Creating a Bilingual Advantage: The Value of World Language and Biliteracy Skills on Academic Persistence and College Readiness

By

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Dedication

To my mother, father, and sister, who always believed in me, even when I did not believe in myself, and provided me with the strength and confidence to complete this dissertation. And to my dog, Sherlock, who proved true to the adage, "man's best friend," and has always been steadfast at my side, quietly (and sometimes not so quietly) supporting me these past few years.

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1 Introduction

Chapter 1

1.1 Central Purpose of Dissertation

The central purpose of the dissertation is to evaluate avenues for reducing the opportunity gap that language-marginalized students face due to perceived achievement gaps by utilizing the linguistic assets and knowledge that language-minoritized students bring to schooling. The linguistic assets and knowledge of interests are bilingual and biliteracy skills that language-minoritized students, such as emergent bilinguals, learn at home and further develop in elementary and secondary education, respectively, through bilingual education programs and World Language education. The literature provides significant evidence that students with bilingual and biliteracy skills benefit from enhanced cognitive, social, and academic abilities, in addition to increased economic opportunities and advantages, collectively referred to as "the bilingual advantage" (Bankston & Zhou, 1995; Bialystok, 2001, 2009; Bialystok et al., 2009; Feliciano, 2001; Fortes & Rumbaut, 2001; Rumbaut, 2014; Saiz & Zoido, 2004; Santibanez & Zarate, 2014; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005; Zarate & Pineda, 2014). This dissertation investigates whether "the bilingual advantage" exists for language-minoritized student populations pursuing college readiness or becoming college-bound through formal World Language education and the recognition of World Language skills and knowledge. Student decision-making to invest in World Language education has been shown by the literature to be motivated by long-term goals of admission to four-year post-secondary institutions, graduation from these institutions, and using language skills to improve economic opportunities and wages (Armstrong, 2013; Brod & Huber, 1996; Chiswick & Miller, 2007a; Chiswick & Miller, 2007b; Christofides & Swidinsky, 2010; Church & King, 1993; Garrouste, 2008; Gonzalez, 2005; Grenier, 1984; Grin, 2003; Horn & Kojaku, 2001; Horn et al., 2001; Kim et al., 2014; Lusin, 2012; Owings, 2015; Planty et al., 2007; Rumbaut, 2014; Saiz & Zoido, 2002, 2004, 2005; Santibanez & Zarate, 2014).

This dissertation examines whether students' long-term goals can be facilitated by participation in World Language education and the recognition of biliteracy skills to influence achievements in benchmark goals, such as passing English Proficiency exams and graduating high school, necessary for achieving their long-term goals. For my dissertation, I conducted two studies: "***Bilingual Advantage and Academic***

Persistence: A Survival Analysis of Participation in World Education on High School Dropout Risk," Chapter 2 of the dissertation, incorporates a Cox-proportional hazard model in a survival analysis of the impact of course-taking patterns, particularly in World Language, English, and English as a Second Language (ESL) course enrollments, on the likelihood of dropping out of high school and the timing of dropping out for students from different language backgrounds, such as immigrant or second/third generation language-minoritized students and English Learners (EL). Chapter 3 of the dissertation, "***Using Low-Cost Incentives in Education to Reduce Wasteful Public Spending: A Policy Analysis of the Seal of Biliteracy***," examines the effect of low-cost state policy credentialing biliteracy skills in the California State Seal of Biliteracy (SoBL) on incentivizing EL students to improve performances on English Proficiency exams, enroll in World Language courses and meet college-readiness requirements. In addition, the study investigates the subsequent impact of SoBL implementation on a district's average expenditure for educating an EL student through its effect on English Proficiency passing rates.

1.2 Chapter 2: Bilingual Advantage and Academic Persistence

Chapter 2 is a survival analysis of the effect of individual student decisions to enroll in World Language courses on the risk of exiting early from high school without a diploma, using a Cox-proportional hazard with time-varying covariates research design. From a vocational psychology perspective, the study examines how course-taking patterns impact students' academic persistence to graduate high school. I explore student motivation to continue investing in education by studying the association between the latent desire to attend a four-year post-secondary institution and participation in World Language education. The study examines the underlying behavioral assumption of whether language-minoritized students' – with a native language background at home – goals to graduate high school and be college-ready can be facilitated by course-taking pathways in World Language education, likely representing the student population that the SoBL would most incentivize. The findings from the study reflect the existence of a "bilingual advantage" in the academic persistence of emergent bilingual students who continue to participate in World Language education, particularly for the goal of college readiness.

However, English Language Development (ELD) services, specifically ESL courses, are seen to be a barrier for emergent bilinguals from graduating high school and meeting college readiness requirements.

One of the findings from the study in Chapter 2 discovers a population of students who identify English as their primary language for speaking and reading that face the most significant risk of dropping out when mandated additional ESL courses. The implications of this finding may indicate a population of students continually misidentified as requiring ELD services that are more likely to be harmed by than benefit from enrollment in additional ESL courses or other ELD services. This phenomenon has been identified as a population of ELs that continually fail annual English Proficiency exams, designated as Long-Term English Learners (LTEL), a problem California has faced for the past twenty years. The emergence of LTELs is a consequence of English Proficiency exams serving as institutional mechanisms that result in the overrepresentation of Latinx students as LTEL students and the underrepresentation of Latinx students in World Language education (Barrett et al., 2012, p. 619; Scott & Ingels, 2007; Gandara & Hopkins, 2010; Siordia & Kim, 2021; Suarez-Orozco et al., 2009). Research has shown that EL students who become reclassified as proficient in English can increase opportunities for academic advancement by receiving greater access to content acquisition from college preparatory courses instead of spending unnecessary amounts of instruction dedicated to English acquisition during class (Callahan et al., 2010; Flores, 2009; Robinson, 2011; Solorzano, 2008).

Furthermore, the problem of the growing population of LTELs is the burden it places on states' education funding systems. Many states, like California, adopted equity-based funding systems; however, the costs of adequately educating marginalized student populations, such as ELs, were miscalculated (Houck & Debray, 2015; Jimenez-Castellanos & Topper, 2012; Longa, 2015; Ramirez et al., 2011). Many states ended up with a regressive funding system rather than providing a progressive funding system, as initially intended, for educating ELs (Imazeki, 2006, 2007; Jimenez-Castellanos & Topper, 2012; Reschovsky & Imazeki, 2003). Furthermore, misidentifying language-minoritized students with enough English proficiency, often Latinx students, as requiring ELD services resulted in wasteful spending, further reducing the available funds for adequately educating ELs who need ELD support services (Imazeki, 2006, 2007, 2008; Imazeki & Reschovsky, 2004; Jimenez-Castellanos & Topper, 2012; Longa, 2015; Ramirez et al., 2011). However, in the study presented in Chapter 3, I found an equity-oriented policy that incentivizes students to reduce the severity of this problem by recognizing and credentialing the linguistic assets that language-minoritized students bring to schools.

1.3 Chapter 3: Using Low-Cost Incentives in Education to Reduce Wasteful Public Spending

In Chapter 3, the quasi-experimental research study aims to analyze whether incentive-based education policies, like the SoBL, can effectively mitigate the phenomenon in school finance systems where districts with high costs and expenditures underperform in high-stake assessments compared to lower-spending districts. The study postulates that underlying information frictions caused by unobserved transaction costs during information transfers reduce the efficiency with which accountability measures can allocate resources to students as policy levers in school funding formulas. The study shows how incentive mechanisms that induce cooperation between Local Education Agencies and the students they serve can reduce information friction, reduce costs for educating students, and increase educational outcomes and opportunities. From 1999 to 2017, California effectively banned bilingual education for over 95% of the EL student population. In 2011, California passed the SoBL policy, and in 2016, California passed Proposition 58, the California Education for a Global Economy Initiative, reversing the state's ban on bilingual education. Therefore, SoBL implementation in California is utilized as an information-smoothing policy for estimating treatment effects from an information economics perspective.

Drawing from the conclusions made in Chapter 2, in Chapter 3, the study hypothesizes that assignment to ELD services creates a barrier for language-minoritized students from meeting California's college readiness requirements since mandating additional ESL courses or other ELD services hinders students' ability to enroll in the necessary subject courses to meet admission requirements for the California State University (CSU) and University of California (UC) systems. Suppose the underlying behavioral assumption is that a population of EL students who want to attend a four-year college believe they have a comparative advantage in World Language education. In that case, a formal credential recognizing their World Language skills or schooling, such as the SoBL, should incentivize this population of ELs to perform better on English Proficiency exams to exit from ELD services, enroll in World Language and other required subject courses for meeting California's college-readiness standards. The study exploits variation in students' flexibility to schedule World Language coursework while meeting district graduation requirements as a natural experiment for an Instrumental Variable approach to estimate the treatment effect of implementing the SoBL on English Proficiency passing and college readiness rates for EL students in California school districts. The study utilized quasi-experimental methods for causal inference, specifically Instrumental Variable regression and an Instrumental Variable approach to Causal Mediation analysis, to evaluate the SoBL's impact, as an equity-oriented policy, on college readiness rates and efficient district expenditure for EL students from minoritized and marginalized populations. The findings from my dissertation's second study provide causal evidence that SoBL implementation incentivizes a population of EL students to improve performance on English proficiency exams, increasing enrollment rates in World Language courses and increasing college-readiness rates while decreasing average district expenditure for educating an EL student.

1.4 Contributions of Chapter 2 and Chapter 3's Studies

My dissertation evaluates state policies and student experiences, opportunities, and outcomes to improve equity for marginalized students, especially EL and language-minoritized student populations. I examine the relationship between the accessibility and the availability of World Language programming and an education policy incentive for ELs, the SoBL, in quantitative analyses of student investment in education and state policy to provide policymakers with practical recommendations for increasing the effectiveness of using academic credentials and access to skill-building college preparatory courses as educational incentives. Furthermore, educational institutions can allocate resources and funding more efficiently to high-impact policies and programs by evaluating the impact of equity-oriented programs on improving educational outcomes and closing the opportunity and achievement gap for minoritized student populations. My findings show that increasing the availability and accessibility of World Language programming can better facilitate the ability of college-oriented emergent bilinguals to graduate high school and meet college readiness requirements. In addition, results indicate that expanding public knowledge of the SoBL and increasing student access to the policy and World Language availability are needed to maximize the effectiveness of the SoBL as an educational incentive.

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2 Bilingual Advantage and Academic Persistence: A Survival Analysis of Participation in World Education on High School Dropout Risk

Chapter 2

2.1 Introduction

One of the ways of conceptualizing student investment in education at the high school level is by considering a student's academic persistence to complete educational benchmarks such as graduating from high school with a diploma. The literature has often defined academic persistence as a behavioral commitment to education, where commitment to continuing tasks and overcoming obstacles is a process occurring throughout the academic year (c.f. Roland et al., 2018, p. 216; Burrus et al., 2013; Miller et al., 1996; Multon et al., 1991; Robbins et al., 2004; Roland et al., 2015). From this definition, academic persistence has been "operationalized as behavioral commitment measures," such as whether a student graduates from an academic institution and the time the student remains enrolled in the academic institution (c.f. Roland et al., 2018, p. 216; Ben-Yoseph et al., 1999; DeRemer, 2002; Pritchard & Wilson, 2003; Robbins et al., 2004). Students with aspirations of participating in post-secondary education must meet high school graduation and college admissions requirements in addition to academically persisting through a traditional four-year high school curriculum.

One primary requirement for college admissions distinguished from high school graduation requirements is participation in a minimum course load of World Language (WL) courses. Many four-year state universities either require or highly recommend one or two years of course completion in a WL for admission to the university, which is often not reflected in local requirements for graduating high school. States usually require four years of course completion in English, three years of math courses, and at least 2-3 years of sciences and social sciences courses as the minimum core academic requirements for admission to a state four-year university. Unlike the core academic courses required for acceptance to state universities, WL course requirements or recommendations often do not overlap with high school graduation requirements. WL courses are not a standard requirement for high school graduation in the U.S. today; the way a minimum number of math, science, social science, and English courses are standard graduation requirements, so it is unlikely that WL course study was a strict requirement for high school graduation that was either widespread or common over twenty years ago. Most core academic courses required for graduating high school substantially overlapped the course requirements for admission to state colleges. Access to and enrollment in World Language programming may likely indicate a desire amongst students to be more competitive than their peers in the college admissions process. This could also indicate a more significant level of academic persistence for graduating high school to achieve admission to a four-year university.

Furthermore, research has found that students with prior language ability are more likely to persist academically when engaging in native language instruction; thus, language-minoritized students who can access WL courses in their native language may have a decreased likelihood of dropping out of high school (Bankston & Zhou, 1995; Feliciano, 2001; Fortes & Rumbaut, 2001; Saiz & Zoido, 2004; Santibanez & Zarate, 2014; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005; Zarate & Pineda, 2014). In addition, if access to WL coursework is believed to improve a student's chance of admission to a public four-year post-secondary institution, the comparative advantage for students that speak a language other than English participating in WL courses may help increase language-minoritized students' motivation to academically persist through the traditional four years of high school. Therefore, a potentially important indicator for revealing an underlying preference for investing in education with a latent desire for admission to post-secondary institutions among students may be whether students attempt one or more World Languages. In addition to attempting at least one WL, given the limited availability of access to courses and time in a student's schedule, consistent or increased enrollment in WL courses instead of enrolling in courses in other subjects over time may also be a strong indicator for increased academic persistence among students. In this paper, I utilize the operationalized definition of academic persistence – whether a student graduates from an educational institution and the time the student remains enrolled in the academic institution – as the measures for the dependent variable for academic persistence, where a student remains enrolled until graduating from high school or the student permanently drops out during a month in the student's final academic year enrolled in high school, in a Cox proportional hazards model with time-varying covariates.

2.2 Theoretical Framework

The educational psychology literature has derived several models to explain academic persistence among marginalized student populations such as minoritized students, language-minoritized students, and students from low socio-economic backgrounds. One such model is Social Cognitive Career Theory (SCCT), which incorporates latent goal concepts, such as socioeconomic mobility and educational self-efficacy associated with background-specific strengths and cultural-based assets. The SCCT framework integrates psychological, social, and economic factors to explain individual career development, where outcome expectations and self-efficacy generate interest (Lent et al., 1994; Lent et al., 2002). In the SCCT Framework, environmental factors influence goal setting and learning experiences, which influence dynamic changes in goal setting and learning experience, changing the dynamics of outcome expectations and self-efficacy (Lent et al., 1994; Lent et al., 2002; Long et al., 2002). In the SCCT Framework, an individual's career development is thus viewed from a developmental perspective of how the interaction of cognitive, personal, and environmental variables influences dynamic learning experiences that affect goal selection through dynamic changes in outcome expectations and self-efficacy. The SCCT Framework has been used as a three-factor causal model, with the core concepts being outcome expectations, self-efficacy, and personal goals (Buthelezi et al., 2009). Lent and Brown (2008) expanded the model to include satisfaction in educational settings and the three interrelated models for career interest development, choice-making, and career performance and persistence originally introduced by Lent et al. (1994). The SCCT model has been applied to at-risk populations facing entry barriers to occupations and employment (Chartrand & Rose, 1996). The SCCT has also been used to design educational interventions that found improving academic support and increasing critical consciousness for immigrant students in high school can decrease the likelihood of dropping out and increase the chances of academic success, such as meeting college and career readiness measures (McWhirter et al., 2019; McWhirter et al., 2021).

SCCT provides a framework for student decision-making that connects student interests, the goals chosen by students, and the attainment of performance outcomes. Lent et al. (1994) originally designed the SCCT Framework to consist of three interrelated models for career interest development, choice-making, and career performance and persistence. This study focuses on SCCT's choice-making model for choices students make in educational investments, such as continuing to invest in education by maintaining consistent enrollment in high school each year until completion of graduation requirements, as well as course enrollment decisions targeted toward the goal of meeting college admission requirements (Lent, 2013). The study also incorporates SCCT's performance model, where performance is defined as a student's academic success and persistence in achieving academic success (Brown & Lent, 2004; Lent, 2013). Persistence is an overlapping feature of both the SCCT's choice model and performance model, where a student's persistence in continually choosing to invest in education and consistently maintain enrollment in high school is perceived as choice stability in the choice model, while performance adequacy in the performance model can be defined as a student's persistence to finish high school (Lent, 2013; Lent & Brown, 2006). Academic persistence in the SCCT Framework has been framed as attainable student performance outcomes in addition to or replacing traditional measures such as GPA or standardized test scores (Lent et al., 2016; Lent & Brown, 2006).

From the SCCT perspective, career choices in secondary schooling primarily consist of student choice-making on whether to graduate high school, attend a post-secondary institution, which type of post-secondary institution to attend (two- or four-year colleges), and what course-subject pathways to take to achieve these goals. A student's interest development in a career in secondary school is mainly focused on what form of educational investments are necessary to meet the traditionally accepted requirements for the student's desired field of choice, and many occupations require at least a Bachelor's degree from a four-year university. Student choice-making at this level consists of what courses and in which subjects students should enroll in in any given year of high school to achieve their educational goals best. Student performance in the courses they choose to enroll in will determine whether they can advance through high school, which can impact their motivation for academically persisting to high school completion. The choices students make regarding which courses and in what subjects to enroll in and their ability to graduate high school will determine whether they can advance to a post-secondary institution and which post-secondary institution they can gain initial admission to for ultimately advancing their career goals.

In this paper, the SCCT's model for interest is not directly incorporated, and interest remains unobserved in the models presented. Instead, a central assumption of the study is that a student's primary interests are either exiting schooling at the most convenient time to enter the labor market or attempting to gain admission to a four-year university after graduating high school, with participation in WL courses potentially as a secondary interest because two years of WL coursework is a common requirement or recommended course study for admission to four-year universities. Since these two interests are interconnected to an expected outcome of helping meet college admission requirements, a student's interest is the latent desire to attend a four-year post-secondary university, and a student's resources include access to WL courses the ability to enroll in multiple years of consecutive WL study constitute environmental supports. The SCCT models student interests as working in both direct and indirect pathways through environmental supports and resources to support academic persistence, where environmental supports and resources influence students' outcome expectations and self-efficacy, which then impacts student decision-making (Lent et al., 2003; Lent & Brown, 2006). From this perspective, academic persistence results from the environmental support and resources available to a student. Thus, continued enrollment in courses prioritized in college admissions that positively impact a student's choice to academically persist to high school completion likely reveals a consistent preference for a latent desire to attend a four-year college as the primary interest driving a student's choice-making and performance outcomes.

I hypothesize that the latent desire to attend four-year post-secondary institutions can be revealed as a student preference by observing student choice-making in course selection, and the ability of students to access the courses they desire should then increase academic persistence to complete high school by increasing academic motivation to achieve their career goals. Under the SCCT Framework, academic motivation will increase for students who can access and enroll in their desired courses, which in turn will improve their ability to academically persist through high school to meet the necessary college admission requirements for enrolling in a four-year university where they can invest in additional education to pursue their career goals and objectives. Meeting requirements for college admissions may help motivate students to academically persist through high school if students already have a consistent latent desire to enroll in a post-secondary institution.

Plank et al. (2008) used a Cox proportional hazard model in a survival analysis of whether student participation in combinations of career and technical education (CTE) and core academic courses in high school influences the risk of students dropping out. The study found a significant curvilinear relationship between the ratio of CTE courses to core academic courses, reducing the dropout risk at an optimal ratio for students who entered high school on time at the age of fourteen (2008). I use Plank et al.'s (2008) paper as an inspiration for the survival models proposed in this paper. However, by utilizing the SCCT Framework to analyze and interpret the results rather than using the framework as an assessment tool or designing an intervention, the perspective and interpretation in investigating the role of language programming in education is vastly different than Plank et al.'s (2008) for CTE programming on student risk for dropping out of high school. One is that by using the SCCT Frameworks, the intertwined relationship between student satisfaction and interest can be observed as a revealed preference for attending a post-secondary institution if a student consistently enrolls in WL courses required for college admission and persists through schooling to reach their personal goal; the dynamic aspect of goal-setting can be revealed by cognitive, individual, and environmental factors that shift that effect their learning experiences and shift their goals, leading them to exit from high school prematurely. Thus, the central difference of using the SCCT as the theoretical Framework for this research design compared to other studies on student dropout and dropout risks is that I focus on students' continued investment in education as a form of academic persistence rather than analyzing the risk of student dropout through the lens of academic failure. In addition, from the SCCT perspective, participation in WL programming and course work is viewed as evidence or an indicator for potentially revealing an underlying preference for graduating high school to fulfill a student's latent desire to continue education in post-secondary settings.

The following sections explain how, under the SCCT framework, the economic benefits of language learning may motivate student interests, especially in terms of social mobility. I will also explore how student satisfaction for language-minoritized populations can be impacted by engaging in language education in terms of increasing academic motivation. And how language education that focuses on

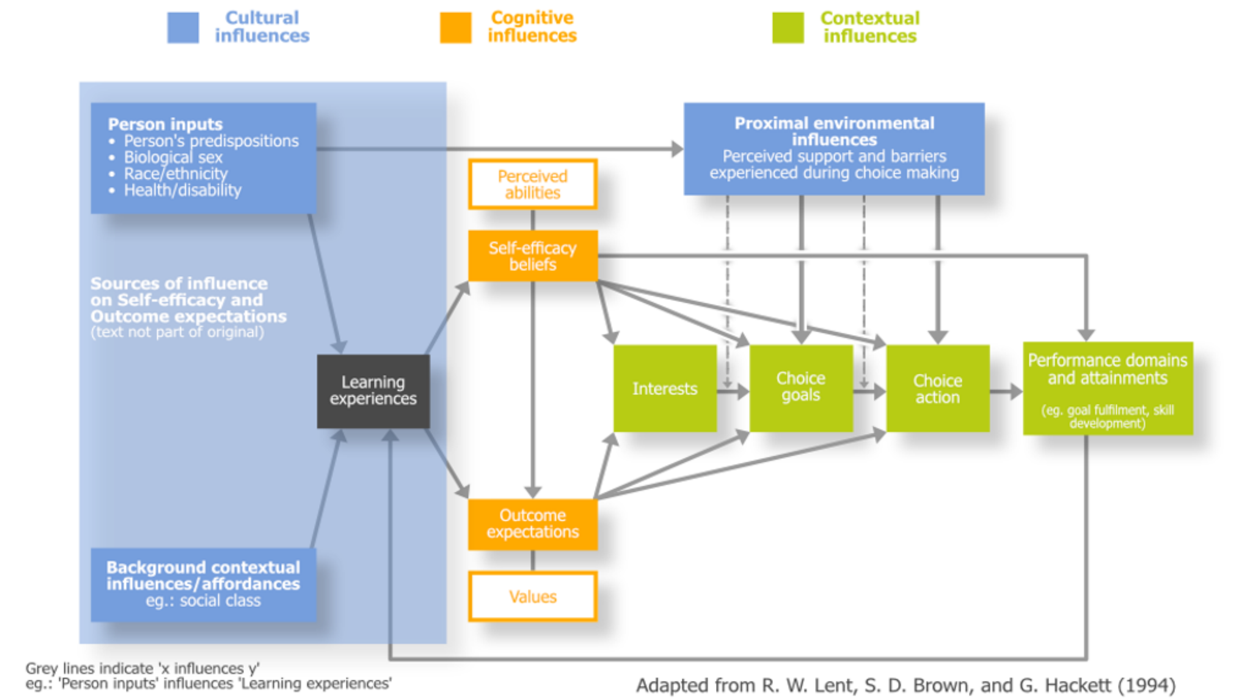

Figure 1: SCCT Choice Model

asset-based and culturally integrating approaches can improve students' self-efficacy and beliefs that achieving expected outcomes is attainable and realizing expected outcomes can increase academic persistence among these student populations (Fortes & Rumbaut, 2001; Plasencia-Romero, 2017; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005). Lent et al. (1994, p.93) provide a diagram for understanding the SCCT Framework, which has been accessed from Career Marcr (https://marcr.net/) who adapted and color-coded the diagram to highlight the cultural influences, cognitive influences, and contextual influences that make up the SCCT Choice Model.

Cultural Influences:

Does a Bilingual Advantage exist?

The literature has shown that students who can speak two languages gain social benefits that present effects on academic and educational outcomes that are positive and result in academic trajectories that are both successful and stable (c.f. Santibanez & Zarate, 2014, pp.211-212; Bankston & Zhou, 1995; Feliciano, 2001; Valenzuela, 1999; Zarate & Pineda, 2014). Social benefits for bilingual students, particularly students proficient in English and their native language, include being able to access broader social networks that can potentially offer greater resources, support, and opportunities from support networks consisting of both English monolinguals and other co-ethnic individuals or communities (Santibanez & Zarate, 2014; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zhou & Bankston, 1994). In addition, English-native language dual speakers can better communicate with teachers, educators, and other adults, as well as have better relationships with native-language speaking parents, which has been associated with greater academic success (Fortes & Rumbaut, 2001; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005). Access to these social networks can help dual-language proficient bilingual students increase access to support networks that can provide important education and career information, help them receive better academic support, such as homework assistance, and help them navigate educational opportunities and choices (Santibanez & Zarate, 2014).

In addition, the literature has shown evidence that learning a second language at an early age leads to cognitive benefits that result in success in academic subjects through the development of improved selective attention, executive control, and working memory (Bialystok, 2001, 2009; Bialystok et al., 2009; Rumbaut, 2014). Cognitive benefits from bilingualism, such as improved working memory, were found to be associated with increased knowledge and skills in reading comprehension and academic subjects such as math (Alloway, 2007; Blair & Razza, 2007; D'Amico & Guarnera, 2005; Gathercole et al., 2006). Guglielmi's (2012) study on math and science achievement among Asian and Latino English Learners, using the National Education Longitudinal Study dataset, found that prior ability in the native language significantly influenced the development of proficiency in English, resulting in increased achievement in math and science. However, the bilingual advantage only exists for students who also have high levels of literacy and proficiency in English, a requirement that, even after controlling for socioeconomic factors, is still a barrier for English Learners demonstrating substantial content knowledge from achieving in math and science assessments as well as receiving successful instruction in those content area subjects (Gersten, Jordan & Flojo, 2005; Grimm, 2008; Stancavage et al., 2007).

Santibanez and Zarate's (2014) study on whether a bilingual advantage exists in college admissions for students who are English proficient and speak a native language at home compared to their English monolingual peers found that bilingual students were more likely to gain admission to college relative to English monolingual students. The study found in two separate models for bilinguals at large and Spanish-English speaking bilinguals that students who were considered high-use bilinguals, or bilinguals who were highly proficient in their native language and often communicated in their native language, had significantly higher odds of initially enrolling at a four-year college compared to English monolingual students. Another important finding was that bilingual in general and Spanish bilingual students, in general, showed increased odds of attending some college – either a two-year community college or a four-year college (including transfers from two-year colleges) – compared to English monolingual students. The economic literature on whether a bilingual advantage exists in labor markets for proficiency in a second language as being human capital – given high proficiency in the dominant language – has found that bilingual workers enjoy increased wage premiums, validating the human capital framework of bilingualism. Though the magnitude of wage premiums is dependent on the worker's primary language and the prevalence of minority language speakers in the economy (Armstrong, 2013, pg.3; see also Albouy, 2008; Christofides & Swidinsky, 2010; Grenier & Nadeau, 2011; Shapiro & Stelcner, 1997), which lead Carliner (1981) and Bloom and Grenier (1996) to believe that the "demand for language skills depends on the underlying linguistic demography of the population in question" (Armstrong, 2013, pg.4). Based on human capital theory, 'language skills' are capital that fluent bilinguals can rent to employers in return for higher wages due to having "higher productivity than their monolingual counterparts, especially when bilingual ability is valued in economic activities" (Kim et al., 2014, pg.94).

Are there economic contextual influences that English monolinguals can benefit from by learning a language from another culture?

The field of economics has produced research and models attempting to understand and conceptualize the benefits of language learning through market dynamics. Economists have focused on the value languages have in the labor market as a form of human capital. Becker proposed human capital theory as investing in "activities that influence future monetary and psychic income by increasing the resources in people" (2009, p. 1). Language has attributes that allow it to be conceived as human capital; for example, language is a form of human capital that workers can invest in through education with the expectation of return on investment (Grenier, 1982). Grenier (1984) defines language as "a form of general human capital used for communication" (p. 23), while Chiswick and Miller (1995) posit that there are three fundamental reasons why language skills can be considered human capital: "they are embodied in the person; they are productive in the labor market and or in consumption; and they are created at a sacrifice of time and out-of-pocket resources" (as cited by Gonzalez, 2005). There are costs associated with gaining language skills, such as time, money, and effort; however, the benefits could be increased opportunities for trade and consumption (Lazear, 1995, 1997; Pendakur & Pendakur, 2002).

Communicative skills are now essential to effectively communicate across teams and fields and become a general yet crucial characteristic of an ideal worker (Cameron, 2000; Gee et al., 1996; Urciuoli, 2008; Urciuoli & LaDousa, 2013). Unlike other resources, language is a "supercollective" or "hypercollective" good that increases in value as network externalities increase through the growth of its respective linguistic population (Garrouste, 2008; Grenier, 1984; Grin, 2003). Language as human capital indicates the ability to communicate. Thus, the more people that can be communicated with or communities that can be accessed, the greater the stakeholders value the language (Church & King, 1993; Dalmazzone, 1999; Grin, 2009; Selten & Pool, 1997). The notion of "communicative benefits" (Selton & Pool, 1991) helps explain the value dominant stakeholders see in non-dominant languages. "Communicative benefits" can be conceptualized as language as human capital, where the returns on investment for learning a second language are potential economic, social, and cultural advantages.

Cognitive Influences:

Self-efficacy (Can I do this?)

The economic literature has found the returns to education so high that economists are often puzzled by why students make minimal investments in education or even disinvest from education (Angrist & Lavy, 2002, 2009; Levitt & List, 2010). Levitt and List posited that one explanation for this could be the long-term nature of the returns or the length of time spent in schooling relative to entering the labor market, which may need more motivation for students to invest effort in schooling (2010). Domina et al. (2011) posit that applying rational choice theory to educational settings cannot account for the uncertainty students face in estimating the returns to any potential investments in education along with the likelihood that they achieve their educational goals, making it difficult to estimate the benefits and costs of investing in education (Benabou & Tirole 2003). Altonji (1993) argues that students who do not believe they have a realistic or likely chance of succeeding in education are less likely to invest in it even if they believe the returns to investing in education will be high, while Rosenbaum (2001) argues that students who have strong confidence in their ability to achieve academic success regardless of the effort they invest, may also invest less effort into schooling. Education psychologists rationalize this phenomenon observed by economists as a reflection of the Eccles expectancy-value model of achievement choices and task performance for understanding utility-value-based motivation (Hulleman & Hendricks, 2010; see Atkinson, 1957; Eccles, 1983; Eccles et al., 1983; Eccles & Wigfield, 2002; Edwards, 1954; Tolman, 1955; Vroom, 1964; Wigfield & Eccles, 1992).

The expectancy-value model states that the belief individuals have about how successful they will be at performing a task influences their motivation for performing that task. For example, students who believe they will be successful at a particular task are more likely to be motivated to perform the task and persist in the task, and students past performances and experiences can predict student motivation and future performances (cf. Hulleman & Hendricks, 2010, pg. 880; Bandura, 1997; Pintrich, 2003; Usher & Pajares, 2008). Barrett et al. (2012) use the expectancy-value model of motivation (Eccles, 1983; Wigfield & Eccles, 2000), where the determinants of motivation are an "individual's expectations of success, the value he or she places on a given task, and their achievement-related choices" (p.1620) as the foundation for their definition for academic motivation. Academic motivation is defined as the "value an individual places on a task (how important it is to do it well, and to which extent doing so is useful for the future) in conjunction with achievement-related choices (academic efforts made to achieve)" (Barrett et al., 2012, p.1620).

Outcome Expectations

In the SCCT Framework, education and career planning are influenced by social cognitive factors, specifically self-efficacy, outcome expectations, and educational and career goals, which are determined by personality traits, often defined by the five-factor model of personality (Costa & McCrae, 1992; DeMulier et al., 2013: Lent et al., 1994). Of the Big Five personality traits, conscientiousness is considered the most prominent personality trait for education and career planning in the SCCT Framework due to the broader career literature's documentation on the influence of conscientiousness on an individual's decision-making process concerning educational choices and subsequent career directions (Brown & Hirschi, 2013; Lent et al.,2019; Rogers et al., 2008; Rustichini et al., 2016). Costa and McCrae (1992) define conscientiousness as "being thoughtful, organized and goal-directed, with good impulse control and attention to detail" (c.f. DeYoung et al., 2016, p.881). In the SCCT Framework, conscientiousness is considered a mediating factor that supports goal setting and actions or decisional behaviors through strengthening self-efficacy, which research has shown to have both direct and indirect impacts on education and career planning (Brown & Hirschi, 2013; Lent et al.,2019; Lent et al., 2016; Rogers et al., 2008). Conscientiousness consists of two separate sub-traits: industriousness and orderliness. Industriousness refers to an individual's ambition and work ethic, how individuals decide on a goal, plan on achieving it, and how hard they work towards achieving the goal. In contrast, orderliness focuses on how well individuals follow and adapt to rules set by themselves or others (DeYoung et al., 2016, p.881).

The most important aspect of conscientiousness relevant to the context of this study is industriousness. Academic persistence reflects "the ability and tendency to suppress disruptive impulses and persist in working toward nonimmediate goals," which was shown by the strength of the positive correlations between the factor representations for intellect and industriousness and the factor representations for intellect and assertiveness, highlighting the connection industriousness has with both an individual's intellect and ambition of (DeYoung et al., 2007, p.885). Industriousness is negatively associated with neuroticism, which allows for making better progress in decision-making by facilitating active engagement in exploration that decreases anxiety regarding the direction of an individual's education and subsequent career, which is then reinforced and reflected as outcomes become increasingly decided (Brown & Hirschi, 2013; DeYoung et al., 2007; Lent et al.,2019). However, industriousness cannot be directly observed through outcome expectations because students with higher industriousness have a higher level of planning for education and career goals due to the better ability and self-efficacy of those students in planning and setting goals for guiding their behavior and decision-making (DeMulier et al., 2013; Rogers & Creed, 2011; Rogers et al., 2008).

Contextual Influences:

Interest (how much do I want to do this?)

Developing interest in a career for a student in secondary school primarily manifests as central decisions a student makes regarding the needed educational investments that a student decides upon to meet the traditionally accepted requirements for the student's desired field of choice (Bartlett, 1997, p.53-54). Students may decide to enroll in courses to acquire "hard skills" that they can use as human capital upon entering the workforce or as a signal of their cognitive abilities or potential "soft skills" (non-cognitive skills) to future employers for increased wages or employment opportunities (Angrist & Krueger, 1992, 1995; Carneiro & Heckman, 2003; Spence, 1978). Saiz and Zoido define WL skills as "hard skills" and identify WL courses in high school as providing students with valuable "hard skills" for the labor market in the form of WL proficiency that can be useful to students post-education (2002, 2004, 2005). Saiz and Zoido's (2004) study used survey data on WL proficiency of college graduates from 1993, interviewed again in 1997, and found that students who fulfilled a curriculum or elective mandate in high school to study a WL were more likely to be proficient in the WL four years after graduating college.

Labor economists have justified learning a second language from a market-based perspective by considering it a set of skills that can increase positive labor market outcomes post-schooling (Chiswick & Miller, 2007a; Kim et al., 2014). Availability and cost for learning a second language, as well as potential benefits of higher wages or increased employment opportunities, are important factors influencing decisions to acquire a second language (Chiswick & Miller, 2007b, pg. 4; see also Armstrong, 2013; Church & King, 1993; Grenier, 1984; Grin, 2003). Saiz and Zoido found that college graduates who can speak a second language receive a 2% to 3% higher wage premium (2005). However, acquiring a second language requires investment in time and resources to learn the language, and the benefits of second language proficiency are distributed throughout time. Proficiency in a WL can be acquired through formal schooling, immersion in the language environment, or on-the-job training (Breton & Mieszkowski, 1977; Hocevar, 1975; Carliner, 1976). However, learning a WL in high school is more likely to be accessible, attainable, and affordable than learning the language in a foreign immersive environment or learning it post-education in the workforce.

In addition to acquiring "hard skills" to use as human capital in future labor markets, interest in a career path for students in secondary school is likely also focused on gaining admission to post-secondary institutions to continue to make additional investments in education. Since many occupations require at least a Bachelor's degree from a four-year university, a student's interests towards achieving admission to a four-year college guide student behavior and decision-making in regards to making educational investments, such as choosing what courses to enroll in based on whether they help a student fulfill university admission requirements without detracting the ability to meet graduation requirements. University admission requirements usually include minimum course requirements for core academic subjects such as English, STEM subjects, the Social Sciences, and electives, usually in WLs or the Arts. These admission requirements can play a major role in guiding student course enrollment decisions. For example, Clotfelter et al. (2018) used a quasi-experimental instrumental variables approach to show that increasing the minimum math course requirement for entry to North Carolina's university systems influenced students' course enrollment and college-going decisions by increasing student enrollment in higher-level math courses in addition to increasing applications and enrollment in the state's four-year university systems. Similar findings to Clotfelter et al. (2018) were presented in Saiz and Zoido's (2004) study, where results show that moving from a state without any colleges in the state requiring a minimum course load in a WL for admission to a state where all colleges in the state require WL study for admission, leads to students, four years after graduating college, being 40% more likely to be conversational in a WL.

Choice Goals

Economic factors are addressed by observing student choice-making in their enrollment decisions to choose a course in one subject over another for each given year. Student performance in the courses they choose to enroll in will determine whether they can advance through high school (Owings, 1995), impacting their motivation for academically persisting to high school completion. Students also need to meet course requirements for graduating high school since a standard high school diploma is a typical prerequisite for employment or enrollment in a post-secondary institution and may have goals for attaining advanced high school diplomas offered by states geared toward college readiness. However, it is uncommon for high schools to mandate a minimum course study in a WL, with only the District of Columbia requiring two years of a WL for graduation from 1996 to 2004, with Maine, New Jersey, and Tennessee in 2002 starting to consistently require WL courses for graduation (Digest of Education Statistics, 1998, 2001, 2002, 2004). However, in 1998, for students to attain an advanced "College Preparatory" high school diploma from Arkansas, Georgia, Rhode Island, South Carolina (starting 2001), Tennessee (until 2002), and Vermont, a tear or two of WL coursework was required, with Georgia, Rhode Island, and South Carolina consistently maintaining this policy (Digest of Education Statistics, 1998, 2001, 2002, 2004). In these states, college-bound students would be incentivized to attain the advanced "College Preparatory" high school diploma to increase their likelihood of achieving the goal of college admission, which would include taking years of WL study. However, since it is only a minority of states offer this incentive, students in other states would have to consider whether achieving a goal to be college-bound or college-ready by graduation is dependent on the courses they self-select into and if self-selecting into WL courses can help facilitate their ability to meet the goal of being college bound.

In 1983, the National Commission on Excellence in Education recommended that college-bound students take two years of courses in a WL (c.f. Snyder et al., 2004, p. 49; *Nation at Risk*, 1983). Owings' (1995) report on important criteria for college admissions officers for highly selective four-year post-secondary institutions defined three years of math, science, and social science courses, along with four years of English and two years of study in a WL as important criteria for admission to a highly selective four-year university or liberal arts college. Of the college-bound students of the 1992 graduating class, 55% of them met the course criteria; however, 87% of highly achieving students (minimum 3.5 GPA and 1250 SAT score) took two or more years of WL courses, and 79% of the remaining college-bound 1992 graduates took two or more years in a WL as well (Owings, 1995, pp. 2-7). The National Center for Education Statistics (NCES) used data from the 1995–96 Beginning Postsecondary Students Longitudinal Study, First Follow-up (BPS:96/98), to categorize high school curriculums into three levels (Horn & Kojaku, 2001; Horn et al., 2001). A basic core curriculum not including any WL study, a mid-level curriculum requiring at least one year of WL study, and a rigorous curriculum requiring three years of courses in a WL, then found in a census of all students enrolled in a four-year college in 1998 that 69% of students completed at least one year of a WL, with 19% completing three or more years of a WL (Horn & Kojaku, 2001; Horn et al., 2001). These percentages of high school WL enrollment for college-bound students should not be surprising since the *MLA Survey of Postsecondary Entrance and Degree Requirements for Languages Other Than English, 1994-1995* found that 37 states and the District of Columbia had four-year post-secondary institutions with minimum course requirements in a WL for admission (Brod & Huber, 1996, p.37).

For example, Rodriguez's (1995) analysis of state universities' course admission requirements showed that WL study was already considered mandatory for admission to some public four-year universities. For example, the University of California system, the California State University system, the City University of New York system, and public four-year universities in Florida required a year or two of WL study (Rodriguez, 1995). In contrast, states such as Illinois and Oklahoma made WLs a recommended elective requirement, and states like Kentucky, Texas, and Oregon highly encouraged WL coursework for college admissions in the early 1990s (Rodriguez, 1995). Interestingly, the percentage of four-year colleges that required WL study for admission in 1994-1995 in states that required a minimum course load in a WL for achieving an advanced “College Preparatory” high school diploma in 1998 and 2001, such as Georgia, Rhode Island, and South Carolina, were respectively 51%, 56%, and 47% (Brod & Huber, 1996, p.37). According to the *MLA Survey of Postsecondary Entrance and Degree Requirements for Languages Other Than English, 1994-1995*, 20.7% of all four-year post-secondary institutions in the U.S. required WL study for admission, with an additional 6.3% highly recommending courses in a WL for admission (Brod & Huber, 1996). A decade later, the *MLA Survey of Postsecondary Entrance and Degree Requirements for Languages Other Than English 2009-2010* found the number of four-year U.S. post-secondary institutions requiring WL study for admission increased by 4%, from 20.7% in 1995 to 24.7% in 2009, with states such as Oregon and Colorado passing policies mandating minimum WL study for admission to state four-year colleges in 1997 and 2009 respectively (Lusin, 2012; Krumholz, 2011; Rodriguez, 1995). In addition, the percentage of four-year post-secondary institutions highly recommending WL study for admission rose by 31.7%, from 6.3% in 1995 to 38% in 2009, and four-year colleges allowing for WLs to satisfy an optional distribution requirement for admission rose by 7.3% at the same time (Lusin, 2012). The late 1990s and 2000s was a transitional period where World Language course study requirements for college admissions shifted from optional to highly recommended or mandatory. Whether state universities highly encourage or require study in WLs for admission, students serious about investing in a post-secondary university education would likely be motivated to enroll in WL classes due to the competitive nature of attaining admission to most four-year post-secondary institutions.

Choice Action

Student choice action in secondary schooling consists of deciding which courses and in what subjects a student enrolls for any given year of high school to achieve their educational goals best (Owings, 1995). The choices students make regarding which courses and in what subjects to enroll in and their ability to graduate high school will determine whether they can advance to a post-secondary institution and which post-secondary institution they can gain initial admission to for ultimately advancing their career goals (Cunha et al.,2018; Owings, 1995). From the SCCT perspective, career choices in secondary schooling primarily consist of student choice-making on whether to graduate high school, attend a post-secondary institution, which type of post-secondary institution to attend (two- or four-year colleges), and what course-subject pathways to take to achieve these goals. For this reason, it should be expected that there is an optimal ratio of subjects to be taken each year to graduate high school and meet the admission requirements for many public four-year universities.

