0.000
Age	0.27	0.006	43.11	0.000
Alternative Certification Preparation	6.72	0.115	58.37	0.000
Out-of-State Preparation	0.05	0.195	0.26	0.795
Post-Bacc Preparation	-0.40	0.186	-2.18	0.029
Number of Classes	0.26	0.007	37.44	0.000
2011-12	-0.09	0.181	-0.50	0.615
2012-13	-0.02	0.175	-0.09	0.928
2013-14	0.25	0.173	1.45	0.148
2015-16	-0.16	0.173	-0.93	0.354
2016-17	0.29	0.176	1.65	0.099
2017-18	0.41	0.179	2.29	0.022
Urban	-0.45	0.144	-3.09	0.002
Central	1.72	0.149	11.55	0.000
Central Suburban	2.21	0.156	14.23	0.000
Independent	3.39	0.240	14.15	0.000
Fast	7.69	0.604	12.72	0.000
Stable	5.60	0.213	26.31	0.000
Rural	11.43	0.242	47.20	0.000
Charter	17.07	0.280	60.93	0.000
Middle School	-2.22	0.108	-20.49	0.000
Combined	1.36	0.235	5.78	0.000
Pedagogy Test Score	-0.11	0.003	-37.56	0.000
_cons	66.83	0.806	82.93	0.000

Research Question 3

The results of the OLS regression to answer Research Question 3 are shown in Table 3. As can be seen, students enrolled in Texas public school in 2017-18 took a significantly higher

percentages of classes out-of-field relative to 2014-15 ($B = 17.93$, $t = 961.45$, $p < 0.001$). For students who took six classes in a school year, this change means students took more than one additional class out-of-field than they took just four years early. Students who were enrolled in charter schools took a higher percentage of courses out-of-field – 1.3 more classes ($B = 22.27$, $t = 817.61$, $p < 0.001$). Students receiving special education services took more classes out-of-field than their matched peers ($B = 8.05$, $t = 448.97$, $p < 0.001$). Students in rural schools took more classes out-of-field compared to students in suburban schools ($B = 7.02$, $t = 238.43$, $p < 0.001$), whereas students in Urban schools took fewer out-of-field classes than their suburban peers ($B = -0.77$, $t = -50.53$, $p < 0.001$). Black students took significantly more classes out-of-field than White students ($B = 2.44$, $t = 136.36$, $p < 0.001$), but Latinx students ($B = -0.32$, $t = -23.61$, $p < 0.001$) and Other-ethnicity students ($B = -0.66$, $t = -29.46$, $p < 0.001$) took fewer out-of-field classes than White students. Female students took fewer out-of-field classes than male students, all else being equal ($B = -0.30$, $t = -29.95$, $p < 0.001$). Students from low-income families took more out-of-field classes than their wealthier peers ($B = 1.05$, $t = 91.16$, $p < 0.001$).

Table 3: Regression Results for Percentage of Classes Taken Out-of-Field by Student and Campus Characteristics.

Pct_Classes	Coef.	Std. Err.	t	P> t
EcoDis	1.05	0.012	91.16	0.000
ELL	3.15	0.017	189.71	0.000
Sped	8.05	0.018	448.97	0.000
Classes Taken	0.04	0.001	37.19	0.000
Female	-0.30	0.010	-29.95	0.000
Black	2.44	0.018	136.36	0.000
Latinx	-0.32	0.013	-23.61	0.000
Other	-0.66	0.022	-29.46	0.000
2011-12	-2.80	0.019	-145.27	0.000
2012-13	-2.10	0.019	-109.91	0.000
2013-14	-0.97	0.019	-51.17	0.000
2015-16	0.83	0.019	44.05	0.000
2016-17	1.33	0.019	70.98	0.000
2017-18	17.93	0.019	961.45	0.000
Urban	-0.77	0.015	-50.53	0.000
Central	-0.08	0.016	-5.44	0.000
Central Suburban	1.17	0.016	72.80	0.000
Independent	3.47	0.025	141.38	0.000
Fast	5.43	0.065	83.26	0.000
Stable	2.61	0.023	113.33	0.000
Rural	7.02	0.029	238.43	0.000
Charter	22.27	0.027	817.61	0.000
_cons	10.88	0.022	504.73	0.000

DISCUSSION

Two of the main purposes of the Every Student Succeeds Act (ESSA) are: 1) ensure students receive a fair, equitable, and high quality education that closes educational achievement gaps (Sec. 1001), and 2) to ensure the equitable distribution of effective teachers (Sec. 1006). ESSA attempts to accomplish these goals by giving states and school districts local control over what constitutes effective teachers. Using Texas' official certification-subject map for teaching, we analyzed over 180 million student-course-teacher records for every student enrolled in Grades 7-12 between 2011-12 and 2017-18 to determine the in-field versus out-of-field teaching rates by course subject, by teacher characteristics, and by student characteristics. There are many new findings that are important from an academic perspective as well as an educational policy perspective.