In high school, students have limited flexibility in scheduling courses, which are constrained by the availability of open seats, the number of periods in a school day, and the need to meet credit requirements for graduation. This environment for scheduling courses each year to meet high school graduation and college admission requirements creates an opportunity cost for students when deciding to enroll in one course over another in most U.S. high schools. In addition, access to courses is highly restrictive for most students due to limited public resources and district policies and requirements. Students have limited time to budget what courses they can take each year, and deciding to enroll in a WL course is also a decision to sacrifice enrolling in another course. From this perspective, where the budget is time, given the constrained scheduling opportunities available for courses each year, and the opportunity cost of scheduling one course over another, especially when that opportunity cost may be meeting a college admission requirement or recommendation over meeting a high school graduation requirement, then the enrollment ratio of courses in a particular subject over courses in another subject may potentially reveal a preference for a latent desire to enroll in a post-secondary institution, which could then help increase academic persistence in completing high school. A loose interpretation of revealed preference theory is applied in the analysis in the paper since I take a dynamic rather than static approach to the analysis of the findings, which vary over time if an educational preference is revealed to be consistently preferred over other educational choices over time, then from an ordinal perspective, I treat the finding as a revealed preference while acknowledging that my interpretation does not follow the strict time-invariant and cardinal rules for properly meeting the requirements for a formal argument for revealed preference theory.

For choice actions to meaningfully represent a revealed preference to attend a post-secondary four-year institution, the immediate choice actions to enroll in a WL course for a given year and academically persist through high school to achieve proximal choice goals for meeting prerequisite requirements or recommendations for college admission should be reflected in distal choice goals of academically persisting through college and being proficient in a WL for students' career ambitions. The NCES (2001) study of high school curriculum rigor on college enrollment and persistence in 1998 found that students who took the most rigorous curriculum requiring completion of at least three years of a WL were on track to graduate at a rate of 87% with a 4% likelihood of exiting college without a degree (Horn & Kojaku, 2001; Horn et al., 2001). In contrast, students who completed a mid-level curriculum requiring at least one year of completion in a WL were on track to graduate at a rate of 71% with a 10% likelihood of dropping out, and 62% of students who did not take a WL course in high school by completing a core curriculum or lower were on track to graduate with a degree with 17% of those students dropping out without a degree (Horn & Kojaku, 2001; Horn et al., 2001). Furthermore, Saiz and Zoido's (2004) study found that the share of colleges in a state that had WL requirements for admission was statistically significant in its association with a student's proficiency in a WL years after graduating college in the workforce (p.7; Saiz & Zoido, 2002, 2005). These studies present strong associations between increased investments in WL education during high school with academic persistence in college and WL skills, valuable as human capital, after graduating college. This study builds upon the existing literature by observing whether distal choice goals for college admissions and beyond influence proximal choice actions regarding the impact of participation in WL education on a student's academic persistence to complete a high school education.

Performance domains and attainment

Although I am not estimating revealed preferences or arguing for a strong existence of a revealed preference for investing in education via WL enrollment since preferences cannot be time-variant in the model, I am providing a framework to observe World Language enrollments as educational investments that incur a price in the opportunity costs of the foregone courses not chosen under a strict budget in the availability and time for scheduling courses for each year. Before even looking at how enrollment or completion of WL courses may impact the probability a student graduates high school, it is essential to assess whether attempting to participate in WL programming, regardless of completion status, already indicates increased academic persistence, implying a latent desire to continue investing in education, including, potentially, post-secondary education. This claim follows from my hypothesis that enrollment in WL courses was more beneficial for students at large to gain admission to colleges than for meeting high school requirements for graduation. Unlike Plank et al., this paper does not seek to make the argument that participation in WL courses and programs can decrease the likelihood of student dropout like Plank et al. found for certain combinations of CTE and core academic courses (2008). Instead, I hypothesize that participation in WL courses and programs may reveal a preference for making current investments in secondary education for potentially gaining access to post-secondary educational investments by academically persisting through high school, where access and participation in WL programming facilitate students' continued investments in secondary schooling. The reasoning behind this hypothesis is that although high schools may or may not require WL credits for graduation, it has become a standard requirement or at least expectation that students participate in a minimum number of WL courses for admission to most four-year public universities and many four-year private universities.

2.3 Research Questions

Does participation in WL Programming indicate continued investment in education?

Is there a bilingual advantage in WL course enrollment on academic persistence?

2.4 Data

The paper uses data from The National Longitudinal Survey of Youth of 1997 (NLSY1997) to study academic persistence and the role of language programming for students enrolled in the ninth grade starting in 1997 and onwards who either complete high school or permanently exit from schooling by the end of the provided high school transcript data by 2004. The total period the study uses data from is from September 1996 to July 2004. Data from 2586 out of the 8984 individuals sampled by the NLSY1997 are used for the descriptive statistics and the estimation of the survival models.

Dependent Variable:

In this paper, I only consider a failure event as the first month a student drops out during their last year of enrollment before exiting high school without a diploma. I do not consider temporary dropout periods for students who ultimately graduate with a high school diploma as failure events, nor do I consider temporary dropout periods in years before a student's last year of enrollment as failure events for students who ultimately do not receive a high school diploma since the paper's primary focus is on the decision to continue investing in education rather than the risk of dropping out. I also dropped all students with missing observations from the sample, leaving us with a subject pool of 2586 students and 91 failure events. A failure event is interpreted as a student's decision not to continue investing in education. To be considered as dropping out or exiting from schooling as a failure for the survival model, a student must have permanently dropped out during the middle of the school year and not returned to school afterward or exited schooling after their first, second, or third year of high school. If a student drops out during their fourth or fifth years of high school and ultimately does not complete schooling, that is also considered a failure event.

Primary Variables of Interest:

The SCCT Framework focuses on how an individual's career development, or for the interest of this paper, the academic persistence of a student is impacted by cognitive, personal, and environmental variables. From the SCCT Framework, cognitive variables consist of psychological factors such as abilities or interests, social factors like socioeconomic status and race, and environmental variables such as economic factors (Lent et al., 2002; Long et al., 2002), which in this model is represented by course enrollment decisions that factor in college admission requirements for four-year state universities.

To address psychological factors in the model for my cognitive variables, I utilize the Armed Services Vocational Aptitude Battery (ASVAB) Math and English percentage score as a proxy for student ability in accordance with the dominant practice in economic literature and common practice within career-based sociological research, and participation in educational programs that indicate ability or psychological needs, specifically, participation in special education and gifted and talented programs. Acknowledging that the ASVAB test is offered to sixteen and older students, I treat it as a static variable for ability per the dominant practice in the economic and career-based sociological literature. The other primary explanatory latent factor in the literature used to explain academic persistence is industriousness, a sub-factor of conscientiousness, one of the Big Five personality traits. Conscientiousness is an especially important and influential personality factor in the SCCT literature concerning academic persistence. The sub-factor industriousness was chosen as the primary psychological personality trait since it focuses on an individual's ambition and work ethic, providing a clearer and more direct logical relationship with the academic persistence displayed by a student than the other factors and sub-factors of the Big Five personality traits. I use the Industriousness Scale, a subset of Chernyshenko Conscientiousness Scales (Green et al., 2016), as a proxy for industriousness as a personality trait while acknowledging the data was collected from the subjects past my initial years of interest during collection rounds 12 (2008) and 14 (2010). For the final scale, the scores from both collection years were averaged for each student. Still, in accordance with the literature on industriousness and conscientiousness, I treat it as a fixed and static psychological personality construct for a student's ambitiousness and work ethic. I also provide a separate survival model incorporating the interaction between language-minoritized populations and industriousness to address the interaction between a student's language background, specifically bilingual or not. The degree of ambition or consistent level of effort students put into their work influences academic persistence and whether this influence comes at a cost concerning the effect of environmental factors such as course enrollment decisions have on academic persistence or decisions to invest in education as represented by the hazard of dropping out from schooling.

For addressing social factors, personal variables included in the model are the subject's birthdate (a grouped variable for the birth year and month), age, sex, race, housing arrangement, household income, parental education, urban location, geographic region, and the language populations that students belong to, as well as students' language background, mainly whether they speak another language and, if so, what language is spoken at home. Plank et al. (2008) found that the age at which a student begins their high school career can impact the probability of dropping out, with students entering high school at fifteen years or older having a significantly higher likelihood of dropping out. One potential reason for age being associated with a greater risk of dropping out is that students are not legally allowed to exit from schooling and gain employment before turning sixteen, so older students can drop out and enter the labor force at earlier grades than their younger peers. Since Plank et al. (2008) and other studies found strong associations between age and dropout likelihood, I utilize two variables: a static time-invariant covariate for a student's birthdate by grouping the student's birth year and month as a proxy for the age a student enters the ninth grade, and a second dynamic age time-varying covariate to assess if there is an interaction effect between age and time that increases or decreases the effect of age over time.

The literature has shown that female students were less likely to drop out than males. Still, as other factors such as school experiences and educational achievement were incorporated into the models, the effect of gender was often attenuated (c.f. Plank et al., 2008, p. 352; Goldschmidt & Wang, 1999; Rumberger, 1987). I follow Plank et al.'s (2008) example and include gender as a variable in my model, with "male" being the excluded reference category. Race has been found by prior research to be an important indicator of a student's academic persistence, though with conflicting results regarding the direction of the effect. Studies have found Black and Latinx students have higher dropout rates than their white or Asian peers (c.f. Plank et al., 2008). At the same time, there has been research showing that by controlling for socioeconomic status and family background, a disadvantage in academic persistence for black and Latinx students is either erased or even reversed (Simmons et al., 2004; Plank et al., 2008). An indicator variable for being Black, Hispanic, or another race is included, with being white as the excluded reference category; the indicator for another race serves as an aggregate variable for students from Asian, Pacific Islander, Indigenous, and other mixed-race ethnic populations. A continuous log family income variable is a proxy for socioeconomic status. The other proxy for socioeconomic status is the highest degree completed by a student's parent as a variable with indicators for graduate degree attained, Bachelor's degree achieved, completion of an Associate's degree, or high school diploma accomplished with being a high school dropout as the excluded reference category. The literature has shown that dropout rates are higher for students who live at home with single parents or stepparents than those living with both biological parents, so an indicator variable for the home living situation is included with living with both biological parents as the excluded reference category (Astone & McLanahan, 1991; Krein & Beller, 1988; McLanahan, 1985; Plank et al., 2008). Since research has shown dropout rates to be greater in urban areas, I include an indicator variable for whether a student lives in an urban area, with the reference category being nonurban areas (Balfanz & Legters, 2004; Simmons et al., 2004; Plank et al., 2008). I also incorporate geographic regions as a variable since the average expenditure on education, as well as educational policies and curriculum, often differ by the various regions of the United States, with the Northeast region of the country being the excluded reference category, compared to the South, Midwest, and Western United States.

One of the primary social factors of interest is a student's language background, such as whether a student's primary language is English and if a student speaks a native language other than English at home. The data on language background comes from the ASVAB dataset from the NLSY1997 database, where students self-identify whether English is their primary language and if a native language is spoken at home. From these data points, I categorize students into three language populations of interest: English monolinguals, emergent bilinguals, and English Learners. English monolinguals are students who self-identify English as their primary language for both speaking and reading and do not speak any other language at home. Emergent bilinguals are students who also self-identify English as their primary language for speaking and reading but also speak a native language or multiple languages other than English at home. English Learners are students who self-identify as English not being the primary language for speaking, reading, or both and may or may not have identified whether another language is spoken at home. Some English Learners have self-identified that a native language is spoken at home. In contrast, others have not, suggesting that these students may be second or third-generation immigrant students or even Black students who are assumed to be limited in their English proficiency, even if the only language they speak or read is English. On the other hand, since the language variables data was generated from student self-identification, it could also be that students were willing to admit not speaking or reading in English as their primary language but unwilling to report any native languages spoken at home for personal or societal reasons.

Since English Learners self-identify as English not being the primary language for speaking, reading, or both, I assume that these students are likely to be considered by districts and schools as being Limited English Proficient (LEP) and requiring additional English Language Development (ELD) support services. However, it is standard practice for school districts in the U.S. to automatically assign students who self-report as speaking a non-English native language at home to ELD support services until students test out from ELD services. This policy implies that although emergent bilingual students (EB) self-identify English as their primary language for both speaking and writing, by self-reporting that a native-language other than English is spoken at home, these students would have been automatically assigned to ELD services upon entering formal schooling until their school and district recognize their proficiency in English. For students assigned as LEP, ELD services can include additional English as a Second Language (ESL) courses. Still, they can also consist of lower-tracked English courses or pull-out specialized services that may fill one or more periods of a student's schedule but do not count towards a college-preparatory progression in English for college admissions (Wang & Goldschmidt, 1999). I do not have data on whether or when students were designated as LEP; however, data on which students participated in ESL courses was tagged in student transcripts and represented as a dummy variable. It is assumed that more EB students received. ELD services are more than those explicitly tagged, but the exact distribution of LEP students is unobserved.

Research has shown that LEP status significantly influences academic motivation, a reliable predictor for academic achievement (Bandura, 1977; Chen & Stevenson, 1995; Pajares & Graham, 1999; Portes, 1999; Suarez-Orozco et al., 2009). English Learners and emergent bilinguals are defined as language-minoritized student populations since students from both populations may be categorized as LEP students by their school district. I also provide a separate survival model incorporating the interaction between language-minoritized populations and industriousness to address whether the interaction between a student's language background, specifically being bilingual, and their degree of ambition or consistent level of effort put into their work influences academic persistence. And whether this influence comes at a cost concerning the effect of environmental factors such as course enrollment decisions on academic persistence or decisions to invest in education as represented by the hazard of dropping out from schooling.

Finally, I incorporate the language a student speaks into the model by using English as the excluded reference category, including an indicator variable for speaking Spanish, a European language, or another language not traditionally from Europe. The NLSY1997 database provided an extensive set of data on languages spoken at home, but given the small proportion of students that speak another language than English, including all the individual languages into the model would prevent the model from presenting robust estimates for languages spoken due to the small sample sizes for each language other than Spanish. Therefore, I aggregated all European-based languages other than Spanish and technically English, such as French, German, Italian, etc., into an aggregated indicator variable. For Asian languages, Semitic languages, Creole languages, indigenous languages, and any other language not traditionally originating from Europe, an aggregated indicator variable for speakers of other languages was created. The reason for separating European languages from other languages was that European languages like Spanish, French, German, and Italian are often taught in U.S. high schools as WL courses. At the same time, it is extremely rare for a U.S. high school to offer WL courses in Asian, Semitic, Creole, and indigenous languages.

Time-varying Covariates Characterizing the High School Experience

The environmental variables of interest are the economic factors of student preferences in course consumption, as represented by the ratios of course-subjects students have chosen to enroll in given a constrained time budget for scheduling courses in a given year or academic term, as well as the opportunity cost of enrolling in one subject over another in terms of meeting high school graduation requirements and potentially course requirements for college admissions. Also included are GPA and grade level as an outcome and performance measures under the SCCT Framework. GPA reflects student outcomes, and grade advancement is conceptualized as a performance indicator for academic persistence. The primary environmental variable of interest is the effect of the enrollment ratio for WL courses as a time-varying covariate on the risk of student dropout as a first-order term and whether increasing the WL enrollment ratio within a year or academic term affects the probability of survival for students, as a second-order term, as well. I expect a curvilinear relationship between the ratio of World Language courses in a student's schedule and high school survival rates since most colleges prefer to see multiple years of continued investment in a single language rather than multiple courses taken in different languages with minimal time investments. Furthermore, multiple classes in different WLs in a single academic year are more likely to be representative of a student who is switching from one WL to another due to poor performance in a previous WL rather than enrolling in two different WLs simultaneously since students are limited in their opportunities for scheduling courses. Since students must meet other course requirements for high school graduation and potentially college admission, it is unlikely that students aiming for college admittance would have a realistic opportunity to enroll in multiple WL courses concurrently in a year. Still, they would be more likely to enroll in different WLs in successive years if they genuinely wanted to invest in becoming multiliterate.

The other time-varying covariates for course enrollment ratios observed for the months in each academic year are courses in STEM, Social Sciences, English, and Art. I include these covariates in my model because STEM, Social Science, and English course requirements are standard for admission to many public four-year universities, and a year of Art is often either a requirement or fulfills an elective requirement for admission to state universities. However, it is unlikely that course enrollment ratios for these subjects would be likely indicators of academic persistence as time-varying covariates, where college admission is the primary goal for students. Four years of study in any STEM subject is not a standard or common requirement for state university admissions (Rodriguez, 1995). In addition, for STEM courses, it is unlikely that the quantity of required courses for high school graduation and college admission is significantly different; instead, the requirements likely differ on the quality of rigor for the courses taken in these subjects. It is unlikely that the enrollment ratio in social science courses would provide statistically significant estimates indicating academic persistence since state universities often have a minimum requirement of two or three years of coursework for admission, which may overlap with high school graduation requirements.

English was the only core subject that required four years of completed study for all state universities studied by Rodriguez (1995). Additional English courses in a single academic year are usually for English language acquisition purposes for students deemed not meeting their peers' English proficiency standards or learning English as a second or third language. These additional English courses are more likely to represent remedial coursework mandatory for Heritage Language speakers who are designated as English Learners or as having Limited English Proficiency that prevents these students from enrolling in courses that would meet the course requirements for admission to state universities, making it less likely for these students to gain college admission and decreasing the level of academic persistence if admission to a four-year university is no longer a primary motivating factor. Owings (1995) found that course-taking patterns for students who make less progress in their English courses also make less progress in both WL and social science courses, and students who take less than two years of WLs are associated with taking less than three years of social science courses. However, Saiz and Zoido (1994) found that high school requirements for English, STEM, and social studies were orthogonal to WL requirements and did not affect WL outcomes, nor were they statistically significant. Thus, including the other core academic subjects and English should not affect the hazard ratio or statistical significance of WL enrollment due to the lack of curriculum connection between WL courses and the other core academic subjects and the importance WL enrollment may have for college admissions over high school graduation requirements, unless potentially when interacting with a language-minoritized population, which could alter the effects based on a student's language status. Students tagged for participating in ESL courses as part of their English course load are represented by an interaction with a dummy variable.

Courses in the Arts usually do not follow a progressive track of courses and often have self-contained semester or yearly curriculums, which can be taken any year or term, unlike WL courses that must be taken in a progressive order by term. A minimum course load in Art is either a requirement for admission to state universities such as the University of California system today (1-year minimum requirement) and the California State University system in the early 1990s (1-year requirement) as presented in Rodriguez's report, or at least fulfilled additional course requirements or elective requirements for admission to other state universities (1995). It is not expected that the limited course requirements in art that colleges may have for admission should have a statistically significant effect on a student's academic persistence as a time-varying covariate. I include art enrollment ratios along with core academic enrollment ratios as time-varying covariates in the final model as robustness checks to support further or dismiss my hypothesis.

A central assumption is that the annual course credits for each WL and core academic course averaged over the total course credits for the year represent the average proportion of students' schedules dedicated to participation in one of the subjects relative to the other available subjects. Very few individual term transcript data provided information on WL enrollment; there needed to be additional transcript data on WL credits and grades for each school term for most students, considering the significantly more robust and accurate information provided by the yearly transcript data. A significant majority of high schools in the U.S. follow a traditional curriculum format, where it is a common assumption that most high school students who start a core academic or World Language course from the first term of an academic year will either continue that course or take another course in the same subject until the end of the final term of the academic year. I consider these assumptions reasonable since, in high school, most academic and World Language courses are year-long commitments, unlike post-secondary schooling. In contrast, Plank et al. (2008) primarily focus on students in general rather than specific student populations for studying the impact of CTE education, where singular-term commitments during an academic year in high school are more common along with subjects such as health, physical education, or other electives courses. Furthermore, Plank et al. (2008) used only students who provided transcript data for each term, leaving a sample size of 896 subjects in the dataset that skewed towards a predominantly white middle-class population of subjects in the sample for their study of CTE enrollment in dropout rates. However, since one of the central focuses of this paper is on students who come from a Heritage Language background, limiting the sample to students who provided individual term transcript data would omit too many students of interest vital to the purpose of this research study.

Sample:

From the initial sample of 8998 subjects from the NLSY1997 data collection, 2586 students were chosen as the subjects for the final sample used in the models. The initial sample of only including students in the ninth grade from 1997 and onward reduces the available NLSY sample from a potential 8984 subjects down to 6387 available subjects. The study only includes students who provided their high school transcript data, which drops the available sample to 3829 students. Students who did not provide their racial and ethnic background data were dropped from the sample along with students who did not provide ASVAB scores and their language background from the ASVAB dataset from the NLSY1997 collection since those variables are considered primary characteristic variables for understanding how choices in language programming may be influenced based on student background and characteristics, reducing the available sample to 3135 available students. The study also dropped students who did not complete the Industriousness scale assessment from the sample since industriousness is the primary cognitive variable proxying a psychological factor in the model, further reducing the available sample to 2886 students. The study also omitted an additional 300 subjects that were missing data for any of the variables used in the models for the final sample used in the study.

2.5 Estimation Strategy

This paper utilizes the commonly used survival model in the student retention literature, a Cox proportional hazard model, to provide estimates of the impact of WL participation on academic persistence (Allison, 1995). Survival models are statistical models for assessing the risk of an event occurring or observing the occurrence of an event over time (Willett & Singer, 1991a, 1991b). They provide an advantage over other probability-based models, such as logit and probit models, in that survival models can estimate how early experiences influence later decisions or choices made by the subjects and account for how that may affect a nonconstant level of risk over time. Dropping out is conceptualized as a consistent pattern of behavior that ultimately affects a student's performance for an academic term, so students may miss a couple of weeks of school and still not fail their classes, while missing at least a month would be a difficult academic obstacle to overcome. Furthermore, the decision to drop out is not a unique event, such as being accepted or enrolling in college, but rather a series of continuous decisions that likely cannot be observed as a meaningful outcome in periods less than a month. For this reason, the use of a continuous-month approach to a continuous time model is deemed appropriate for analyzing an event that consists of a continual pattern of behavior and choice-making, where the decision-making process and defining a student's decision likely extend over a significant time, which I deem to be at least a month, to be consequential on my outcome of interest, the academic persistence of a student. In addition, the Cox proportional hazards model can incorporate how the estimates of predictors may vary over time and the lengths of time that subjects are exposed to risk in multiple records, which is impossible in singular record logit and probit models. Kim et al. (2018) argue that discrete survival analysis should be used for estimating time-to-event analysis for educational outcomes over Cox proportional hazard models. However, Ter Hofstede and Wedel (1999) found that aggregating smaller periods, such as a day, into larger periods, such as a month, tended to result in discrete models overestimating the hazard estimates while continuous models underestimated the hazard estimates.

A discrete-time hazard model was attempted and provided similar results to the continuous-time Cox proportional hazard model for most covariates, except that the estimates for several primary variables of interest, such as WL and English enrollment ratios, were overestimated. Some of the hazard ratio estimates provided by the discrete-time hazard model were found to be too extreme to justify the analysis and interpretation of those estimates seriously as reasonably being within realistic bounds. The study observes reduced form estimates instead of treatment effects on the association between student investment in WL schooling and academic persistence since student interest and ability to acquire relevant information on college admission is an unobserved latent trait. Given that my preference is to take a conservative approach to my estimation strategy, preferring to underestimate rather than overestimate hazard estimates in my models, as well as conceptualizing the choice to drop out of high school as a month-long continuous decision-making process where smaller units of time measurement are not meaningful in a student's decision to drop out; a continuous-month approach to a continuous time-to-event model is considered as reasonable estimation strategy.

2.6 Model

The Cox proportional hazards model treats time as continuous, or in continuous month analysis for this paper, allowing for the instantaneous risk or likelihood that an event will happen at time t if the event has not already occurred before time t. The risk or hazard that this paper estimates is the risk of a student dropping out prematurely from high school. Thus, the survival function represents the estimated probability that the student will not drop out of high school early, implying high school completion.

The primary models of interest for the paper are non-proportional hazard models with time-varying covariates with the baseline hazard function for an individual $h_{0n}(t)$, where x represents cognitive variables, y represents personal variables, z represents environmental variables, and α, β, and γ being the respective hazard ratio estimates for the variables. The environmental variables are time-varying covariates where $z_{rn}(t)$ should be treated as $z_{rn}(t) = z_{rn}g(t)$ since $z_{1i}, \ldots, z_{rn}$ are baseline covariates which vary continuously with time by interacting with a function of the current time $g(t)z_{rn}$ to produce an estimation of a hazard ratio γ_r.

$$h_n(t) = h_{0n}(t)\exp\{\alpha_1 x_{1n} + ... + \alpha_p x_{pn} + \beta_1 y_{1n} + ... + \beta_q y_{qn} + g_n(t)(\gamma_1 z_{1n} + ... + \gamma_r z_{rn})\} \tag{1}$$

Equation 1 is the product of an unspecified non-negative baseline hazard function $h_{0n}(t)$ and an exponentiated linear function comprised of both fixed and time-varying covariates to predict the hazard of a student n permanently exiting from high school at time t, assuming that before t the student has not already exited from schooling. Equation 1 is used as the general model for Models 8-10; however, the rest of the models presented in the paper stratify the baseline hazard function by language population m. The hazard at time t for a student n in language population m, in the stratified estimator, is given as

$$h_{nm}(t) = h_{0nm}(t)\exp\{\alpha_1 x_{1n} + ... + \alpha_p x_{pn} + \beta_1 y_{1n} + ... + \beta_q y_{qn} + g_n(t)(\gamma_1 z_{1n} + ... + \gamma_r z_{rn})\}. \tag{2}$$

In Equation 2, unlike Equation 1, the baseline hazard is specific to each language group. From this, Equation 2 can be re-expressed, given an indicator i for the status of an event happening for the n^{th} individual at the observed time t_i, from risk set $R(t_i)$, where the subject is censored if $i = 0$ or an event occurred and $i = 1$. The baseline hazard function for language population m at time t is $h_{0m}(t) = e^{a(t)}$, where the vector of x, y, and z covariates for n individuals is represented by X, Y, and Z respectively, and the risk associated with the covariate values are

$$\exp\left(\sum_{f=1}^{p} \alpha_f X_f + \sum_{k=1}^{q} \beta_k Y_k + g(t)\sum_{l=1}^{r} \gamma_l Z_l\right) \tag{3}$$

with the hazard function

$$h_m\left(\frac{t}{X, Y, Z}\right) = h_{0m}(t)\exp\left(\sum_{f=1}^{p} \alpha_f X_f + \sum_{k=1}^{q} \beta_k Y_k + g(t)\sum_{l=1}^{r} \gamma_l Z_l\right). \tag{4}$$

Regardless of the language population grouping, the assumption is that the hazard ratios are the same since the Cox proportional hazards model estimates the partial likelihood rather than the maximum likelihood, presented in Equation 5, where the set of all-time occurrences D is indexed by n in risk set $R(t_i)$ as the set of all subjects likely to experience an event just before t,

$$L(\alpha, \beta, \gamma) = \prod_{i \in D}^{n} \frac{\exp\left(\sum_{f=1}^{p} \alpha_f X_f + \sum_{k=1}^{q} \beta_k Y_k + g(t) \sum_{l=1}^{r} \gamma_l Z_l\right)}{\sum_{N \in R(t_i)} \exp\left(\sum_{f=1}^{p} \alpha_f X_f + \sum_{k=1}^{q} \beta_k Y_k + g(t) \sum_{l=1}^{r} \gamma_l Z_l\right)}. \tag{5}$$

The hazard ratio (HR) in a proportional hazard model has a constant ratio of hazard rates for two individuals, for example, with covariate values X^*, Y^*, Z^* and X, Y, Z respectively – where $X^* = X_1^*, X_2^*, X_3^*, \ldots, X_p^*$ and $X = X_1, X_2, X_3, \ldots, X_p$, and Y^*, Y, Z^*, Z are defined similarly – is defined as (Ali & Hussein, 2023):

$$\widehat{HR} = \frac{h(t, X^*, Y^*, Z^*)}{h(t, X, Y, Z)} \tag{6}$$

$$= \frac{\widehat{h}(t)\exp\left(\sum_{f=1}^{p} \alpha_f X_f^* + \sum_{k=1}^{q} \beta_k Y_k^* + g(t) \sum_{l=1}^{r} \gamma_l Z_l^*\right)}{\widehat{h}(t)\exp\left(\sum_{f=1}^{p} \alpha_f X_f + \sum_{k=1}^{q} \beta_k Y_k + g(t) \sum_{l=1}^{r} \gamma_l Z_l\right)} \tag{7}$$

$$= e^{\left(\sum_{f=1}^{p} \widehat{\alpha_f}(X^* - X) + \sum_{k=1}^{q} \widehat{\beta_k}(Y^* - Y) + g(t) \sum_{l=1}^{r} \widehat{\gamma_l}(Z^* - Z)\right)}. \tag{8}$$

The observed risk period begins for students starting from the first month of attendance in the ninth grade and ends when a student experiences a failure event. Or the observation period could end with right censoring for students who completed high school or for those who are continuing their high school education in additional years past the traditional four-year curriculum and continuing to pursue a diploma past the 2003-2004 academic school year. The unit of analysis is the month for each student with risk periods that vary in length and methods for exiting the risk set. Robust standard errors that cluster standard errors for each student in the sample are used, and sampling weights are also incorporated into the estimation procedure.

The Efron method was used for breaking ties for failure events $i_n = 1$ at time t for n subjects in the risk pool; for example, when i_1 and i_2 fail, $i_1 = 1$ and $i_2 = 1$ at time t. Assuming two risk pools, the first risk pool is $i_1 + i_2 + i_3 + \ldots + i_n$, and the second risk pool can be either $i_2 + i_3 + \ldots + i_n$ or $i_1 + i_3 + \ldots + i_n$. Then, the Efron method assigns the probability of i_1 and i_2 being in the second risk pool at 50%, so the second risk pool used is $0.5(i_1 + i_2) + i_3 + \ldots + i_n$.

2.7 Results

Descriptive Statistics

Table 1a displays the raw frequencies and percentages and the sample weighted percentages for the variables of interest. Cumulative sampling weights were used for the weighted percentage results, while panel sampling weights were used for the survival model estimations. Table 1b and Table 1c displays the frequencies, percentages (absolute and relative), Pearson's chi-squared estimate, and the likelihood chi-squared estimate of the variables of interest for whether a student is part of a language-minoritized population and whether students attempted a WL, respectively. The percentages of language-minoritized students across the nation from *The Condition of Education 2007* were 14% of students were EB students in 1995, and 5% were EL students that year, while in 2000, 18% of students were EB students and 6% were EL students (Planty et al., 2007). In my sample, the weighted percentage of EB students is 14.79, with the raw percentage being 17.44; the weighted percentage of EL students is 7.49, with a raw percentage of 8.62. The final sample reflects national trends in the demographics of language-minoritized students for the study's time frame.

Table 1a

Variable		Raw Frequency	Raw Percentage	Weighted Percentage
Sex				
	Male	1,279	49.5	50.34
	Female	1,307	50.5	49.66
Race				
	White	1,623	62.76	75.92
	Black	621	24.01	14.12
	Hispanic	258	9.98	5.69
	Other	84	3.25	4.27
Language Population				
	English Monolingual	1912	73.94	77.72
	Heritage Language Speaker	451	17.44	14.79
	English Learner	223	8.62	7.49
Region				
	Northeast	433	16.74	17.28
	Midwest	613	23.7	27.68
	South	970	37.51	34.1
	West	570	22.04	20.94

Table 1a - Descriptive Results

In Table 1b, the percentage of students in a language-minoritized population is presented by race, with 65.2% of Latinx students being in a language-minoritized population and, respectively, 23.6%, 17.5%, and 46.1% of Black, white, and students of other races being in a language-minoritized population. The western region of the U.S. has the greatest percentage of students in a language-minoritized population at 26.7%, with the Northeast at 24.1%, the South at 21%, and the Midwest at 19.3%.

Table 1b		Language-Minoritized Student						
Variable		Frequency 0	Frequency 1	% 0	% 1	Relative %	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals	1,912	674	73.94	26.06			
	Weighted %			77.72	22.28			
Sex							0.6	0.6
	Male	937	342	38.44	11.91	23.66		
	Female	975	332	39.29	10.37	20.88		
Race							223.84***	196.32***
	White	1,287	336	62.65	13.27	17.48		
	Black	483	138	10.79	3.33	23.58		
	Hispanic	97	161	1.99	3.71	65.2		
	Other	45	39	2.29	1.97	46.14		
Region							29.18***	28.83***
	Northeast	310	123	13.11	4.17	24.13		
	Midwest	487	126	22.33	5.35	19.33		
	South	736	234	26.93	7.17	21.03		
	West	379	191	15.35	5.59	26.7		

Table 1b - Descriptive Results for EB and EL Students

In Table 1c, the percentage of students who attempted a WL by race is 80% of white students, 73.9% of Black students, 79.4% of Latinx students, and 85.5% of students from another race. The percent of EB students who attempted a WL is 81%, with 80% English monolinguals attempting a WL, while 67% of ELs – regularly facing structural barriers to WL enrollment – attempt a WL. Table 1c shows that 73.93% of men and 85% of women in the sample attempted a WL, providing rates identical to the NCES report, The 1998 High School Transcript Study Tabulations, findings of 73.93% of men and 85% of women participated in WL education for all 1998 high school graduates in the nation (Roey et al., 2001). In addition, the NCES found the percentages of high school graduates in 1998 who participated in a WL by ethnicity as being 79.5% of white students, 71.8% of Black students, 83.2% of Latinx students, and 89% of Asian students (Roey et al., 2001). These findings are very close to the percentages in the study's sample, with the rates of white and black students being within the standard error of the percentages from the NCES report's sample. In my sample, 84.6% of students from the Northeast attempted a WL, with approximately 78% of students in the other three regions attempting a WL.

Table 1c		Attempted WL						
Variable		Frequency 0	Frequency 1	% 0	% 1	Relative%	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals	556	2,030	21.5	78.5			
	Weighted %			20.6	79.4			
Sex							38.74***	38.98***
	Male	340	939	13.12	37.22	73.94		
	Female	216	1091	7.48	42.18	84.94		
Race							19.12***	18.66***
	White	321	1,302	15.14	60.78	80.06		
	Black	171	450	3.67	10.44	73.94		
	Hispanic	52	206	1.17	4.52	79.44		
	Other	12	72	0.62	3.65	85.48		
Language Population							18.42***	16.8***
	English Monolingual	394	1,518	15.31	62.41	80.3		
	Emergent Bilingual	89	362	2.82	11.96	80.87		
	English Learner	73	150	2.46	5.03	67.16		
Region							13.84***	14.72***
	Northeast	65	368	2.66	14.62	84.61		
	Midwest	136	477	5.97	21.71	78.43		
	South	230	740	7.42	26.68	78.24		
	West	125	445	4.54	16.4	78.32		

Table 1c - Descriptive Results for Attempting a WL

The NCES found similar percentages of WL participation by region for 1998 high school graduates, with 84.6% of students in the Northeast participating in WL education, around 80% of students in the South and the West participating in a WL, and 74% WL participation in the Midwest (Roey et al., 2001). The chosen sample for this study also shows evidence of reflecting regional trends in WL participation. Interestingly, the Northeast had the greatest percentage of four-year colleges requiring WL study for admission at 26.3%, with the West at 25%, the South at 23.5%, and the Midwest at 10.1%, according to the *MLA Survey of Postsecondary Entrance and Degree Requirements for Languages Other Than English, 1994-1995* (Brod & Huber, 1996, p.37). The higher percentage of four-year colleges requiring WL study for admission in the Northeast could potentially be a reason for the higher rates of students participating in WL education in the NCES 1998 graduate transcript estimate and the sample for this study in the Northeast.

The variables of interest are presented in the full Tables 2a, 2b, and 2c in Appendix A and include sex, race, living in an urban area, the highest degree attained by a parent, the language spoken by a student (Spanish, a European Language, or another language), and being a language minoritized and which language-minoritized population, English Learner (EL) or Heritage Language Speaker. Finally, the primary independent variables of interest, data on the number of WLs attempted, and progress in a WL are displayed. Table 2a displays the raw frequencies and percentages and the sample weighted percentages for the remaining variables of interest. Table 2b displays the frequencies, percentages (absolute and relative), Pearson's chi-squared estimate, and the likelihood chi-squared estimate for the variables of interest for whether a student dropped out before completing high school by round 8 of the NLYS 1997 data collection process. Table 2c presents the same statistics as Table 2b but with enrollment in a four-year university by round 9 as the column variable.

In Table 2a, the percentage of students who never attempted a WL is 20.6%, while 72.18% of students attempted 1 WL, and 7.22% attempted at least 2 WLs. These findings reflect the findings from the National Education Longitudinal Survey of 1988: Second Follow-up 1992 (NELS:88/92), which surveyed students from 1988 to 1993 and found 28.3% of students did not attempt a WL, 64.7% of students attempted 1 WL, while 7.3% of students attempted 2 WLs (Snyder et al., 2004). Furthermore, my sample found that for students who attempted a WL, the mean course load was around 2.24 years of WL study with a standard deviation of 1.08; similarly, the NELS:88 sample found a mean of 2.22 years of courses in a WL with a standard deviation of 1.24 (Snyder et al., 2004). The findings show that the sample is consistent with the data from other samples generated from different surveys lightly before my study. It also makes sense that the sample for this study would show greater participation in WL courses because findings from *The Condition of Education (2007)* show that WL enrollment has increased over time; in 2000, 52.8% of students enrolled in two or fewer years of a WL, 29.8% enrolled in three or more WL courses, with 16.5%, 7.8%, 5.4% enrolled in year 3, year 4, or an AP class in a WL respectively (Planty et al., 2007). In my sample, I found 52.3% participated in less than two years in a WL, 27.1% enrolled in three or more WL courses, with 16.4%, 7.5%, 3.2% enrolled in year 3, year 4, or an AP class in a WL respectively. The descriptive statistics show that the enrollment decisions for WL in the sample closely match the national trends in WL enrollment at the time and fit recent historical patterns of enrollment in WLs, indicating that the sample is representative of student WL enrollment decisions across the nation during the study's period of interest.

Table 2a

Variable		Raw Frequency	Raw Percentage	Weighted Percentage
Urban				
	Yes	1,938	74.94	72.62
	No	648	25.06	27.38
HDC Parent				
	High School Dropout	310	11.99	8.4
	High School Graduate	1,008	38.98	37.81
	AA Graduate	506	19.57	20.26
	College Graduate	468	18.1	19.9
	Graduate Degree	294	11.37	13.63
Spanish Speaker				
	Yes	319	12.34	8.17
	No	2267	87.66	91.83
European Language Speaker				
	Yes	119	4.6	4.82
	No	2467	95.4	95.18
Other Language Speaker				
	Yes	168	6.5	6.36
	No	2418	93.5	93.64
Language-Minoritized Population				
	Yes	674	26.06	22.28
	No	1912	73.94	77.72
World Language attempts				
	0	556	21.5	20.6
	1	1,847	71.42	72.18
	2 or more	183	7.08	7.22
Language Pipeline1				
	Never attempted language	556	21.5	20.6
	Attempted, no progress	140	5.41	4.57
	Completed less than 2 years	514	19.88	19.28
	Completed 2 years	736	28.46	28.49
	Completed 3 years	390	15.08	16.36
	Completed 4 years	164	6.34	7.52
	Completed AP/IB course	86	3.33	3.19

Table 2a - Descriptive Results Language Variables

Table 2b		Exited	HS					
Variable		Freq 0	Freq 1	% 0	% 1	Relative %	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals	2,495	91	96.48	3.52			
	Weighted %			96.56	3.44			
Sex							0.18	0.18
	Male	1,232	47	48.59	1.76	3.5		
	Female	1,263	44	47.98	1.68	3.4		
Race							4.4	4.18
	White	1,565	58	73.27	2.65	3.49		
	Black	605	16	13.78	0.34	2.41		
	Hispanic	244	14	5.4	0.3	5.27		
	Other	81	3	4.12	0.15	3.51		
Spanish Speaker							3.51	3.12
	Yes	302	17	7.81	0.35	4.28		
	No	2,193	74	88.75	3.09	3.36		
EU Speaker							0.37	0.4
	Yes	116	3	4.7	0.12	2.5		
	No	2,379	88	91.86	3.32	3.5		
Other Language Speaker							4.85**	3.97**
	Yes	157	11	5.98	0.37	5.82		
	No	2,338	80	90.58	3.07	3.28		
Language Population							1.19	1.14
	English Monolingual	1849	63	75.09	2.63	3.38		
	Emergent Bilingual	433	18	14.25	0.53	3.58		
	English Learner	213	10	7.21	0.28	3.74		
WL attempts							5.75	5.38
	0	528	28	19.56	1.04	5		
	1	1,792	55	70.61	1.57	2.9		
	2 or more	175	8	6.95	0.27	4.3		
Language Progress							35.43***	37.77***
	0 attempts	528	28	19.56	1.04	5		
	Attempted, no progress	129	11	4.29	0.28	8.75		
	<2 years	484	30	18.08	1.2	6.2		
	2 years	723	13	27.95	0.55	1.93		
	3 years	383	7	16.13	0.23	1.41		
	4 years	162	2	7.48	0.03	0.4		
	AP/IB course	86	0	3.19	0	0		

Table 2b - Descriptive Results for Exiting High School

In Table 2b, the columns present descriptive data on the frequencies and percentages using sampling weights for the dependent variable "Exited" for exiting schooling before completing high school, with 91 students exiting from high school enrollment before the end of twelfth grade and 2495 out of the 2586 students sampled staying enrolled for at least four years of high school. In Table 2c, the columns provide the data for whether students enrolled in a four-year university from round 1 through round 9, including students who may have previously enrolled in a community college and transferred to a four-year university by round 9. Table 2b shows that Pearson's chi-squared estimate and the likelihood chi-squared estimate for WL attempts and WL course progress and exiting high school before completing a student's final academic year necessary for attaining a diploma are statistically significant ($p < .05$). Approximately 5% of students who never attempted a WL exited early from high school. In comparison, only approximately 3% of students who attempted one WL and about 4% of students who completed two or more WLs exited early from high school. Table 2b shows that 8.75% of students who attempt a WL and fail exit early, and 6.2% who complete less than two years of a WL exit early. Interestingly, for two years of WL course completion – the most common requirement or recommendation for college admission to four-year state universities –the percentage of students that exit early after taking two years of a WL drops down to 1.9% while taking three years of a WL further drops the exit percentage to 1.4%. The rate of early exits from high school for students that take at least four years of courses in a WL, or the fourth year of the WL is an AP course, drops to 0.4% and 0%, respectively.

In Table 2c, these findings are mirrored in the relative percentages of students that enroll in a four-year university, which increase for the number of WLs attempted and progress made in completed years of study in a WL, where the Pearson's chi-squared estimate and the likelihood chi-squared estimate are statistically significant ($p < 0.001$). Only 11% of students who never attempted a WL enrolled in a four-year university, while 53.5% of students who attempted one WL and nearly 63% who attempted more than one WL had enrolled in a four-year university. Only 10.9% of students who had attempted but failed to progress in a WL enrolled in a four-year university, and 25% of students who completed less than two years of courses in a WL enrolled in a four-year university. However, approximately 57% of students who completed two years of classes in a WL enrolled in a four-year university, and about 74% of students who completed three years of courses in a WL had enrolled in a four-year university. Most students who either took a fourth year of a WL course or their fourth WL course was an AP course enrolled in a four-year university with rates of approximately 90% and 86%, respectively. College-bound students completed two or more years of study in a WL at a rate of 83% in the sample, reflecting historical national trends based on the unweighted average of 83% derived from the 87% of highly achieving college-bound graduates (minimum 3.5 GPA and 1250 SAT score) and 79% of the remaining graduates that completed two or more years of WL study from the NCES report on the course taking patterns of college-bound 1992 high school graduates (Owings, 1995, p. 2-7).

The descriptive statistics for the number of WLs attempted and the progress made in years of WL study support the argument that students who took at least the minimum recommended or required two years of enrollment in a WL were much less likely to drop out of high school than those that took less or no WL courses as well as attend four-year universities in significantly higher percentages than students who never attempted a WL course. In fact, over half of the students who take the often minimum course load of two years of study in a WL for admission to a four-year state university enrolled in a four-year post-secondary institution, almost three-fourths of students who take a recommended three years of study in a WL enrolled in a four-year university, and nearly 90% of students who complete a WL course for each year of high school ultimately enrolled in a four-year university.

Furthermore, students who completed the most commonly required or recommended minimum two-year course load in a WL for admission to four-year state universities drop out at 40% of the rate that students who never attempted a WL drop out. Students who failed in their attempt at a WL course took less than the college recommended or required two years of study in a WL and dropped out at even higher rates than those who never attempted a WL. Still, the dropout rate drastically reduced from 6.2% to 1.9% for finishing the second year of a WL instead of stopping at one year or less of study. This drastic drop in the dropout percentage between one and two WL courses and the drastic 25+% increase in college enrollment for students who took a second consecutive WL class is unlikely to be a coincidence. Instead, the raw data reflects that students who intend to pursue post-secondary opportunities after finishing high school are motivated to enroll in two or more consecutive WL courses to improve their college admission chances.

Table 2c		Enrolled	in 4yr	College				
Variable		Freq 0	Freq 1	% 0	% 1	Relative%	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals	1,482	1,104	57.31	42.69			
	Weighted %			54.53	45.47			
Sex							23.55***	23.6***
	Male	794	485	30.05	20.29	40.3		
	Female	688	619	24.48	25.18	50.7		
Race							32.28***	32.78***
	White	869	754	39.68	36.24	47.7		
	Black	392	229	8.75	5.37	38		
	Hispanic	177	81	3.86	1.83	32.2		
	Other	44	40	2.23	2.04	47.8		
Spanish Speaker							5.38**	5.45***
	Yes	202	117	4.94	3.22	39.4		
	No	1,280	987	49.58	42.25	46		
EU Speaker							2.42	2.4
	Yes	60	59	2.35	2.47	51.24		
	No	1,422	1,045	52.17	43.01	45.12		
Other Lang. Speaker							0.58	0.58
	Yes	101	67	3.61	2.75	43.24		
	No	1,381	1,037	50.92	42.72	45.62		
Language Population							24.27***	25.24***
	English Monolingual	1,055	857	41.03	36.69	47.21		
	Emergent Bilingual	266	185	8.2	6.59	44.56		
	English Learner	161	62	5.3	2.19	29.24		
WL Attempts							307.41***	352.46***
	0	499	57	18.28	2.32	11.26		
	1	905	942	33.55	38.63	53.52		
	2 or more	78	105	2.7	4.52	62.6		
Language Progress							746.41***	820.45***
	0 attempts	499	57	18.28	2.32	11.26		
	Attempted, no progress	126	14	4.09	0.5	10.9		
	<2 years	385	129	14.44	4.81	25		
	2 years	329	407	12.28	16.15	56.8		
	3 years	108	282	4.4	12.14	74.4		
	4 years	18	146	0.77	6.72	89.62		
	AP/IB course	17	69	0.45	2.73	85.57		

Table 2c - Descriptive Results for Enrolled in College

Finally, only two students who completed four years of courses in a WL exited high school prematurely, which is possible since it is common for districts to allow students to start taking high school level WL courses beginning in the 8th and sometimes 7th grade. This pattern of continued enrollment and completion of WL courses with lower dropout rates and increased enrollment percentages in four-year universities is likely not a simple coincidence. Instead, it is significantly more likely that students who continue to enroll in a WL course year after year do so with the intent of gaining admission to a four-year post-secondary institution since approximately 90% of students who take a WL course for each of the four years of high school gain admission to a four-year university compared to the roughly 11% of students that enroll in a four-year university that never attempted a WL. From this perspective, completing high school is a primary pre-requisite for enrollment in a four-year post-secondary institution, which is likely being reflected in the 0.4% of students that take four years of a WL and the 1.9% of students that take two years of a WL prematurely exiting high school compared to the approximately 5% of students that never attempted a WL that drop out early. Continued enrollment in a WL likely reveals the latent preference of a student for attending a four-year university, which then motivates the students to academically persist until high school completion.

2.8 Survival Model Results

Does participation in World Language Programming indicate continued investment in education?

The models presented in Tables 3a, 3b, and 3c are stratified by language background—English monolingual, emergent bilingual (EB), or English Learner (EL), and the models all utilize robust standard errors clustered for each student. In Model 1 of Table 3a, the baseline model shows three statistically significant ($p < 0.05$) variables that decrease the risk of dropping out: first, there is a very slight decrease in the hazard ratio estimate for ability as measured by the ASVAB Math and Verbal score, an increased reduction in the risk of dropping out for students who had a parent graduate from high school rather than drop out, and a notable decrease by whether a parent graduated from college over dropping out from high school. The hazard ratio estimates for the indicator for having a parent with a college degree remain statistically significant ($p < 0.05$) predictors of a decrease in the hazard risk or increased academic persistence throughout all the models presented in Tables 3a, 3b, and 3c. The only statistically significant factor in Model 1 associated with an increased risk of dropping out is, surprisingly, family income when other factors such as parental education, living situation, and race are removed from the baseline hazard function. Family income remains a statistically significant indicator of a lower probability of survival when other factors are controlled for the models presented in Tables 3a, 3b, and 3c.

In Model 2, the second model in Table 3a, with no time-varying covariates, the number of WLs attempted by a student is added. I found that attempting one WL is associated with a statistically significantly lower risk of dropping out, indicating that participating in a WL is associated with increased academic persistence. The smoothed hazard risk of attempting a WL over time compared to not attempting any WLs is presented in Figure 2. In Model 3, language background variables of interest are added, specifically if the student is a member of a language-minoritized population and the student's language background (spoken at home). The indicator variables for speaking Spanish or a native language, not Spanish, English, or another European language at home, had a statistically significant increase in the hazard ratio associated with a greater risk of dropping out. However, Model 3 shows no statistically significant effect on the hazard function for students from a language-minoritized population and students who speak a European language at home. The statistically significant increase in the hazard risk remains for Spanish speakers and native speakers of a non-European language (including Spanish and English) for Model 4 in

Table 3a	Model 1		Model 2		Model 3		Model 4	
Variable	coefficient	HR	coefficient	HR	coefficient	HR	coefficient	HR
Spanish Speaker					0.847**	2.333**	0.915**	2.497**
					(0.425)	(0.991)	(0.445)	(1.11)
EU Speaker					0.368	1.445	0.345	1.412
					(0.601)	(0.868)	(0.676)	(0.955)
OL Speaker					1.034**	2.811**	1.339***	3.817***
					(0.453)	(1.275)	(0.478)	(1.824)
Family Income	0.152***	1.164***	0.150***	1.162***	0.149***	1.161***	0.147***	1.158***
	(0.0215)	(0.0251)	(0.0215)	(0.025)	(0.0215)	(0.025)	(0.0231)	(0.0267)
HS Grad	-0.708**	0.493**	-0.719**	0.487**	-0.593*	0.553*	-0.455	0.634
	(0.299)	(0.147)	(0.302)	(0.147)	(0.324)	(0.179)	(0.357)	(0.227)
AA Degree	-0.446	0.64	-0.416	0.66	-0.307	0.735	-0.133	0.875
	(0.314)	(0.201)	(0.318)	(0.21)	(0.334)	(0.245)	(0.362)	(0.317)
BA/BS Degree	-1.821***	0.162***	-1.775***	0.170***	-1.647***	0.193***	-1.403***	0.246***
	(0.516)	(0.0836)	(0.517)	(0.0877)	(0.519)	(0.1)	(0.535)	(0.131)
Graduate Degree	-0.509	0.601	-0.484	0.616	-0.349	0.705	-0.129	0.879
	(0.424)	(0.255)	(0.426)	(0.263)	(0.439)	(0.31)	(0.462)	(0.406)
ASVAB	-1.21e-05 ***	1.000***	-1.07e-05 ***	1.000***	-1.10e-05 ***	1.000***	-1.24e-05 ***	1.000***
	(3.99e-06)	(3.99e-06)	(4.07e-06)	(4.07e-06)	(4.12e-06	(4.12e-06)	(4.25e-06)	(4.25e-06)
1 WL Attempt			-0.506**	0.603**	-0.529**	0.589**	-0.316	0.729
			(0.23)	(0.138)	(0.232)	(0.136)	(0.253)	(0.185)
2+ WL Attempts			-0.0083	0.992	0.0176	1.018	0.222	1.249
			(0.43)	(0.427)	(0.431)	(0.439)	(0.442)	(0.553)
Black	-0.404	0.668	-0.413	0.662	-0.379	0.684	-0.655**	0.519**
	(0.282)	(0.188)	(0.284)	(0.188)	(0.288)	(0.197)	(0.323)	(0.168)
Latinx	-0.171	0.843	-0.126	0.882	-0.151	0.86	0.00405	1.004
	(0.31)	(0.261)	(0.316)	(0.278)	(0.324)	(0.279)	(0.336)	(0.337)
Other Race	-0.118	0.889	-0.0373	0.963	-0.124	0.883	-0.0363	0.964
	(0.628)	(0.558)	(0.632)	(0.609)	(0.658)	(0.581)	(0.689)	(0.664)
Ind.							-0.00749	0.993
							(0.035)	(0.0348)

Table 3a - Survival Models without Time-Varying Covariates

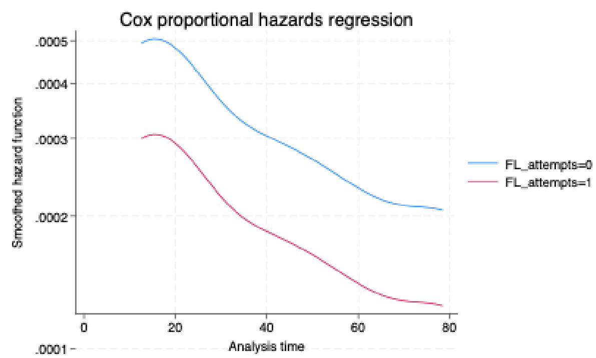

Figure 2: Smoothed Hazard Risk for Model 2

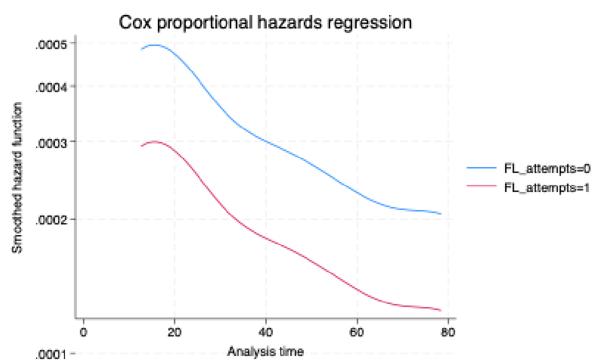

Figure 3: Smoothed Hazard Risk for Model 3

Table 3a. Introducing the language background variables in Model 3 resulted in the estimate for indicating a parent being a high school graduate rather than a high school dropout losing its statistical significance in decreasing the hazard risk displayed in Model 2.Introducing language background variables in Model 3 did not noticeably impact the effect of attempting progress in a WL on the hazard function compared to Model 2, as presented in Figure 2 for Model 2 and Figure 3 for Model 3. In addition, Models 2 and 3 were run as unstratified regressions with a language-minoritized student included as an indicator variable instead, which was not presented in Table 3 since the findings would be redundant with Model 2 and 3, and the indicator for being a language-minoritized student did not produce a statistically significant estimate.

However, two survival curves were generated to show the difference between English monolingual students and language-minoritized students who attempted a WL or not, with language background variables excluded in Figure 4 and included in Figure 5. When excluding language background variables, English

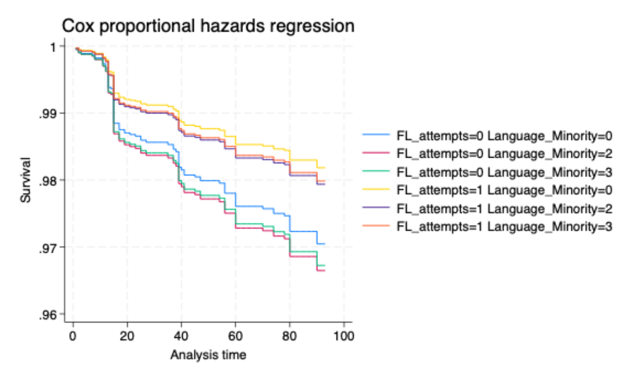

Figure 4: Survival Curves with Language Background Variables Excluded

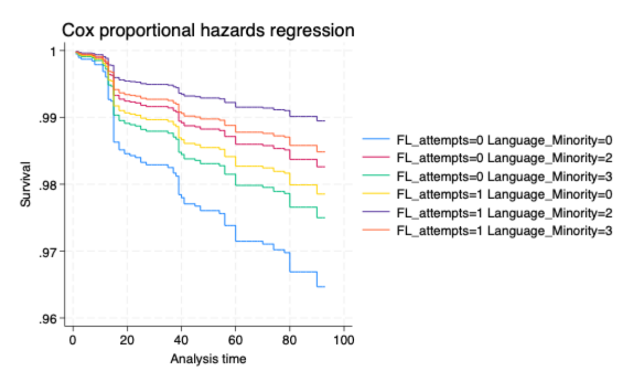

Figure 5: Survival Curves with Language Background Variables Included

monolinguals have a higher probability of survival, and attempting a WL results in a higher likelihood of survival. The difference in survival probabilities between English monolingual students and language-minoritized students who attempt a WL is noticeably smaller than between the two student populations who never attempted a course in a WL. The survival probabilities for language-minoritized students significantly increase after including language background variables in Figure 5. The survival probability of an EL student who does not attempt a WL course is close to that of an English monolingual who formally attempts to learn a WL. However, an English monolingual who formally attempts to learn a WL still has a lower probability of survival than an EB student who does not attempt a course in a WL. Figure 4 and Figure 5 provide evidence to support stratifying the models by the language-minoritized group, which should offer better baseline estimates and allow for more robust estimates for any additional effects of being a language-minoritized student.

Table 3b	Model 5				Model 6			
Variable	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
Spanish Speaker	0.626		1.87		0.643		1.903	
	(0.566)		(1.058)		(0.56)		(1.066)	
EU Speaker	0.716		2.047		0.715		2.045	
	(0.731)		(1.497)		(0.721)		(1.474)	
OL Speaker	1.635***		5.127***		1.659***		5.3***	
	(0.582)		(2.984)		(0.592)		(3.111)	
Fam. Income	0.152***		1.165***		0.157***		1.17***	
	(0.0251)		(0.0292)		(0.0258)		(0.03)	
BA/BS Deg.	-1.424**		0.241**		-1.253**		0.286**	
	(0.602)		(0.145)		(0.626)		(0.179)	
SPED	-1.368**		0.255**		-1.407**		0.245**	
	(0.604)		(0.154)		(0.603)		(0.148)	
ASVAB	-6.7e-06		1		-6.6e-06		1	
	(5.2e-06)		(5.2e-06)		(5.4e-06)		(5.4e-06)	
1 WL Att.	0.323		1.381		0.253		1.288	
	(0.314)		(0.433)		(0.325)		(0.418)	
2+ WL Att.	0.843*		2.324*		0.939*		2.557*	
	(0.488)		(1.134)		(0.491)		(1.255)	
Black	-0.913**		0.401**		-0.871**		0.419**	
	(0.383)		(0.154)		(0.379)		(0.159)	
Latinx	0.0629		1.065		0.144		1.155	
	(0.428)		(0.456)		(0.426)		(0.492)	
GPA		-0.009*		0.991*		-0.00578		0.994
		(0.005)		(0.005)		(0.0052)		(0.005)
10.grade		0.0034		1.003		0.00592		1.006
		(0.0156)		(0.0157)		(0.0157)		(0.0158)
11.grade		-0.00491		0.995		-0.00129		0.999
		(0.0151)		(0.015)		(0.0156)		(0.0155)
12.grade		-0.05***		0.955***		-0.044**		0.957**
		(0.0171)		(0.0164)		(0.0174)		(0.0166)
age		0.002***		1.002***		0.002***		1.001***
		(0.0003)		(0.0003)		(0.0003)		(0.0003)
1.WL ratio		-0.349**		0.705**		-0.349**		0.705**
		(0.152)		(0.108)		(0.168)		(0.118)
2.WL ratio		0.534***		1.706***		0.493***		1.638***
		(0.137)		(0.234)		(0.153)		(0.25)
1.STEM ratio						-0.0639		0.938
						(0.0626)		(0.0587)
2.STEM ratio						0.0692		1.072
						(0.0935)		(0.1)
1.SocSci ratio						-0.105*		0.900*
						(0.0584)		(0.0526)
2.SocSci ratio						0.097		1.102
						(0.0605)		(0.0667)
1.Art ratio						-0.124		0.884
						(0.0875)		(0.0773)
2.Art ratio						0.0668		1.069
						(0.105)		(0.112)
1.English ratio						-0.107		0.899
						(0.0676)		(0.0607)
2.English ratio						0.115		1.121
						(0.0828)		(0.0929)

Table 3b - Survival Model with Time-Varying Covariates

Model 4, the final model in Table 3a with no time-varying covariates, adds the psychological cognitive variable of interest, industriousness. As expected, I found no statistical significance associated with the estimates for industriousness. Based on the SCCT literature, industriousness is usually a mediating variable that does not directly affect outcomes but indirectly through self-efficacy beliefs and setting goals or goal formation. Model 4 shows that the indicator variable for attempting a WL lost statistical significance. From the perspective of the SSCT Framework, introducing Industriousness in the model likely removed the effect of goal formation or goal setting from attempting to learn a WL through schooling, causing the indicator variable to lose its statistical significance. Model 4 shows that after introducing the time-varying covariates, being Black presents a decrease in the hazard risk with a hazard ratio estimate of 0.52, which is nearly identical to the statistically significant ($p < 0.05$) estimate of 0.53 that Plank et al. (2005) found in their model for the effect of being Black on the hazard ratio. These findings for being Black on the hazard ratio estimates not only agree with Plank et al.'s (2005) findings but also the work done by Simmons et al. (2004), who hypothesized that after controlling for socioeconomic and family factors, minority students are more likely to stay in school because they lack attract alternative opportunities outside of schooling.

In Table 3b, Model 5 introduces time-varying covariates for grade level, GPA, first and second-order WL enrollment ratios, and age. The hazard ratio estimate for GPA is not statistically significant and remains statistically insignificant in all models incorporating GPA as a time-varying covariate. Both the first and second WL ratios are statistically significant, with the first-order estimate for WL enrollment showing an increase in the survival probability and the second-order estimate presenting a decrease in the survival probability. Interestingly, when using the birth variable, the indicator variable for birth month and year was never found to be statistically significant for any model as a time-invariant covariate. Interestingly, after introducing the time-varying covariates for WL enrollment ratios, the hazard ratio estimate for speaking Spanish at home loses its statistical significance as seen in Models 3 and 4; however, the estimate for speaking a native language at home that is not English, Spanish, or another European language continues to present a statistically significant increase the in risk of dropping out in Models 5-7b in Tables 3b and 3c, as well as Models 8-21 in Tables 4-6c. The statistical significance of the effect of being a non-European native language speaker on increasing the risk may be reflecting a lack of opportunity or ability of students who speak a language not traditionally from Europe to participate in WL courses in their native tongue, potentially mitigating any comparative advantage in WL courses these students could have had relative to their English monolingual peers. In contrast, Spanish is likely the most taught WL in the U.S., with 58.7% of Latinx students in our sample identifying as speaking Spanish at home, 65% of Latinx identifying as being language-minoritized, with 90% of EB, and 89% of EL Latinx students speaking Spanish at home. Thus, Spanish is likely to be a far more accessible WL for Latinx students, who largely already speak Spanish at home, to invest in compared to their peers who speak a non-European native language at home.

However, in Model 5, age is a statistically significant strong indicator of an increased risk of dropping out as a time-varying covariate. This result supports the theory that students' opportunities outside of schooling are limited due to the age restriction of being at least sixteen to legally exit schooling or join the workforce. Thus, older students are more likely to exit schooling than their younger peers. After controlling age as a time-varying covariate, the statistically significant decrease in the risk of dropping out for being in the twelfth grade over being in the ninth grade could be interpreted under the SCCT Framework as representing a motivating factor to continue with schooling rather than dropping out since the student has persisted into the 12th grade as a performance outcome, they have a greater interest in finishing their high school education because they are near completion. These findings suggest that making it to the twelfth grade increases a student's academic persistence since the student is in the last year of high school and is close to exiting secondary schooling. In addition, introducing the time-varying covariates to the model allows the indicator variable for being in a special education program to show statistically significant effects of decreasing the risk of dropping out. This estimate may be a result of the lack of opportunities students in special education may face outside of schooling in the labor market, or possibly it could also reflect a lower set of standards or alternative requirements for students in such programs for receiving a high school diploma or a program equivalent certificate of completion for high school.

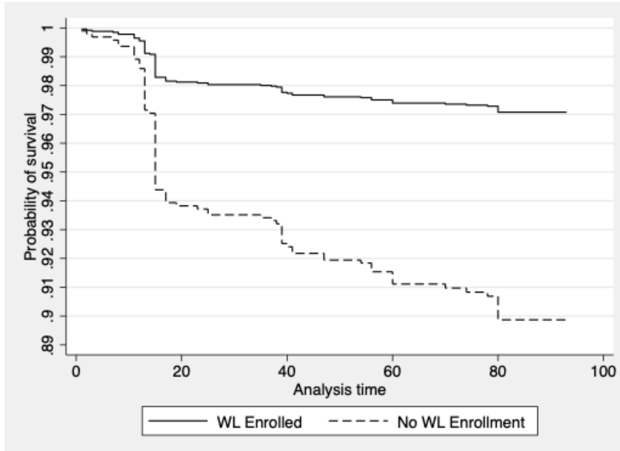

Figure 6: Time-Varying Survival Curves for WL Enrollment

Model 6 introduces first and second-order terms for the enrollment ratios for English, STEM, social sciences, and art courses. Model 6 shows that the estimates and statistical significance thresholds $p < 0.05$ for the first-order term and $p < 0.01$ for the second-order term) for WL enrollment ratios remain unchanged when including first and second-order terms for STEM, social science, and art enrollment ratios. As predicted, both the estimates of the first and second-order term for the English enrollment ratios, as well as the estimates for enrollment ratios in the other core academic subjects – STEM, social sciences, and the arts – that may be required for high school graduation and college admission included in the model as time-varying covariates are not statistically significant.

In Figure 6, Ruhe's (2016) scurve_tvc program for estimating survival curves for time-varying covariates for unstratified total population estimation of the survival curve for the first-order WL enrollment ratio time-varying covariate. By removing the effects of the other time-varying covariates other than the first-order WL enrollment ratio and holding the WL enrollment ratio to the mean for students that were enrolled in a WL course, which is approximately 0.153, representing enrollment in 1 period of a WL course out of a total 6 or 7 periods in an academic term interacting with time, over time, compared to students that took no WL courses, interacting with time over time. As time increases, the survival probability for enrolling in the mean ratio for WL courses reduces from nearly 100% to a 97% probability of survival over time for all students.

In Figure 7, Ruhe's (2016) scurve_tvc program for estimating survival curves for the first-order WL enrollment ratio time-varying covariate while removing the effects on the survival function from the other time-varying covariates is used again to split the time-varying effects of the WL enrollment ratio between English monolinguals and language-minoritized students for students that are enrolled in a WL course. Figures 7-9 contain the survival curves for English monolinguals, while Figures 10-12 represent language-minoritized students. Figures 7 and 10 hold the WL enrollment ratio at the mean (0.153) compared to students with a 0% enrollment in a WL. Figures 8 and 11 hold the WL enrollment ratio at one standard deviation above the mean, approximately 0.2 or one period of a WL course out of five, compared to students with a 0% WL enrollment. In Figures 9 and 12, the WL enrollment ratio is held at two standard deviations above the mean, which is 0.24 or one period of a WL course taken for every four periods, compared to students with a WL enrollment percentage of 0. The baseline survival function for language-minoritized students is lower than for English monolinguals, going from close to 100% to approximately 89.5% probability of survival, compared to going from nearly 100% to a 90% probability of survival, respectively, for students held at a 0% WL course enrollment percentage. However, for a WL enrollment ratio held at the mean, the probability of survival for English monolinguals ends barely above 97%, while language-minoritized students end with a 97% probability of survival. This pattern holds with English monolinguals, ending with a 98% probability of survival for one standard deviation above the mean and nearly 99% when held at two standard deviations above the mean.

In contrast, the probability of survival for language-minoritized students is nearly indistinguishable from the respective first and second standard deviation estimates for English monolinguals. Figures 7-12 show that although the initial baseline probabilities of survival for language-minoritized students is lower than for English monolinguals when neither enroll in WL courses, enrolling in WL courses seems to nearly erase the deficit in the survival probability between the two student populations. This indicates that language-minoritized students have a relative advantage over English monolinguals for increasing academic persistence through WL enrollment because the probability of survival increases more for language-minoritized students for higher ratios of WL enrollment than their English monolingual peers who have a higher initial baseline for no WL courses taken.

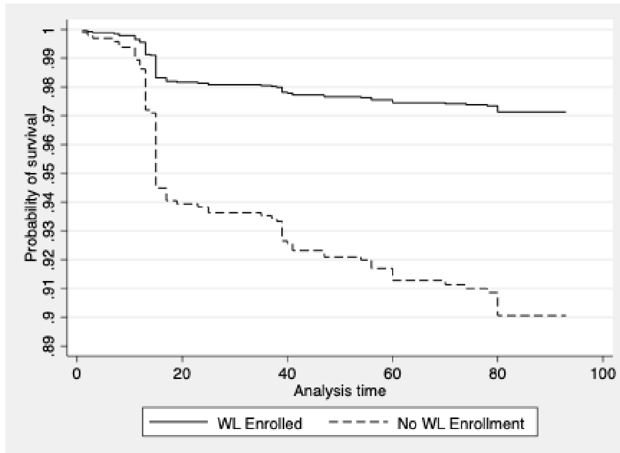

Figure 7: Mean English Monolingual TVC Survival Curves

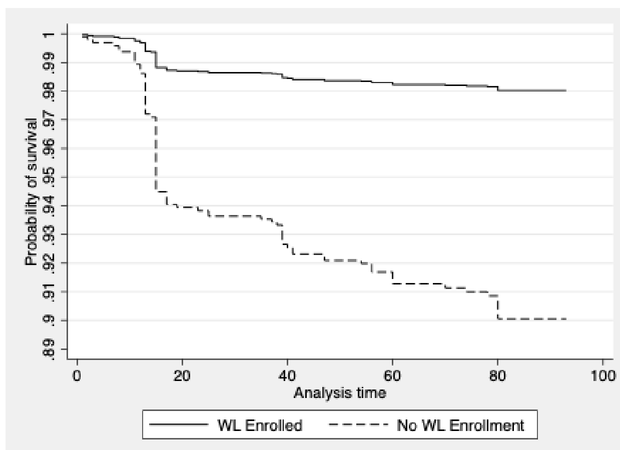

Figure 8: +1 Standard Deviation English Monolingual TVC Survival Curves

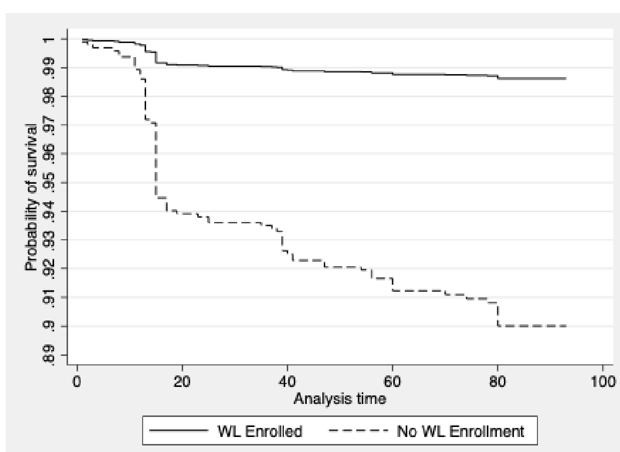

Figure 9: +2 Standard Deviation English Monolingual TVC Survival Curves

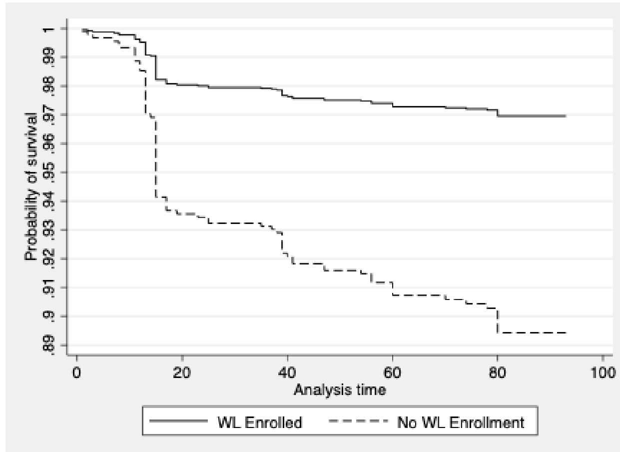

Figure 10: Mean Language-Minoritized Student TVC Survival Curves

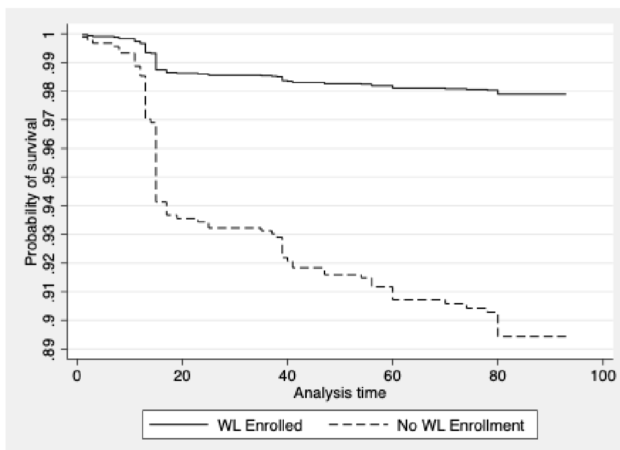

Figure 11: +1 Standard Deviation Language-Minoritized Student TVC Survival Curves

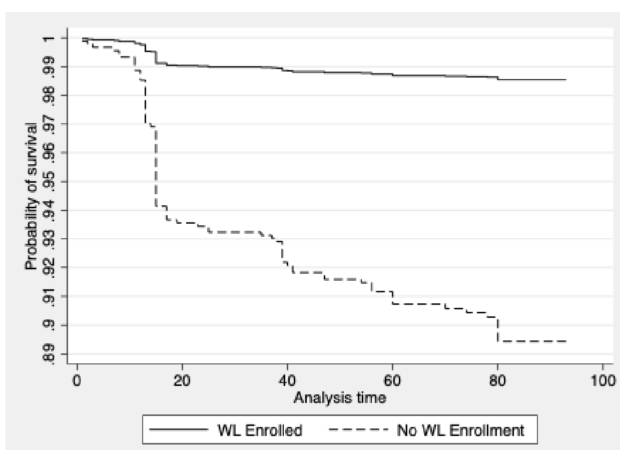

Figure 12: +2 Standard Deviation Language-Minoritized Student TVC Survival Curves

In Table 3c, Model 7a adds the interaction effect between being either an EB or EL student, with English monolingual students as the reference category and the first-order term for WL enrollment. I find that the first-order term for the WL enrollment ratio slightly increases the hazard ratio for English monolinguals as the excluded reference category but loses any statistical significance after the interaction term is introduced, and the interaction between being an EL student and enrollment ratio in WL also provides estimates that lack statistical significance. In contrast, attempting more than one WL as a time-invariant covariate becomes a statistically significant predictor of an increased risk in the hazard of dropping out when removing the interaction between the language-minoritized population and the WL enrollment ratio from the baseline hazard function. Attempting more than one WL is a statistically significant predictor of an increased risk of dropping out for all models, including the presented interaction between the language-minoritized population and the WL enrollment ratio.

The interaction between being an EB student and the first-order WL enrollment ratio is found to be statistically significant, with a hazard ratio estimate signifying an even lower risk of dropping out compared to the non-interacted term in the current and previous models, suggesting that EB students exhibit greater levels of academic persistence compared to their English monolingual and English learning peers when participating in a WL. Thus, EB students with access to WL courses may reflect more remarkable levels of academic persistence. Since I classify students with a home language that is not English but whose primary language is English as EB students, they would be much more confident in taking a course in their home language without facing an English barrier, which fuels their persistence to continue schooling. This discrepancy between the estimates and the statistical significance of the estimates between EB students and their English-dominant speaking and English-limited speaking peers may potentially indicate a comparative advantage in WL programming for students who are bilingual in English and a native language than their peers who are either less proficient in a WL or in English.

Model 7b adds the dummy for students tagged in the high school transcript data for participating in ESL courses as a time-invariant variable and its interaction with the second-order term for the English enrollment ratio, which represents increasing the percentage of English courses in student schedules, as a

Table 3c	Model	7a			Model	7b		
Variable	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
Spanish Speaker	0.695		2.004		0.708		2.03	
	(0.577)		(1.156)		(0.57)		(1.166)	
EU Speaker	0.77		2.159		0.884		2.421	
	(0.719)		(1.552)		(0.74)		(1.798)	
OL Speaker	1.691***		5.43***		1.84***		6.31***	
	(0.606)		(3.287)		(0.65)		(4.073)	
SPED	-1.443**		0.236**		-1.40**		0.246**	
	(0.6)		(0.142)		(0.596)		(0.147)	
1 WL Attempt	0.269		1.308		0.296		1.345	
	(0.323)		(0.423)		(0.326)		(0.439)	
2+ WL Attempt	0.967**		2.631**		0.999**		2.715**	
	(0.492)		(1.294)		(0.494)		(1.341)	
Black	-0.883**		0.413**		-0.87**		0.417**	
	(0.385)		(0.159)		(0.387)		(0.162)	
ESL					0.212		1.236	
					(1.192)		(1.474)	
12.grade		-0.045**		0.957**		-0.047***		0.95***
		(0.0175)		(0.0168)		(0.0177)		(0.0169)
age		0.002***		1.001***		0.002***		1.002***
		(0.0003)		(0.00034)		(0.00036)		(0.0004)
1.WL ratio		-0.277		0.758		-0.277		0.758
		(0.192)		(0.146)		(0.194)		(0.147)
EBxWL ratio		-0.911**		0.402**		-0.914**		0.401**
		(0.386)		(0.155)		(0.392)		(0.157)
ELxWL ratio		-0.127		0.88		-0.12		0.887
		(0.139)		(0.123)		(0.135)		(0.12)
2.WL ratio		0.416**		1.515**		0.413**		1.511**
		(0.163)		(0.247)		(0.164)		(0.248)
1.STEM ratio		-0.0611		0.941		-0.0642		0.938
		(0.0626)		(0.0589)		(0.062)		(0.0582)
2.STEM ratio		0.0646		1.067		0.0619		1.064
		(0.0936)		(0.0998)		(0.0971)		(0.103)
1.SocSci ratio		-0.109*		0.896*		-0.111*		0.895*
		(0.0573)		(0.0513)		(0.0587)		(0.0525)
2.SocSci ratio		0.100*		1.105*		0.0984		1.103
		(0.0595)		(0.0658)		(0.0601)		(0.0663)
1.Art ratio		-0.127		0.881		-0.119		0.888
		(0.0886)		(0.0781)		(0.0887)		(0.0787)
2.Art ratio		0.0702		1.073		0.0579		1.06
		(0.107)		(0.114)		(0.108)		(0.114)
1.English ratio		-0.106		0.9		-0.116*		0.890*
		(0.0668)		(0.0601)		(0.0665)		(0.0592)
2.English ratio		0.115		1.122		0.123		1.131
		(0.0821)		(0.092)		(0.083)		(0.0938)
ESLx2.English ratio						0.534**		1.707**
						(0.23)		-0.392
(RBSE)								
*** p<0.01,	** p<0.05,	* p<0.1						

Table 3c - Survival Models with Interactions time-varying covariate. The interaction between participating in ESL and the second-order English enrollment ratio is found to be statistically significant, with a hazard ratio estimate signifying an even greater risk of dropping out compared to the non-interacted term in the current and previous models, suggesting that language-minoritized students exhibit decreased levels of academic persistence compared to their English monolingual peers when assigned to additional ESL courses. The discrepancy between the estimates and the statistical significance of the estimates between language-minoritized students who take additional English courses designated as ESL, a non-college preparatory course, and their English-monolingual peers with an increased percentage of English classes indicate a disadvantage that language-minoritized students face compared to their peers in meeting college admission requirements. Since mandated ESL courses are a barrier to college preparatory courses, the observed decreased academic persistence among students assigned to ESL services is expected.

Is there a bilingual advantage in WL course enrollment on a student's academic persistence?

Table 4, in Appendix A, presents a second set of survival models, Models 8-10. These models are not stratified by language-minoritized population and instead include indicator variables for being an EB student or EL student as time-invariant covariates with English monolinguals as the excluded reference category. The objective is to observe the potentially differing effects of being an EB student versus an EL student on the hazard model and as an interaction effect with WL enrollment ratios when the model has a common baseline hazard function. Model 8 in Table 4 is essentially an unstratified version of Model 6 from Table 3b that includes an indicator variable for being an EB or EL student, with English monolingual being the reference group. Model 8 finds that the hazard ratio estimates for being an EB or EL student are not statistically significant, and the remaining variable estimates and statistical significances are very similar to those presented in Model 6 in Table 3b. Model 9 is an unstratified version of Model 7b from Table 3c, with the language-minoritized population indicator variable as a time-invariant covariate and as an interaction term with the first-order term for the WL enrollment ratio as a time-varying covariate and like Model 8, finds no statistically significant effects of the estimates for the language-minoritized indicator variable. Unlike Model 7b from Table 3c, Model 9 from Table 4 provides hazard ratio estimates for the interaction terms between being an EB or EL student, with English monolinguals as the excluded reference group, and the first-order WL enrollment ratio term as statistically significant for both language-minoritized populations. Model 9 reflects the findings of Model 7b, showing that EB students with both English proficiency and a native language-speaking background from home benefit from a comparative advantage in WL course enrollment compared to English monolinguals, and based on the magnitude of the hazard estimates, EL students as well. Unlike Model 7b in Table 3c, EL students also show a statistically significant decrease in hazard risk in the estimate for the interaction term with the first-order WL enrollment ratio in Model 9. However, the hazard ratio is slightly higher than the hazard ratio for the first-order term for the WL enrollment ratio for English monolinguals as the excluded reference group. Interpreting the unstratified hazard baseline of Model 9 suggests EL students may benefit similarly to English monolinguals in taking WL courses.

Model 10 adds an interaction term between the first-order term for the English enrollment ratio and whether the student is an EB or EL student compared to an English monolingual student as a time-varying covariate and the variables present in Model 9. There are no notable changes in the hazard ratios and statistical significance of the estimates for EL and English monolingual students; however, there is a very strong statistically significant estimate signifying an increase in the hazard risk for the interaction of being an EB student and the English enrollment ratio as a first order term, indicating that even though a bilingual advantage may exist in improving academic persistence through engagement in WL courses for EB students, increasing enrollment in English can serve as a barrier and decrease the academic persistence of an EB student relative to their peers. Unlike Model 9, by including the interaction term for language-minoritized population and the English enrollment ratio, the time-invariant indicator for being an EB student provides a statistically significant strong effect in reducing the hazard risk, which may indicate that English enrollment can serve as a barrier rather than as a support to EB students in terms of meeting educational goals. Surprisingly, the changes to the hazard ratio estimates for the variables in Model 9 included in Model 10 when adding the time-varying interaction of language-minoritized population and the first-order term for the English enrollment ratio are that the estimate for the EB indicator variable shows a statistically significant decrease in the hazard ratio.

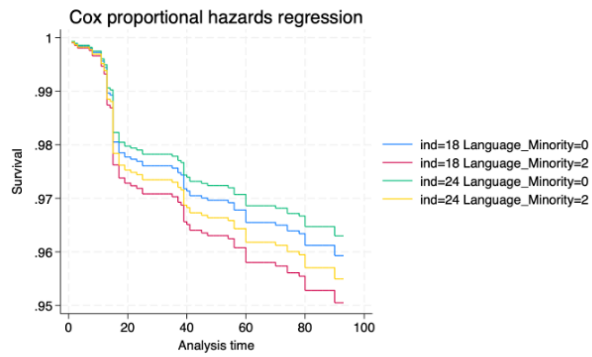

Figure 13: Industriousness Mean Vs. 2 Standard Deviations Below Mean For an EB Student compared to an English Monolingual Student

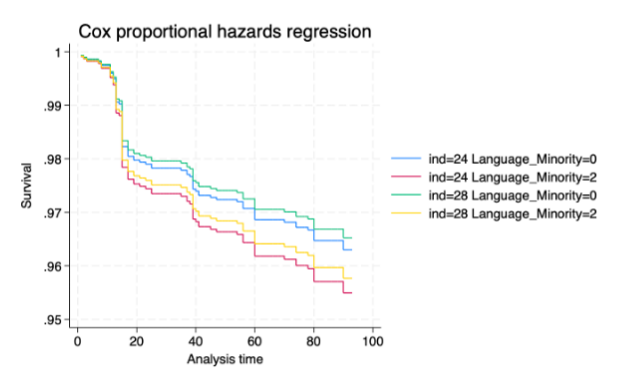

Figure 14: Industriousness Mean Vs. Maximum Below Mean For an EB Student compared to an English Monolingual Student

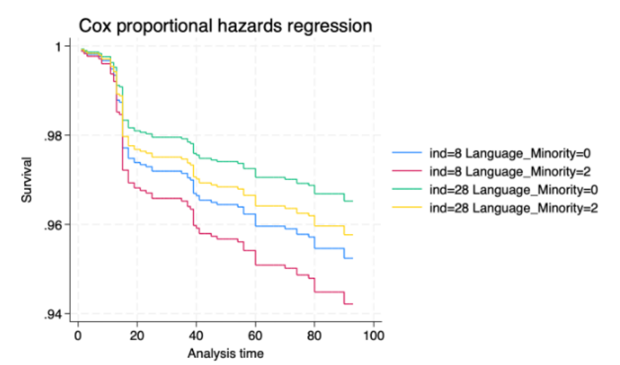

Figure 15: Industriousness Minimum Vs. Maximum Below Mean For an EB Student compared to an English Monolingual Student

Figures 13-15 present the survival curves for an EB student with a specified level of industriousness compared to an English monolingual with the same level of industriousness from a time-invariant model with only language-minoritized population and industriousness as the covariates. Figure 13 shows the survival curves for EB and English monolingual students with a level of industriousness that is approximately two standards below the mean compared to the mean level. In contrast, Figure 14 compares the mean level of industriousness to the maximum level presented in the data. Both figures show that EB students have a lower baseline survival probability than English monolinguals. Still, increased industriousness increases the survival probability for EB students more than it does for English monolinguals. This observation is especially apparent in Figure 15, which compares the maximum and minimum levels of industriousness presented in the data for EB and English monolingual students. Figure 15 shows that EB students with the highest level of industriousness have a greater probability of survival than English monolinguals with the lowest level of industriousness.