Impacts on Student Courses

Our first important finding is that there is not an equitable distribution of out-of-field teachers in Texas public schools. Black students, male students, students who receive special education services, students from low-income families, and students who are English-language learners are significantly more likely to be taught classes by teachers teaching out-of-field compared to their peers, all else being equal. Given the strength of numerous studies that have shown the negative impacts of out-of-field teaching on student academic achievement and growth (Chaney, 1995; Clotfelter et al., 2010; Dee & Cohodes, 2008; Goldhaber & Brewer, 2000; Ingersoll et al., forthcoming; Raudenbush et al., 1999; Riordan, 2009), our present results imply that some groups of students are not receiving the same level of education as other groups. If you are a Black, male student from a low-income family, then you are likely to receive an inferior education compared to a White or Latinx female from a wealthier family. This basic finding is inconsistent with the stated intention of ESSA and with the core purpose of educational equity in the Texas Education Code (Sec. 1.002). ESSA is likely to be exacerbating, not closing, the "educational achievement gaps" that it was designed to fix (Sec. 1001). Additional research that directly examines the impacts of in-field versus out-of-field teaching on student academic achievement post-NCLB is clearly warranted.

Our results are partially consistent with prior studies, but they also provide boundary conditions. For example, Ingersoll and Curran (2004; see also Lankford, Loeb, & Wycoff, 2002) found that students in majority non-White schools were more likely to take classes out-of-field than students in majority White schools. These prior studies grouped non-White students into a single category. We found that not all non-White students are treated equally. Latinx and Other ethnicity students were more likely to take in-field classes than White students, whereas Black students were most likely to take out-of-field classes. Additionally, Lankford and colleagues (Lankford et al., 2002) analyzed school-level data and found that schools with predominately low-income students had large numbers of teachers teaching out-of-field. We

found the same general pattern while analyzing student class enrollment data, thereby strengthening Lankford and colleagues' findings.

Our second important finding is that students in rural and charter schools are more likely to take classes taught out-of-field than their suburban peers, whereas students in urban schools were less likely to take classes taught out-of-field. Our findings are somewhat consistent with prior out-of-field teaching results. Nixon et al. (2017) used a small sample of data from new science teachers and found teachers in urban and rural schools were significantly more likely to teach classes out-of-field compared to teachers in suburban schools. Ingersoll (2004) used SASS data and found that teachers in urban and suburban schools were equally likely and teachers in rural schools were most likely to teach out-of-field. Since we used real student-course-teacher data, the differences between the present results and these prior studies might reflect either inaccurate survey responses or differences in state licensure requirements.

Our third new finding, and one that has important national policy implications, is that the rate of students taking classes taught out-of-field has increased significantly and substantially since the passage of ESSA and Texas' Districts of Innovation. Also disturbing, the rate of out-of-field teaching is increasing. Since the passage of ESSA, students in Texas are much more likely to take classes taught out-of-field than they did under NCLB. Giving states control over teacher assignment qualifications is having a negative impact on students.

Impacts on Teacher Assignments

Our fourth new finding is that teaching assignments are similarly inequitable and getting more so since the passage of ESSA. Black teachers, male teachers, and older teachers are assigned to teach out-of-field at higher rates than their peers. Teachers teaching in charter and rural schools are also assigned to teach out-of-field at higher rates than their suburban counterparts, all else being equal. As with the student results, teachers teaching in 2017-18 were assigned to teach a significantly greater percentage of classes out-of-field than in 2014-15, which again implies that the longer ESSA is in effect, the greater the negative impact on out-of-field teaching assignments. Some of these findings are consistent with the extant literature. For example, as previously noted, several studies found that teachers in rural schools were more likely to be assigned to teach out-of-field (Ingersoll, 2004; Nixon et al., 2017), and Butler (2013) found that male teachers were twice as likely to be assigned to teach out-of-field than female teachers.

This finding is inconsistent with Ingersoll (2019) who used SASS data. He reported no differences in out-of-field teaching rates across the many years of SASS data (page 27). This difference in results may have occurred because our results are based on actual student-course enrollment instead of on self-reported survey responses.