Model 14 of Table 5b introduces the interaction between the language-minoritized population and the second-order term for the WL enrollment ratio to the model and finds that the interaction effects between the language-minoritized population and the first-order term for the WL enrollment ratio lose statistical significance for the EB and EL populations and attempting more than one WL is once again not statistically significant as well. The second-order term for the WL enrollment ratio is still a statistically significant indicator of increased hazard risk. However, the interaction between being an EB student and increasing enrollment in WL courses within a year is such a strong statistically significant estimate for decreasing the risk of dropping out that for EB students, increasing WL course enrollment within a year leads to much greater academic persistence, easily overcoming the higher risk of dropping out associated with being an EB student and increasing the WL enrollment ratio on academic persistence. This result makes a strong case that EB students have a bilingual advantage in increasing their WL courses compared to English monolinguals and EL students. This comparative advantage EB students have as being proficient in two languages increases their academic persistence to graduate high school and reveals that they view a track of courses in a WL as a viable pathway to admission to a four-year university by helping improve their native language proficiency (or potentially proficiency in a third language) while also meeting college admission requirements or recommendations. Model 15 introduces the interaction between the first-order term for English enrollment and the language-minoritized population as a time-varying covariate and produces similar interaction effects to Model 10 for EB and EL students; however, unlike Model 10, the first-order term for the English enrollment ratio produced a statistically significant decrease

Table 5b	Model 14				Model 15			
Variable	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
ESL	0.158		1.172		0.436		1.547	
	(1.21)		(1.418)		(1.305)		(2.018)	
Ind.	0.0421		1.043		0.042		1.043	
	(0.0522)		(0.0544)		(0.0526)		(0.0548)	
EBxInd.	-0.181**		0.834**		-0.184**		0.832**	
	(0.0864)		(0.0721)		(0.0867)		(0.0721)	
ELxInd.	-0.0808		0.922		-0.0599		0.942	
	(0.0909)		(0.0838)		(0.0869)		(0.0818)	
1.WL ratio		-0.3		0.741		-0.294		0.745
		(0.206)		(0.152)		(0.205)		(0.153)
EBx1.WL ratio		0.373		1.453		-0.91***		0.404***
		(0.39)		(0.566)		(0.33)		(0.133)
ELx1.WL ratio		0.117		1.124		-0.0828		0.921
		(0.55)		(0.618)		(0.194)		(0.179)
2.WL ratio		0.476**		1.609**		0.454**		1.575**
		(0.189)		(0.303)		(0.185)		(0.292)
EBx2.WL ratio		-8.972**		0.00013**				
		(3.49)		(0.00044)				
ELx2.WL ratio		-1.087		0.337				
		(2.773)		(0.935)				
1.English ratio		-0.105		0.9		-0.134*		0.874*
		(0.0677)		(0.0609)		(0.0726)		(0.0634)
EBx1.English ratio						0.149***		1.160***
						(0.0559)		(0.0649)
ELx1.English ratio						-0.402*		0.669*
						(0.231)		(0.155)
2.English ratio		0.11		1.116		0.14		1.15
		(0.0845)		(0.0944)		(0.0892)		(0.103)
ESLx 2.English ratio		0.517**		1.676**		0.407		1.502
		(0.239)		(0.401)		(0.335)		(0.503)
10.grade		0.00699		1.007		0.00418		1.004
		(0.0159)		(0.0161)		(0.0169)		(0.017)
11.grade		-0.0033		0.997		-0.00235		0.998
		(0.0161)		(0.016)		(0.0172)		(0.0172)
12.grade		-0.05***		0.952***		-0.05***		0.952***
		(0.0185)		(0.0176)		(0.0191)		(0.0182)
age		0.002***		1.002***		0.002***		1.002***
		(0.00036)		(0.00036)		(0.0004)		(0.00043)
(RBSE)								

*** p<0.01, ** p<0.05, * p<0.1

Table 5b - Survival Model with Industriousness in the hazard risk, which only has an effect of increasing the academic persistence of English monolinguals likely have a comparative advantage in English courses. EL students were not shown to benefit from consistent enrollment in an English course in Model 15, and the baseline effect and interaction effect of English enrollment were neutralized for EB students, likely signifying no additional benefit on academic persistence for either language-minoritized population from English enrollment. The results from Model 15 indicate that consistent enrollment in English likely only serves as an indicator for increased academic persistence for English monolingual students at best and either is neutral for language-minoritized populations or may serve as a barrier to access prerequisite courses needed to meet educational goals.

In Table 6a, Models 16 and 17 do not include the time-invariant dummy for participation in an ESL course and the time-varying covariate for the interaction between ESL participation and the second-order term for the English enrollment ratio. In contrast, Models 18 and 19 in Table 6b, respectively, reflect Models 16 and 17 but also include the time-invariant dummy for participation in an ESL course and the time-varying covariate for the interaction between ESL participation and the second-order term for the English enrollment ratio. In addition to including the ESL dummy and interaction term included in Models 18 and 19, Models 20 and 21 in Table 6c, respectively, build on Models 18 and 19 by incorporating a second interaction between whether the student is an English monolingual (as the excluded reference group, an EB, or EL and the interaction between ESL participation and the second-order term for the English enrollment ratio.

In Model 16 of Table 6a, an interaction between the language population indicator variable and the second-order term for the English enrollment ratio was added, and it was found that the hazard ratio estimates for the interaction effects of being an EL student or an English monolingual are not statistically significant. However, increasing the number of English courses (often English acquisition support courses) for EB students within a given year has a very strong statistically significant effect of increasing the dropout risk over time, indicating that additional support services in English for EB students are much more likely to serve as a barrier to accessing other desired courses and will more likely decrease the academic motivation of an EB student to academically persist than improve educational outcomes. Model 17 includes the interaction between the language-minoritized population and the second-order term for the WL enrollment ratio to the model as presented in Model 16 and finds once again that the interaction effects between the language-minoritized population and the first-order term for the WL enrollment ratio are not statistically significant for any language population. However, the second-order term for the WL enrollment ratio is once again a statistically significant indicator of increased hazard risk.

Table 6a	Model 16				Model 17			
Variable	coef	twc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
Ind.	0.0425		1.043		0.0429		1.044	
	(0.0523)		(0.055)		(0.052)		(0.0547)	
EBxInd.	-0.181**		0.84**		-0.18**		0.832**	
	(0.0856)		(0.071)		(0.085)		(0.0707)	
ELxInd.	-0.0644		0.938		-0.0631		0.939	
	(0.0871)		(0.082)		(0.087)		(0.0814)	
1.WL ratio		-0.298		0.742		-0.301		0.74
		(0.205)		(0.152)		(0.207)		(0.153)
EBx1.WL ratio		-0.9***		0.39***		0.178		1.195
		(0.308)		(0.121)		(0.512)		(0.611)
ELx1.WL ratio		-0.135		0.874		0.0519		1.053
		(0.196)		(0.171)		(0.495)		(0.521)
2.WL ratio		0.465**		1.591**		0.47**		1.601**
		(0.186)		(0.296)		(0.19)		(0.304)
EBx2.WL ratio						-8.22**		0.0003**
						(3.867)		(0.001)
ELx2.WL ratio						-1.012		0.363
						(2.167)		(0.787)
1.English ratio		-0.0972		0.907		-0.0944		0.91
		(0.0699)		(0.0634)		(0.07)		(0.0637)
2.English ratio		0.0972		1.102		0.0938		1.098
		(0.0925)		(0.102)		(0.093)		(0.102)
EBx2.English ratio		0.19***		1.21***		0.18***		1.2***
		(0.0649)		(0.0787)		(0.065)		(0.0778)
ELx2.English ratio		-1.981*		0.138*		-2.000*		0.135*
		(1.092)		(0.151)		(1.136)		(0.154)
SocSci ratio		-0.111**		0.895**		-0.11**		0.895**
		(0.0558)		(0.0499)		(0.056)		(0.0502)
2.SocSci ratio		0.0929		1.097		0.0934		1.098
		(0.0577)		(0.0633)		(0.058)		(0.0636)
(RBSE)								

*** p<0.01, ** p<0.05, * p<0.1

Table 6a - Survival Models with EB, EL Interactions

In contrast, the interaction between being an EB student and increasing enrollment in WL courses within a year is still a great statistically significant indicator for academic persistence that increasing WL enrollment for EB students overcomes the estimated baseline risk of taking additional WL courses on the hazard function for EB students. Interestingly, the removal of the interaction between the language-minoritized population and second-order term for English enrollment ratio from the stratified baseline hazard functions in Models 16 and 17 results in the first-order term for the social studies enrollment ratio presenting a statistically significant decrease in the risk of dropping out, further highlighting the role that increasing English course enrollment in a year more likely serves as a barrier than a benefit to language-minoritized students.

Table 6b	Model 18				Model 19			
Variable	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
ESL	0.429		1.536		0.421		1.523	
	(1.3)		(1.997)		(1.297)		(1.976)	
Ind.	0.0425		1.043		0.0428		1.044	
	(0.052)		(0.055)		(0.053)		(0.0548)	
EBxInd.	-0.18**		0.84**		-0.18**		0.836**	
	(0.089)		(0.074)		(0.088)		(0.0735)	
ELxInd.	-0.0665		0.936		-0.0654		0.937	
	(0.089)		(0.084)		(0.089)		(0.0833)	
1.WL ratio		-0.297		0.743		-0.299		0.741
		(0.207)		(0.154)		(0.208)		(0.154)
EBx1.WL ratio		-0.96***		0.38***		0.121		1.129
		(0.315)		(0.121)		(0.577)		(0.652)
ELx1.WL ratio		-0.119		0.888		0.0261		1.026
		(0.196)		(0.174)		(0.472)		(0.485)
2.WL ratio		0.460**		1.584**		0.47**		1.592**
		(0.188)		(0.298)		(0.191)		(0.305)
EBx2.WL ratio						-7.98*		0.0003*
						(4.1)		(0.0014)
ELx2.WL ratio						-0.782		0.457
						(1.98)		(0.904)
1.English ratio		-0.108		0.898		-0.105		0.9
		(0.069)		(0.062)		(0.069)		(0.0625)
2.English ratio		0.109		1.115		0.105		1.111
		(0.089)		(0.099)		(0.09)		(0.0997)
ESLx2.English ratio		0.556		1.744		0.547		1.729
		(0.35)		(0.61)		(0.343)		(0.592)
EBx2.English ratio		0.21***		1.23***		0.2***		1.22***
		(0.0614)		(0.0756)		(0.066)		(0.0796)
ELx2.English ratio		-2.055*		0.128*		-2.08*		0.125*
		(1.072)		(0.137)		(1.123)		(0.141)
SocSci ratio		-0.110*		0.895*		-0.111*		0.895*
		(0.0587)		(0.0526)		(0.059)		(0.0528)
2.SocSci ratio		0.089		1.093		0.0893		1.093
		(0.0604)		(0.066)		(0.061)		(0.0664)
(RBSE)								
*** p<0.01, ** p<0.05, * p<0.1								

Table 6b - Survival Models with ESL Interactions

In Table 6b, Model 18 adds the interaction between ESL participation and the second-order term for the English enrollment ratio as a time-varying covariate to Model 16 and a time-invariant dummy for ESL participation. Like previous models, the time-invariant dummy for ESL participation is not statistically significant. However, unlike previous models, its time-varying interaction with the second-order term for the English enrollment ratio is not statistically significant. Interestingly, in Model 18, the first-order term for the social science enrollment ratio loses the statistical significance observed in Model 16. The same pattern that Model 18 exhibits relative to Model 16 is observed for Model 19 relative to Model 17, except

Table 6c	Model 20				Model 21			
Variable	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
ESL	0.0077		1.008		-0.0052		0.995	
	(1.376)		(1.386)		(1.38)		(1.373)	
Ind.	0.0425		1.043		0.0429		1.044	
	(0.052)		(0.055)		(0.0524)		(0.055)	
EBxInd.	-0.18**		0.84**		-0.18**		0.84**	
	(0.088)		(0.074)		(0.0875)		(0.073)	
ELxInd.	-0.0625		0.939		-0.0613		0.941	
	(0.088)		(0.083)		(0.088)		(0.083)	
1.WL ratio		-0.297		0.743		-0.299		0.742
		(0.207)		(0.154)		(0.208)		(0.154)
EBx1.WL ratio		-0.96***		0.38***		0.115		1.122
		(0.314)		(0.12)		(0.58)		(0.651)
ELx1.WL ratio		-0.102		0.903		0.0369		1.038
		(0.214)		(0.193)		(0.467)		(0.484)
2.WL ratio		0.459**		1.58**		0.464**		1.59**
		(0.188)		(0.297)		(0.191)		(0.304)
EBx2.WL ratio						-7.934*		0.00036*
						(4.109)		(0.0015)
ELx2.WL ratio						(0.732)		(0.481)
						(1.775)		(0.854)
1.English ratio		-0.107		0.899		-0.104		0.901
		(0.0689)		(0.062)		(0.0693)		(0.0625)
2.English ratio		0.108		1.114		0.104		1.11
		(0.0892)		(0.099)		(0.0899)		(0.0998)
ESLx 2.English ratio		-0.677		0.508		-0.702		0.496
		(0.587)		(0.298)		(0.595)		(0.295)
EBx2.English ratio		0.209***		1.23***		0.195***		1.215***
		(0.0614)		(0.076)		(0.0655)		(0.0796)
ELx2.English ratio		-2.544		0.0786		-2.567		0.0767
		(2.092)		(0.164)		(2.177)		(0.167)
ESLxEBx 2.English ratio		1.503***		4.5***		1.506**		4.510**
		(0.575)		(2.584)		(0.586)		(2.645)
SocSci ratio		-0.110*		0.896*		-0.110*		0.896*
		(0.0584)		(0.052)		(0.0587)		(0.0526)
2.SocSci ratio		0.0891		1.093		0.0893		1.093
		(0.0601)		(0.066)		(0.0604)		(0.0661)
(RBSE)								
*** p<0.01, ** p<0.05, * p<0.1								

Table 6c - Survival Models with EB, EL, and ESL Interactions including the ESL interaction in Model 19 also leads to the estimate for the interaction between being an EB student and the second-order term for WL enrollment losing the statistical significance observed in Model 17. However, when adding a second interaction between the language-minoritized population and the interaction between ESL participation and the second-order term for the English enrollment ratio in Model 20 of Table 6c, not only does increasing the English enrollment ratio statistically significantly increase the risk of dropping out for EB students, increasing the percentage of English courses in student enrollment via ESL programming provides a much stronger predictor of increased risk of dropping out for EB students that is also statistically significant. Model 21 provides the same results as Model 19 but with similar estimates and statistical significance for the additional interaction seen in Model 20.

2.9 Discussion

Discussion of the results:

From the perspective of the SCCT Framework, the findings can be interpreted such that academic persistence is considered a performance outcome and can be fostered further by consistent and continual enrollment in a WL. A student's choice action reveals a preference for goal formation to be set at achieving college admission rather than just simply graduating high school as the primary interest driving the motivation to academically persist to high school completion. In addition, the conceptualization of self-efficacy and industriousness within the SCCT Framework allows for the interpretation that accessing WL courses may be increasing the self-efficacy of EB students by improving their bilingual proficiency, which has been shown to increase the likelihood of college enrollment and the likelihood of initial enrollment at a four-year college for "High-use," or highly proficient, bilingual students over their English monolingual peers (Santibanez & Zarate, 2014). The distributional patterns found in the descriptive statistics provide strong evidence that the sample used for this study is representative of period-current and historical trends by aligning closely with the distributional patterns presented in multiple NCES reports, drawing data from NCES collected surveys and census, the Current Population Survey, NELS:88/92, BPS:96/98, Education Longitudinal Study of 2002, and National Assessment of Educational Progress (NAEP) 1998 and 2000 High School Transcript Studies (Horn & Kojaku, 2001, Horn et al., 2001; NCES, 2003; Owings, 1995; Planty et al., 2007; Roey et al., 2001; Snyder et al., 2004).

Furthermore, the descriptive statistics find that course-taking patterns, particularly regarding student self-selection into WL courses, in the sample strongly align with the distributional patterns of self-selection in WLs, overall, and by sex, race, and region presented in national reports from the NCES, such as *The Condition of Education 2007* and The 1998 High School Transcript Study Tabulations (Horn & Kojaku, 2001; Horn et al., 2001; Planty et al., 2007; Roey et al., 2001; Snyder et al., 2004). These findings show that although self-selection into WLs is not randomized in the study – and treatment effects are not observed – the representative nature of the chosen sample with the general population in the late 1990s to early 2000s allow for the claim that the reduced form estimates presented in this paper are representative of national and historical trends, even if they are not truly generalizable. The descriptive statistics show that students who meet or exceed college admission requirements or recommendations for WL study attend four-year universities at greater percentages than those who take either a singular course in a WL or no course. This association is heightened by the decrease in dropout rates for students who take a second consecutive WL course than those who stop before completing the second year of study in a WL. By enrolling in two or more consecutive WL courses, the motivation to complete high school appears to be associated with a significant increase after completing each additional WL course from the second year onward, and these students seem to be rewarded with greater enrollment rates in four-year universities. These findings support research showing that highly selective four-year colleges prioritize student investment in WL learning and that student investment in a WL leads to increased enrollment in four-year institutions of higher education (Brod & Huber, 1996; Horn & Kojaku, 2001; Horn et al., 2001; Owings, 1995; Saiz & Noido, 2004).

The survival model results provide greater evidence that consistent WL enrollment is associated with increased academic persistence, which reveals a preference for attending a four-year post-secondary institution, as observed in the descriptive data. Even attempting a WL indicates increased academic persistence, though that may be confounded with a student's level of industriousness. However, after controlling for ability and industriousness, the preference for consistent enrollment in WL coursework has a stronger association with academic persistence to complete high school, likely because it is a requirement for college admissions rather than only high school graduation. This finding reveals a latent preference that students who consistently enroll in a WL class year after year have for gaining college admission, which fuels the academic motivation of students to persist academically and finish a high school education. Both models stratified by language population and those that are not stratified provide similar results that strongly suggest that enrolling in a WL course for each of the traditional four years of high school decreases the risk of dropping out of high school and indicates an increased academic persistence, revealing a preference for meeting four-year state university requirements or recommendation for admission among students. The survival curves also suggest that enrollment in WL courses is more important for language-minoritized students since those students who do not participate in WL education have a lower likelihood of survival than their English monolingual counterparts who opt out of WL programming.

The implications of my findings for Latinx students should not be overlooked either since the majority of Latinx students in the sample speak Spanish at home. The first four models, without time-varying covariates that did not include the WL enrollment ratio variables in the model, had the effect of speaking Spanish at home on the hazard of dropping out as a statistically significant predictor of an increased likelihood of dropping out. However, when the WL enrollment ratios were included as time-varying covariates, the hazard estimate of being a Spanish speaker lost its statistical significance, but being a native language speaker of a non-European language maintained its statistically significant increased risk of exiting high school early. The benefits and comparative advantage in WL participation can largely be attributed to Latinx students with greater access to more widely available WL courses in Spanish, a language many are already proficient in. Native speakers of non-European languages may benefit from access to any WL course, even if it is not related to their native language spoken at home. Still, the lack of availability and access to WL courses for many students who speak native languages that are not Eurocentric diminishes much of the comparative language they could have had over their English monolingual peers if course variety in WL education was greatly expanded. The findings show that increasing language-minoritized students' access to WLs and the availability of a variety of WLs would likely broaden the percentage of language-minoritized students who can benefit from a comparative advantage in WL education. Since Spanish is already a widely available WL course to most high schools in the U.S., and most language-minoritized students are Spanish-speaking Latinx students, it should be a major imperative to improve Latinx students access and enrollment in Spanish language classes to increase the academic persistence of Latinx EB and EL students that want to attend a four-year college after graduation.

In contrast, increasing the number of English courses within a given year, especially for EB students who participated in ESL programming, has a very strong statistically significant effect of increasing the dropout risk over time, indicating that additional English support services, periods in rudimentary English course tracks, and most significantly adding ESL courses for EB students, who self-identify English as their primary language, are barriers to accessing other desired courses, particularly in the social sciences and WLs, decreasing the academic motivation of an EB student to academically persist instead of improving educational outcomes for EB students. Any decrease in academic motivation that leads to a decrease in academic persistence and a greater risk of dropping out before completing high school due to additional enrollment in English courses within a year is likely because of the significant opportunity cost a student incurs, preventing the student from enrolling in another course required for meeting college admissions or graduation requirements. The result is that additional ELD support courses serve more as a barrier than a benefit for EB students to meet their academic goals. This is observed by how removing the interaction between being in a language-minoritized population and increasing enrollment in English courses from the baseline hazard model allows enrollment in social science courses to become a statistically significant predictor of increased academic persistence. Once ELD support courses are removed as a hazard for student dropout, EB students could enroll in both WL and social sciences courses required or recommended for admission to highly selective four-year institutions of higher education.

Owings (1995) found that course-taking patterns showed that students who made less progress in a WL also made less progress in the social sciences and that this association was tied to progress in English courses, where students who made less progress in English also made less progress in both WL and social science courses. Owings' (1995) findings are supported by evidence from my results, which show that the interaction between increasing the ratio of English classes for students who participated in ESL programming has such a strong effect on increasing the risk of dropping out that the benefits of consistent enrollment in the social sciences and increasing the ratio of WL enrolments disappear, likely due to the unlikelihood of ESL participating students having the opportunity in their schedules for enrolling in advanced social science or additional WL courses. Since the social sciences are heavily reliant on being highly proficient in English, an explanation for the phenomenon I observe is that students need to persist academically in English courses before social science courses can impact academic persistence through increased academic motivation. Furthermore, enrollment in additional ELD support courses, especially ESL classes, can hinder a student's progress in meeting the social science requirements for graduation and college admissions. Decreasing barriers to enrollment in required or recommended WL and social sciences courses for admission to selective four-year colleges can increase academic persistence to finish high school by making proximal choice actions to take WL and social science courses to meet distal choice goals of gaining entry to a four-year college.

In addition, the results reveal that students who have a native language background learned at home along with English as their primary language have a comparative advantage over their peers in persistence through WL course enrollment. The finding that attempting more than one WL increases the hazard risk when observing the effect of EB student enrollment in WL courses on academic persistence supports Santibanez and Zarate's (2014) argument that the level of proficiency in a student's native language as a "High-use" bilingual is associated with increased academic success. The results show that a student's consistent enrollment in WL courses is more likely to increase academic persistence when a student consistently enrolls in a WL year after year rather than different WLs for different years. These results suggest that increasing proficiency in a WL by consistent enrollment in the WL chosen has a greater association with increasing academic persistence than taking multiple WL courses in different WLs, where proficiency in any WL is likely to be more limited than committing to learning a WL. The findings suggest that a bilingual advantage exists for EB students with a latent preference for attending a four-year university through accessing and enrolling in a WL as a pathway to achieve their goals. This bilingual advantage is seen in how EB students with higher levels of industriousness have greater academic persistence than English monolingual students with similar levels of industriousness.

Thus, under the SCCT Framework, findings suggest that EB students may be exhibiting more significant self-efficacy beliefs or outcome expectations than their English monolingual counterparts, providing further evidence of a bilingual advantage that the literature has repeatedly shown evidence for regarding the cognitive, social, academic, and economic benefits for being bilingual (Bankston & Zhou, 1995; Bialystok, 2001, 2009; Bialystok et al., 2009; Feliciano, 2001; Fortes & Rumbaut, 2001; Rumbaut, 2014; Saiz & Zoido, 2004; Santibanez & Zarate, 2014; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005; Zarate & Pineda, 2014). The critical takeaway from the results presented in the models is consistent evidence that access to WL courses has a significant potential to be consequential, especially for language-minoritized students, in achieving fundamental benchmarks such as completing high school and meeting college admission requirements needed to achieve career goals in the labor market after enrolling in post-secondary institutions.

Limitations

One of the main limitations of the model is that the latent trait that drives causality in the model is not being observed. In contrast, the effects of this latent trait on student behavior and decision-making are being observed. So, causality cannot be directly claimed; however, the expected correlations and associations derived from the theory observed in the results provide evidence that suggests that the hypothesized causation is likely driving the observed estimations and results and should be explored in further research that utilizes experimental or quasi-experimental approaches. Interestingly, when including a variable for the percentage of likelihood that a student expects to go to college, the fundamental findings from those results presented in the Appendix are quite similar to the main results presented in the paper. However, under the SCCT Framework, outcome expectations and interest are different factors. Although outcome expectations help form interest, the expectation a student has on the likelihood that they will go to college may help develop a student's interest towards pursuing a post-secondary degree but does not substitute for the effects that pursuing admission to a four-year university as the primary latent interest of a student has on the student's academic persistence.

In addition, only a fraction (901 out 2595) of the students had an opportunity to answer the college expectations survey question administered by the NLSY1997 data collection team, and many students who may not have been interested in going to college may have omitted answering the question in the first place. Thus significantly skewing the sample in the model to students who had high expectations for going to college while dropping students with low or no expectations for going to college from the sample. Including outcome expectations as a variable in the model resulted in dropping most of the language-minoritized students from the sample and did not provide any additional information that improved the understanding of the impact that a latent interest in gaining admission to college and enrollment in a WL has on academic persistence. Thus, the college expectations variable was not included in the primary models of interest but is presented in Appendix C. Future research that incorporates stated preference, where students state their desire to attend college or not, and random assortment in WLs, potentially by random delay in entry or timing of entry into a WL program, may help delineate the causal effects of student interest and the impact of WL enrollment on the effect of student interest on academic persistence. Another limitation was that the data on student accessibility to WL programs was not in the data set, particularly on whether schools classified students as LEP. It is assumed that all high schools would provide some access to WLs. However, students designated as LEP or in special education or other support services may have been limited in their ability to enroll in WL courses. In addition, it is unknown how many students classified as EB or EL students were designated as LEP students by their school districts or received additional ELD support services that may have hindered their ability to access or enroll in a WL for a given year. Further information and data on student language programming and language background may help understand access to entry into post-secondary institutions and the potential role WL programming may play for language-minoritized students in future research.

A limitation of the Cox proportional hazards model in studying education outcomes is the reliance on a continuous-time approach rather than the discrete time that events in education happen, according to Kim et al. (2018). Kim et al. (2018) argue that many educational outcomes may occur in the same period, violating the Cox proportional hazard assumptions of events happening at unique times for individuals. However, the study's design does not reflect the conditions that Kim et al. (2018) argue for educational researchers to use discrete-time analysis over the Cox proportional hazards model. The research design utilizes an estimation strategy including 93-time points compared to 20 and censoring proportions of 96.5% instead of the 17/24% presented in Kim et al.'s (2018) Cox proportional hazards models. The high censoring proportion with many time points results in the month with the most event occurrence having a probability of less than a percent of students facing the event at that time – compared to the 31% event co-occurrence seen in Kim et al. (2018) paper – that allows for maintaining the Cox assumption of unique time-to-event occurrence with the use of the Efron method for breaking ties.

Implications of the study:

Additional English courses and increased enrollment in ELD support services and assignments to mandated ESL courses are barriers to EB students already proficient in English, whether recognized by school districts, decreasing student motivation for academically persisting through high school by increasing the difficulty of meeting college admission requirements for these students. EB students are self-identified in this study as speaking English as a primary language and speaking a native language at home; however, in schools, some of these students may be classified as Limited English Proficient due to the standard practice of U.S. districts to automatically enroll any self-identified non-English native language speakers in ELD support services until tested out. Therefore, EB students who may be designated as LEP students by their school district and mandated to enroll in ESL courses or additional periods in a lower-tracked English course that does not count toward a college preparatory progression in English for college admissions likely incur a significant opportunity cost, preventing them from enrolling in courses in other subjects, or even in college preparatory English, required for college admissions or meeting graduation requirements, becoming barriers to meeting academic goals for EB students.

Evidence shows that increasing the ratio of English courses over time and adding ESL courses decreases the motivation of EB students to persist academically. This result is likely because adding ESL or extra English support courses to tight schedules would block access to desired courses for college admissions for many EB students who would likely benefit otherwise from having a bilingual advantage in WL courses that increase academic persistence for EB students. In addition, the consequences of being categorized as an LEP may negatively influence their self-efficacy and outcome expectations, resulting in changes in the formation of goal settings that likely decrease their academic motivation. The result is reduced academic persistence and a greater risk of dropping out before completing their high school education. Barriers to accessing WL courses for students, especially students who speak a native home language, can decrease their academic motivation by making their career goals harder to accomplish, leading to decreased academic persistence and a greater likelihood of prematurely exiting high school. EL students are not consistently seen as benefiting from an optimal ratio of WL courses from the presented models.

The comparative advantage observed by EB student enrollment in WL courses is not consistently observed for EL students, highlighting some potential barriers that EL students face that prevent them from accessing the bilingual advantage or comparative advantage from WL course enrollment, even with increased industriousness. These barriers are likely associated with how EL students' English proficiency may prevent them from accessing WL courses in the first place or put them on tracks where WL courses are only accessible by succeeding in English coursework. In addition, EL students show no benefits from increasing the English enrollment ratio over time in any of the models on academic persistence. If a lack of English proficiency or a greater emphasis on the role of English enrollment for academic success are unintended barriers hindering EL students from accessing WL courses, the result could potentially diminish their self-efficacy beliefs that college admission is a realistic outcome to expect. The descriptive statistics show that EL students are less likely to enroll in a WL than their English monolingual and EB peers and are less likely to attend college than their peers. The possible unintended consequences may be limiting their interest in pursuing post-secondary education and potentially neutralizing the benefits of WL enrollment on their academic persistence. Furthermore, increasing the English course enrollment for any given year does not benefit EL students, nor is there any evidence that it benefits English monolinguals. The only evidence found for the effect of increasing the yearly English enrollment ratio on the hazard function is an increased risk of dropout for EB students due to increasing the opportunity cost for EB students mandated to participate in ESL rather than enrolling in the necessary courses to meet the educational goals they set instead.

The success of EB students as English-native language proficient bilinguals in WL programming should be considered a model to expand positive outcomes for EL students by expanding instruction in native languages and proficiency in WLs to core academic subjects and improving native language instruction programming and access to native language instruction for both EL and EB students. Research has shown that students who participate in WL education in high school are more likely to gain admission and enroll in a four-year post-secondary institution; furthermore, the more progress a student makes in a WL, the greater the likelihood that the student not only gains college entry but also graduates college rather than dropping out (Brod & Huber, 1996; Horn & Kojaku, 2001; Horn et al., 2001; Owings, 1995; Saiz & Noido, 2004). In addition, research has shown that learning a WL in high school has implications that extend beyond success and persistence in graduation from high school and college, but also gaining proficiency in the WL that are "hard skills" that can be used as human capital to leverage higher wages in students' post-education labor markets (Christofides & Swidinsky, 2010; Garrouste, 2008; Gonzalez, 2005; Rumbaut, 2014; Saiz & Noido, 2002, 2004, 2005). Therefore, by increasing access to native language instruction for both EL and EB students, more students with a latent desire to attend four-year universities can be motivated to persist academically until high school completion and meet college and career readiness requirements by gaining pathways for college admission that are accessible, realistic in expectations, and allow for outcomes that are achievable for language-minoritized students.

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3 Using Low-Cost Incentives in Education to Reduce Wasteful Public Spending: A Policy Analysis of the Seal of Biliteracy

Chapter 3

3.1 Introduction

It is 2014; Maria is a third-generation Mexican American emergent bilingual (Spanish and English speaking) student in the ninth grade at a Los Angeles public high school where over 80% of the students are assigned to English Learner (EL) support services. Maria was assigned to EL support services when she entered the school district as a kindergartener. She was scheduled to pass the English proficiency exam and exit from EL support services by the sixth grade. However, she continued to fall short of achieving a passing score on the English proficiency exams and has been classified as a Long-Term English Learner (LTEL). Maria wants to go to college, but she does not know how to plan for the college admissions process, and her school can only afford to prepare the seniors in the school for college due to budgetary limitations and an overworked, understaffed college counseling department that prioritizes to underclassmen high school graduation over college preparation and readiness. Two educators at the high school implement the Seal of Biliteracy (SoBL) program in the LA high school to encourage and incentivize students to utilize their Spanish-speaking skills to prepare for post-secondary education. These two educators inform Maria about the SoBL, a policy that recognizes students' biliteracy skills in reading, writing, speaking, and listening in both English and a world language as an award placed on high school diplomas, and how she needs to take four years of Spanish language classes to achieve the award. Being fluent in Spanish, Maria is excited to take a four-year world language course sequence utilizing skills she has already attained outside of schooling that could increase her chances of admission to one of the state's four-year universities.

However, there is a catch: to be able to receive the award and have access to scheduling a Spanish class for each year of high school, but as an EL student, she is forced to take too many ESL classes, preventing her from taking college preparatory and Advanced Placement Spanish classes. Thus, to take the fourth year of Spanish or AP Spanish in 12th grade, she must pass the English proficiency exam before entering the 10th grade. Motivated by the SoBL as an incentive to prepare for the English proficiency exam at the end of the year, she successfully passed the exam after a decade of failure. Did the SoBL incentivize Maria to the point that she miraculously learned enough English in one academic year after a decade of underwhelming results, or did Maria already possess the capability to pass the English proficiency test but was not functioning under the performative conditions needed to succeed on the exam until the SoBL was provided as an incentive?

Maria is not an actual student but rather the hypothetical embodiment of the findings from focus groups with emergent bilingual Latinx students and staff at an urban public high school in Los Angeles from Castro-Santana's (2014) ethnographic study on the value of biliteracy and the SoBL. A phenomenon has been occurring in California for the past twenty years where a population of English Learners (EL), designated as Long-Term English Learners (LTEL), were persistently underperforming on English proficiency tests – as defined by the expectations of policymakers and educators for indicating adequate progress in ELA (Barrett et al., 2012, p. 619; Scott & Ingels, 2007; Gandara & Hopkins, 2010; Suarez-Orozco et al., 2009). Policymakers and educators expect EL students in California to exit from English Language Development (ELD) services within seven years. Nevertheless, a significant population of EL students continues to fail English proficiency tests after receiving seven or more years of ELD support; even though studies have shown that EL students who become reclassified receive increased opportunities for academic advancement from receiving greater access to content acquisition from college preparatory courses rather than focusing only on English acquisition during class instruction (Callahan et al., 2010; Flores, 2009; Robinson, 2011; Solorzano, 2008). Davin found through focus groups that EL students who had invested in learning their native tongue were less motivated to increase their investment in learning Academic English when school systems, educators, and administrators dismissed their investments in non-English languages as valueless or wasteful while only prioritizing English Language acquisition instead (Hancock & Davin, 2020). Furthermore, Castro-Santana found that students were either unaware of the consequences regarding their ability to enroll in college preparatory coursework from failing to be reclassified as English proficient on schedule or did not view reclassification with a sense of urgency until they entered high school (2014).

Economists have often wondered why students often disinvest or make minimal investments in education, especially when the returns to education are so high (Angrist & Lavy, 2002, 2009; Levitt & List, 2010).

Levitt and List posited that the long-term nature of the returns or the length of time spent in schooling relative to entering the labor market might not be enough motivation for students to invest effort in education (2010). While Altonji (1993) argues that students that do not believe they have a realistic or likely chance of succeeding in education are less likely to invest in it even if they believe the returns to investing in education will be high. Amartya Sen argued that what students can accomplish in practice is derived from the resources they have and the accessibility of utility-maximizing opportunities for them, often rephrased by economists as the rhetorical question: "what utility can a book provide to someone who is not literate?". For this reason, we adopt a Capability Approach perspective, as articulated by Amartya Sen, to analyze what students can accomplish in practice given the resources they have at hand and access to utility-maximizing opportunities.

The Capability Approach is based on a concept referred to as functioning rather than standard expected utility; functioning is what a person "is" or "does" and what they achieve (Sen, 1992, p. 39). Sen defines capabilities as the "freedom that a person actually has to do this or be that − things that he or she may value doing or being" (Sen, 2009, pp. 231–232); capabilities are essentially the choices available to a person. The set of capabilities available to a person is "the various combinations of functionings (beings and doings) that the person can achieve [. . .] reflecting the person's freedom to lead one type of life or another" (c.f. Vecchio & Martens, 2021, pg.3; Sen, 1992, p. 40). The primary capability we observe from the example of Maria and will focus on in greater detail and scope later in the paper is accessibility as a capability. Marten defines accessibility as a capability based on "persons' possibility of engaging in a variety of out-of-home activities" (Martens, 2017, p. 137), which the actual participation would be a functioning, given "the possibility of a person to translate the resource into something useful" (c.f. Vecchio & Martens, 2021, pg.4; Martens & Golub, 2012, p. 202). However, the issue could have likely been that Maria always had the capability to perform well on the English Proficiency exam but was not functioning to the performative nature of the exam until given an incentive that altered her set of capabilities by allowing her to use skills she learned outside schooling to improve her future academic outcomes by providing her with access to coursework that aligns with her pre-existing skills. Maria's capability to overcome her historically poor performances on the English proficiency exam after being offered an educational incentive utilizing her current set of achieved skills to improve academic outcomes likely indicates the significance that standardized English proficiency scores being an imperfect measure of actual English proficiency have on the allocation of limited school resources.

However, that does not mean that high-stakes exams are entirely meaningless; instead, some threshold of performative effort is likely needed for high-stakes exams to elicit accurate information about students' English proficiency. From Castro-Santana's dissertation (2014) and book (2020), from which we constructed the example of Maria, focus groups of Latinx EL students displayed a belief that the SoBL would help increase their college admission chances as well as improve future employment opportunities and the possibility of demanding higher wages or other increases to future financial incentives from employers as the reasons for why the SoBL functioned as a successful incentive for exiting from EL services (Castro-Santana, 2014; 2020). In addition, Castro-Santana discovered that after implementing the SoBL in the school, English Learner (EL) reclassification rates increased from 7% to 19%, and student enrollment in world language courses increased by approximately 20-25% (2014, p. 150). To address the overidentification of ELs, we advance an argument that provides robust causal evidence and causal indicators supporting that accurately identifying students for EL support services will likely lead to a more significant percentage of EL students meeting college entry requirements, as well as reducing districts' average necessary expenditure for providing EL students with an adequate education.

3.2 The Problem:

The Costs of Overidentifying Students for ELD Services

Significant research has highlighted the deficiencies of current English proficiency exams in accurately measuring English proficiency and predicting academic success, as well as the concerns with using high-stakes testing as a policy lever (Solorzano, 2008). Siordia and Kim (2021) argue that English Proficiency standardized tests are institutional mechanisms that result in the overrepresentation of Latinx students as LTEL students and the underrepresentation of Latinx students in Seal of Biliteracy programs. Since high-stakes exams are performative assessments by design, students need to perform to the parameters of the exam for the test scores to be efficient measurements. If students are not performing to the assessment standards, traditional interpretations of assessment scores can unintentionally overidentify the number of English Learners that require English Language Acquisition (ELA) support services. Suppose students do not exert effort to pass or show progress on these English proficiency exams. In that case, they will be assigned to English Language Development services without regard for whether the services will benefit them or prevent them from pursuing other valuable educational opportunities (Jimenez-Castellanos & Topper, 2012).

The literature on school funding systems has found that categorical and block grant programs aimed at increasing vertical equity had the unintended consequence of decreasing the adequacy of funding for educating EL student populations (Houck & Debray, 2015; Jimenez-Castellanos & Topper, 2012; Longa, 2015; Ramirez et al., 2011; Underwood, 1995). We define equity as a fair distribution of resources, services, and costs for meeting established goals (Jimenez-Castellanos & Topper, 2012; Underwood, 1995). In contrast, adequacy is defined as providing "sufficient resources to ensure students an effective opportunity to acquire appropriately specified levels of knowledge and skills" (c.f. Guthrie & Rothstein, 2001, p. 103; Rice, 2004, p.138; p. 103). Goals are often established based on the concept of fairness, often defined through legal recourse and court rulings, such as Lau vs. Nichols and Serrano v. Priest (Alexander, 2012; Monk, 1990; Rice, 2004). The goal of vertical equity-based funding formulas is to ensure equality of outcomes amongst student populations. Research on financing the education of ELs found that the marginal cost of educating an English Learner increase for each additional EL student in the district at a compounding rate (Jimenez-Castellanos & Topper, 2012). Therefore, any overidentification of students assigned to EL services, such as English Language Development (ELD) courses, increases the total necessary expenditure for adequately educating districts' EL student populations (Imazeki, 2006, 2007; Jimenez-Castellanos & Topper, 2012). Unfortunately, California's vertical equity-based funding formula that relied on utilizing categorical aid grants did not incorporate the compounding cost of educating each additional EL student requiring support services, resulting in an education funding crisis for ELs due to the emergence of a population of LTELs (Jimenez-Castellanos & Topper, 2012; Longa, 2015; Ramirez et al., 2011). One explanation for the phenomenon is that LEAs were restricted by how they could spend the categorical funds they received. They could not increase necessary expenditures for educating ELs if revenue shortfalls occurred. Due to California's funding formula incorporating a flat marginal cost for educating each additional EL student instead of an accurate compounding marginal cost per EL student, each additional EL student that does not exit from EL services on schedule further dwindles the constrained district funds for English acquisition programming that have been insufficient at providing EL student populations with an adequate education – particularly in underfunded rural schools or overcrowded urban schools (Imazeki, 2003, 2007; Jimenez-Castellanos & Topper, 2012; Longa, 2015; Ramirez et al., 2011).

3.3 Historical Context

In 1998, California voters passed Proposition 227, mandating that English Learners (EL) receive all content instruction in English unless enough parents of EL students in a district requested to be exempt from the mandate. The proposition restricted districts and schools from initiating new bilingual programs and forced the termination of existing bilingual programming in nearly all districts across the state (Gandara & Hopkins, 2010). Before Proposition 227, over 10% of students designated by the state as Limited English Proficient (LEP) were receiving educational support services in their native language. By 2002, this percentage had dwindled to 3% since only a limited number of districts and schools garnered enough signatures from the parents of EL students to be exempt from Proposition 227's Sheltered English Immersion (SEI) programming mandate (2010). Proposition 227 was motivated by a belief that bilingual education programs were inefficient and resulted in slower rates of English acquisition for emergent bilingual students. In addition, SEI programs (English-only instruction) would be more effective based on results from high-stakes standardized English proficiency assessments. However, rather than increasing the number of EL students that are English proficient, after Proposition 227, the number of EL students that would never be reclassified as English proficient in K-12 schooling drastically increased (Suarez-Orozco et al., 2009). Furthermore, the increasing numbers of Latinx students classified as Limited English Proficient (LEP) corresponded with lower achievement in math assessments, as well as a decrease in the rate of EL students meeting the state's college admission requirements, which emerged as a significant problem for the state (Gandara & Hopkins, 2010).

A strong consensus emerged amongst researchers and practitioners alike; bilingual education and native language instruction develops English language skills and promotes heritage language and culture; increasing English proficiency, self-esteem, and educational outcomes for English Learners (Thomas & Collier, 2002; see also: Aarts & Verhoeven, 1999; Guglielmi, 2008, 2012; Rolstad, Mahoney, & Glass, 2005; Slavin & Cheung, 2005; Wright, & Taylor, 1995). Furthermore, World Language knowledge and skills, including cultural competency and language proficiency, have increased in prominence due to the COVID-19 pandemic by complementing new communication technologies such as Zoom, Skype, and WhatsUp applications. Although COVID-19, video conferencing, and the emergence of streaming services have only recently entered mainstream international prominence from a consumption perspective; these trends are rooted in the emergence of the internet in the early 1990s and were noticeably apparent to economists by 2002 (Autor, 2003; Acemoglu, 2004). Despite the information and technological revolution occurring in California during the late 1990s and the 2000s that increased the economic importance and returns on investment for multiliteracy skills and cultural competency, efforts to revive bilingual education in California were struggling to gain traction until a novel idea emerged: change the rhetoric of bilingual education. Instead of emphasizing the benefits of bilingual education for English Learners, emphasize the benefits of bilingual education for all.

In 2011, the California legislature passed the State Seal of Biliteracy (SoBL), with over thirty states following suit. The policy aims to: "encourage students to study languages, certify attainment of biliteracy skills, recognize the value of language diversity, and prepare students with 21st-century skills that will benefit them in the labor market and the global society" by encouraging students to meet the state's English proficiency requirements (SoBL, 2011). The Seal of Biliteracy innovated language education by credentialing biliteracy skills through public schooling by recognizing academically credited World Language skills as an award on students' high school diplomas. The SoBL is intended to function as an informative signal for communication, cultural, and language skills, allowing language-minoritized students to signal their comparative advantage in an economic market where technological advances require a labor force with increasingly complex communication skills for optimizing complementary information and communication technologies. In 2013, the first year of statewide implementation of the SoBL, California passed the Local Control Funding Act; allowing LEAs to exceed expenditure to educate ELs that, before LCFF, was limited by the level of categorical aid received through consolidating block grants and categorical aid into a local discretionary fund for LEAs to spend based on the expenditure needs of their district and schools (Contreras & Fujimoto, 2019; Johnson & Tanner, 2018; Lavadenz et al., 2019; Ward, 2019). Finally, in 2016, Proposition 58, The California Non-English Languages Allowed in Public Education Act, received support from 73.5% of the voters, with a unanimous majority in all California counties voting yes on Proposition 58, repealing Proposition 227, and removing restrictions on bilingual instruction and programming for California's school districts.

3.4 Information Smoothing in Policy Design:

Incentives in Education and the SoBL as an Educational Incentive

Behavioral economics research in education finds that providing students with increased information and improving student understanding can also enhance the decisions students make regarding educational investment, resulting in improved academic and economic outcomes (Levitt & List, 2013; Jensen, 2010; Nguyen, 2008; Bergman, 2012; Hastings & Weinstein, 2008; Dynarski & Scott-Clayton, 2008; Bettinger, 2012; Hoxby & Turner, 2013; Hastings & Mitchell, 2011). Levitt and List (2013) performed a series of randomized control trials to estimate the effects of non-pecuniary incentives on inducing student effort on low-stakes exams. They found that nonfinancial incentives are a more attractive option for schools, which may be less comfortable awarding students cash rewards than trophies and certificates, and a significantly more cost-effective option for improving student performance on exams. In addition, they also found that students who had a low effort on standardized assessments perceived low stakes when there were no immediate incentives for performing well on the assessments. They argue that the primary takeaway from their research is that to design effective educational interventions, educators must understand to what extent are performance gaps in standardized assessments a result of lower effort rather than a lower ability because "the former requires an intervention that increases student motivation, the latter requires an intervention that improves student knowledge and skills" (Levitt & List, 2013, p. 188). Especially when considering that the standardized assessments may be perceived as low stakes from the student perspective but are considered high from the perspective of district administrators and local educators. Levitt and List (2013) posit that public institutions must implement policies that stimulate student investment in schooling by using incentives to increase student effort.

Researchers have looked at reclassification rates as an outcome measurement of how successful schools and districts have been at educating ELs and preparing EL students for success in secondary and post-secondary institutions (see, e.g., Grissom, 2004; Jepsen & de Alth, 2005; Thomas & Collier, 2005). Although there is an overwhelming consensus in the literature on the economic and academic value of being highly proficient in English in the United States, there has not been any robust evidence supporting test scores from English proficiency exams used in the EL reclassification process having any direct causal impact on future economic outcomes, despite having a substantial effect on student's academic attainment (Imazeki, 2004, 2007, 2008; Robinson, 2011). Robinson (2011) expands on Imazeki's (2007, 2008) argument – high-stakes exams are poor measures of post-education economic outcomes – by positing that the reclassification of EL students is less of a measure of success for schools and districts than it is a policy lever influencing how districts decide to distribute its resources by determining the instructional support services assigned to students. From this perspective, the academic impact and subsequent post-graduation economic impact of English proficiency exams on student outcomes and post-education wages are more of a consequence of how English proficiency exam scores affect how districts allocate the resources and educational opportunities that determine the choices available to students regarding the level and depth of education achieved rather than reflecting English proficiency as human capital.

From the district perspective, utility can be tied to lowering marginal costs and reducing unnecessary expenditures, allowing districts to shift funding to other areas of need, which ultimately benefit students since public schools are viewed as a redistributive mechanism for resources in public policy rather than profit-generating firms. From a Capability Approach perspective, Sen defines resources as not only being the available commodities/goods and intangible goods accessible to a person but also as a "means to achievement" (Sen, 1992, p. 33), depending on choice; which "refers to the person's decision in favor of a particular 'state' over another, selected from within their capability set (c.f. Vecchio & Martens, 2021, p. 3; Sen, 1992, pp. 31–34)." The resources we refer to in this paper are districts' average daily expenditure in improving English acquisition and increasing English proficiency rates amongst EL student populations. We assume that an individual's life experiences, as well as their contextual conditions (personal, social, and environmental), determine the possibilities for a student to convert resources into the freedom to lead one type of life over another, conceptualized by Sen as "conversion factors" (Vecchio & Martens, 2021, p. 3; Sen, 1992). These conversion factors remain unobserved without access to micro-level data, similar to understanding individual student utility in the absence of micro-level post-education data. Unfortunately, observing these conversion factors is necessary to elicit a direct revelation mechanism for determining whether districts allocate resources inefficiently.

We use Rolle's (2004) definition of efficiency as the ability to achieve established goals by expending the fewest resources possible (Jung, 2014). Imazeki (2007, 2008) found that district spending and allocation of resources for educating EL students in California are inefficient due to school funding allocations and funding formulas being decided from school performance indices constructed from the outcome measures of high-stakes standardized exams. Imazeki further argues that the high-stakes testing used to build school performance indices for determining school funding allocations create information frictions since the exams do not accurately reflect students' future academic performance, nor do they predict students' post-education economic outcomes, outside of influencing the level of education achieved by students (2004, 2007, 2008). Imazeki's argument implies that standardized exams are poor measures of the attained human capital of students, yet influence the resources students are provided, as well as the education investment plans students are allowed to choose from, which ultimately have a more significant impact on the human capital attainment and future wages than English proficiency exam scores. The information frictions central to this paper are unobserved heterogeneous student preferences for alternative education investment plans that involve biliteracy skills and incorporate biliteracy-based course pathways that exist for EL student populations and individual EL students functioning level of English proficiency rather than their observed perceived/performative level of ability. Since we lack micro-level data that directly reveal student preferences, we cannot claim to estimate a direct revelation principle or mechanism that reveals student preferences for education investment plans within EL student populations. However, we can assess how a policy can reduce information friction by observing the shift in population distributions when an education incentive is introduced as an alternate education investment plan. If the change in population distributions results in reduced average expenditure for educating a student on average, then the education incentive can be considered as an information smoothing policy.

There are three conditions for a policy to function as an information-smoothing incentive. One, students must receive utility from the policy as an incentive. The price of effort and other associated costs for pursuing the incentive outweighs the educational and eventual economic benefits of attaining the incentive-based policy. Two, students must receive information about the incentive-based policy, as well as how to access the policy and achieve the benefits of the policy, for the policy to incentivize students to improve their performance on standardized exams effectively. A Capability Approach to framing micro-level expected utility in a model that relies on meso-level aggregated data on the distribution of populations must focus on the role of access to utility. For example, an incentive can change a student's behavior if that student can receive greater utility from the incentive than the currently available alternatives, but only if students have the capability to access the incentive in the first place. Moreover, suppose the first two conditions are met. In that case, the third condition is introducing an incentive-based education policy that creates a population shift in the EL student demography, resulting in reduced average expenditure for educating an EL student; the education incentive can be considered an information-smoothing policy.

For example, since we cannot observe individual students' conversion factors, we cannot assume that a randomly chosen EL student can access the SoBL or has even received information about the policy, even if we know the student's ethnicity, grade level, or language status. We assume that all students from the sixth to twelfth grades are informed about the SoBL since it is a California state policy to notify all students by letter about the SoBL starting in the sixth grade. However, we acknowledge there is likely information loss regarding this policy during the implementation process. We also recognize that an EL student may be of Spanish-speaking background, for example, but not have any pre-existing knowledge or skills in Spanish; for this student, the SoBL is unlikely to be an effective incentive. For the SoBL to incentivize students, students need to draw from their pre-existing skills or, as sociologists conceptualize, "funds of knowledge" to reduce the costs of effort and possibly other fiscally related costs that would make a SoBL-based pathway to graduation and college admission more appealing than traditional or currently existing pathways.In addition, there are likely some students that can change their behavior and perform to the standards of the English proficiency exam to pass it after being directly incentivized by the SoBL. Still, most of the other EL students likely need increased resources in addition to the incentive to pass the exam. However, by incentivizing the students who are underperforming on the English proficiency exams to perform and start exiting from EL services, they are saving precious funds from students who would not benefit from the resources provided by those funds. In addition, the saved resources can be reallocated to students who are benefitting from those resources and would further benefit from increased resources, which in theory would further promote students to increase their chances of passing the English proficiency exams, resulting in increased English proficiency passage rates for ELs in SoBL-adopting schools and districts.

Understanding accessibility to educational investments and other education policies/programs can help better identify student capabilities and transaction costs for transferring accurate information between districts and students. Davin and Heineke (2018) conducted a mixed-method study utilizing surveys and focus groups of students in selected Illinois public high schools that corroborated Castro's findings across state lines and found students were incentivized to pursue the SoBL to increase their chances of getting scholarships for college as well as receiving college credit from Illinois' public four-year universities. Burnet (2017) conducted a similar study in Washington to Davin and Heineke's study in Illinois but focused on administrators' and educators' perceptions of the SoBL as an incentive. They found that educators valued the SoBL for its potential to increase students' post-graduation academic and economic opportunities, which they conveyed to the population of students they were tasked to serve. Although the findings from Castor-Santana (2014, 2020), Davin and Heineke (2018), and Burnet's (2017) studies are not generalizable, they do indicate that the underlying behavior is driving students' decision to pursue the SoBL as primarily being motivated by financial interest and rational expectations of ultimately benefiting from increased human capital or signaling value in post-college labor markets. From an economic perspective, findings of rational expectations of financial gain can be generalized under the assumption that policy incentives affect student decision-making as we would expect from a rational actor with myopic discounting of the future after receiving improved or increasingly accurate information. Suppose the primary issue is that English proficiency exams are entirely unsuited for determining students' levels of English proficiency. In that case, there should be no observed positive treatment effects for adopting the SoBL on the rate of ELs passing the English proficiency exam because no incentive exists that allows students to overcome improper measuring devices. However, an incentive that can reduce the cost of transferring accurate information regarding the consequences of delayed reclassification to EL student populations from districts while also simultaneously rewarding EL student populations for passing EL proficiency exams on the pre-determined schedule should theoretically provide positive treatment effects on increasing the percentage of students in EL student populations that pass California's English Language Development Test (CELDT).

3.5 Research Questions

Student Outcome and Achievement Questions:

What effect does district adoption of the Seal of Biliteracy have on English Learners' English proficiency outcomes?

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on enrollment of EL students in World Language coursework and programming?

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on college readiness measures?

School District Finance Question:

Does adopting the Seal of Biliteracy reduce districts' average aggregate expenditure on language acquisition programming and instruction for EL education?

Does district adoption of the Seal of Biliteracy after implementing the Local Control Funding formula affect the average distribution of expenditures targeted toward the goal of bilingual education and educational programming for ELs from districts' discretionary funds?

3.6 Empirical Estimation

The incentive effect can be estimated through a Causal Mediation Analysis approach that utilizes Instrumental Variables for assigning treatment based on the accessibility of the incentive. By varying the accessibility of an incentive for different student populations and observing how the variations affect the distribution of functions within the student populations, we can observe shifts within the distribution of student populations towards the targeted behavior as a reflection of the distribution of students who receive greater utility from the incentive than the alternative after receiving access to the incentive. A statistically significant shift in the population distribution toward the education incentive can be interpreted as evidence of heterogeneity in student preferences for education investment plans within EL student populations. We achieve this by using the Seal of Biliteracy as our policy incentive; world language enrollment, average district student expenditure targeted towards improving English proficiency scores, as well as the distribution of English proficiency scores as the capabilities set, with English Proficiency score distributions and the distribution of K-12 graduating students that meet college-readiness requirements for the state's four-year post-secondary institutions being the relevant functionings of interest.

Data Sources for Resources and Functionings:

The paper utilizes longitudinal and cross-sectional California English Language Development Test (CELDT), California's longitudinal school-level data on English proficiency assessments from 2007-2017, and Cohort Graduation federal datasets from 2009-2017. The California Department of Education provided annual school-aggregate data on SoBL adoption by district and county from 2012-2017. Common Core of Data and CALPADS contain balanced data that can be aligned by primary indicator variables for LEP status, language minority group, and language program participation. The Common Core of Data, American Community Survey, Longitudinal Employer-Household Dynamics, and CALPADS datasets provide demographic, socioeconomic, community, district-level, and district-nested school-level variables regarding characteristics, quality, finances, and any other variables of interests that could potentially be confounders. In addition, the paper utilizes the Common Core of Data, American Community Survey, Ed Facts assessment data, Longitudinal Employer-Household Dynamics, Civil Rights Data Collection, and CALPADS datasets for demographic, socioeconomic, community, district-level, and district-nested school and grade-level covariates regarding school and district characteristics, school and teacher quality, district finances and investments, school resources, truancy issues, suspension/expulsion issues, and annual student retention by student population, district, school, and grade level.

Sample:

The sample consists of approximately 1300 public high schools in California from 2007-2017 ($n = 1339$). Although 32 states have adopted the SoBL, California is the only state with the widespread adoption of the policy, with approximately 80% of SoBL awards going to Californian students. By the end of 2018, there had been over 230,000 students awarded the SoBL in close to 1000 high schools in California. Before 2017, implementation of the SoBL could not alter school and district trends in bilingual education programming and investment since Prop. 227 would prevent such action.

Outcome Measures:

The measures for educational outcomes reflect post-secondary requirements for academic achievement mirrored in the SoBL's assessments for English proficiency. The outcome variables are related to SoBL requirements, such as enrollment in World Language courses and meeting the state's college-readiness course requirements, as well as the distribution of district expenditure on language programming and policies for educating an EL student on average. Educational outcomes use concrete measures for policymakers and practitioners, where assessment scores and graduation rates signal academic achievement. There are four primary outcome measures:

1. The difference between treatment and control groups in (local) average treatment affects the percentage of EL students, by language minority population and schooling level, that meet the threshold score for signaling proficiency in English.

2. The difference between treatment and control groups in the (local) average treatment effects regarding the percentage of the average daily expenditure for educating an EL student that is dedicated toward the listed target goal for bilingual education from district financial data and local accountability reports.

3. The difference in (local) average treatment effects regarding the percentage of EL students enrolling in World Language courses between treatment and control groups.

4. The difference in (local) average treatment effects on CSU/UC requirement-completion rates by mediating mean scores for English proficiency assessments for EL students between treatment and control groups.

We used English proficiency outcome measures from 2007-2017. English proficiency outcomes are measured by the California English Language Development Test school and grade-mean scores by minority-language populations in the domains of reading, writing, listening and speaking English. The primary outcome measure is the percentage of students that achieve an overall English proficiency-level score of 4 or 5 on the CELDT, which indicates an English proficiency level of "Proficient" for four and "Advanced Proficient" for five and is a requirement for starting the EL reclassification process. CELDT scores before 2007 have not been standardized and are inappropriate for longitudinal analysis. My outcome measures are disaggregated at the grade level for each language group in all the schools included in the sample ($n = 5582$). All Seal of Biliteracy awards require students to attain an English proficiency quantile score of 4 or 5 on the CELDT by the end of elementary school, middle school, or before graduating high school, depending on the SoBL award level.

Treatment, Instrument, and Accessibility

Treatment is defined by whether a district is participating in the SoBL program by awarding the SoBL to students at their graduation rather than districts formally adopting the SoBL. Treatment assignment is based on a binary option for each year a district either participates in the SoBL or not; the total number of years a district participates in treatment is treated as a linear treatment effect. Districts regularly participating in the SoBL comprise 55% of all California districts with high schools. In comparison, around 25% of districts with high schools have never participated in the SoBL during the five years since California first implemented the SoBL until the state repealed Proposition 227; the remaining 20% of districts started participating in the SoBL years after its initial adoption by the state. The state collects data on the SoBL and categorizes a district as a "SoBL Participating District" at the end of the year when districts request SoBL insignias from the state to affix on student high school diplomas. Students need to see other students in their district graduate with a Seal of Biliteracy for the SoBL to become an incentive valued by students. Districts that may have formally adopted the SoBL and may even have encouraged and promoted the SoBL to an extent but failed to graduate a single student with a SoBL diploma cannot seriously be considered a SoBL-participating district because the SoBL cannot be regarded as a valuable incentive if not a single student chose to pursue the seal.

Ethnographies on SoBL adoption in California by Castro-Santana (2014, 2020) and in Washington by Burnet (2017) both found that the trigger for SoBL adoption in the school districts studied was SoBL's existing compatibility with pre-existing programs and policies, particularly regarding students' capability to meet SoBL requirements through four years of world language high school credit towards graduation. Lee (2018) conducted an ethnography in California on barriers to adopting the SoBL, and Davin et al. (2018) conducted a mixed-methods study, also about access to the SoBL in three Illinois school districts; both studies found the lack of extended world language course sequences and student schedule limitations were significant barriers to SoBL adoption. Furthermore, the rigidity of high school graduation requirements in California allows for observing a period before and after the SoBL adoption. It assesses the capability of students in a district to schedule four years of world language study and still meet the district's high school graduation requirements. Considering the SoBL often involves a process of taking a sequence of world language courses or preparing for standardized world language exams, Lee argues that:

> "Given that the seal is earned through one of the previously mentioned methods of a 4-year language program, AP, SAT-II exam, IB, or "off-the-shelf" assessment, increases in seal earners based on programmatic or pedagogical changes made within the district in 1 year may not be reflected in outcomes until 3 or 4 years later" (2018, p. 38).

The literature on SoBL implementation in various states across the country reveals a consensus that schedule limitations in students' ability to take extended world language course sequences and the time delay before internal programming or policy changes can affect student participation in the SoBL. We decided to utilize the likelihood of a student's ability to schedule a four-year extended world language course sequence as a "natural experiment" type instrument for assigning treatment, in the form of years of SoBL adoption, to districts based on reconstructing the average student's schedule that first meets the district's graduation requirements, and then allows for students to schedule a world language class for each year of high school. District graduation requirements are constrained mainly by state guidelines and influenced by the state's four-year university system requirements. Still, they allow districts to design localized requirements around local priorities within the rigid parameters of the state policy. However, localized graduation requirements reflect the number of required credits, not the quality of those credits. A poor and wealthy district can require the same number of Career and Technical Education (CTE) credits. However, an affluent district is more likely to offer computer programming, while a poorer district is more likely to offer agriculture classes for CTE credit. Depending on the number of CTE credits both districts require, it could limit the likelihood that any students in poor and wealthy districts attain the SoBL.

The instruments are two dummy variables that represent whether a district's graduation requirements result in scheduling conflicts that prevent students from taking a world language class each year, particularly freshman year. The second instrument is a dummy that represents whether district credit requirements result in a packed student schedule, making it difficult for students to schedule a four-year world language course load, given that there are no scheduling conflicts that outright prevent students from scheduling a world language class at any particular grade level. Neither instrument shows any statistically significant correlation between English proficiency and college-readiness outcomes when conditioning on treatment. Instead of utilizing any specific subject/credit requirements, we operationalize the requirements' structure to determine the feasibility of enrolling in a world language course for each year of high school to maintain the exclusion restriction. We also implement robust controls for potentially relevant or related social, political, cultural, and demographic variables to preserve the exclusion restriction.

3.7 Estimation Strategy

We organize our estimation strategy and regression equations into three stages for estimating the impact of the Seal of Biliteracy as an information-smoothing policy on EL educational outcomes:

1. Stage 1: Estimating the effect of Information Smoothing on Student Capabilities

2. Stage 2: Estimating the impact of Information Smoothing on Student Functionings

3. Stage 3: Estimating the distributional effect of an information-smoothing policy on Student Resources, specifically regarding the allocation of school funds

Stage 1: Estimating the impact of Information Smoothing on Student Capabilities

What effect does district adoption of the Seal of Biliteracy have on English Learners' English proficiency outcomes?

The IV model will use a two-stage least squares (2SLS), where California School Districts can choose how many years to participate in the SoBL program after statewide adoption. In the model, Y_{it} is the outcome, T_{it} represents the instrument used as a treatment indicator where school implementation of the SoBL at time t equals one and zero otherwise, α_t is a time-level fixed effect, γ_{ds} is a student population group fixed effect, ε_{it} is the error term, and X_i is observed characteristics, such as LEP status by ethnicity/language by education level for schools and districts. The average treatment effect is represented by β_T and F with district finances that were not tagged for the goal of Bilingual Education characteristics. In contrast, B represents the average daily attendance expenditure percent allocated toward the goal of bilingual education – explicitly stated in the financial data – for EL students' acquisition of English. Demographic variables represented by the parameter matrix Z and school characteristics, curriculum, programming, and demographics accounted for in the parameter matrix W_{ds}; with a grade level parameter θ, and a quantile parameter, Q, for ranking districts' level of investment toward the goal of bilingual education and language education programs for ELs:

$$Y_{it} = \alpha_t + \gamma_{ds} + \beta_T T_{dt} + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{Y_{dsit}} \quad (9)$$

The probability of treatment is determined by two dummy variables that are used to predict the likelihood that students in the district graduated with the Seal of Biliteracy in the previous academic year based on whether there were conflicts in their schedule that prevented them from taking a 4-years world language course track, C. If there are no direct scheduling conflicts, whether they have an open/flexible schedule that makes it easy for students to schedule four years of world language classes easily, G, and the coefficients for the instrumental variable dummies are β_1 and β_2:

$$T_{dt} = \alpha_t + \gamma_{ds} + \beta_1 C_d + \beta_2 G_d + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \epsilon_{dsit} \quad (10)$$

The effect of the SoBL as an incentive to improve English proficiency scores is estimated for EL students at different schooling levels and grade levels. The impact of treatment on English Learners based on the primary language spoken at home is also estimated for different schooling levels and individual grades. The Instrumental Variable approach can assess the effect of adopting the SoBL for a school's overall EL population and specific minority language-speaking EL populations, such as Spanish and Chinese native speakers.

Stage 2: Estimating the impact of Information Smoothing on Student Functionings

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on enrollment of EL students in World Language coursework and programming?

We use a framework for causal mediation analysis developed by Dippel et al. (2019) that utilizes our Instrumental Variables to estimate the value of implementing low-powered incentives for encouraging students to participate and enroll in World Language coursework upon passing the CELDT (Dippel et al., 2019; Dippel et al., 2020; Frölich & Huber,2017; Small, 2011). The rate of ELs passing the CELDT threshold score mediates the impact of implementing the Seal on the percent increase of ELs enrolled in World Language courses for each year of SoBL implementation. To accomplish this, we redefine our original outcome variable Y, for English Proficiency percentile, as $\widehat{Y}$ to indicate that passing the English proficiency exam is our mediating variable. We shall define our new outcome variable, the enrollment rate of EL students for World Language coursework, as E. We then get a model that is structured as a system of linear equations:

$$C_d = \varepsilon_C = \varepsilon_D \tag{11}$$

$$T_{dt} = \alpha_t + \gamma_{ds} + \beta_1 C_d + \beta_2 G_d + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{dsit} \tag{12}$$

$$Y_{it} = \alpha_t + \gamma_{ds} + \beta_T T_{dt} + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{Y_{dsit}} \tag{13}$$

$$E_{it} = \alpha_t + \gamma_{ds} + \beta_T T_{dt} + \beta_Y \hat{Y}_{dt} + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{E_{dsit}} \tag{14}$$

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on college readiness measures?

We utilize a causal mediation analysis approach using our Instrumental Variables to estimate the value of implementing low-powered incentives on increasing the density of student populations labeled as college-ready upon graduation by encouraging students to exert effort on language proficiency exams. The rate of ELs passing the CELDT threshold score mediates the impact of implementing the Seal on the CSU/UC requirement-completion rate, also considered a threshold for academic achievement for both students and districts. The data structure is organized into cohort college-readiness outcomes upon graduation using high school grades' English proficiency passing rates as the mediating variable. To accomplish this, we redefine our original outcome variable Y, for English Proficiency percentile, as $\hat{Y}$ to indicate that passing the English proficiency exam is our mediating variable. Our new outcome variable, the CSU/UC requirement-completion rate, we shall define as R. We then get a model that is structured as a system of linear equations:

$$C_d = \varepsilon_C = \varepsilon_D \tag{15}$$

$$T_{dt} = \alpha_t + \gamma_{ds} + \beta_1 C_d + \beta_2 G_d + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{dsit} \tag{16}$$

$$Y_{it} = \alpha_t + \gamma_{ds} + \beta_T T_{dt} + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{Y_{dsit}} \tag{17}$$

$$R_{it} = \alpha_t + \gamma_{ds} + \beta_T T_{dt} + \beta_Y \hat{Y}_{dt} + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{R_{dsit}} \tag{18}$$

Stage 3: Estimating the Impact of Information Smoothing on Student Resources

Does adopting the Seal of Biliteracy reduce districts' average aggregate expenditure on language acquisition programming and instruction for EL education?

While regressing T on Y, we also estimate district investment B as an exogenous variable. Transaction cost theory states that $\beta_B B$ reflects the transaction costs of utilizing resources to maximize the treatment's effectiveness rather than expressing the impact of increasing financial resources on students' English proficiency outcomes. Thus, in an education production function, $\beta_B B$ would reflect the inverse impact (or negative coefficient) of treatment T on B rather than B on Y in the regression results as a negative effect that needs to be subtracted from the positive effect of treatment rather than expressing the impact of increasing financial resources on students' English proficiency outcomes.

$$Y_{it} = \alpha_t + \gamma_{ds} + \beta_{T_1} T_{dt} + \beta_B B_{dt} + F_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{Y_{dsit}} \tag{19}$$

$$T_{dt} = \alpha_t + \gamma_{ds} + \beta_1 C_d + \beta_2 G_d + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \varepsilon_{dsit} \tag{20}$$

Based on the theoretical predictions, β_B should have a negative coefficient as an exogenous variable in an education production regression that can be subtracted from the positive effect of treatment. Since the marginal cost of educating an EL student increases for each EL student, higher English proficiency rates or lower numbers of EL students should correlate with decreases in B, or a negative β_B, reflecting the transaction cost reduced by the incentive effect rather than estimating the direct effect of allocating funds for EL education on student English proficiency outcomes. Further *Robustness Checks* and *Instrument Validation* can be found in Appendix D.

Does district adoption of the Seal of Biliteracy after implementing the Local Control Funding formula affect the average distribution of expenditures targeted toward the goal of bilingual education and educational programming for ELs from districts' discretionary funds?

Since equation [11] is an education production function for an empirical-based assessment, we can construct a cost function for a cost function analysis of policy effects by inverting the education production function such that:

$$B_{dt} = \alpha_t + \gamma_{ds} + \beta_{T_2} T_{dt} + \beta_Y Y_{dsit} + F_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \epsilon_{Y_{dsit}} \tag{21}$$

$$T_{dt} = \alpha_t + \gamma_{ds} + \beta_1 C_d + \beta_2 G_d + F_{dt} + B_{dt} + \theta_{dst} + X_{dsit} + Z_{dt} + W_{dsit} + Q_d + \epsilon_{dsit} \tag{22}$$

Since equation [13] is an inverse function of equation [11], β_{T_2} should be approximate in magnitude but opposite in direction to β_B if the SoBL is an information-smoothing policy that reduces transaction costs while improving student outcomes as an educational incentive.

3.8 Results

What effect does district adoption of the Seal of Biliteracy have on English Learners' English proficiency outcomes?

We address the research question above with a series of different models that utilize instrumental variables with district and school level clustering in a random effects model and models that use fixed effects, inverse probability weighting, and instrumented causal mediation analysis as robustness checks. If standardized exams can perfectly measure a student's English proficiency or if standardized assessments are wildly imperfect instruments for measuring language proficiency, then no policy incentive can positively influence students toward a particular behavior that is statistically significant. If standardized assessments are fair measures of some aspects of language proficiency, while imperfect measures for other elements due to the performative nature of high-stakes testing; an incentive that increases the distribution of students' expected utility should positively influence that distribution of students towards the targeted behavior upon receiving access to the incentive. Moreover, when denied access to the incentive, there should be no statistically significant movement within the student population distribution induced toward the target behavior since no student has the capability to increase their utility without the incentive. Consequently, no student has an incentive to alter their initial behavior to align with the target behavior.

Looking across the top row of Table 1.a., we can see remarkable consistency in the magnitude and positive direction regarding the point estimate of the LATE across all models. Across all random effect models, this consistency is particularly evident as all the random effect models produced an estimate between 5.5-5.6%, regardless of whether treatment of SoBL adoption has interacted as a continuous variable or a categorical variable with district allocation of funds targeted towards Bilingual Education, or if inverse probability weights were applied as well. These point estimates can be interpreted as the adoption of the SoBL incentivizes 5.5-5.6% of EL students, on average, to exert enough effort to pass the English proficiency exam for each year, on average, that the SoBL is implemented in California school districts. A Capability Approach micro-level perspective of the point estimates can be interpreted as a district adopting the SoBL increases the probability, by 5.5-5.6%, of incentivizing an average EL student to pass

Table 1.a.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Outcome Variable	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)
Seal_years	5.556***	5.566**	5.279***	5.515***	5.528**	5.556***	5.545**	5.558***	5.556**
	(1.104)	(2.520)	(1.625)	(1.057)	(2.511)	(1.047)	(2.564)	(1.059)	(2.527)
Bilingual Expenditure	-2.387***	-2.648***	-1.585***	-2.876***	-2.749***	-2.543***	-2.700***	-2.572	-2.119***
	(0.251)	(0.302)	(0.0401)	(0.236)	(0.311)	(0.249)	(0.316)	(1.626)	(0.652)
Seal Years×Bilingual Expenditure						0.220	2.148**	0.294	-14.94
						(0.186)	(0.860)	(4.064)	(16.12)
1.Seal Years×Bilingual Expenditure				3.358***	2.977***				
				(0.662)	(1.087)				
2.Seal Years×Bilingual Expenditure				4.245***	-3.448**				
				(1.012)	(1.518)				
3.Seal Years×Bilingual Expenditure				-1.604	7.234				
				(4.226)	(6.204)				
4.Seal Years×Bilingual Expenditure				0.811	-0.0600				
				(1.025)	(2.361)				
5.Seal Years×Bilingual Expenditure				-0.217	0.757				
				(1.033)	(2.551)				
Constant	-77.27	-260.5		-301.6**	-205.5	-301.0**	-213.2	-302.8*	-271.5
	(129.7)	(286.4)		(135.8)	(284.6)	(135.1)	(286.6)	(158.5)	(303.9)
Observations	189,602	189,602	483,230	189,602	189,602	189,602	189,602	189,602	189,602
R-squared	0.395	0.432	0.327	0.391	0.432	0.39	0.432	0.39	0.397
Number of SchoolCode			5,143						
Robust standard errors in parentheses									
*** p<0.01, ** p<0.05, * p<0.1									

Figure 16: Table 1.a. Outcome: Pass % for English Proficiency Exam, Full Size in Appendix C

the English proficiency exam each year the SoBL is implemented in the district. Since we have a statistically significant positive effect for adopting the SoBL as the treatment on English proficiency exam passage rates, we can infer that these estimated rates ranging from 5.5-5.6% reflect that between five and six out of every hundred EL students in a SoBL-adopting district have received information about the SoBL and how to access and attain the award, as well as have the capability to meet the language course and testing requirements for the SoBL. Furthermore, we can infer that at least 5.5-5.6% of EL students receive increased utility from pursuing a biliteracy-based course path towards graduation and college readiness than other traditional or currently available education investment plans, or else they would not be changing their past behavior by passing the English proficiency exams to meet the SoBL's English requirement for ELs in California.

Model 3 in Table 1.a. utilizes fixed effects at the school level and produced a point estimate of 5.28%, which is less than half a percent lower than the point estimates from the random effects models. The close point estimates between the random effects models and the school-level fixed effects model suggest that the distribution of student populations within schools did not drastically vary enough during the years studied to distort the fixed effect significantly from the random averaged treatment effect for schools and districts. The 5.3-5.6% range of the point estimates from the various models indicates a consistent LATE that seems to be supported by descriptive statistics on the percentage of EL students in California that ultimately achieved the SoBL upon graduation.

Table 1.b.

Year	SoBL Recipients	Total	English Learners
2016	Number	44594	2863
	Rate (%)	11	5.9
	% SoBL Awarded		6.4
2017	Number	47248	2591
	Rate (%)	11	5.1
	% SoBL Awarded		5.5
2018	Number	48311	2565
	Rate (%)	12	5.1
	% SoBL Awarded		5.3
2019	Number	51229	2494
	Rate (%)	12	5.1
	% SoBL Awarded		4.9
Average	Number	47845.5	2628.25
	Rate (%)	11.5	5.3
	% SoBL Awarded		5.5

Table 1.b. - SoBL Recipients by Year

Looking at Table 1.b., it is evident that for the EL students that had at least four years to plan for the SoBL after California started implementing the policy statewide that the percentage of EL students receiving the SoBL, rounded to 5.3% on average is slightly lower than the point estimates for treatment in the random effects models and matches the point estimate for treatment in the fixed effects model. The congruence between the point estimates for the treatment effect and the average percentage of EL students that received the SoBL between 2016-2019 makes sense, considering that if the SoBL was indeed an incentive that motivated EL students to pass the English proficiency exam, then those very same students incentivized by the opportunity to pursue the SoBL, given that they had the capability of achieving the SoBL, would likely attain the SoBL upon graduation. The point estimates from the random effects model are probably more accurate than the fixed effects model since it is more likely that some students who were incentivized to pass the English proficiency exam by the SoBL would ultimately fail to achieve it due to extraneous circumstances than a nearly identical percentage of students passing the exam and attaining the award. However, the 0.2-0.3% difference between the point estimates for the treatment effect and the 5.3% on average EL students that ultimately go on to achieve the SoBL is effectively negligible and likely accounts for the few students that the SoBL may have incentivized before passing the English proficiency exam but either decided against meeting the requirements for the SoBL or were prevented from attaining the SoBL as a consequence of an extraneous reason unrelated to this study.

Table 1.c.	RE	School FE
Outcome Variable	Pass Rate (%)	Pass Rate (%)
Total Effect	5.559***	5.267***
	(0.417)	(1.561)
Direct Effect	-3.244	1.590
	(2.336)	(2.246)
Indirect Effect	8.802	3.677
	(7.369)	(10.49)
Observations	189,602	483,230
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 1.c. - Causal Mediation Analysis of Pass Rate

The instrumented causal mediation models are in Table 1.c. and reflect the point estimates as the IV random effects and fixed effects models, respectively, within a fraction of a percentage point. For example, compare Model 7 in Table 2.a. with the RE model in Table 1.b. and Model 2 and 7 from Table 1.a. with the RE and District FE Models in Table 2.b.; by using instrumental mediation analysis of the two endogenous variables as mediators for treatment of the outcome variable and on each other, we can

Table 2.a.	Model 1	Model 2	Model 3	Model 4	Model 6	Model 7	Model 8	Model 9
Outcome Variable	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp
Seal Years	2.413**	2.614***	2.089	2.451***	2.600*	2.603**	2.114	2.682**
	(1.071)	(0.823)	(1.890)	(0.738)	(1.500)	(1.044)	(1.521)	(1.087)
Passing Rate (%)	-8.364***	-5.737***	-10.27***	-7.584***	-7.372***	-5.561***	-8.477***	-5.843***
	(1.880)	(1.263)	(0.508)	(0.128)	(2.477)	(1.310)	(2.619)	(1.345)
Seal Years×Passing Rate (%)					-0.814	-0.826		
					(1.283)	(0.767)		
1.Seal Years×Passing Rate (%)							5.608**	3.278***
							(2.308)	(0.941)
2.Seal Years×Passing Rate (%)							3.991	-0.886
							(3.375)	(1.863)
3.Seal Years×Passing Rate (%)							-7.641*	-3.736
							(4.215)	(2.410)
4.Seal Years×Passing Rate (%)							1.430	-5.033
							(5.079)	(3.287)
5.Seal Years×Passing Rate (%)							-2.288	-8.251*
							(6.313)	(4.380)
Constant	-1,692***	-465.3***			-1,676***	-446.2***	-1,760***	-497.7***
	(169.5)	(124.4)			(165.3)	(119.4)	(168.1)	(122.6)
Observations	189,602	189,602	189,600	293,627	189,602	189,602	189,602	189,602
R-squared	0.321	0.458	0.210	0.410	0.321	0.458	0.322	0.458
Number of DistrictCode			344	345				
Robust standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

Figure 17: Table 2.a. Outcome: Bilingual Expenditure, Full Size in Appendix C

observe that the coefficient effects are close enough to be considered inverse coefficients as would be expected based on economic theory and analysis of the inverse relationship between education production functions and cost function analysis methods. Estimates from secondary school can be better interpreted as the preferences of EL students, of which much of the population would be classified as LTELs in California, for biliteracy pathways to high school graduation and college admission, as well as an academic recognition of biliteracy skills. Furthermore, due to Prop. 227, the vast majority of these EL students (approximately 97%) would likely have received little to no native language support, and according to the literature on second language acquisition, increased funding and support for bilingual education or biliteracy programs at the secondary level would have an insignificant impact on EL student outcomes, due to the intervention arriving too late in the student's educational path, while also being too negligible to alter the direction of the student's academic pathway. Estimates from the elementary schools can be attributed to the investment from the district towards supporting bilingual and biliterate education pathways for admission to the state's post-secondary four-year institutions.

Table 2.b.	RE	District FE
Outcome Variable	Bilingual Expenditure	Bilingual Expenditure
Total Effect	2.674***	2.641**
	(0.995)	(1.159)
Direct Effect	0.657***	-0.128
	(0.135)	(0.0895)
Indirect Effect	2.017*	2.769
	(1.031)	(1.890)
Observations	189,602	483,230
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

Table 2.b. - Causal Mediation Analysis of Expenditure

In Table 3 (Tables 3.a. to 3.d. are in Appendix C) , we look at the point estimates for different schooling levels and different grades from four different models. Table 3. a. is the random effects model with no interaction term between the treatment and bilingual education funding variable, while Table 3.b. is the school-level fixed effect model. Table 3. c. is the continuous interaction Model 6 from Table 1. a. and Table 3.d. is the categorical interaction Model 4 from Table 1.a. The three random effect models show a relative consistency amongst point estimates for both the elementary and secondary levels within a percent range of the overall point estimate range of 5.5-5.6, falling between a 5.3-5.9 range, often closer to the 5.5 average. The fixed effects model shows a different result that provides a more substantial effect magnitude at the middle school grades starting at 6th grade when students are supposed to be informed by the school district and educators about the SoBL and the requirements to attain it but shows no statistically significant effect at the high school level and for high school grades, unlike the random effects models. The difference between the random effects results and fixed effects results is likely due to the composition of EL students in high school changing due to EL students exiting EL services in elementary and largely middle school grades to pursue the SoBL, making the random effects model more robust than the fixed effects model in this situation since the school characteristics for high schools are changing due to the incentive effect of the SoBL at earlier grades.

The grade level estimates show that the SoBL has the greatest statistically significant effect on English proficiency in the 2nd, 3rd, 5th, 6th, 7th, 8th, 9th, 10th, and 11th-grade assessments. This result is especially revealing because it shows when the SoBL is most often first introduced to incoming students to the district or school (early elementary, 6th grade, and 9th grade). Furthermore, the results also imply that a moral hazard issue exists because teachers personally observe student effort on the CELDT exams for each student in Kindergarten and the 1st grade but stop observing individual students from the 2nd grade onward, except for the speaking portion of the CELDT exam. The results show that there is no statistically significant incentive effect on English proficiency scores for kindergarten and 1st grade for implementing the Seal of Biliteracy but starting in the 2nd grade, a statistically significant effect of an increase of approximately 7%, on average, of EL students passing the CELDT exam is observed. The requirement to achieve an Elementary SoBL is getting a 4 or 5 on the CELDT by the 5th grade. EL students who are in native-language instruction programs are more likely to receive information regarding the Elementary Biliteracy Pathway award earlier in elementary school, which is reflected in the statistically significant effect of an increase of approximately 9% in the third grade and of an increase in the effect of roughly 8% in the fifth-grade results. The fourth grade does not show any statistically significant effect, considering most elementary schools end at either the 3rd or 5th grade, and any SoBL pathway award would likely be given out either in the 3rd or 5th grades at the elementary level. It would make sense that the fourth grade has no statistically significant effect considering that the SoBL would most incentivize elementary students upon first entering the district, or instead taking the exam independently in the 2nd grade, or during the years they would more likely be given a pathway award (ex. the 3rd and 5th grades).

The letter to district leaders from the state regarding the SoBL asks them to disseminate information about the SoBL to students entering middle school, usually in the 6th grade, and incoming first-year high school students in the 9th grade, which reflects the incentive effect of SoBL implementation peaking in 6th grade, as well as the 9th grade, when students, based on state policy and district practices, are most likely to receive information about the Seal of Biliteracy for the first time. However, it is unlikely that any effect from adopting the SoBL is a result of the SoBL incentivizing student to improve their English proficiency. The SoBL can be better explained as an incentive for students to put more effort toward performing better on English proficiency exams. I separate my analysis of the effect of the SoBL by the school, grade, and language population. When looking at the analysis at the grade level, the grades where services are assigned (5,6,9, and 11) show a more substantial and statistically significant effect than the grades where students are effectively stuck in their designated track (4, 7, 8, 10, 12). The main barrier for EL students from realistically attaining the SoBL is the English proficiency requirement unless they speak a language that is not taught in schools or have a formal SAT II assessment.