Our fifth new finding was that alternatively prepared teachers were significantly more likely to be assigned to teach out-of-field than traditionally prepared teachers. Given the

negative impact that teaching out-of-field has on teachers (e.g., higher stress, higher attrition, less success with student growth), these mis-assignment of ACP teachers may explain some of the reasons why ACP teachers leave the profession at higher rates than traditional teachers (Van Overschelde & Wiggins 2019).

Differences by Course Subject

Finally, we found that the out-of-field teaching rates varied substantially by subject. However, our findings were more detailed and more varied than prior studies. We found that Fine Arts subjects were most likely to be taught by qualified teachers, followed closely by STEM subjects. Large numbers of classes in English, History, Social Studies, and PE are assigned teachers who are not certified to teach these courses.

These results are partially inconsistent with prior research in several ways. First, Hill (2011) used SASS data and found a greater percentage of teachers were teaching English in-field (75%) compared with teachers teaching Math (66%). Hill also found that the majority of dance and theater teachers were teaching out-of-field, whereas we found some of the highest rates of teaching in-field for these subjects. Ingersoll (1999) used three series of SASS data and found nominally higher rates of teaching out-of-field for Math teachers than for English teachers.

Texas Equity Report

Our present results also appear inconsistent with the state's Equity Report (Texas Education Agency, 2019), but it is difficult to determine what data are actually summarized in the report. For example, for 2017-18 the state reports that 9% of teachers (full-time equivalents) were teaching out-of-field, but it reports data for all teachers of records and not just teachers of core subjects as defined in ESSA. The state does generate an annual report of out-of-field teaching by subject (e.g., Ramsay, 2018) and these data also seem inconsistent with the present results because of the way the data are aggregated. For example, Ramsay reports out-of-field rates for Math in Grades 6-8 separately from Grades 9-12, and almost all calculations exclude data from charter schools where the out-of-field teaching rates are the highest.

Limitations

This study is limited to the State of Texas and may not reflect what is occurring in other states. For example, Texas implemented "Districts of Innovation" that allows principals to assign teachers to teach any classes, regardless of certification. Other states may not permit principals such discretion to mis-assign teachers. In addition, states have different standards and requirements for certification and for the qualifications for teaching courses (National Association of State Directors of Teacher Education and Certification, 2018).

This study is also limited by the quality of the data collected by the state. For example, 10% of the classes taught to students in Grades 7-12 in Texas public schools have no corresponding teacher record. If the state data were of higher quality and these records were

not missing, our results might have been different. However, given the almost 15 million class records included in this study, the patterns of results are likely to be robust despite the loss of 1.5 million records.

CONCLUSION

Under NCLB, all teachers were required to be highly qualified – certified to teach the classes they taught. ESSA eliminated this important requirement and gave states freedom to define teacher qualifications as they chose. As a result of this legislative freedom, the percentage of classes taught out-of-field in Texas has increased dramatically. The assignment of teachers to out-of-field classes is worse for Black, male, and older teachers compared to White, female, and younger teachers, respectively, and worse for teachers working in charter schools and rural schools compared to suburban schools.

The increase in teacher mis-assignment has also dramatically and negatively impacted the rate at which students take out-of-field classes, and the distribution of out-of-field classes is not equitable. Black students, male students, student attending charter or rural schools, and student receiving special education services are disproportionately taking classes that are taught out-of-field. The rate of out-of-field teaching has increased dramatically since ESSA became law. Given the negative impact that out-of-field teaching is known to have on student academic achievement and on academic achievement gaps (Chaney, 1995; Clotfelter et al., 2010; Dee & Cohodes, 2008; Goldhaber & Brewer, 2000; Ingersoll et al., forthcoming; Raudenbush et al., 1999; Riordan, 2009), we conclude that ESSA is negatively impacting student academic achievement growth and likely increasing student achievement gaps. ESSA, and Texas' Districts of Innovation, are making it so many children in Texas are not receiving a "fair, equitable, and high-quality education" (ESSA, Sec. 1001) and not receiving "equal educational services or opportunities" (Texas Education Code, Sec 1.002).

Author's Note

1. We used the same methodology for in-field and out-field determination as used by the state (Ramsay, 2018). As the state does, only valid, non-expired teaching certificates were considered. Certificates that were considered in-field only when the teacher completed additional coursework or a special degree were counted as out-of-field. However, unlike the state reports, Charter schools were included for all subjects. Although excluding the charter school data makes the state look better, doing so distorts the actual negative impact of teaching out-of-field on students.
2. Technically, it was each unique combination of school year, district, campus, class_ID, course sequence, service code, service code description, and subject.

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