In Table 4.a.(Table 4.a. and 4.b. are in Appendix C), we compare the effects of district adoption of the SoBL on English proficiency exam passage rates for EL student populations that may potentially have access to native language support and services, likely have an awareness that bilingual programs exist for their native languages such as Spanish, Mandarin, Cantonese, and Korean, or have access to AP, IB, or SAT II coursework or standardized exams in their native tongue. In Table 4.b., we compare the exact effects of SoBL implementation with EL student populations that do not currently or historically have had access to language education or language testing in their native languages. We can observe that EL student populations that do not have access to language education services or language testing in their native language do not exhibit any statistically significant effect with greater than 95% confidence for treatment at any level and any grade. However, EL student populations with some degree of access to language education and testing in their native language show statistically significant effects with a greater than 95% confidence level for all levels and all grades, excluding kindergarten, 1st, 3rd, 5th, and 12th grades. The most substantial effects are seen in the 2nd, 4th, and 7th to 9th grades, where there is a more substantial effect at the secondary level; with the most substantial impact at the middle school level right when students would be receiving a letter from the state of California informing them of the SoBL program and requirements. The high school level shows a higher treatment effect but at a less significant confidence level than the elementary school level results.

We break up the EL student population group with native language education and testing access into its two largest language populations: Spanish and Chinese (Mandarin and Cantonese). Table 5.a. (Appendix C) depicts the treatment effects of district adoption of the SoBL on English proficiency exam passage rates for the Spanish-speaking EL student population by school level and grade, while Table 5.b. (Appendix C) presents the treatment effects for both the Mandarin and Cantonese-speaking EL student populations by school and grade. We see statistically significant treatment effects for Spanish-speaking EL students at greater than 95% confidence level for both elementary and secondary levels, though only for middle school, not high school, at the secondary level. We also see statistically significant effects for Spanish-speaking EL students starting in the 2nd grade until the 9th grade and including the 11th grade.

Chinese estimates differ in significance levels and magnitude from the estimates for Spanish-speaking EL students. For example, Chinese-speaking EL students show statistically significant effects at the elementary level but not the secondary level; however, Spanish-speaking EL students present statistically significant effects in middle school but not high school. The treatment effects for Chinese students districtwide are approximately three times the effect for Spanish-speaking EL students districtwide, with Chinese students producing a treatment effect size of about 16% to the 4.7% increase in English proficiency rates for Spanish-speaking EL students. At the elementary level, Chinese students produce a treatment effect that is approximately 2.5 times the effect on Spanish-speaking students, with a point estimate comparison of 13.3% to 4.8%; and a treatment effect magnitude 1.5 times greater for Chinese-speaking EL students than Spanish-speaking EL students in middle school, with a point estimate comparison of 8.3% to 5.6% increase in English proficiency rates. Chinese-speaking EL students show statistically significant treatment effects for grades 1-3 and 5-8, with the most significant effect in the 2nd and 3rd grades, with the 5th and 6th grades close behind. The difference between the treatment effects for Spanish-speaking ELs and Chinese-speaking ELs is likely due to the geographic distribution of Chinese and Spanish-speaking ELs and the consequent access to language education programs and testing services available to distributions within these student populations, which will be discussed in further depth in the discussion section.

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on enrollment of EL students in World Language coursework and programming?

We now observe the marginal effect of SoBL adoption on EL enrollment in World Language courses with English proficiency rates serving as the mediating variable in a school-level fixed effects instrumental variables causal mediation analysis model in Table 6.a. and in Table 6.b. (both tables in Appendix C), a district level fixed effects version of the instrumented mediation model. We find in the school fixed effects model in Table 6.a. that the total effect of implementing the SoBL increases the enrollment of ELs in world language courses by 5.27%, from an 0% baseline, each year after meeting the English proficiency threshold; in Table 6.b., with district-level fixed effects, we find an increase in the total effect of 5.24 %. Both results are very similar to the descriptive data results that an average of approximately 5.3%, rounded up, of EL students, were awarded the SoBL, as seen in Table 1.b., in the years relevant to this study. The congruence of these estimates with earlier IV and causal IV mediation results for increased English proficiency rates, approximately 5.3-5.6%, with the raw data that about 5.3% of EL students during this study period did ultimately receive the SoBL, lend further support to the credence of these estimates.

The school-level fixed effects results did not find any statistically significant total effect for any individual grade. Still, they did find a statistically significant direct effect of treatment on the outcome variable, EL World Language enrollment rate, of 0.42% for the 12th grade only. The direct effect result is congruent with theoretical expectations that by the 12th grade, an EL student would likely have had to exit from EL services to have access to enrolling in a 4th-year world language class. Thus, it is unlikely that a population of EL students could enroll in three years of world language classes without passing the English proficiency exam, so the decision to enroll in the 4th year of a world language class would likely be motivated by the SoBL program. This assertion is because UC/CSU four-year university systems require two years of world language classes for college admission and recommend students take three. The SoBL, on the other hand, requires four years of world language coursework, making the 4th year of a world language course track superfluous for college admission requirements but necessary for meeting the SoBL requirements. The district-level fixed effects model is in Table 6.b. and shows statistically significant results for the total effect in the 10th and 11th grades and statistically significant results for the direct effect in the 12th grade, mirroring the school-level fixed effects model with a point estimate of 0.4%. The 10th and 11th-grade point estimate results for total effect are respectively 6.1% and 7.6 %, which is also consistent with theoretical predictions that EL students would need to exit from EL services to enroll in 2nd and 3rd-year world language courses in a four-year course sequence and would be incentivized by the SoBL to do as such. The lack of statistical significance for the indirect and direct effects is likely a reflection that the mediating effect of English proficiency rates as a proxy for English proficiency as a barrier to access for the SoBL is likely random across both districts and schools with enough variation rendering the average indirect and direct effect as effectively meaningless, short of there likely exists some combination of effects both direct and indirect different for each school and district. However, the combination of direct and indirect effects, on average, as an aggregate of direct and indirect effects, produces an approximately 5.3% fixed total effect point estimate. The lack of statistical significance for the ninth-grade results likely reflect that many schools and district may require all students to take a world language class, so the SoBL would not reflect any significant incentive effect to motivate students to complete an essential requirement for graduation.

As a robustness check, we ran this model as a standard IV model without the mediating variable of English proficiency rates and the treatment being whether the SoBL was implemented in a particular year for a school district or not rather than years of SoBL implementation. Since our instrument is the capability of enrolling in four consecutive years of world language in high school, then introducing high school grade level dummies into the regression should result in a positive overidentification result in the Hansen J Statistic. We find that the 9th, 10th, and 11th-grade parameters for θ_{s_t} absorb the effect of Treatment β_{d_u}. The grade dummies' coefficients are approximately 8-10% for those three grades. We also found the treatment effect for passing the English proficiency exam for those grade levels to be about 8-10% for passing the English proficiency exam, as we predicted. We also found that the Hansen J statistic shows no evidence that the model is overidentified when the grade level dummies are excluded but indicates that the model is overidentified. The instruments are likely endogenous to the model after incorporating a grade-level indicator variable. Once again, supporting our earlier prediction provides further evidence that our instruments are valid exogenous predictors of treatment selection.

Do the English proficiency outcomes of EL students serve as a mediating variable for the effect of district adoption of the Seal of Biliteracy on college readiness measures?

Finally, we estimate the effect of the Seal on the rate of high school student cohorts that meet the course requirements for admission to the state's four-year universities. Implementing the Seal has a statistically significant positive causal effect on the percentage of EL students that pass the CELDT English proficiency threshold, which then impacts the rate of ELs that meet the CSU/UC course requirements for admission upon graduating high school.

We find that both the school-level fixed effects model and the district-level fixed effects model produce statistically significant results for the total effect for the overall high school results and the 9th-grade total effect results. The school-level fixed effects model is in Table 7.a. (Appendix C) and produces a point estimate of a 5.53% increase in the rate of EL students that graduate high school with the requirements for UC/CSU admission. The district-level fixed effects model is in Table 7.b. (Appendix C) and produces a similar but slightly downward biased estimate of 4.8% from the less than a percent greater school fixed effects result. The 9th-grade results are in Table 7.a. and found a total effect of 8.2%, and for the district effects model in Table 7.b. a result of 8.3% was produced. The lack of statistical significance after the ninth-grade results likely indicates that the SoBL has its greatest effect when students first receive information about the SoBL in the 9th grade, so students can exit out of supplemental English courses and gain access to enrolling in 2nd and 3rd-year world language courses in the 10th and 11th grades as seen in our EL World Language enrollment rate results. The results indicate that the earlier students receive information about the SoBL and can gain access to world language coursework to attain the SoBL, the more likely they will meet UC/CSU requirements for admission upon high school graduation.

Does adopting the Seal of Biliteracy reduce districts' average aggregate expenditure on language acquisition programming and instruction for EL education?

By observing the estimates for the effect of bilingual funding in Table 1.a., we find the correlation between English proficiency rates and average daily expenditure targeted towards bilingual education for EL students are between -1.6% to -2.9%. The negative point estimates should not be interpreted as reducing average expenditure for bilingual educational purposes will result in increased English proficiency rates. Instead, these estimates should be interpreted as an increase in the English proficiency rate should result in lower average expenditure for EL education since greater English proficiency rates imply a decrease in students needing EL services. Since the marginal cost of educating an EL student increases with each additional EL student that needs to be educated in a district, the negative coefficient slope reflects the reduction in the marginal cost of educating an EL student when there is a decrease in the percentage of students that need EL services. The negative point estimate also reflects that the effect of treatment is mediated through district investments in education and that the impact of treatment is dependent on district funding for the observed effect rather than being purely independent. This statistical phenomenon makes sense since it is unlikely that students can become English proficient through sheer will alone once given an incentive, but rather through the combination or interaction between increased motivation and available district resources as well as district investment in language education for EL students. The negative slope coefficient likely represents the proportion of the treatment effect dependent on district funding. It is motivated by SoBL adoption, particularly reductions in average aggregate expenditure on language acquisition programming and instruction for EL education due to the SoBL encouraging EL students to exit from EL services on schedule.

After 2013, districts also could increase investment in bilingual education programs; thus, we implemented inverse probability weighting into the models to account for the likelihood that the SoBL incentivizes districts to increase investment in language acquisition programming and instruction for EL education. In Table 1.a., we see that for the models that utilized inverse probability weighting, we observe a narrower correlation range between -2.65% and -2.75%, with an average estimate of approximately 2.7%. In Table

2.a. and 2.b., we position the bilingual funding variable as the dependent variable rather than the independent variable, expecting that the effects of adopting the SoBL as treatment should be close to the negative slope coefficients as an independent variable in magnitude. However, the point estimate should be opposite in direction or have a positive slope coefficient instead to support the theory that increasing English proficiency rates through educational incentives will lower aggregate costs for educating EL students. In Table 2.a., we see that the point estimates match our predicted estimates by providing slope coefficients in the range of 2.1-2.7%, with the models utilizing inverse probability weighting providing statistically significant results in the range of 2.6-2.7%, which is very close (<0.5% difference) to the point estimates for IP weighted models seen in Table 1.a. in magnitude, but opposite in direction by providing positive slope coefficients, as predicted.

According to statistical theory, inverse probability weighting should result in point estimates for the total treatment effect that can be closely replicated with the expectation of similar point estimates in magnitude and direction from a casual mediation model. In Table 2.b., we find a point estimate for a total effect of 2.67% in the random effects model with a statistically significant direct treatment effect of 0.66% on implementing the SoBL as treatment concerning district increases in bilingual funding motivated by SoBL adoption. Much of the effect magnitude can be attributed to English proficiency rates as the mediating variable for SoBL treatment on bilingual expenditure for EL education. Though the results for the indirect effect are not significant, it can be assumed that if the statistically significant direct effect is a meager 0.66% increase on average to bilingual expenditure for each year of SoBL implementation, the rest of the approximately 2.6-2.7% of the total effect is a result of the savings created by exiting EL students from EL services on schedule which can now be allocated toward the remaining EL students that need EL services. This reallocation of funds likely comprises approximately 75% of the total effect of treatment on average daily expenditure toward bilingual education for the average EL student and explains the positive coefficient for the effect of treatment on available funds; which also further explains the equivalent negative coefficient for bilingual expenditure as an independent variable when English proficiency is the dependent variable, as representing the average reduction of necessary expenditure on bilingual programming and services for the average EL student.

Revisiting Table 2.a., we can see for the models without inverse probability weighting that the slope coefficients for English proficiency rates show a correlation range between -7.4% to -10.3%, with point estimates of -7.6%, -8.4%, and -8.5% comprising the interior of the range. These point estimates should be interpreted as the percentage of decrease in the marginal cost of educating EL students for each additional percentage of EL students that exit from EL services. According to Imazeki (2006), the marginal increase in cost in California for educating an additional Spanish-speaking EL student is approximately 8%. For non-Spanish-speaking EL students, the marginal cost can increase by 25% per student. Given that we have normalized the average daily expense for bilingual purposes for EL students into percentiles and that 85% of California's EL population speak Spanish as their primary language (with the majority of the 15% non-Spanish EL students lacking access to the SoBL), it would be expected that for a 1% increase in students exiting from EL services should correlate with a decrease of 8% for the point estimate (a point estimate of approximately -8); which is what we observe. Furthermore, although not statistically significant, in Table 1.c., the random effects model shows a positive 8.8% indirect effect, which could reflect the effect of the marginal savings and reallocation of bilingual funds from incentivizing EL students to exit on schedule to pursue the SoBL and reallocate those resources to EL students that need the services. Thus, the -7.4% to -10.3% range of point estimates for the correlation between increased English proficiency rates and lower expenditure for EL education could be seen as the 8.8% indirect effect of bilingual funding as a mediating variable for treatment on English proficiency rates with 2-3% of the savings being reallocated to EL education and supporting the SoBL, explaining the positive 2-3% treatment effect range of the SoBL on an an EL's average daily expenditure share from bilingual funding, and its inverse effect of -2-3% when English proficiency is the outcome, and bilingual expenditure is the independent variable.

Does district adoption of the Seal of Biliteracy after implementing the Local Control Funding formula affect the average distribution of expenditures targeted toward the goal of bilingual education and educational programming for ELs from districts' discretionary funds?

It is clear from Table 2.b. that we observe a statistically significant direct effect of treatment in adopting the SoBL, leading to a 0.66% increase in average daily expenditure targeted towards bilingual education for an average EL student. In Table 1.a., we include interaction effects between treatment as a continuous variable and bilingual expenditure for Models 6 to 9 and interacting treatment as a categorical variable with bilingual expenditure for Models 4 and 5. In the continuous interaction models, only Model 7, which utilizes inverse probability weights to account for district decision-making concerning bilingual expenditure, shows a statistically significant effect of approximately a 2.2% increase in the English proficiency rate for a 1% increase in bilingual expenditure and an additional year of SoBL implementation. However, Model 4 shows a statistically significant effect of 3.4% for the 1st year of SoBL implementation with a 1% increase in bilingual expenditure and a statistically significant effect of 4.3% for the 2nd year of SoBL implementation with a 1% increase in bilingual expenditure. On the other hand, Model 5, which is the same as Model 4 but with inverse probability weights, shows a statistically significant effect of approximately 3% for the 1st year of SoBL implementation, with a 1% increase in bilingual expenditure and a statistically significant effect of -3.4% for the 2nd year of SoBL implementation with a 1% increase in bilingual expenditure.

The difference in the point estimates provided in the two models is only significant for the second year of SoBL implementation and its interaction with bilingual expenditure, which can probably be explained by Model 6's inverse probability weights biasing the saving effect of increased English proficiency rates downwards over the incentive effect of interacting district bilingual expenditure with multiple years of treatment. The best takeaway from the results is that the SoBL likely incentivizes districts to invest in bilingual education and purposes only for the first year of SoBL implementation, likely to pay for the initial program setup and installation costs. Districts may increase bilingual expenditure to better support the SoBL program in the second year. Still, district investment in bilingual expenditure likely drops off in the following years after the initial adoption of the SoBL. We see this phenomenon reflected in Table 2.a. with Models 8 and 9, where the only statistically significant effect between the interaction of years of SoBL implementation with a 1% increase in EL students exiting EL services is only statistically significant in the first year of SoBL implementation, with a point estimate of 5.6% in Model 8, mirroring the approximate treatment effect range in Table 1.a. In Model 9, only the first year of SoBL as treatment interacting with a 1% increase in English proficiency rates is statistically significant, and adding the treatment effect point estimate with the interaction point estimate provides a total effect magnitude of 5.96% for the first year of SoBL implementation, which is very close in magnitude with the point estimate from Model 8 and point estimates for treatment effect across Table 1.a.'s models.

Finally, since the LCFF was passed in 2013 and Proposition 227 was repealed in 2016, 2016 should be the only year where districts could invest their preferred amount of funds into bilingual education and services without severe restrictions and penalties about how those funds could be spent under Proposition 227's ban on bilingual education. To ensure that the repeal of Proposition 227 in 2016 is not biasing the estimates we would expect, including the LCFF as a dummy variable for 2013 and the years following would result in the regression dropping the dummy variable for 2016 for being collinear with the LCFF variable. The only year districts could practically utilize the LCFF to invest the district's preferred amount instead of the maximal amount restricted by the state would be 2016, so if the dummy for 2016 is collinear with the LCFF dummy, we can expect our models to be robust to any potential bias through district expenditure on bilingual education after Proposition 227's repeal by controlling for the effect of the LCFF on English proficiency rates. Across all models that utilize random effects in Tables 1 through 7, we find that the LCFF dummy is collinear with the dummy variable for 2016. However, since funds and spending decisions during the categorical aid era and the LCFF are made at the district level, any district-level clustering removes any statistically significant Seal effects on Bilingual Education funding. In addition, by removing district clustering, we can see that the Seal of Biliteracy's distributional impact on the allocation of resources for schools in SoBL-implementing districts shows increased per-pupil investment in primary schools in the first year and no significant effect on investment for secondary schools in later years. This phenomenon further indicates that districts likely invest in the implementation and marketing of the SoBL during the first year of adoption but are constrained by Proposition 227 from investing in additional or expanded bilingual educational services and materials until 2016, when Proposition 227 was repealed. The findings help support the notion that increasing investment in Bilingual Education at earlier grades and adopting the Seal of Biliteracy decreases the necessary expenditure for educating ELs at the secondary level.

3.9 Discussion

The statistically significant positive treatment effects for adopting the SoBL on English proficiency rates – with consistent estimates in both direction and magnitude across several different models – strongly suggest the existence of information frictions regarding the level of performative effort EL students exert on English proficiency exams as well as the preference for biliteracy pathways to graduation and admission to college amongst EL student populations. If standardized high stake English proficiency exams were perfect measures of actual English proficiency, we would not be able to observe any statistically significant positive treatment effects that an incentive could have on outcomes. However, if the English proficiency exams were completely imperfect measures of functioning English proficiency, no incentive would be strong enough to provide meaningful and consistent positive effects for treatment on statistically significant outcomes. We find that standardized exams require a performative level of effort that a population distribution of EL students is not exercising until they are provided access to the SoBL as an incentive.

Much attention regarding the Seal of Biliteracy has focused on the high school Seal of Biliteracy and the value of biliteracy skills in labor markets. However, following the economic literature on the effectiveness of non-pecuniary incentives for inducing student effort on high-stakes exams (see Levitt & List, 2013), the most tangible value the SoBL may have as an incentive is at the elementary school level as a non-pecuniary elementary award. What makes the Seal of Biliteracy attractive from a school finance perspective is that the Seal is a low-cost program that reduces expenditures. We find that the seal of biliteracy influences the distribution of funds within districts toward younger EL students for bilingual education instructional purposes due to SoBL-implementing districts having a decreasing rate of Long-Term EL students that have exited out of EL services before primary schooling due to the incentive effect (for both student and district investment) of the SoBL. The funds saved by former EL students exiting from EL services when capable, given they were incentivized by the SoBL, allow districts to reinvest those funds to help current students assigned to EL services improve their English proficiency and further support their path to achieving the Seal of Biliteracy. The SoBL can have substantial labor market implications by incentivizing EL students at risk of becoming LTELs or "forever" ELs, tracked into a low-level curriculum not designed to prepare students for post-secondary education to become reclassified as English proficient in elementary school. Reclassification tracks EL students into higher-level courses that lead to increased and higher quality college opportunities, as well as access to STEM skills, which are more likely to have a more significant potential for growing post-educational wages than a wage premium for biliteracy skills and language knowledge the Seal of biliteracy intends to signal.

If a district's goal is to improve access and participation in the SoBL program, relying on students passing high stake standardized exams to obtain access to the program and meeting the requirements to achieve the award is highly problematic. High-stakes testing remains an unnecessary barrier to accessing world language coursework and meeting course and credit requirements for admission to one of the state's four-year public universities. Other assessments that require greater observation from educators, like portfolio projects and mock interviews with business leaders, would likely have a more substantial effect on encouraging students to participate in the SoBL by removing further non-economically and possibly non-academic barriers to credentialing as biliterate. In addition, districts can plan for future bilingual programming, such as hiring bilingual staff and creating Biliteracy Pathways, benchmark awards at the elementary level to encourage younger students to embrace their native tongue and become proficient in English. Suppose a district's goal is to incentivize students to perform to the standards of a high-stakes exam. In that case, the SoBL provides an example of a policy that appeals to students by drawing on students' pre-existing or currently-embodied skills, knowledge, and abilities – or "funds of knowledge" according to sociological conceptualizations – not being utilized in their schooling to improve academic outcomes. This example could be further expanded to providing awards or credentials of ability for CTE programs, especially for students from working-class backgrounds who learn technical skills from parents or other family members but lack theoretical, academically relevant knowledge. The example of the SoBL as an incentive for credentialing labor-market skills often not taught in public schools can be repurposed as an incentive to encourage more women and students of color to participate in STEM coursework and programming. Programs that credential students' skills in computer programming and languages, as well as logic-based problem solving, may be used to incentivize students on the autism spectrum to meet the requirements of individualized education plans. These examples are areas of research that scholars should pursue to understand better the value of educational incentives on students' decisions to invest in education.

The accessibility and information availability of the SoBL to EL students are paramount for the SoBL to have a successful effect. If EL students do not believe they can meet the foreign language requirements, they will not be motivated to meet the English language requirements. If EL students have not heard of the SoBL, even if the districts/state/school has adopted and implemented the policy, there is no way it can serve as an incentive. California succeeded because the state promoted the policy in districts that adopted it; the foreign language requirements were not insurmountable for students if they had enough time to plan and prepare an academic pathway for pursuing the SoBL. In Minnesota, attaining the SoBL will provide college credits in the state's public universities; thus, a Minnesota SoBL has a higher labor market/college finance incentive for their students compared to California, but the lack of awareness of the SoBL in the state as well as the higher requirements required to attain the Minnesota SoBL, likely reflect the lower SoBL participation rates in Minnesota compared to California, especially amongst the EL student population. The SoBL's valuation is based on the costs needed to attain the SoBL compared to the benefits of receiving the SoBL. Adding extra benefits, such as college credits for achieving the SoBL, would likely increase the incentive effect of the SoBL for EL students because it would also provide financial relief because students would not have to pay tuition to meet university language requirements. Reducing the costs for EL students, particularly those who cannot take four years of language classes in their native tongue, would also increase the effectiveness of the SoBL as an incentive. Adding extra benefits, such as college credits for attaining the SoBL, would likely increase the incentive effect of the SoBL for EL students by providing financial relief. Thus, allowing students to save money or invest in other courses rather than paying expensive tuition fees to fulfill world language requirements at post-secondary institutions. Increasing post-secondary educational opportunities and signaling complex communication and language skills should improve the productivity of EL students in domestic and foreign labor markets. Furthermore, expanding EL access to the Seal of Biliteracy and increasing the availability of information regarding the Seal will increase human capital accumulation for EL students.

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4 Conclusion

Chapter 4

4.1 Findings And Takeaways

The dissertation utilized quantitative methodology, particularly quasi-experimental design and survival analysis, to evaluate the impact of state policy and language education programs on increasing the likelihood of high school graduation and college readiness for English Learner (EL) students from Latinx and other language-minoritized marginalized populations. The connective thread between dissertation Chapters 2 and 3 is that students incentivized by language-skill credentialing policies in secondary schooling have an underlying latent interest in attending a four-year college, have a native language background, are proficient in English, and find participating in World Language education and the recognition of World Language skills as a viable pathway to provide a comparative advantage in achieving the goal of becoming college ready. My research shows that EL students with initial desires to attend college but face barriers in meeting college admission requirements will utilize the opportunity to graduate high school and be college-ready once presented with a viable pathway to college with perceived lower barriers through World Language education.

The results show that students whose goal is to attend a four-year college, have a native language background at home, and self-identify English as their primary language, defined as emergent bilinguals, show more remarkable academic persistence when having help meeting college admission requirements by gaining access to and making progress in a World Language. However, emergent bilinguals' academic persistence decreases when mandated to take English as a Second Language (ESL) courses, detracting from their opportunities and ability to meet college admission requirements. Based on the findings, emergent bilingual students who are assigned to English Language Development (ELD) services, however, identify English as their primary language and want to attend a four-year college, are the students most likely being incentivized by a low-cost state policy credentialing biliteracy skills in the California State Seal of Biliteracy (SoBL) to exit from ELD services, enroll in WL courses, and meet the UC/CSU college-readiness requirements. Ultimately, the findings from the dissertation provide causal evidence that the SoBL incentivized EL students to improve performance on English Proficiency exams, increase enrollment rates in World Language courses, and increase college-readiness rates in a quasi-experimental design using Instrumental Variable regression and an Instrumental Variable approach to Causal Mediation Analysis.

One of the primary takeaways from the studies is the existence of a “bilingual advantage” in meeting high school graduation and college readiness requirements for students who speak a native language at home and are proficient in English. The findings from both Chapter 2 and Chapter 3’s studies have substantial implications for educating Latinx students, given that most Latinx students are language-minoritized students from Spanish-speaking backgrounds and are more likely to receive instruction in Spanish through bilingual education programming or World Language courses, respectively, through elementary or secondary schooling. Latinx students have a comparative advantage over their peers in World Language education when achieving academic standards for English proficiency or being identified as English proficient. However, in Chapter 2, the findings show that this comparative advantage is diminished when Spanish-speaking students who identify their primary language for speaking and reading as English are assigned to additional ESL courses regarding students’ academic persistence to graduate high school with a latent desire to be college-bound.

The results from Chapter 3 reinforce the findings from the Cox-proportional hazard model used in Chapter 2 through a quasi-experimental Instrumental Variable Approach to Causal Mediation. The SoBL as treatment in the quasi-experimental design provides treatment effects that allow for a causal interpretation of the SoBL as an incentive that motivates Latinx students proficient in English but still assigned to ELD services to begin the reclassification process to become identified as English-Proficient. The policy rewards these students by increasing their access to World Language courses and recognizing their progress in World Language schooling or skills, which help them meet California’s college readiness standards. Through Causal Mediation Analysis, where the SoBL is the treatment and English Proficiency exam pass rates are the mediating variable, I find that increasing the percentage of EL students that pass English Proficiency exams increases enrollment rates in World Language courses and subsequent rates for meeting state standards for college readiness for districts treated with implementation of the SoBL. The causal findings support the survival analysis results that ELD services and ESL courses are barriers to meeting college readiness or admission requirements for emergent bilinguals. However, the students most motivated by and benefiting the greatest from World Language education and skill recognition in becoming a college-bound high school graduate are emergent bilinguals, consistent in both studies for Latinx or Spanish-speaking student populations.

In Chapter 2, the study utilized micro-level student data from a national sample from the NLSY1997 database from 1997 to 2004 and found in the sample used that student course enrollment patterns and post-secondary admission requirements and enrollments reflected historical and concurrent national trends and estimates from NCES surveys and census reports (Brod & Huber, 1996; Horn & Kojaku, 2001; Horn et al., 2001; Lusin, 2012; Snyder et al., 2004; Owings, 1995; Planty et al., 2007; Roey et al., 2001). In the first study, a survival analysis using NLSY1997 survey data, the impact of students who spoke a European language was not statistically significant. It did not reflect an increase or decrease in the dropout risk. In contrast, students who spoke a native language at home other than English, Spanish, or another European language always had statistically significant estimates of an increased risk of dropping out. In the sample, approximately 80% of European native-language speakers are White. Students from a race or ethnicity other than White, Black, or Latinx served as an aggregate representation of Asian, Pacific Islander, Indigenous, and other mixed-race students, where 83% of language-minoritized students from those populations spoke a non-European native language at home.

In Chapter 3, the study used aggregate grade-level and cohort data from all public schools in California from 2007 to 2016. Unlike the rest of the nation, California has large populations of diverse Asian language-speaking communities, often intensely concentrated in regional areas, lacking significant French, German, and Italian-speaking communities as seen in the Northeast, Midwest, and South. In California's aggregate grade-level and cohort data for all public schools, European languages other than Spanish, such as French and German, were widely taught. Still, the population of native French, German, or even Italian speakers who are also ELs was too low to provide robust estimates. However, California's dataset represented large populations of Asian language-speaking populations. In California, only bilingual education and World Language programming in Mandarin and Cantonese were accessible to a larger EL population of Chinese-speaking students. In specific smaller locales with concentrated ethnic Korean, Japanese, or Hmong communities, bilingual education or World Language courses in the native language of these communities were available to their EL student populations. In contrast, large Vietnamese, Filipino, South Asian, Southeast Asian, and Indigenous EL student populations lacked access to public educational programming or instruction in their native languages.

The study results from Chapter 3 showed that the positive treatment effects of SoBL implementation were evident amongst EL students from language populations with access to bilingual instruction or World Language courses in their native language. In contrast, EL students in the same SoBL implementing districts from language populations that lacked access to instruction or education in their native language did not show any statistically significant effect of academically performing better by being incentivized by the SoBL. In the studies from both Chapters 2 and 3, native European language speakers are either too few in numbers to show significant effects or likely come from student populations that are not marginalized and are unlikely to face opportunity gaps or perceived achievement gaps. Therefore, improvements from programs or treatment are unlikely to be observed when initial outcomes are likely optimistic. However, California's investment in bilingual education programs and World Language courses for its large population of Chinese Mandarin or Cantonese-speaking students provides evidence that expanding student access and the availability of World Language education programs and native language bilingual instruction nationwide, evidence that a comparative advantage in World language courses benefit other native language speakers as it does for Spanish speakers in high school graduation and college-readiness and enrollment outcomes would likely be reflected in findings of the survival analysis from Chapter 2.

4.2 Contributions to the Literature and Future Research

The dissertation builds upon the existing literature showing the existence of a "bilingual advantage" for students demonstrating proficiency in a native language spoken at home and English while developing biliteracy skills through developing native language knowledge and ability or learning a second language through academic World Language education and schooling on educational outcomes such as high school and college graduation rates, indicting more significant post-educational economic opportunities and outcomes for meeting early-stage human capital investment benchmarks (Bankston & Zhou, 1995; Bialystok, 2001, 2009; Bialystok et al., 2009; Brod & Huber, 1996; Christofides & Swidinsky, 2010; Feliciano, 2001; Fortes & Rumbaut, 2001; Garrouste, 2008; Gonzalez, 2005; Horn & Kojaku, 2001; Horn et al., 2001; Lusin, 2012; Rumbaut, 2014; Saiz & Zoido, 2002, 2004, 2005; Santibanez & Zarate, 2014; Stanton-Salazar & Dornbusch, 1995; Valenzuela, 1999; Zarate et al., 2005; Zarate & Pineda, 2014). My research provides additional evidence to the literature that increasing students' self-efficacy and beliefs that achieving expected outcomes is attainable by improving access and expanding availability to language education focused on asset-based and culturally integrating approaches, where language-minoritized students' academic persistence can increase by the realization of expected outcomes (Fortes & Rumbaut, 2001; Plasencia-Romero, 2017; Stanton-Salazar & Dornsbusch, 1995; Valenzuela, 1999; Zarate et al., 2005).

The research conducted and presented in Chapters 2 and 3 adds to the existing literature by providing quantitative analysis and causal evidence supporting that the misidentification of emergent bilingual students for assigning ELD services such as ESL courses by relying on English Proficiency exams as the instruments for assignment decisions, results as barriers to meeting graduation and college admission goals for emergent bilinguals, increasing the likelihood that they disinvest from education instead of benefiting from ELD services (Barrett et al., 2012, p. 619; Gandara & Hopkins, 2010; Scott & Ingels, 2007; Siordia & Kim, 2021; Suarez-Orozco et al., 2009). However, my research provides further evidence, both reduced form and causal estimates, showing that emergent bilingual students who exit from ELD services do invest in World Language programming to meet college admission requirements and college-readiness standards and take the necessary courses in the core academic subjects to meet not only high school graduation requirements but also the requirements for college-readiness standards and course requirements for admission to in-state four-year colleges and universities (Callahan et al., 2010; Flores, 2009; Robinson, 2011; Santibanez & Zarate, 2014; Solorzano, 2008).

My research shows the profound effect of policies that improve equitable outcomes for K-12 students from marginalized populations on efficiently allocating public resources, decreasing costs, and wasteful spending. Policies that improve equitable outcomes allow adequate funding for educating marginalized student populations to become available. Building on the existing literature, the implications of the findings from the dissertation provide additional evidence that earlier implementation in K-12 schooling of programs and policies aiming to increase equitable outcomes for marginalized student populations regarding high school graduation or college readiness rates as well as the continuation of investments throughout K-12 education in these programs and policies, the more significant the impact on closing the opportunity and achievement gap will be for marginalized students from language-minoritized communities. Removing language barriers for students and increasing the accessibility and availability of World Language programming and native language instruction should be studied to see how it affects student course-taking patterns and enrollment decisions in other subjects, including STEM, CTE, and the social sciences, as well as how it may impact student's choice of major as an undergraduate and opportunities and decision-making regarding investments in graduate school. Research on World Language investment and credentialing biliteracy skills can be extended to investigate the impact of language learning and credentialing on post-secondary enrollment, perseverance, and outcomes for language-minoritized and marginalized student populations by expanding the SoBL program to post-secondary institutions. Another promising direction for future research is advancing how the comparative advantage for bilingual students in language-diverse urban labor markets can be best utilized in secondary and post-secondary institutions to improve academic outcomes for language-minoritized students from marginalized populations and meet the workplace language needs that serve communities with extensive and diverse immigrant populations.

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5 Appendix A

Table 2a and 2b					Exited						
Variables		Raw Frequency	Raw Percentage	Weighted Percentage	Frequency 0	Frequency 1	Percentage 0	Percentage 1	Relative Percentage	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals				2,495	91	96.48	3.52			
	Weighted %						96.56	3.44			
Sex										0.18	0.18
	Male	1,279	49.5	50.34	1,232	47	48.59	1.76	3.5		
	Female	1,307	50.5	49.66	1,263	44	47.98	1.68	3.4		
Race										4.4	4.18
	White	1,623	62.76	75.92	1,565	58	73.27	2.65	3.49		
	Black	621	24.01	14.12	605	16	13.78	0.34	2.41		
	Hispanic	258	9.98	5.69	244	14	5.4	0.3	5.27		
	Other	84	3.25	4.27	81	3	4.12	0.15	3.51		
Urban										1.4	1.47
	Yes	1,938	74.94	72.62	1,865	73	69.92	2.7	3.72		
	No	648	25.06	27.38	630	18	26.64	0.74	2.7		
HDC Parent										16.92***	18.64***
	High School Dropout	310	11.99	8.4	291	19	7.83	0.57	6.8		
	High School Graduate	1,008	38.98	37.81	975	33	36.71	1.1	2.9		
	AA Graduate	506	19.57	20.26	482	24	19.18	1.08	5.3		
	College Graduate	468	18.1	19.9	463	5	19.68	0.21	1.1		
	Graduate Degree	294	11.37	13.63	284	10	13.16	0.47	3.45		
Spanish Speaker										3.51	3.12
	Yes	319	12.34	8.17	302	17	7.81	0.35	4.28		
	No	2267	87.66	91.83	2,193	74	88.75	3.09	3.36		
European Language Speaker										0.37	0.4
	Yes	119	4.6	4.82	116	3	4.7	0.12	2.5		
	No	2467	95.4	95.18	2,379	88	91.86	3.32	3.5		
Other Language Speaker										4.85**	3.97**
	Yes	168	6.5	6.36	157	11	5.98	0.37	5.82		
	No	2418	93.5	93.64	2,338	80	90.58	3.07	3.28		
Language-Minoritized Population										1.08	1.05
	Yes	674	26.06	22.28	646	28	21.47	0.81	3.64		
	No	1912	73.94	77.72	1849	63	75.09	2.63	3.38		
Language Population										1.19	1.14
	English Monolingual	1912	73.94	77.72	1849	63	75.09	2.63	3.38		
	Heritage Language Speaker	451	17.44	14.79	433	18	14.25	0.53	3.58		
	English Learner	223	8.62	7.49	213	10	7.21	0.28	3.74		
World Language attempts										5.75	5.38
	0	556	21.5	20.6	528	28	19.56	1.04	5		
	1	1,847	71.42	72.18	1,792	55	70.61	1.57	2.9		
	2 or more	183	7.08	7.22	175	8	6.95	0.27	4.3		
Language Pipeline										35.43***	37.77***
	Never attempted language	556	21.5	20.6	528	28	19.56	1.04	5		
	Attempted, no progress	140	5.41	4.57	129	11	4.29	0.28	8.75		
	Completed less than 2 years	514	19.88	19.28	484	30	18.08	1.2	6.2		
	Completed 2 years	736	28.46	28.49	723	13	27.95	0.55	1.93		
	Completed 3 years	390	15.08	16.36	383	7	16.13	0.23	1.41		
	Completed 4 years	164	6.34	7.52	162	2	7.48	0.03	0.4		
	Completed AP/IB course	86	3.33	3.19	86	0	3.19	0	0		

Table 2a and 2c					Enrolled in University						
Variables		Raw Frequency	Raw Percentage	Weighted Percentage	Frequency 0	Frequency 1	% 0	% 1	Relative Percentage	Pearson Chi-Squared	Likelihood Chi-Squared
	Raw Totals				1,482	1,104	57.31	42.69			
	Weighted %						54.53	45.47			
Sex										23.55***	23.6***
	Male	1,279	49.5	50.34	794	485	30.05	20.29	40.3		
	Female	1,307	50.5	49.66	688	619	24.48	25.18	50.7		
Race										32.28***	32.78***
	White	1,623	62.76	75.92	869	754	39.68	36.24	47.7		
	Black	621	24.01	14.12	392	229	8.75	5.37	38		
	Hispanic	258	9.98	5.69	177	81	3.86	1.83	32.2		
	Other	84	3.25	4.27	44	40	2.23	2.04	47.8		
Urban										4.31**	4.34**
	Yes	1,938	74.94	72.62	1,088	850	38.74	33.88	46.7		
	No	648	25.06	27.38	394	254	15.78	11.59	42.3		
HDC Parent										377.93***	390.41***
	High School Dropout	310	11.99	8.4	257	53	6.97	1.43	17		
	High School Graduate	1,008	38.98	37.81	708	300	26.25	11.56	30.6		
	AA Graduate	506	19.57	20.26	283	223	11.22	9.04	44.6		
	College Graduate	468	18.1	19.9	159	309	6.62	13.28	66.7		
	Graduate Degree	294	11.37	13.63	75	219	3.47	10.16	74.5		
Spanish Speaker										5.38**	5.45***
	Yes	319	12.34	8.17	202	117	4.94	3.22	39.4		
	No	2267	87.66	91.83	1,280	987	49.58	42.25	46		
European Language Speaker										2.42	2.4
	Yes	119	4.6	4.82	60	59	2.35	2.47	51.24		
	No	2467	95.4	95.18	1,422	1,045	52.17	43.01	45.12		
Other Language Speaker										0.58	0.58
	Yes	168	6.5	6.36	101	67	3.61	2.75	43.24		
	No	2418	93.5	93.64	1,381	1,037	50.92	42.72	45.62		
Language-Minoritized Population										13.61***	13.75***
	Yes	674	26.06	22.28	427	247	13.5	8.78	39.41		
	No	1912	73.94	77.72	1,055	857	41.03	36.69	47.21		
Language Population										24.27***	25.24***
	English Monolingual	1912	73.94	77.72	1,055	857	41.03	36.69	47.21		
	Heritage Language Speaker	451	17.44	14.79	266	185	8.2	6.59	44.56		
	English Learner	223	8.62	7.49	161	62	5.3	2.19	29.24		
World Language attempts										307.41***	352.46***
	0	556	21.5	20.6	499	57	18.28	2.32	11.26		
	1	1,847	71.42	72.18	905	942	33.55	38.63	53.52		
	2 or more	183	7.08	7.22	78	105	2.7	4.52	62.6		
Language Pipeline										746.41***	820.45***
	Never attempted language	556	21.5	20.6	499	57	18.28	2.32	11.26		
	Attempted, no progress	140	5.41	4.57	126	14	4.09	0.5	10.9		
	Completed less than 2 years	514	19.88	19.28	385	129	14.44	4.81	25		
	Completed 2 years	736	28.46	28.49	329	407	12.28	16.15	56.8		
	Completed 3 years	390	15.08	16.36	108	282	4.4	12.14	74.4		
	Completed 4 years	164	6.34	7.52	18	146	0.77	6.72	89.62		
	Completed AP/IB course	86	3.33	3.19	17	69	0.45	2.73	85.57		

Table 3a	Model 1		Model 2		Model 3		Model 4	
VARIABLES	coef	HR	coef	HR	coef	HR	coef	HR
SEX	-0.181	0.834	-0.143	0.867	-0.160	0.852	-0.206	0.814
	(0.203)	(0.169)	(0.205)	(0.178)	(0.207)	(0.176)	(0.214)	(0.174)
Midwest	0.0573	1.059	0.0273	1.028	0.00844	1.008	0.107	1.113
	(0.301)	(0.318)	(0.302)	(0.310)	(0.303)	(0.305)	(0.326)	(0.363)
South	-0.187	0.830	-0.199	0.819	-0.237	0.789	-0.0520	0.949
	(0.318)	(0.264)	(0.324)	(0.265)	(0.325)	(0.257)	(0.342)	(0.325)
West	-0.0853	0.918	-0.119	0.888	-0.166	0.847	-0.216	0.805
	(0.318)	(0.292)	(0.320)	(0.284)	(0.325)	(0.275)	(0.357)	(0.288)
birth	0.00126	1.001	0.00119	1.001	0.00164	1.002	0.00135	1.001
	(0.00578)	(0.00579)	(0.00575)	(0.00576)	(0.00574)	(0.00575)	(0.00603)	(0.00604)
Urban	0.279	1.322	0.317	1.373	0.289	1.335	0.302	1.353
	(0.253)	(0.335)	(0.250)	(0.343)	(0.254)	(0.338)	(0.270)	(0.366)
Father+Stepmother	0.117	1.125	0.0391	1.040	0.0503	1.052	0.269	1.309
	(0.470)	(0.529)	(0.477)	(0.496)	(0.471)	(0.495)	(0.472)	(0.618)
Mother+Stepfather	-0.100	0.905	-0.0560	0.946	-0.0816	0.922	-0.0101	0.990
	(1.040)	(0.941)	(1.036)	(0.979)	(1.050)	(0.968)	(1.058)	(1.047)
Single Mother	0.205	1.228	0.181	1.198	0.196	1.217	0.352	1.422
	(0.322)	(0.396)	(0.324)	(0.388)	(0.323)	(0.393)	(0.343)	(0.487)
Single Father	-0.00550	0.995	-0.114	0.892	-0.0141	0.986	0.292	1.339
	(0.638)	(0.634)	(0.650)	(0.580)	(0.652)	(0.643)	(0.656)	(0.879)
Other Guardian	0.355	1.426	0.315	1.371	0.332	1.393	0.425	1.529
	(0.259)	(0.370)	(0.263)	(0.361)	(0.263)	(0.366)	(0.283)	(0.433)
Spanish Speaker					0.803*	2.231*	0.855*	2.351*
					(0.436)	(0.972)	(0.455)	(1.071)
EU Speaker					0.325	1.383	0.262	1.300
					(0.590)	(0.816)	(0.659)	(0.856)
OL Speaker					0.989**	2.688**	1.268***	3.552***
					(0.451)	(1.212)	(0.475)	(1.686)
Family Income	0.151***	1.163***	0.150***	1.161***	0.149***	1.160***	0.147***	1.158***
	(0.0214)	(0.0250)	(0.0214)	(0.0249)	(0.0214)	(0.0249)	(0.0229)	(0.0265)
HS Grad.	-0.698**	0.498**	-0.708**	0.493**	-0.585*	0.557*	-0.498	0.608
	(0.297)	(0.148)	(0.300)	(0.148)	(0.322)	(0.180)	(0.351)	(0.213)
AA Degree	-0.433	0.649	-0.400	0.670	-0.294	0.745	-0.163	0.849
	(0.312)	(0.202)	(0.315)	(0.211)	(0.332)	(0.247)	(0.358)	(0.304)
BA/BS Degree	-1.803***	0.165***	-1.755***	0.173***	-1.636***	0.195***	-1.457***	0.233***
	(0.514)	(0.0847)	(0.516)	(0.0892)	(0.518)	(0.101)	(0.529)	(0.123)
Grad. Degree	-0.497	0.608	-0.470	0.625	-0.341	0.711	-0.175	0.839
	(0.421)	(0.256)	(0.424)	(0.265)	(0.437)	(0.311)	(0.463)	(0.388)
Gifted & Talented	-0.661*	0.517*	-0.604	0.547	-0.606	0.545	-0.612	0.542

	(0.392)	(0.202)	(0.399)	(0.218)	(0.400)	(0.218)	(0.403)	(0.218)
Special Education	-0.278	0.757	-0.431	0.650	-0.461	0.631	-0.790*	0.454*
	(0.377)	(0.285)	(0.380)	(0.247)	(0.385)	(0.243)	(0.480)	(0.218)
ASVAB score	-1.20e-05***	1.000***	-1.07e-05***	1.000***	-1.09e-05***	1.000***	-1.11e-05***	1.000***
	(3.98e-06)	(3.98e-06)	(4.05e-06)	(4.05e-06)	(4.10e-06)	(4.10e-06)	(4.29e-06)	(4.29e-06)
1 WL Attempt			-0.504**	0.604**	-0.523**	0.593**	-0.349	0.705
			(0.228)	(0.138)	(0.230)	(0.136)	(0.250)	(0.176)
2+ WL Attempts			-0.00682	0.993	0.0187	1.019	0.184	1.202
			(0.428)	(0.425)	(0.429)	(0.437)	(0.441)	(0.530)
Black	-0.403	0.669	-0.413	0.662	-0.374	0.688	-0.558*	0.572*
	(0.281)	(0.188)	(0.283)	(0.187)	(0.286)	(0.197)	(0.315)	(0.180)
Latinx	-0.174	0.840	-0.129	0.879	-0.165	0.848	0.0163	1.016
	(0.308)	(0.259)	(0.313)	(0.275)	(0.322)	(0.274)	(0.332)	(0.338)
Other Race	-0.134	0.875	-0.0551	0.946	-0.134	0.874	-0.0352	0.965
	(0.628)	(0.549)	(0.631)	(0.597)	(0.656)	(0.574)	(0.683)	(0.660)
_t								
Industrious							0.00686	1.007
							(0.0286)	(0.0288)
Observations	89,772	89,772	89,772	89,772	89,772	89,772	89,772	89,772

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3b	Model 5				Model 6			
Variables	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
SEX	0.0604		1.062		0.174		1.19	
	(0.237)		(0.252)		(0.244)		(0.29)	
Midwest	0.111		1.117		0.0246		1.025	
	(0.36)		(0.402)		(0.363)		(0.372)	
South	-0.111		0.895		-0.193		0.824	
	(0.396)		(0.354)		(0.402)		(0.331)	
West	-0.681		0.506		-0.686		0.504	
	(0.429)		(0.217)		(0.423)		(0.213)	
birth	-0.002		0.998		-0.000516		0.999	
	(0.00655)		(0.00653)		(0.00658)		(0.00658)	
Urban	0.432		1.541		0.356		1.428	
	(0.308)		(0.474)		(0.305)		(0.435)	
Father+ Stepmother	0.0921		1.096		0.0813		1.085	
	(0.542)		(0.595)		(0.54)		(0.585)	
Mother+ Stepfather	0.0339		1.034		0.135		1.144	
	(1.141)		(1.18)		(1.087)		(1.244)	
Single Mother	0.144		1.154		0.061		1.063	
	(0.389)		(0.449)		(0.386)		(0.411)	
Single Father	0.414		1.513		0.328		1.388	
	(0.686)		(1.038)		(0.682)		(0.947)	
Other Guardian	0.124		1.132		0.0263		1.027	
	(0.304)		(0.344)		(0.314)		(0.322)	
Spanish Speaker	0.626		1.87		0.643		1.903	
	(0.566)		(1.058)		(0.56)		(1.066)	
EU Speaker	0.716		2.047		0.715		2.045	
	(0.731)		(1.497)		(0.721)		(1.474)	
OL Speaker	1.635***		5.127***		1.659***		5.255***	
	(0.582)		(2.984)		(0.592)		(3.111)	
Family Income	0.152***		1.165***		0.157***		1.170***	
	(0.0251)		(0.0292)		(0.0258)		(0.0302)	
HS Grad	-0.506		0.603		-0.42		0.657	
	(0.408)		(0.246)		(0.43)		(0.283)	
AA Degree	-0.0482		0.953		0.105		1.11	
	(0.389)		(0.37)		(0.413)		(0.458)	
BA/BS Degree	-1.424**		0.241**		-1.253**		0.286**	

	(0.602)		(0.145)		(0.626)		(0.179)	
Grad Degree	-0.211		0.81		-0.0411		0.96	
	(0.526)		(0.426)		(0.545)		(0.523)	
gifted	-0.437		0.646		-0.398		0.672	
	(0.459)		(0.297)		(0.474)		(0.319)	
SPED	-1.368**		0.255**		-1.407**		0.245**	
	(0.604)		(0.154)		(0.603)		(0.148)	
ASVAB Score	-6.65e-06		1		-6.63e-06		1	
	(5.23e-06)		(5.23e-06)		(5.38e-06)		(5.38e-06)	
1 WL Attempt	0.323		1.381		0.253		1.288	
	(0.314)		(0.433)		(0.325)		(0.418)	
2+ WL Attempts	0.843*		2.324*		0.939*		2.557*	
	(0.488)		(1.134)		(0.491)		(1.255)	
Black	-0.913**		0.401**		-0.871**		0.419**	
	(0.383)		(0.154)		(0.379)		(0.159)	
Latinx	0.0629		1.065		0.144		1.155	
	(0.428)		(0.456)		(0.426)		(0.492)	
Other Race	0.176		1.192		0.0939		1.098	
	(0.674)		(0.803)		(0.718)		(0.789)	
Industriousness	-0.00259		0.997		-0.00796		0.992	
	(0.0389)		(0.0388)		(0.0392)		(0.0389)	
tvc								
GPA		-0.00858*		0.991*		-0.00578		0.994
		(0.00496)		(0.00492)		(0.00515)		(0.00512)
10.grade		0.0034		1.003		0.00592		1.006
		(0.0156)		(0.0157)		(0.0157)		(0.0158)
11.grade		-0.00491		0.995		-0.00129		0.999
		(0.0151)		(0.015)		(0.0156)		(0.0155)
12.grade		-0.0458***		0.955***		-0.0439**		0.957**
		(0.0171)		(0.0164)		(0.0174)		(0.0166)
age		0.00165***		1.002***		0.00146***		1.001***
		(0.000322)		(0.000323)		(0.000328)		(0.000329)
1.WL ratio		-0.349**		0.705**		-0.349**		0.705**
		(0.152)		(0.108)		(0.168)		(0.118)
2.WL ratio		0.534***		1.706***		0.493***		1.638***
		(0.137)		(0.234)		(0.153)		(0.25)
1.STEM ratio						-0.0639		0.938
						(0.0626)		(0.0587)

2.STEM ratio						0.0692		1.072
						(0.0935)		(0.1)
1.SocSci ratio						-0.105*		0.900*
						(0.0584)		(0.0526)
2.SocSci ratio						0.097		1.102
						(0.0605)		(0.0667)
1.Art ratio						-0.124		0.884
						(0.0875)		(0.0773)
2.Art ratio						0.0668		1.069
						(0.105)		(0.112)
1.English ratio						-0.107		0.899
						(0.0676)		(0.0607)
2.English ratio						0.115		1.121
						(0.0828)		(0.0929)
Observations	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1					

Table 3c	Model 7a				Model 7b			
Variables	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
SEX	0.169		1.185		0.157		1.17	
	(0.244)		(0.289)		(0.245)		(0.286)	
Midwest	-0.0172		0.983		-0.0484		0.953	
	(0.364)		(0.358)		(0.366)		(0.349)	
South	-0.201		0.818		-0.191		0.826	
	(0.404)		(0.331)		(0.405)		(0.334)	
West	-0.705*		0.494*		-0.706*		0.494*	
	(0.422)		(0.209)		(0.424)		(0.209)	
birth	-0.000532		0.999		-0.000501		0.999	
	(0.00662)		(0.00662)		(0.00665)		(0.00665)	
Urban	0.338		1.402		0.316		1.371	
	(0.306)		(0.428)		(0.303)		(0.416)	
Father+ Stepmother	0.0756		1.079		0.137		1.147	
	(0.535)		(0.577)		(0.522)		(0.598)	
Mother+ Stepfather	0.137		1.146		0.114		1.121	
	(1.09)		(1.249)		(1.099)		(1.232)	
Single Mother	0.038		1.039		0.0437		1.045	
	(0.385)		(0.4)		(0.386)		(0.403)	
Single Father	0.371		1.449		0.381		1.464	
	(0.685)		(0.992)		(0.689)		(1.008)	
Other Guardian	0.0229		1.023		0.0185		1.019	
	(0.315)		(0.322)		(0.316)		(0.322)	
Spanish Speaker	0.695		2.004		0.708		2.03	
	(0.577)		(1.156)		(0.574)		(1.166)	
EU Speaker	0.77		2.159		0.884		2.421	
	(0.719)		(1.552)		(0.743)		(1.798)	
OL Speaker	1.691***		5.426***		1.842***		6.312***	
	(0.606)		(3.287)		(0.645)		(4.073)	
Family Income	0.159***		1.172***		0.158***		1.171***	
	(0.0265)		(0.031)		(0.0263)		(0.0308)	
HS Grad	-0.415		0.661		-0.433		0.649	
	(0.425)		(0.281)		(0.424)		(0.275)	
AA Degree	0.0978		1.103		0.113		1.119	
	(0.408)		(0.45)		(0.412)		(0.461)	
BA/BS Degree	-1.246**		0.288**		-1.269**		0.281**	

	(0.617)		(0.178)		(0.615)		(0.173)	
Grad Degree	-0.0561		0.945		-0.0593		0.942	
	(0.54)		(0.51)		(0.539)		(0.508)	
Gifted	-0.427		0.653		-0.462		0.63	
	(0.479)		(0.313)		(0.484)		(0.305)	
SPED	-1.443**		0.236**		-1.401**		0.246**	
	(0.6)		(0.142)		(0.596)		(0.147)	
ASVAB Score	-6.68e-06		1		-6.18e-06		1	
	(5.36e-06)		(5.36e-06)		(5.32e-06)		(5.32e-06)	
1 WL Attempt	0.269		1.308		0.296		1.345	
	(0.323)		(0.423)		(0.326)		(0.439)	
2+ WL Attempts	0.967**		2.631**		0.999**		2.715**	
	(0.492)		(1.294)		(0.494)		(1.341)	
Black	-0.883**		0.413**		-0.874**		0.417**	
	(0.385)		(0.159)		(0.387)		(0.162)	
Latinx	0.127		1.136		0.0958		1.101	
	(0.418)		(0.475)		(0.41)		(0.451)	
Other Race	0.0691		1.072		0.0939		1.098	
	(0.737)		(0.79)		(0.724)		(0.795)	
Industriousness	-0.0101		0.99		-0.00645		0.994	
	(0.0388)		(0.0384)		(0.0392)		(0.039)	
ESL					0.212		1.236	
					(1.192)		(1.474)	
GPA		-0.00549		0.995		-0.00599		0.994
		(0.00516)		(0.00513)		(0.00518)		(0.00515)
10.grade		0.00781		1.008		0.00797		1.008
		(0.0159)		(0.0161)		(0.016)		(0.0162)
11.grade		-0.000211		1		-0.00145		0.999
		(0.0157)		(0.0157)		(0.0158		(0.0158)
12.grade		-0.0445**		0.957**		-0.0466***		0.954***
		(0.0175)		(0.0168)		(0.0177)		(0.0169)
age		0.00149***		1.001***		0.00153***		1.002***
		(0.000343)		(0.000344)		(0.000355)		(0.000356)
1.WL ratio		-0.277		0.758		-0.277		0.758
		(0.192)		(0.146)		(0.194)		(0.147)
EBxWL ratio		-0.911**		0.402**		-0.914**		0.401**
		(0.386)		(0.155)		(0.392)		(0.157)
ELxWL ratio		-0.127		0.88		-0.12		0.887

		(0.139)		(0.123)		(0.135)		(0.12)
2.WL ratio		0.416**		1.515**		0.413**		1.511**
		(0.163)		(0.247)		(0.164)		(0.248)
1.STEM ratio		-0.0611		0.941		-0.0642		0.938
		(0.0626)		(0.0589)		(0.062)		(0.0582)
2.STEM ratio		0.0646		1.067		0.0619		1.064
		(0.0936)		(0.0998)		(0.0971)		(0.103)
1.SocSci ratio		-0.109*		0.896*		-0.111*		0.895*
		(0.0573)		(0.0513)		(0.0587)		(0.0525)
2.SocSci ratio		0.100*		1.105*		0.0984		1.103
		(0.0595)		(0.0658)		(0.0601)		(0.0663)
1.Art ratio		-0.127		0.881		-0.119		0.888
		(0.0886)		(0.0781)		(0.0887)		(0.0787)
2.Art ratio		0.0702		1.073		0.0579		1.06
		(0.107)		(0.114)		(0.108)		(0.114)
1.English ratio		-0.106		0.9		-0.116*		0.890*
		(0.0668)		(0.0601)		(0.0665)		(0.0592)
2.English ratio		0.115		1.122		0.123		1.131
		(0.0821)		(0.092)		(0.083)		(0.0938)
ESLx2.English ratio						0.534**		1.707**
						(0.23)		-0.392
Observations	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1					

Table 4	Model 8				Model 9				Model 10			
Variables	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	HR
SEX	0.134		1.143		0.132		1.141		0.11		1.117	
	(0.246)		(0.282)		(0.247)		(0.282)		(0.245)		(0.273)	
Midwest	0.0174		1.018		-0.0396		0.961		-0.0892		0.915	
	(0.368)		(0.375)		(0.372)		(0.358)		(0.368)		(0.337)	
South	-0.176		0.838		-0.205		0.815		-0.22		0.803	
	(0.405)		(0.339)		(0.407)		(0.332)		(0.404)		(0.324)	
West	-0.631		0.532		-0.657		0.518		-0.707*		0.493*	
	(0.419)		(0.223)		(0.421)		(0.218)		(0.422)		(0.208)	
birth	0.000138		1		0.000128		1		0.000216		1	
	(0.00668)		(0.00668)		(0.00676)		(0.00677)		(0.00661)		(0.00661)	
Urban	0.323		1.381		0.319		1.376		0.214		1.238	
	(0.301)		(0.416)		(0.305)		(0.42)		(0.295)		(0.366)	
Father +Stepmother	0.0624		1.064		0.0367		1.037		0.324		1.382	
	(0.544)		(0.579)		(0.54)		(0.56)		(0.485)		(0.671)	
Mother +Stepfather	0.104		1.109		0.111		1.117		0.111		1.118	
	(1.115)		(1.237)		(1.11)		(1.24)		(1.159)		(1.296)	
Single Mother	0.049		1.05		0.0279		1.028		0.0661		1.068	
	(0.389)		(0.408)		(0.386)		(0.397)		(0.384)		(0.411)	
Single Father	0.346		1.413		0.383		1.467		0.367		1.443	
	(0.687)		(0.97)		(0.688)		(1.009)		(0.701)		(1.012)	
Other Guardian	0.0312		1.032		0.0169		1.017		0.0826		1.086	
	(0.317)		(0.327)		(0.318)		(0.323)		(0.319)		(0.346)	
Spanish Speaker	0.725		2.064		0.734		2.083		0.877*		2.403*	
	(0.547)		(1.129)		(0.553)		(1.153)		(0.508)		(1.221)	
EU Speaker	0.86		2.363		0.886		2.426		0.966		2.627	
	(0.747)		(1.766)		(0.763)		(1.85)		(0.707)		(1.857)	
OL Speaker	1.776***		5.907***		1.805***		6.079***		1.999***		7.383***	
	(0.593)		(3.501)		(0.604)		(3.673)		(0.539)		(3.98)	
Family Income	0.157***		1.170***		0.158***		1.171***		0.167***		1.182***	
	(0.0252)		(0.0295)		(0.0256)		(0.0299)		(0.0262)		(0.0309)	
HS Grad.	-0.403		0.668		-0.402		0.669		-0.475		0.622	
	(0.428)		(0.286)		(0.424)		(0.284)		(0.402)		(0.25)	
AA Degree	0.14		1.15		0.132		1.141		0.103		1.108	
	(0.417)		(0.479)		(0.413)		(0.471)		(0.407)		(0.45)	
BA/BS Degree	-1.239**		0.290**		-1.238**		0.290**		-1.286**		0.276**	
	(0.622)		(0.18)		(0.614)		(0.178)		(0.605)		(0.167)	
Grad Degree	-0.0462		0.955		-0.0607		0.941		-0.0623		0.94	
	(0.535)		(0.511)		(0.529)		(0.498)		(0.527)		(0.495)	
Gifted	-0.402		0.669		-0.421		0.657		-0.425		0.654	
	(0.474)		(0.317)		(0.478)		(0.314)		(0.481)		(0.314)	
SPED	-1.382**		0.251**		-1.408**		0.245**		-1.441**		0.237**	
	(0.603)		(0.151)		(0.6)		(0.147)		(0.608)		(0.144)	
ASVAB Score	-6.83E-06		1		-6.79E-06		1		-6.45E-06		1	
	(5.33E-06)		(5.33E-06)		(5.29E-06)		(5.29E-06)		(5.34E-06)		(5.34E-06)	
1 WL Attempt	0.257		1.293		0.281		1.325		0.339		1.404	
	(0.334)		(0.431)		(0.33)		(0.438)		(0.337)		(0.473)	
2+ WL Attempts	1.003**		2.727**		1.038**		2.824**		1.088**		2.969**	
	(0.501)		(1.366)		(0.497)		(1.404)		(0.488)		(1.45)	
Industriousness	-0.0143		0.986		-0.0165		0.984		-0.0125		0.988	
	(0.0398)		(0.0392)		(0.0395)		(0.0389)		(0.0403)		(0.0398)	
Black	-0.873**		0.418**		-0.885**		0.413**		-0.876**		0.416**	
	(0.383)		(0.16)		(0.387)		(0.16)		(0.392)		(0.163)	
Latinx	0.151		1.163		0.134		1.143		0.274		1.315	
	(0.438)		(0.51)		(0.428)		(0.49)		(0.41)		(0.539)	
Other Race	0.0964		1.101		0.0476		1.049		0.03		1.03	
	(0.716)		(0.789)		(0.739)		(0.775)		(0.705)		(0.726)	
EB	-1.289*		0.276*		-1.003		0.367		-1.731**		0.177**	
	(0.681)		(0.188)		(0.685)		(0.251)		(0.744)		(0.132)	
EL	-1.034*		0.356*		-1.110*		0.329*		-0.139		0.87	
	(0.583)		(0.207)		(0.621)		(0.205)		(0.857)		(0.746)	
GPA		-0.00506		0.995		-0.00466		0.995		-0.00589		0.994
		(0.00468)		-0.00466		(0.00472)		(0.0047)		(0.00503)		(0.005)
1. WL ratio		-0.339**		0.713**		-0.275		0.76		-0.276		0.759
		(0.17)		(0.121)		(0.188)		(0.143)		(0.206)		(0.156)
2. WL ratio		0.481***		1.617***		0.413***		1.512***		0.402**		1.495**
		(0.152)		(0.246)		(0.155)		(0.235)		(0.181)		(0.27)
1. English ratio		-0.106*		0.900*		-0.102*		0.903*		-0.107*		0.899*
		(0.0623)		(0.0561)		(0.0617)		(0.0557)		(0.063)		(0.0566)
2. English ratio		0.113		1.12		0.111		1.118		0.115		1.122
		(0.0764)		(0.0856)		(0.0757)		(0.0846)		(0.0802)		(0.09)

1. STEM ratio		-0.0722		0.93		-0.0695		0.933		-0.0467		0.954
		(0.0671)		(0.0625)		(0.068)		(0.0634)		(0.061)		(0.0582)
2. STEM ratio		0.0911		1.095		0.0867		1.091		0.0481		1.049
		(0.0976)		(0.107)		(0.0988)		(0.108)		(0.0894)		(0.0938)
1. SocSci ratio		-0.101		0.904		-0.107*		0.899*		-0.119*		0.888*
		(0.0618)		(0.0559)		(0.0612)		(0.055)		(0.0617)		(0.0548)
2. SocSci ratio		0.0972		1.102		0.104*		1.110*		0.111*		1.117*
		(0.0623)		(0.0687)		(0.0617)		(0.0684)		(0.0618)		(0.069)
1. Art ratio		-0.137		0.872		-0.139		0.87		-0.145		0.865
		(0.0895)		(0.078)		(0.0912)		(0.0793)		(0.094)		(0.0813)
2. Art ratio		0.09		1.094		0.0896		1.094		0.0979		1.103
		(0.0988)		(0.108)		(0.102)		(0.111)		(0.106)		(0.116)
10.grade		0.00644		1.006		0.00815		1.008		0.00764		1.008
		(0.0157)		(0.0158)		(0.016)		(0.0162)		(0.0165)		(0.0166)
11.grade		0.00109		1.001		0.00162		1.002		0.000559		1.001
		(0.0164)		(0.0164)		(0.0166)		(0.0166)		(0.0169)		(0.0169)
12.grade		-0.0420**		0.959**		-0.0418**		0.959**		-0.0465**		0.955**
		(0.0185)		(0.0177)		(0.0187)		(0.018)		(0.0192)		(0.0183)
age		0.00136***		1.001***		0.00139***		1.001***		0.00161***		1.002***
		(0.00029)		(0.00029)		(0.000299)		(0.000299)		(0.000346)		(0.000346)
EBx1. WL ratio						-0.896***		0.408***		-0.826***		0.438***
						(0.347)		(0.142)		(0.291)		(0.127)
ELx1. WLratio						-0.191**		0.826**		-0.106		0.899
						(0.0937)		(0.0774)		(0.154)		(0.138)
EBx1. English ratio										0.115***		1.122***
										(0.0373)		(0.0418)
ELx1. English ratio										-0.423*		0.655*
										(0.239)		(0.157)
Observations	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1									

Table 5a	Model 11				Model 12				Model 13			
Variables	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	HR
SEX	0.164		1.178		0.156		1.169		0.146		1.157	
	(0.248)		(0.292)		(0.247)		(0.288)		(0.247)		(0.286)	
Midwest	0.0221		1.022		-0.0178		0.982		-0.0497		0.952	
	(0.361)		(0.369)		(0.36)		(0.354)		(0.362)		(0.345)	
South	-0.216		0.806		-0.225		0.798		-0.213		0.808	
	(0.411)		(0.331)		(0.412)		(0.329)		(0.412)		(0.333)	
West	-0.736*		0.479*		-0.763*		0.466*		-0.764*		0.466*	
	(0.431)		(0.206)		(0.43)		(0.201)		(0.43)		(0.2)	
birth	-0.000144		1		-0.000233		1		-0.000349		1	
	90.00674)		(0.00674)		(0.00677)		(0.00676)		(0.00679)		(0.00679)	
Urban	0.342		1.408		0.326		1.386		0.305		1.357	
	(0.306)		(0.431)		(0.306)		(0.423)		(0.304)		(0.412)	
Father +Stepmother	0.0528		1.054		0.0318		1.032		0.102		1.108	
	(0.568)		90.599)		(0.567)		(0.585)		(0.552)		(0.611)	
Mother +Stepfather	0.206		1.229		0.198		1.219		0.18		1.197	
	(1.075)		(1.321)		(1.079)		(1.315)		(1.088)		(1.302)	
Single Mother	0.0767		1.08		0.0522		1.054		0.0601		1.062	
	(0.388)		(0.419)		(0.385)		(0.406)		(0.386)		(0.41)	
Single Father	0.346		1.414		0.398		1.489		0.41		1.506	
	(0.687)		(0.971)		(0.685)		(1.02)		(0.689)		(1.037)	
Other Guardian	0.029		1.029		0.0239		1.024		0.0184		1.019	
	(0.313)		(0.322)		(0.315)		(0.322)		(0.315)		(0.321)	
Spanish Speaker	0.697		2.008		0.746		2.109		0.746		2.108	
	(0.598)		(1.2)		(0.61)		(1.286)		(0.602)		(1.268)	
EU Speaker	0.746		2.108		0.786		2.194		0.889		2.432	
	(0.718)		(1.514)		(0.713)		(1.565)		(0.734)		(1.787)	
OL Speaker	1.793***		6.005***		1.836***		6.271***		1.981***		7.251***	
	(0.6)		(3.603)		(0.615)		(3.857)		(0.656)		(4.757)	
Family Income	0.157***		1.170***		0.159***		1.172***		0.157***		1.170***	
	(0.0259)		(0.0304)		(0.0266)		(0.0312)		(0.0265)		(0.031)	
HS Grad.	-0.465		0.628		-0.477		0.62		-0.496		0.609	
	(0.432)		(0.271)		(0.424)		(0.263)		(0.423)		(0.258)	
AA Degree	0.0769		1.08		0.0482		1.049		0.0638		1.066	
	(0.412)		(0.445)		(0.407)		(0.427)		(0.411)		(0.438)	
BA/BS Degree	-1.292**		0.275**		-1.300**		0.273**		-1.316**		0.268**	
	(0.628)		(0.173)		(0.619)		(0.169)		(0.616)		(0.165)	
Grad Degree	-0.0788		0.924		-0.114		0.892		-0.115		0.891	
	(0.563)		(0.52)		(0.553)		(0.493)		(0.552)		(0.492)	
Gifted	-0.377		0.686		-0.397		0.672		-0.431		0.65	
	(0.486)		(0.333)		(0.489)		(0.329)		(0.494)		(0.321)	
SPED	-1.373**		0.253**		-1.412**		0.244**		-1.374**		0.253**	
	(0.599)		(0.152)		(0.597)		(0.145)		(0.594)		(0.15)	
ASVAB Score	-7.13E-06		1		-7.20E-06		1		-6.67E-06		1	
	95.45E-06)		(5.45E-06)		(5.43E-06)		(5.43E-06)		(5.39E-06)		(5.39E-06)	
1 WL Attempt	0.299		1.348		0.316		1.371		0.337		1.401	
	(0.338)		(0.455)		(0.336)		(0.461)		(0.338)		(0.474)	
2+ WL Attempts	0.968*		2.633*		0.993**		2.701**		1.016**		2.761**	
	90.505)		(1.331)		(0.503)		(1.357)		(0.503)		(1.39)	
Black	-0.871**		0.418**		-0.883**		0.414**		-0.873**		0.418**	
	(0.38)		90.159)		(0.385)		(0.159)		(0.387)		(0.162)	
Latinx	0.0949		1.1		0.083		1.087		0.0511		1.052	
	(0.451)		(0.496)		(0.438)		(0.476)		(0.432)		(0.454)	
Other Race	0.0839		1.088		0.0439		1.045		0.0643		1.066	
	(0.745)		(0.81)		(0.766)		(0.801)		(0.751)		(0.801)	
Industriousness	0.0431		1.044		0.0407		1.041		0.041		1.042	
	(0.0517)		(0.054)		(0.0518)		(0.0539)		(0.0519)		(0.054)	
EBxIndustriousness	-0.191**		0.826**		-0.180**		0.835**		-0.177**		0.838**	
	(0.0871)		(0.072)		(0.0855)		(0.0714)		(0.087)		(0.0729	
ELxIndustriousness	-0.0875		0.916		-0.0933		0.911		-0.0816		0.922	
	(0.0871)		(0.0798)		(0.0882)		(0.0804)				(0.0836)	
GPA		-0.00582		0.994		-0.0056		0.994	-0.0907	-0.00618		0.994
		(0.00514)		(0.00511)		(0.00518)		(0.00515)		(0.00523)		(0.0052)
1. WL ratio		-0.361**		0.697**		-0.292		0.747		-0.291		0.748
		(0.171)		(0.12)		(0.195)		(0.146)		(0.196)		(0.147)
2. WL ratio		0.539***		1.714***		0.463***		1.588***		0.456***		1.577***
		(0.16)		(0.275)		(0.169)		(0.269)		(0.17)		(0.268)
1. English ratio		-0.0967		0.908		-0.0956		0.909		-0.107		0.899
		(0.0684)		(0.0621)		(0.0676)		(0.0614)		(0.0671)		(0.0603)
2. English ratio		0.103		1.109		0.103		1.108		0.112		1.118
		(0.0844)		(0.0936)		(0.0836)		(0.0927)		(0.0842)		(0.0942)
1. STEM ratio		-0.0713		0.931		-0.0683		0.934		-0.0728		0.93
		(0.06)		(0.0559)		(0.0602)		(0.0562)		(0.0596)		(0.0554)
2. STEM ratio		0.0784		1.082		0.0738		1.077		0.0722		1.075

		(0.0877)		(0.0949)		(0.0886)		(0.0954)		(0.092)		(0.0989)
1. SocSci ratio		-0.103*		0.902*		-0.107*		0.899*		-0.107*		0.898*
		(0.058)		(0.0523)		(0.057)		(0.0512)		(0.0584)		(0.0524)
2. SocSci ratio		0.0915		1.096		0.0942		1.099		0.0914		1.096
		(0.06)		(0.0657)		(0.0592)		(0.065)		(0.0597)		(0.0654)
1. Art ratio		-0.116		0.89		-0.119		0.888		-0.112		0.894
		(0.0879)		(0.0783)		(0.0889)		(0.079)		(0.0892)		(0.0798)
2. Art ratio		0.051		1.052		0.0544		1.056		0.0426		1.044
		(0.109)		(0.115)		(0.111)		(0.117)		(0.112)		(0.117)
10.grade		0.00497		1.005		0.00663		1.007		0.00676		1.007
		(0.0156)		(0.0157)		(0.0158)		(0.0159)		(0.0159)		(0.016)
11.grade		-0.00308		0.997		-0.00192		0.998		-0.00329		0.997
		(0.0158)		(0.0158)		(0.0159)		(0.0159)		(0.016)		(0.016)
12.grade		-0.0465***		0.955***		-0.0472***		0.954***		-0.0495***		0.952***
		(0.018)		(0.0172)		(0.0182)		(0.0174)		(0.0184)		(0.0175)
age		0.00147***		1.001***		0.00151***		1.002***		0.00154***		1.002***
		(0.000334)		(0.000334)		(0.000348)		(0.000348)		(0.000359)		(0.000359)
EBx1. WL ratio						-0.886**		0.412**		-0.887**		0.412**
						(0.365)		(0.151)		(0.37)		(0.152)
ELx1. WLratio						-0.141		0.868		-0.135		0.873
						(0.14)		(0.121)		(0.137)		(0.12)
ESL									0.204		1.227	
									(1.214)		(1.489)	
ESLx2.English ratio										0.510**		1.665**
										(0.239)		(0.399)
Observations	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1									

Table 5b	Model 14				Model 15			
Variables	coef	tvc coef	HR	tvc HR	coef	tvc coef	HR	tvc HR
SEX	0.146		1.157		0.112		1.119	
	(0.247)		(0.286)		(0.247)		(0.277)	
Midwest	-0.0617		0.94		-0.121		0.886	
	(0.365)		(0.343)		(0.366)		(0.324)	
South	-0.228		0.796		-0.207		0.813	
	(0.413)		(0.329)		(0.41)		(0.333)	
West	-0.782*		0.458*		-0.770*		0.463*	
	(0.435)		(0.199)		(0.428)		(0.198)	
birth	-0.000282		1		0.000394		1	
	(0.0068)		(0.0068)		(0.00681)		(0.00682)	
Urban	0.305		1.357		0.226		1.253	
	(0.304)		(0.412)		(0.297)		(0.373)	
Father +Stepmother	0.087		1.091		0.313		1.368	
	(0.549)		(0.599)		(0.499)		(0.683)	
Mother +Stepfather	0.188		1.207		0.26		1.297	
	(1.088)		(1.313)		(1.097)		(1.422)	
Single Mother	0.0537		1.055		0.107		1.113	
	(0.386)		(0.407)		(0.389)		(0.433)	
Single Father	0.418		1.519		0.421		1.524	
	(0.687)		(1.044)		(0.703)		(1.071)	
Other Guardian	0.0188		1.019		0.0924		1.097	
	(0.316)		(0.322)		(0.322)		(0.353)	
Spanish Speaker	0.73		2.075		0.957		2.604	
	(0.599)		(1.242)		(0.616)		(1.605)	
EU Speaker	0.852		2.343		0.83		2.293	
	(0.726)		(1.702)		(0.703)		(1.612)	
OL Speaker	1.951***		7.038***		2.102***		8.181***	
	(0.659)		(4.638)		(0.638)		(5.223)	
Family Income	0.157***		1.170***		0.163***		1.177***	
	(0.0265)		(0.0311)		(0.0272)		(0.032)	
HS Grad.	-0.507		0.603		-0.576		0.562	
	(0.422)		(0.254)		(0.414)		(0.233)	
AA Degree	0.0584		1.06		0.0629		1.065	
	(0.411)		(0.436)		(0.403)		(0.43)	
BA/BS Degree	-1.323**		0.266**		-1.343**		0.261**	
	(0.614)		(0.164)		(0.61)		(0.159)	
Grad Degree	-0.119		0.887		-0.136		0.873	
	(0.547)		(0.486)		(0.542)		(0.473)	
Gifted	-0.427		0.653		-0.419		0.657	
	(0.493)		(0.322)		(0.493)		(0.324)	

SPED	-1.375**		0.253**		-1.411**		0.244**	
	90.592)		(0.15)		(0.619)		(0.151)	
ASVAB Score	-6.81E-06		1		-6.16E-06		1	
	(5.38E-06)		(5.38E-06)		95.52E-06)		(5.52E-06)	
1 WL Attempt	0.337		1.401		0.404		1.498	
	(0.339)		(0.475)		(0.344)		(0.515)	
2+ WL Attempts	1.008**		2.741**		1.021**		2.776**	
	(0.505)		(1.384)		(0.496)		(1.376)	
Black	-0.873**		0.418**		-0.859**		0.424**	
	(0.387)		(0.162)		(0.387)		(0.164)	
Latinx	0.0508		1.052		0.0689		1.071	
	(0.429)		(0.451)		(0.45)		(0.482)	
Other Race	0.0339		1.035		0.0426		1.044	
	(0.759)		(0.785)		(0.726)		(0.757)	
Industriousness	0.0421		1.043		0.042		1.043	
	(0.0522)		(0.0544)		(0.0526)		(0.0548)	
EBxIndustriousness	-0.181**		0.834**		-0.184**		0.832**	
	(0.0864)		(0.0721)		(0.0867)		(0.0721)	
ELxIndustriousness	-0.0808		0.922		-0.0599		0.942	
	(0.0909)		(0.0838)		(0.0869)		(0.0818)	
GPA		-0.00617		0.994		-0.00765		0.992
		(0.00523)		(0.00519)		(0.00536)		(0.00532)
1. WL ratio		-0.3		0.741		-0.294		0.745
		(0.206)		(0.152)		(0.205)		(0.153)
2. WL ratio		0.476**		1.609**		0.454**		1.575**
		(0.189)		(0.303)		(0.185)		(0.292)
1. English ratio		-0.105		0.9		-0.134*		0.874*
		(0.0677)		(0.0609)		(0.0726)		(0.0634)
2. English ratio		0.11		1.116		0.14		1.15
		(0.0845)		(0.0944)		(0.0892)		(0.103)
1. STEM ratio		-0.0744		0.928		-0.0434		0.957
		(0.0594)		(0.0552)		(0.0574)		(0.055)
2. STEM ratio		0.0761		1.079		0.0367		1.037
		(0.0914)		(0.0987)		(0.0821)		(0.0852)
1. SocSci ratio		-0.109*		0.897*		-0.109*		0.897*
		(0.0588)		(0.0527)		(0.0616)		(0.0553)
2. SocSci ratio		0.0931		1.098		0.0863		1.09
		(0.0601)		(0.0659)		(0.0629)		(0.0686)
1. Art ratio		-0.111		0.895		-0.123		0.884
		(0.0896)		(0.0802)		(0.0873)		(0.0772)
2. Art ratio		0.0412		1.042		0.0641		1.066
		(0.113)		(0.117)		(0.111)		90.119)
10.grade		0.00699		1.007		0.00418		1.004
		(0.0159)		(0.0161)		(0.0169)		(0.017)
11.grade		-0.0033		0.997		-0.00235		0.998
		(0.0161)		(0.016)		(0.0172)		(0.0172)
12.grade		-0.0491***		0.952***		-0.0496***		0.952***
		(0.0185)		(0.0176)		(0.0191)		(0.0182)
age		0.00154***		1.002***		0.00172***		1.002***
		(0.000357)		(0.000358)		(0.000424)		90.000425)
EBx1. WL ratio		0.373		1.453		-0.907***		0.404***
		(0.39)		(0.566)		(0.33)		(0.133)
ELx1. WLratio		0.117		1.124		-0.0828		0.921
		(0.55)		(0.618)		(0.194)		(0.179)
ESL	0.158		1.172		0.436		1.547	
	(1.21)		(1.418)		(1.305)		(2.018)	
ESLx2.English ratio		0.517**		1.676**		0.407		1.502
		(0.239)		(0.401)		(0.335)		(0.503)
EBx2. WL ratio		-8.972**		0.000127**				
		(3.49)		(0.000443)				
ELx2. WLratio		-1.087		0.337				
		(2.773)		(0.935)				
EBx1. English ratio						0.149***		1.160***
						(0.0559)		(0.0649)
ELx1. English ratio						-0.402*		0.669*
						(0.231)		(0.155)
Observations	89,699	89,699	89,699	89,699	89,699	89,699	89,699	89,699
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1					

6 Appendix B

Table 7a	Model A		Model B			
Variables	Coef	HR	Coef	TVC Coef	HR	TVC HR
1 WL Attempt	-0.536	0.585	0.205		1.227	
	(0.359)	(0.21)	(0.524)		(0.643	
2+ WL Attempts	-0.113	0.893	0.303		1.354	
	(0.732)	(0.654)	(0.924)		(1.251)	
Black	-1.067**	0.344**	-1.405**		0.245**	
	(0.484)	(0.166)	(0.68)		(0.167)	
Latinx	0.582	1.789	0.695		2.005	
	(0.546)	(0.977)	(0.575)		(1.152)	
Other Race	1.147	3.149	1.575*		4.832*	
	(0.791)	(2.49)	(0.916)		(4.425)	
College Expectation %	-0.0116**	0.988**	-0.0114**		0.989**	
	(0.00516)	(0.0051)	(0.0053)		0.00524)	
Industriousness			0.077		1.08	
			(0.0654)		(0.0706)	
GPA				-0.00566		0.994
				(0.00711)		(0.00707)
1. WL ratio				-0.562		0.57
				(0.363)		(0.207)
2. WL ratio				1.500**		4.483**
				(0.651)		(2.92)
10.grade				-0.0118		0.988
				(0.0273)		(0.027)
11.grade				-0.00442		0.996
				(0.0244)		(0.0243)
12.grade				-0.0392		0.962
				(0.0261)		(0.0251)
age				0.00217***		1.002***
				(0.000488)		(0.000489)
Observations	35,484	35,484	35,484	35,484	35,484	35,484
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1			

In Models A, B, C, and D, the sample size is 1062 students with 39 failures. In Table 7a, Model A has no time-varying covariates and shows that the outcome expectations variable for the percent likelihood that a student expects to attend college is a statistically significant predictor for increased academic persistence and a lower risk of dropping out of high school. The effect of the percentage a student expects to go to college on academic persistence absorbs the statistical significance of the effect of attempting a WL course, which is expected since students are likely to take a WL course as part of satisfying the desire to attend college. Thus, students who expect that they are more likely to attend a college will likely attempt a WL course to meet college admission requirements or recommendations, so it is not expected that attempting a WL course or enrolling in a WL would override the statistical significance of the effect of expecting to go to college. Model B further supports this theory by showing that the percentage a student expects to attend college is a statistically significant predictor of a decreased likelihood of dropping out, whereas the estimate for the first-order WL enrollment ratio is not statistically significant.

In contrast, Models C and D in Table 7b show that after including the enrollment ratio for the other subjects customarily required for college admission, the statistically significant estimate of the percentage a student expects to go to college, previously seen in Models A and B, is lost. In contrast, the first-order WL enrollment ratio estimate gains statistical significance in Models C and D, while the estimates for the other subjects do not. The contrasting results of Model C and D show that a student's interest is observed by the percentage they expect to go to college; however, when all of the choice actions are included in the model, the variable proxying interest loses its statistical significance to the variables representing students' choice actions observed in the courses they chose to enroll. The results show that enrolling in WL is a choice action that stands out from other choice actions by absorbing the statistical significance of the college expectations variable since enrolling in multiple consecutive annual courses in the same WL is required more for college admission than high school graduation, unlike the other subjects, usually needed for both graduation and college admissions.

Model D shows that consistent enrollment in a WL provides a comparative advantage in academic persistence for EB students over English monolinguals, similar to the main results; however, the model also presents an extremely strong comparative advantage for EL students that was not present for the main models used in the study. Since many students from the NLSY1997 sample did not answer the college expectations question, likely, many EL students who did not expect to go to college omitted answering the survey question, and EL students who expected to go to college answered the survey question. This bias in the sample pool likely reflects why EL students who expect to go to college have such a strong comparative advantage in increasing academic persistence through consistent enrollment in a WL compared to their peers. For one, a much smaller sample of ELs likely responded to the survey

Table 7b	Model C				Model D			
Variables	Coef	TVC Coef	HR	TVC HR	Coef	TVC Coef	HR	TVC HR
1 WL Attempt	0.281		1.324		0.3		1.349	
	(0.547)		(0.724)		(0.541)		(0.73)	
2+ WL Attempts	0.481		1.618		0.46		1.583	
	(1.008)		(1.631)		(1.038)		(1.644)	
Black	-1.551**		0.212**		-1.566**		0.209**	
	(0.726)		(0.154)		(0.725)		(0.151)	
Latinx	0.817		2.263		0.767		2.153	
	(0.578)		(1.309)		(0.59)		(1.27)	
Other Race	1.575*		4.830*		1.644**		5.178**	
	(0.829)		(4.005)		(0.804)		(4.165)	
College Expectation	-0.0113*		0.989*		-0.0118*		0.988*	
	(0.00608)		(0.00601)		(0.00625)		(0.00618)	
Ind.	0.0903		1.094		0.0901		1.094	
	(0.0635)		(0.0695)		(0.0632)		(0.0691)	
GPA		-0.00179		0.998		-0.00183		0.998
		(0.00704)		(0.00703)		(0.00711)		(0.00709)
1. WL ratio		-0.675**		0.509**		-0.553		0.575
		(0.319)		(0.163)		(0.354)		(0.204)
EBx1.WL ratio						-0.797***		0.450***
						(0.298)		(0.134)
ELx1.WLratio						-192.4***		2.71e-84***
						(12.29)		(3.33e-83)
2. WL ratio		1.800***		6.050***		1.557**		4.746**
		(0.6)		(3.632)		(0.673)		(3.194)
1. English ratio		-0.0122		0.988		-0.00445		0.996
		(0.0915)		(0.0904)		(0.0953)		(0.0949)
2. English ratio		-0.0685		0.934		-0.0883		0.915
		(0.261)		(0.243)		(0.29)		(0.265)
1. STEM ratio		-0.117*		0.890*		-0.116*		0.890*
		(0.0688)		(0.0612)		(0.0691)		(0.0615)
2. STEM ratio		0.167		1.181		0.167		1.182
		(0.137)		(0.162)		(0.135)		(0.159)
1. SocSci ratio		0.00537		1.005		0.00307		1.003
		(0.0896)		(0.0901)		(0.0852		(0.0854)
2. SocSci ratio		0.00939		1.009		0.0132		1.013
		(0.093)		(0.0939)		(0.089)		(0.0902)
1. Art ratio		-0.345		0.708		-0.345*		0.708*
		(0.212		(0.15)		(0.209)		(0.148)
2. Art ratio		0.261		1.298		0.263		1.301
		(0.202)		(0.262)		(0.198)		(0.257)
10.grade		-0.00547		0.995		-0.00522		0.995
		(0.0279)		(0.0277)		(0.0281)		(0.0279)
11.grade		-0.00815		0.992		-0.00873		0.991
		(0.0273)		(0.027)		(0.027)		(0.0268)
12.grade		-0.0401		0.961		-0.0405		0.96
		(0.0271)		(0.0261)		(0.0271)		(0.026)
age		0.00191***		1.002***		0.00193***		1.002***
		(0.00051)		(0.000511)		(0.000523)		(0.000524)
Observations	35,484	35,484	35,484	35,484	35,484	35,484	35,484	35,484
(RBSE)	*** p<0.01,	** p<0.05,	* p<0.1					

question than EBs, and the responding sample was more likely to have realistic expectations of attending college in the future. Because students who answered the college expectations question were more likely to have a realistic belief that attending college is an attainable goal, it is essential to note that both EB and EL students found that consistent enrollment in a WL was a viable pathway or choice action for facilitating achievement in the choice goal of admission to a four-year university.

7 Appendix C

Table 1.a.	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Outcome Variable	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)	Passing Rate (%)
Seal_years	5.556***	5.566**	5.279***	5.515***	5.528**	5.556***	5.545**	5.558***	5.556**
	(1.104)	(2.520)	(1.625)	(1.057)	(2.511)	(1.047)	(2.564)	(1.059)	(2.527)
Bilingual Expenditure	-2.387***	-2.648***	-1.585***	-2.876***	-2.749***	-2.543***	-2.700***	-2.572	-2.119***
	(0.251)	(0.302)	(0.0401)	(0.236)	(0.311)	(0.249)	(0.316)	(1.626)	(0.652)
Seal Years×Bilingual Expenditure						0.220	2.148**	0.294	-14.94
						(0.186)	(0.860)	(4.064)	(16.12)
1.Seal Years×Bilingual Expenditure				3.358***	2.977***				
				(0.662)	(1.087)				
2.Seal Years×Bilingual Expenditure				4.245***	-3.448**				
				(1.012)	(1.518)				
3.Seal Years×Bilingual Expenditure				-1.604	7.234				
				(4.226)	(6.204)				
4.Seal Years×Bilingual Expenditure				0.811	-0.0600				
				(1.025)	(2.361)				
5.Seal Years×Bilingual Expenditure				-0.217	0.757				
				(1.033)	(2.551)				
Constant	-77.27	-260.5		-301.6**	-205.5	-301.0**	-213.2	-302.8*	-271.5
	(129.7)	(286.4)		(135.8)	(284.6)	(135.1)	(286.6)	(158.5)	(303.9)
Observations	189,602	189,602	483,230	189,602	189,602	189,602	189,602	189,602	189,602
R-squared	0.395	0.432	0.327	0.391	0.432	0.39	0.432	0.39	0.397
Number of SchoolCode			5,143						

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.a.	Model 1	Model 2	Model 3	Model 4	Model 6	Model 7	Model 8	Model 9
Outcome Variable	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp	Bilingual Exp
Seal Years	2.413**	2.614***	2.089	2.451***	2.600*	2.603**	2.114	2.682**
	(1.071)	(0.823)	(1.890)	(0.738)	(1.500)	(1.044)	(1.521)	(1.087)
Passing Rate (%)	-8.364***	-5.737***	-10.27***	-7.584***	-7.372***	-5.561***	-8.477***	-5.843***
	(1.880)	(1.263)	(0.508)	(0.128)	(2.477)	(1.310)	(2.619)	(1.345)
Seal Years×Passing Rate (%)					-0.814	-0.826		
					(1.283)	(0.767)		
1.Seal Years×Passing Rate (%)							5.608**	3.278***
							(2.308)	(0.941)
2.Seal Years×Passing Rate (%)							3.991	-0.886
							(3.375)	(1.863)
3.Seal Years×Passing Rate (%)							-7.641*	-3.736
							(4.215)	(2.410)
4.Seal Years×Passing Rate (%)							1.430	-5.033
							(5.079)	(3.287)
5.Seal Years×Passing Rate (%)							-2.288	-8.251*
							(6.313)	(4.380)
Constant	-1,692***	-465.3***			-1,676***	-446.2***	-1,760***	-497.7***
	(169.5)	(124.4)			(165.3)	(119.4)	(168.1)	(122.6)
Observations	189,602	189,602	189,600	293,627	189,602	189,602	189,602	189,602
R-squared	0.321	0.458	0.210	0.410	0.321	0.458	0.322	0.458
Number of DistrictCode			344	345				

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table 3.a.i. M1	District Average	Elementary	Secondary	Jr High	High
Seal Years	5.556***	5.903***	5.056***	4.090*	5.247*
	(1.104)	(1.236)	(1.848)	(2.149)	(2.835)
Bilingual Expenditure	-2.387***	-2.934***	-1.269	-1.398	-1.021
	(0.251)	(0.243)	(0.84)	(1.291)	(0.746)
Constant	-77.27	-54.35	-323.2	-332.2	-644.1*
	(129.7)	(141.1)	(239.8)	(292)	(347.2)
Observations	189,602	144,387	45,215	19,716	25,499
R-squared	0.395	0.414	0.244	0.27	0.259

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.a.ii. M1	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Seal Years	-0.265	1.067	7.224**	9.139**	8.833*	8.494**	6.587***	5.690**	4.555**	6.767**	6.004**	6.730**	5.995*
	(1.543)	(3.283)	(3.403)	(4.63)	(4.533)	(3.919)	(2.461)	(2.34)	(2.301)	(2.7)	(2.871)	(3.087)	(3.487)
Bilingual Expenditure	2.924***	-2.665***	-2.692***	-2.521***	-2.456***	-2.770***	-2.619***	-3.854***	2.504	-1.879	-2.172**	-0.717	0.408
	(0.689)	(0.256)	(0.301)	(0.52)	(0.393)	(0.305)	(0.679)	(0.891)	(2.101)	(1.156)	(0.919)	(0.973)	(1.593)
Constant	-212.7	41.85	-80.32	-546.3	-360.2	-141.2	125.9	-524.5	-615.3	-411.7	-766.7*	-1,105**	-936.9*
	(236.9)	(353.1)	(522)	(642.9)	(628.9)	(553.5)	(303.3)	(353.1)	(382.1)	(406.2)	(414)	(454.5)	(495.8)
Observations	17,407	24,200	23,965	23,772	22,966	22,080	14,089	7,953	7,671	6,608	6,463	6,353	6,075
R-squared	0.451	0.368	0.353	0.266	0.148	0.107	0.164	0.222	0.206	0.317	0.234	0.178	0.159

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.b.i. M3	District Average	Elementary	Secondary	Jr High	High
Seal Years	5.279***	4.826**	7.311**	11.53***	2.257
	(1.625)	(1.953)	(3.036)	(3.653)	(4.27)
Bilingual Expenditure	-1.585***	-1.753***	-1.220***	-1.269***	-1.119***
	(0.0401)	(0.0484)	(0.0636)	(0.0881)	(0.0877)
Observations	483,230	358,064	125,166	52,499	72,666
R-squared	0.327	0.345	0.286	0.258	0.319
Number of SchoolCode	5,143	3,414	2,114	1,210	960

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.b.ii. M3	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Seal Years	-0.046	-0.765	7.456**	8.502***	0.119	7.638**	12.64***	12.77***	8.056**	0.75	6.797	2.685	-0.314
	(1.518)	(2.56)	(2.995)	(3.093)	(2.842)	(3.203)	(4.084)	(4.827)	(4.045)	(6.059)	(6.011)	(4.739)	(4.728)
Bilingual Expenditure	-0.647**	-2.160***	-1.284***	-1.240***	-1.364***	-1.710***	-1.360***	-1.368***	-1.096***	-0.980***	-0.974***	-1.094***	-1.280***
	(0.26)	(0.0646)	(0.063)	(0.0613)	(0.0751)	(0.0848)	(0.124)	(0.117)	(0.109)	(0.112)	(0.127)	(0.123)	(0.124)
Observations	41,048	62,660	61,171	59,853	56,181	53,024	34,940	21,321	20,353	19,510	18,628	17,951	16,576
R-squared	0.063	0.307	0.202	0.192	0.258	0.295	0.18	0.254	0.308	0.279	0.282	0.354	0.34
Number of SchoolCode	3,059	3,276	3,258	3,277	3,237	3,232	2,262	1,181	1,164	935	922	918	888

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.c.i. M6	District Average	Elementary	Secondary	Jr High	High
Seal Years	5.556***	5.348***	5.484***	3.824*	6.022**
	(1.047)	(1.182)	(1.693)	(1.974)	(2.556)
Bilingual Expenditure	-2.543***	-2.974***	-1.233	-2.017	-0.712
	(0.249)	(0.252)	(0.89)	(1.489)	(0.827)
Seal Years×Bilingual Expenditure	0.22	-0.133	0.171	0.0809	0.364
	(0.186)	(0.189)	(0.302)	(0.412)	(0.536)
Constant	-301.0**	-266.5*	-538.7**	-491.1*	-854.7**
	(135.1)	(146.9)	(246.6)	(296.8)	(353.2)
Observations	189,602	144,387	45,215	19,716	25,499
R-squared	0.39	0.414	0.233	0.268	0.241

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.c.ii. M6	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Seal Years	-0.218	1.089	7.201**	9.108**	8.777*	8.499**	6.581***	5.611**	4.540**	6.724**	5.956**	6.753**	5.900*
	(1.538)	(3.287)	(3.391)	(4.625)	(4.515)	(3.935)	(2.465)	(2.323)	(2.29)	(2.679)	(2.846)	(3.072)	(3.472)
Bilingual Expenditure	4.236***	-2.775***	-2.547***	-2.390***	-2.311***	-2.801***	-2.947***	-3.434***	2.251	-1.932*	-2.224***	-0.864	1.059
	(1.069)	(0.24)	(0.262)	(0.46)	(0.274)	(0.27)	(0.67)	(1.029)	(2.985)	(1.133)	(0.813)	(0.905)	(1.901)
Seal Years×Bilingual Expenditure	-0.872**	0.282	-0.48	-0.334	-0.477	0.094	0.811	-0.782	0.171	0.302	0.18	0.704	-0.883
	(0.406)	(0.343)	(0.482)	(0.455)	(0.479)	(0.408)	(0.586)	(0.584)	(0.699)	(1.602)	(1.097)	(0.895)	(1.047)
Constant	-216.1	40.24	-70.77	-537.8	-347.3	-144.4	120.3	-499.6	-621.2	-412.9	-766.7*	-1,114**	-921.0*
	(236)	(354.3)	(518.4)	(637.8)	(622.8)	(555)	(303.3)	(351.6)	(381.8)	(404.9)	(412.8)	(453.2)	(494.5)
Observations	17,407	24,200	23,965	23,772	22,966	22,080	14,089	7,953	7,671	6,608	6,463	6,353	6,075
R-squared	0.451	0.368	0.353	0.267	0.149	0.107	0.164	0.224	0.206	0.318	0.235	0.178	0.161

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.d.i.	District Average	Elementary	Secondary	Jr High	High
Seal_years	5.515***	5.372***	5.365***	3.670*	5.843**
	(1.057)	(1.205)	(1.702)	(1.964)	(2.577)
Bilingual Expenditure	-2.876***	-3.213***	-1.748**	-3.000**	-1.064
	(0.236)	(0.257)	(0.736)	(1.297)	(0.738)
1.Seal Years×Bilingual Expenditure	3.358***	2.062***	4.214**	5.869**	4.188***
	(0.662)	(0.683)	(2.137)	(2.317)	(1.497)
2.Seal Years×Bilingual Expenditure	4.245***	1.581	6.549**	7.668**	6.956***
	(1.012)	(1.093)	(2.914)	(3.898)	(2.374)
3.Seal Years×Bilingual Expenditure	-1.604	-7.504*	15.79*	1.983	24.68**
	(4.226)	(4.494)	(9.251)	(15.68)	(10.68)
4.Seal Years×Bilingual Expenditure	0.811	-0.0549	-1.005	0.641	-4.642
	(1.025)	(1.100)	(1.922)	(2.007)	(2.963)
5.Seal Years×Bilingual Expenditure	-0.217	-1.567	-0.358	0.305	-0.500
	(1.033)	(1.081)		(2.435)	(3.116)
Constant	-301.6**	-291.2**	-511.4**	-485.1	-815.0**
	(135.8)	(148.5)	(246.2)	(297.6)	(351.4)
Observations	189,602	144,387	45,215	19,716	25,499
R-squared	0.391	0.413	0.235	0.270	0.245

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3.d.ii.	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Seal Years	-0.333	0.981	7.104**	9.039**	8.502*	8.372**	6.515***	5.491**	4.462*	6.727**	5.879**	6.688**	5.397
	(1.486)	(3.256)	(3.361)	(4.608)	(4.440)	(3.897)	(2.451)	(2.324)	(2.290)	(2.668)	(2.843)	(3.062)	(3.437)
Bilingual Expenditure	3.302***	-3.145***	-2.714***	-2.581***	-2.631***	-3.025***	-3.333***	-3.787***	1.659	-1.764	-2.313***	-0.853	-0.207
	(0.742)	(0.266)	(0.270)	(0.458)	(0.303)	(0.306)	(0.651)	(1.031)	(2.765)	(1.115)	(0.683)	(0.917)	(2.107)
1.Seal Years×Bilingual Expenditure	1.431	5.630***	0.131	2.851***	3.926***	3.081***	3.261	9.033***	1.051	-4.311	1.790	3.064	2.795
	(1.154)	(0.970)	(0.757)	(0.982)	(1.045)	(1.037)	(2.072)	(3.347)	(2.351)	(3.184)	(3.618)	(4.882)	(2.775)
2.Seal Years×Bilingual Expenditure	4.270***	-0.931	4.677***	0.456	6.806***	2.437	3.984	-2.377	13.66***	1.037	2.410	0.882	7.262*
	(0.594)	(1.047)	(1.445)	(2.416)	(1.848)	(2.346)	(2.875)	(3.454)	(3.502)	(6.878)	(6.965)	(3.918)	(4.328)
3.Seal Years×Bilingual Expenditure	17.24	-2.310	-2.754	-2.581	13.08	2.748	-11.48	14.75	0.421	3.368	19.98	28.81	16.60
	(15.61)	(4.800)	(7.744)	(8.903)	(13.70)	(11.24)	(12.72)	(15.09)	(17.93)	(18.41)	(29.68)	(22.29)	(15.29)
4.Seal Years×Bilingual Expenditure	-4.009***	1.541	0.433	-3.368	-2.722	1.798	3.077	-2.752	-0.00605	5.549	-4.676	-1.367	-13.22***
	(1.138)	(2.136)	(2.454)	(2.209)	(3.414)	(2.208)	(4.862)	(2.592)	(3.198)	(6.523)	(2.891)	(3.514)	(4.439)
5.Seal Years×Bilingual Expenditure	-4.952***	1.532	-7.077**	0.642	-4.449*	-2.862	2.476	-3.495	1.386	-3.496	3.654	7.441*	-5.252
	(1.339)	(1.821)	(2.980)	(3.099)	(2.674)	(3.223)	(1.758)	(3.030)	(3.095)	(9.459)	(7.841)	(4.101)	(4.845)
Constant	-217.1	67.91	-78.61	-507.0	-298.8	-123.5	126.1	-451.2	-639.4*	-434.4	-748.1*	-1,088**	-842.1*
	(238.7)	(353.0)	(520.3)	(633.7)	(620.7)	(553.5)	(303.2)	(352.2)	(381.8)	(404.5)	(412.8)	(452.6)	(492.0)
Observations	17,407	24,200	23,965	23,772	22,966	22,080	14,089	7,953	7,671	6,608	6,463	6,353	6,075
R-squared	0.453	0.369	0.356	0.269	0.156	0.110	0.166	0.227	0.208	0.318	0.237	0.180	0.171

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.a.i. M4	All Students	Elementary	Secondary	JrHigh	High
Bilingual Possible					
Seal Years	6.939***	6.291***	8.540***	8.713***	7.304**
	(1.456)	(1.502)	(2.262)	(2.572)	(3.324)
Bilingual Expenditure	-1.766***	-2.056***	-1.169***	-1.068***	-1.207***
	(0.0628)	(0.072)	(0.0972)	(0.137)	(0.131)
Constant	-157.8	-46.85	-759.7***	-798.9**	-902.3**
	(155.2)	(165.1)	(275.2)	(348.4)	(392.8)
Observations	225,925	168,066	57,859	24,505	33,354
R-squared	0.314	0.331	0.27	0.28	0.297
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 4.a.ii. M4	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Bilingual Possible													
Seal Years	-1.632	2.285	9.935**	11.07*	10.34**	7.374*	8.250***	10.02***	9.321***	9.425***	8.607***	7.408**	5.666*
	(1.337)	(3.796)	(4.327)	(6.084)	(5.243)	(3.768)	(2.578)	(2.655)	(3.054)	(3.345)	(3.289)	(3.2)	(3.432)
Bilingual Expenditure	0.475	-2.331***	-1.592***	-1.705***	-1.843***	-2.242***	-1.369***	-1.083***	-0.622***	-0.966***	-0.755***	-0.909***	-1.010***
	(0.594)	(0.148)	(0.151)	(0.192)	(0.207)	(0.214)	(0.178)	(0.157)	(0.16)	(0.199)	(0.163)	(0.183)	(0.18)
Constant	-326.8	22.77	-527.3	-496	78.41	38.36	266.4	-1,162***	-1,221***	-666.6	-1,223**	-1,619***	-861.8
	(285.1)	(461.6)	(614.2)	(743.9)	(703.5)	(580.9)	(340.3)	(437.7)	(440.7)	(438.3)	(489.8)	(511.7)	(528.4)
Observations	19,641	29,159	28,530	27,981	26,333	24,897	16,475	9,960	9,595	8,787	8,534	8,297	7,736
R-squared	0.339	0.338	0.275	0.208	0.144	0.217	0.185	0.254	0.277	0.266	0.267	0.313	0.307
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													

Table 4.b.i. M4	District	Elementary	Secondary	JrHigh	High
No Bilingual Ed					
Seal Years	8.124	4.333	6.963	-14.18	21.15*
	(4.997)	(5.713)	(8.193)	(14.35)	(10.95)
Bilingual Expenditure	-1.540***	-1.391***	-1.396***	-1.512***	-1.179***
	(0.0757)	(0.0925)	(0.105)	(0.137)	(0.14)
Constant	-230.6	102.1	-841.9*	1,161	-1,554**
	(303.8)	(338.8)	(485.7)	(803.9)	(636.8)
Observations	67,703	45,611	22,092	8,279	13,813
R-squared	0.44	0.488	0.397	0.442	0.313

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4.b.ii. M4	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
No Bilingual Ed													
Seal Years	7.663	12.13	31.63	0.799	-2.213	-92.21	-61.78*	-5.162	-12.37	32.85*	22.39*	0.582	41.27*
	(5.218)	(20.91)	(40.54)	(20.22)	(29.63)	(286.1)	(34.73)	(23.71)	(19.39)	(17.6)	(11.73)	(11.67)	(21.57)
Bilingual Expenditure	1.028***	-1.574***	-1.103***	-1.186***	-0.941**	-1.186	-1.525***	-1.665***	-1.302***	-0.630***	-0.978***	-1.306***	-1.175***
	(0.254)	(0.285)	(0.244)	(0.295)	(0.398)	(0.93)	(0.24)	(0.228)	(0.22)	(0.182)	(0.224)	(0.173)	(0.294)
Constant	511.2	-300.5	-1,747	-306.7	257.4	2,525	898.3	-234.7	735.1	-494.7	-1,352	-2,462***	-2,865**
	(883.8)	(693.2)	(2,194)	(1,114)	(991.4)	(6,287)	(1,201)	(957.7)	(1,233)	(865.3)	(882.4)	(895.7)	(1,309)
Observations	4,000	9,305	8,679	8,101	6,883	6,048	4,379	3,408	3,087	4,115	3,631	3,301	2,766
R-squared	0.222	0.473	0.429	0.548	0.557	0.12	0.147	0.485	0.462	0.265	0.272	0.402	0.156

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.a.i. M4	District	Elementary	Secondary	JrHigh	High
Spanish Speakers					
Seal Years	4.693***	4.745***	4.951**	5.571**	4.071
	(1.176)	(1.368)	(2.072)	(2.567)	(3.129)
Bilingual Expenditure	-1.754***	-2.018***	-1.176	-1.423	-0.699
	(0.161)	(0.15)	(0.728)	(0.941)	(0.761)
Constant	-73.14	44.26	-362.3	-417.5	-594.4
	(132.9)	(144.5)	(257.4)	(323.2)	(371.8)
Observations	182,314	137,980	44,334	19,312	25,022
R-squared	0.367	0.354	0.222	0.23	0.243

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.a.ii. M4	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Spanish Speakers													
Seal Years	-0.845	4.039*	4.558**	5.855***	8.253***	6.053**	5.382**	7.321***	6.407**	6.469**	5.369*	8.795**	3.118
	(0.968)	(2.204)	(1.825)	(1.864)	(2.484)	(2.537)	(2.539)	(2.823)	(3.01)	(2.645)	(2.902)	(4.417)	(4.273)
Bilingual Expenditure	1.480**	-2.284***	-1.258***	-1.775***	-2.181***	-2.759***	-2.336***	-3.433***	-0.968	-1.564	-1.541*	1.29	-0.286
	(0.602)	(0.329)	(0.172)	(0.168)	(0.235)	(0.238)	(0.427)	(1.211)	(1.497)	(1.145)	(0.906)	(1.856)	(1.283)
Constant	-355.9*	-212.1	14.46	-254.8	-11.42	0.526	391.6	-727.4*	-813.7*	-260	-851.7*	-1,440***	-664.9
	(186.2)	(267.1)	(208.8)	(237.3)	(279.4)	(286)	(342.7)	(411.8)	(429.1)	(426.8)	(468.7)	(544.2)	(538.7)
Observations	16,518	23,061	22,828	22,720	21,997	21,204	13,651	7,802	7,511	6,504	6,376	6,229	5,913
R-squared	0.304	0.254	0.172	0.118	0.056	0.115	0.132	0.162	0.171	0.265	0.208	0.129	0.188

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5.b.i. M4	District	Elementary	Secondary	JrHigh	High
Chinese Speakers					
Seal Years	15.95***	13.26***	7.892	8.335**	0.79
	(4.247)	(3.298)	(6.417)	(3.561)	(6.625)
Bilingual Expenditure	-2.105***	-2.127***	-1.197***	-0.917***	-0.812***
	(0.228)	(0.313)	(0.267)	(0.331)	(0.281)
Constant	-3,181***	-3,230***	-1,828	-2,244	110.3
	(1,047)	(1,132)	(1,197)	(1,614)	(1,154)
Observations	20,118	13,675	6,443	2,333	4,110
R-squared	0.414	0.491	0.411	0.492	0.442
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 5.b.ii. M4	(Kindergarten)	(Grade 1)	(Grade 2)	(Grade 3)	(Grade 4)	(Grade 5)	(Grade 6)	(Grade 7)	(Grade 8)	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Chinese Speakers													
Seal Years	2.913	13.86***	22.34***	18.38***	14.77*	16.03***	15.13**	12.41**	9.068**	3.086	-2.461	-4.063	11.51
	(2.354)	(4.16)	(4.907)	(5.249)	(7.829)	(5.855)	(5.892)	(5.538)	(4.268)	(4.897)	(5.086)	(5.506)	(10.6)
Bilingual Expenditure	-0.363	-2.143***	-0.957**	-1.467***	-1.393*	-0.971	0.496	-0.862*	-0.684	-0.564	-0.554*	0.198	-1.803***
	(0.729)	(0.375)	(0.471)	(0.44)	(0.754)	(0.655)	(0.752)	(0.495)	(0.439)	(0.493)	(0.336)	(0.383)	(0.457)
Constant	-3,498***	-2,506*	-4,821***	-2,638	-3,875**	-2,455	-3,103	-3,484	-2,402	-1,278	-964.2	1,568	-128.8
	(1,300)	(1,465)	(1,534)	(1,853)	(1,937)	(1,970)	(2,228)	(2,133)	(1,888)	(1,478)	(1,535)	(1,466)	(1,846)
Observations	1,647	2,979	2,720	2,420	1,824	1,479	1,044	949	946	1,101	1,055	1,038	916
R-squared	0.437	0.511	0.466	0.525	0.547	0.579	0.486	0.541	0.493	0.486	0.455	0.525	0.514
Robust standard errors in parentheses													
*** p<0.01, ** p<0.05, * p<0.1													

Table 6.a. School FE	High School	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Outcome Variable	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)
total effect	5.266**	10.33*	4.363	6.964*	1.342
	(2.628)	(5.981)	(2.919)	(3.661)	(1.276)
direct effect	1.426	-2.375	1.734	1.127	0.415**
	(2.021)	(3.921)	(6.733)	(1.202)	(0.172)
indirect effect	3.840	12.70	2.630	5.837	0.927
	(8.283)	(16.43)	(17.58)	(9.779)	(1.083)
Effect (%) attributed to English Proficiency Passage Rate	69.96	100	65.74	83.91	76.55
Observations	24,988	5,435	5,133	4,860	4,424
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 6.b. District FE	High School	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Outcome Variable	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)	EL WL Enrollment Rate (%)
total effect	5.236**	10.02*	6.051**	7.604**	1.686
	(2.332)	(5.568)	(2.914)	(3.656)	(1.401)
direct effect	1.573	-2.154	2.073	1.224	0.395**
	(3.027)	(4.461)	(15.11)	(1.602)	(0.179)
indirect effect	3.664	12.18	3.978	6.380	1.291
	(11.81)	(19.74)	(47.79)	(14.91)	(1.228)
Effect (%) attributed to English Proficiency Passage Rate	72.92	100	60.26	83.82	69.08
Observations	24,988	5,435	5,133	4,860	4,424
Robust standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 7.a. School FE	High School	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
Outcome variable	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)
total effect	5.528**	8.210**	6.429	3.295	1.588
	(2.645)	(3.577)	(4.134)	(3.810)	(2.502)
direct effect	1.137**	-7.014	1.078	0.941	0.724
	(0.577)	(22.98)	(1.313)	(0.607)	(0.545)
indirect effect	4.390	15.22	5.351	2.355	0.864
	(5.237)	(48.37)	(12.28)	(4.039)	(2.708)
Effect (%) attributed to English Proficiency Passage Rate	79.43	100	83.24	71.45	54.38
Observations	16,678	4,341	4,263	4,146	3,928
Standard errors in parentheses					
*** p<0.01, ** p<0.05, * p<0.1					

Table 7.b. District FE	High School	(Grade 9)	(Grade 10)	(Grade 11)	(Grade 12)
VARIABLES	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)	College Readiness Rate (%)
total effect	4.804**	8.286**	4.661	3.303	0.217
	(1.989)	(3.371)	(3.358)	(3.065)	(3.021)
direct effect	1.179*	-3.360	0.874	1.163*	0.358
	(0.675)	(9.608)	(1.066)	(0.658)	(0.595)
indirect effect	3.625	11.65	3.787	2.140	-0.141
	(5.330)	(29.88)	(9.207)	(4.258)	(2.891)
Effect (%) attributed to English Proficiency Passage Rate	75.46	100	81.25	64.78	0
Observations	16,678	4,341	4,263	4,146	3,928

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

8 Appendix D

Robustness Check

We can test the accuracy of this model by using outcome variables for English Proficiency passing rates and Bilingual Expenditure share as mediators for each other to check that they still produce inverse effects when mediating each other's treatment effects from SoBL adoption using IV regression. At the same time, the other variable is the mediator and vice versa, while using the same instruments for SoBL as treatment.

$$C_d = \epsilon_C = \epsilon_D \tag{23}$$

$$T_{d_t} = \alpha_t + \gamma_{d_s} + \beta_1 C_d + \beta_2 G_d + F_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{d_{sit}} \tag{24}$$

$$Y_{i_t} = \alpha_t + \gamma_{d_s} + \beta_T T_{d_t} + F_{d_t} + B_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{Y_{dsit}} \tag{25}$$

$$B_{d_t} = \alpha_t + \gamma_{d_s} + \beta_T T_{d_t} + \beta_Y \hat{Y}_{d_t} + F_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{B_{dsit}} \tag{26}$$

and

$$C_d = \epsilon_C = \epsilon_D \tag{27}$$

$$T_{d_t} = \alpha_t + \gamma_{d_s} + \beta_1 C_d + \beta_2 G_d + F_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{d_{sit}} \tag{28}$$

$$B_{d_t} = \alpha_t + \gamma_{d_s} + \beta_T T_{d_t} + F_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{B_{dsit}} \tag{29}$$

$$Y_{i_t} = \alpha_t + \gamma_{s_d} + \beta_T T_{d_t} + \beta_B \hat{B}_{d_t} + F_{d_t} + \theta_{d_{st}} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{E_{dsit}}. \tag{30}$$

Where we observe β_B to be an equivalent inverse coefficient to β_Y for the SoBL to serve as a mechanism incentivizing districts to increase investment in bilingual programming for ELs along with adopting the SoBL, as well as improved performance from students via the increase in investment from the districts due to the adoption of the SoBL as well as the isolated effect of adopting the SoBL on a student's frame of reference, which is represented by the dynamically consistent recursive preference of students who are being primed for college early in education and are assumed to have still the same quantile preference and risk attitudes toward available education pathways to college near the end of secondary schooling.

Instrument Validation:

Furthermore, in addition to statistical tests for instrument validation such as the Monteil-Pflueger test, the Stock-Yogo test, Anderson-Rubin confidence intervals, Kleibergen-Paap LM statistic, and the Hansen J statistic for overidentification, grade level parameters $\theta_{d_{st}}$ were replaced with dummies for each grade g_{st} in the high school only models to observe whether the effect from treatment gets absorbed by the grade level dummy variables.

$$Y_{i_t} = \alpha_t + \gamma_{d_s} + \beta_T T_{d_t} + F_{d_t} + B_{d_t} + l_{st} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{Y_{dsit}} \tag{31}$$

$$T_{d_t} = \alpha_t + \gamma_{d_s} + \beta_1 C_d + \beta_2 G_d + F_{d_t} + B_{d_t} + l_{st} + X_{d_{sit}} + Z_{d_t} + W_{d_{sit}} + Q_d + \epsilon_{d_{sit}} \tag{32}$$

For the IV to be considered a valid instrument for eliciting the revelation mechanism parameter for the incentive effect, we should expect the 9th, 10th, and 11th-grade parameters for l_{st} to absorb the effect from β_T and the coefficients for the grade dummies should be approximately within a reasonable range close to the treatment effect for passing the English proficiency exam, with the expectation: $\beta_T = \beta_l$. In addition, we should also expect the Hansen J statistic to show no evidence that the model is overidentified when the grade level dummies are excluded but indicate that the model is overidentified when the dummies are included. The instruments are likely endogenous to the model after including grade-level indicator variables, which provide evidence that our Instrumental Variables are empirically estimating the primitive that, theoretically, they are designed to measure.

The estimates 9th, 10th, and 11th-grade dummies for β_l are found to absorb the effect of Treatment β_T. The coefficients for the grade dummies are approximately around 8-10% for those three grades, and we also found the treatment effect for passing the English proficiency exam for those grade levels to be approximately around 8-10% of the treatment effect for passing the English proficiency exam, as we predicted. Furthermore, we also found that the Hansen J statistic shows no evidence that the model is overidentified when the grade level dummies are excluded but indicates the model is overidentified. The instruments are likely endogenous to the model after incorporating a grade-level indicator variable. Once again, this supports our earlier prediction and provides further evidence that our instruments are valid exogenous predictors for treatment selection.

The Instruments and Treatment Assignment:

When deciding whether or not to adopt the Seal of Biliteracy, districts take into consideration how feasible attaining the SoBL is for their students by looking at credit requirements for graduation and college admission, the scheduling and timeframe for foreign language tracks as well as other academic tracks, the academic programming and courses offered to students, and the pedagogical priorities of the district. Essentially, a district's decision to adopt the SoBL comes down to logistics: Is it reasonable to expect that students will take four years of foreign language classes in addition to the math, science, social science, English, art, and Career Technical Education courses necessary for graduation and admission into state universities considering the structure and timeframe of their academic schedule?

The instrumental variables do not reflect any particular graduation requirement or set of graduation requirements but represent how the totality of the district's credit requirements for graduation and limited scheduling space to meet those requirements create congestion in students' schedules. The timing of SoBL adoption in a district depends on the variation between district increases on California's minimum state graduation requirements in combinations of marginal academic and non-academic course requirements. For students already in high school when SoBL became state policy, students with highly congested schedules due to the structure and totality of district credit and course requirements for graduation interested in the SoBL were unable to replace previously scheduled classes with a world language class for one or more academic years to satisfy the SoBL's four-year world language course requirement, while still meeting the district's graduation requirements. Thus, districts that did not graduate students with the SoBL were not considered SoBL participating districts until a student achieved the SoBL in a district. If one year of a student's schedule, such as a student's freshman year, was designed to be completely congested or filled up with previously designated requirements that would prevent the student's ability to schedule a world language course for that specific year, then an indicator variable for the congested year was created to serve as an additional instrumental variable for the inability of students in a district to graduate with a SoBL on their diploma.

The instrumental variables do not reflect any particular graduation requirement or set of graduation requirements but represent the totality of how a district's credit requirements for graduation and limited scheduling space to meet those requirements create congestion in students' schedules. The timing of SoBL adoption in a district depends on the variation between district increases on California's minimum state graduation requirements in combinations of marginal academic and non-academic course requirements. For students already in high school when SoBL became state policy, students with highly congested schedules due to the structure and totality of district credit and course requirements for graduation interested in the SoBL were unable to replace previously scheduled classes with a world language class for one or more academic years to satisfy the SoBL's four-year world language course requirement, while still meeting the district's graduation requirements. Thus, districts that did not graduate students with the SoBL were not considered SoBL participating districts until a student achieved the SoBL in a district. If one year of a student's schedule, such as a student's freshman year, was designed to be completely congested or filled up with previously designated requirements that would prevent the student's ability to schedule a world language course for that specific year, then an indicator variable for a congested year was created to serve as an additional instrumental variable for the inability of students in a district to graduate with a SoBL on their diploma.

Instrument Construction:

Districts have the option of adding additional credit requirements on top of the minimum credits required for different subjects by the state; most districts require a total of 240 credits, with 130 of those credits structured to meet state minimum requirements. The remaining 110 credits can be assigned to fulfill any additional credit requirements that the district would like to add to specific subject areas or particular programs, or the district can allocate credits to fulfill an elective requirement, giving students greater flexibility to construct their course schedule along with the opportunity to enroll in classes that interest them. The more flexibility students have over their course schedule; the easier it is for them to take four years of a foreign language to receive the SoBL. The more additional subject or program-based credit requirements unrelated to foreign languages that students must fulfill, the harder it becomes for students to enroll in a four-year foreign language sequence. A district is less likely to adopt the SoBL if students' opportunity to enroll every year in a foreign language class is limited because their schedule is impacted by additional credit requirements that reduce the availability of electives and potentially create scheduling conflicts.

The more additional course requirements a district has, the longer it will take a district to organize and plan a course schedule that provides a clear pathway for students to participate in the SoBL. By utilizing data on the number of independent periods a district mandates in high schools' daily or weekly schedules and studying district course-pathway schedules, I was able to construct indicator variables for a congested one-year schedule and four-year schedule plan by utilizing the district's course graduation requirements. For example, suppose students, on average, have six periods, with 4-5 periods dedicated usually to primary academic subjects and physical education or health. In that case, the combination of credit requirements in different subjects with the potential to occupy two or more periods concurrently presents a greater obstacle for districts than if a district requires a greater number of courses for just one subject. The course requirements were standardized to determine how much marginal space, on average, in students' schedules certain credit requirements will occupy in students' schedules in a given year than the total number of courses required. When constructing hypothetical student schedules, it was found that a greater than average increase in one course requirement along with a greater than average increase in another course requirement can better instrument concurrent periods dedicated specifically to non-world language courses becoming roadblocks to student and district participation in the SoBL for each year, and over four years.

The distinction between districts with a more flexible structure for meeting graduation requirements and districts with a more rigid structure may indicate a potential violation of the exclusion restriction. However, the distinction between flexible versus rigidly structured districts is only made in this paper to help articulate how the instruments predict treatment assignment in practice. The flexibility in student course scheduling due to district graduation requirements is better thought of as a spectrum artificially designated as a dichotomy around an artificial tipping point. The tipping point used in the study was whether students were entering their junior year, as their district adopted the SoBL, had at least two slots during their junior and senior years to schedule a world language class for each year without conflicting with any other district credit requirements and preventing them from taking another elective/sport/extracurricular class in their final two years.

The Role of the Instrument in Treatment Assignment:

The IV works particularly well for this design because of the policy's timeline and time frame observed in the data. The SoBL became official California state policy in 2012, becoming available to the graduating class of 2013. However, the graduating class of 2013 did not have time to prepare or plan for the SoBL, so the 2012-2013 academic year can be considered a pilot year for the SoBL because students did not have enough time to plan a pathway for the SoBL if they were not already close to meeting the requirements; therefore, it is unlikely that a district implementing the SoBL that year would have any effect as an incentive on English Proficiency scores and educational outcomes for English Learners. Four years of post-treatment data was observed after the initial pilot year, starting from the 2013-2014 to the 2016-2017 academic year, with districts participating in the SoBL program each year by graduating seniors with SoBL diplomas. In the four years after California initially rolled out the SoBL, there is a relatively consistent group of regularly participating districts that make up 55% of all California districts and districts that never participate in the SoBL, consisting of 25% of California's districts.

The first year of treatment is the second year that students could participate in the SoBL, the 2013-2014 academic year, so students would have had at least two years to work towards attaining the SoBL if they had not met all of the SoBL requirements yet, like passing their English proficiency assessments and taking 3rd and 4th year world language classes. Because the CSU and UC universities require at least two years of world language classes with a recommended third year of a world language class, districts would create enough space so students could schedule at least two and likely three years of world language classes (all 3rd-year world language classes are elective classes, they are a UC-suggested elective course). However, a fourth-year world language class has little impact on student college admission outcomes or meeting any necessary CTE/career pathway or IB/other district-priority program requirements or goals, so there is no pressure for districts – before the SoBL was adopted by the state – to design the course requirements for graduation in a manner that ensures students can schedule a fourth-year world language class by senior year, as long as students could at least schedule a second or potentially third-year world language class by the time they were seniors. Until California passed the SoBL policy in 2012, 4th-year world language classes were purely elective credits that did not meet any particular program requirements, so students would only take them as electives if they preferred foreign language classes over other electives.

Meeting the Exclusion Restriction

Minimum credit requirements for high school graduation have a couple of distinguishing properties that make it uniquely suited to answer the question posed above and meet the exclusion criteria. The concern was whether there are factors that influence district decision-making in the assignment of minimum credit requirements that also influence English proficiency outcomes for English Learners. There are two primary reasons why high school credit requirements do not violate the exclusion restriction with respect to these concerns:

1. State policies primarily determine minimum credit requirements for high school graduation; districts have more flexibility in structuring credit requirements than in setting the requirements. The California Department of Education sets the parameters for what districts are allowed to do with respect to assigning credit requirements, and the state's public university systems provide a standard set of credit requirements for college admission to guide district decision-making.

2. Districts are limited in their ability to update or restructure credit requirements to accommodate changing local preferences in a timely or responsive manner because incoming freshmen need to be able to plan a four-year course schedule that satisfies newly enacted credit requirements; essentially, school boards have to publicly introduce changes to graduation credit requirements four to five years before the enacting the changes.

The distinction between how a district decides to take a flexible approach or a structured approach may seem like an area for a potential violation of the exclusion restriction. Still, flexible and structured districts are less of a dichotomy and more of a spectrum, and most districts are somewhere in the middle when you look at the primary subject credit requirements. Therefore, the tipping points used are arbitrary for any other reason outside measuring the constraints of scheduling a same-subject progressive track of courses for four years in a row when neither the state, district, or state university systems require or recommend more than three years of courses in a progressive track of subject-specific courses.