Does Reclassification Matter? An Examination of English Learner Status and High School Science Course-Taking in One Washington State School District

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ABSTRACT

Does Reclassification Matter? An Examination of English Learner Status and High School Science Course-Taking in One Washington State School District

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This quantitative study examines the science course-taking outcomes and patterns of reclassified English learner (EL) students—a relatively large, yet often overlooked and not fully understood, sub-group. Inspired by the question, "Does reclassification out of English learner status matter for science course-taking?", and the concept of opportunity to learn (OTL), I explore the relationship between reclassification before high school and access to and performance in rigorous, college-preparatory science course-taking in one urban district located in Washington State—a single-criterion reclassification policy context which represents the most common reclassification policy profile across U.S. states. Drawing on panel data from one cohort of students (N = 2,477), I employee descriptive and inferential statistical techniques to answer four research questions comparing the demographics, academic achievement, and rates of access to and performance in different science course tracks of three mutually-exclusive student subgroups: Reclassified ELs (N = 362), Still ELs (N = 227), and Never ELs (N = 1,888). Of most interest are the subgroups' descriptive rates and predicted probabilities of achieving two important science course-taking milestones by the end of high school, and of enrolling in a college or university within one year of high school graduation.

Descriptive results confirmed that Reclassified ELs in the district performed very well academically, often better than their Never EL peers, and always better than their Still EL peers. At the same time, by failing to meet the minimum college eligibility requirements for science course-taking, more than three of every ten Still ELs (36%) who attended all four years of high school in the district and successfully made it to Grade 12 were nonetheless apparently ineligible for admission to Washington State four-year public colleges and universities (compared to 13% of Reclassified ELs and 15% of Never ELs). Still ELs also experienced disproportionally high rates of exclusionary tracking, with almost a quarter (23%) not enrolled in any science class in Grade 9 (compared to 4% of Reclassified ELs and 8% of Never ELs). Multilevel models controlling for select student- and school-level factors indicated that Reclassified EL status was positively associated ($p < .01$), while Still EL status was negatively associated ($p < .05$), with meeting the two science course-taking milestones. Reclassified ELs exhibited a 91% predicted probability of meeting the science course-taking college eligibility requirements, compared to

Still ELs' 79% predicted probability, and Never ELs' 86% predicted probability. However, after including statistical controls, neither Still EL status (p = .869) nor Reclassified EL status (p = .272) were found to be unique predictors of college enrollment. Implications for policy and practice and future research directions are discussed.

Keywords: English learners, reclassification, tracking, course-taking, science

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This dissertation, like most, was a long time in the making. Isn't it ironic that this thing that is supposed to be the pinnacle of an individual's expertise and achievement, up to that point in their lives anyway, is impossible without one's loyal, consistent support system?

I started my first official dabbling into this research topic of English learners and science course-taking in the fall of 2013, during the first year of my PhD program. Almost six years, multiple and varied research projects, and two children later, here it is—ready to be shared with the world. My first year in the classroom was as a teacher, and not a very good one at that point, of sheltered 8th grade science in the Fruitvale neighborhood of Oakland, California, and that singular experience has continued to propel me, to urge me, to better understand and work to improve the science exposure, experiences, and outcomes of our secondary EL students, especially those who are relatively new to the country.

I first thank my advisor, Dr. Manka Varghese, for accepting me as one of her doctoral students, and for providing so many opportunities for me to become a researcher. Manka: Your decision to take me on as a student changed not only my life, but that of my family, as Seattle is now our home. Thank you for believing in me, trusting me, pushing me, and making things happen for me. It's been an honor to learn from and work with you. You have made me think more critically about the intersections of power, privilege, race, ethnicity, language, and schooling, and, because of that, I leave this program a different person and scholar than who I was when I began. Thank you, Manka. I also am indebted to Dr. Liz Sanders—one of the statistical experts on my committee, and a fellow member of our research team here at the University of Washington. Liz has worn many hats, first as my statistics professor, and then as my guide to multilevel modeling in this dissertation. While I'll always have more to learn about statistics, I hope I made you proud. Thank you, Liz.

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I thank several other truly remarkable professors in the College of Education who have helped me grow and learn as a researcher: Dr. Ana Elfers, Dr. Marge Plecki, Dr. Min Li, Dr. Jessica Thompson, and Dr. Mark Windschitl. Thank you for inviting me into your research teams and classrooms and guiding my work, my thinking, and my future opportunities. The College of Education is an amazing, equity-oriented institution with a storied past and a bright future. I am proud to say this is where I received my doctoral training.

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I also thank our lovely, joyful Eloise (5 years old) and Margot (2 years old). When people seem surprised that I had two kids during graduate school, I think, "But, I had almost 20 months total of carrying around not only two brains, but two hearts! Of course I could do it!" While I have a feeling our daughters won't remember much of this time in their young lives, I will always remember the effect they have had on my thinking, my research, my motivation. I now understand what parents all over the world feel about their children. We all just want the best for our kids. And we are willing to travel the world, to cross oceans, to scale mountains, to find it. We want schools to be safe places that help our children develop into their full potential and that teach them about the wide, incredible world all around them. We want them to leave the K-12 system with limitless options and opportunities. I am grateful to our girls for bringing so much joy, laughter, and excitement into our lives. Whenever I enter the house after a long day of work at the office, there are smiles, tears, laughter, conflict, screaming, resolutions, footsteps, falls, snuggles (so many snuggles), and "Mama, Mama, Mama". Action. Love. Home. Warmth. Acceptance. Together. Family. Forever and always.

Speaking of Mama—how do I thank my mother, Camille Wheeler, enough? She's always been there for us—flying across the country from North Carolina to Washington anytime we needed her. Leaving her life temporarily and coming to live with us for months to help care for our daughters as newborns, making our lives easier and better and richer, and saner. At this very minute, she is home with Eloise, who is sick, so that I can be here in my office on a Sunday, finishing this dissertation! I know how lucky I am to have you, Mom, and I'm sorry if I don't show it enough. You are amazing and I thank you so much for all you do for us.

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I also thank the University of Washington Children's Center at Portage Bay. Eloise was given the incredible and rare opportunity to attend preschool on the same campus where I work,

and it made the last two and a half years of my time at UW so very sweet—taking her to school with me and picking her up each day. We were both UW Huskies! I loved leaving my office and walking down the hill into another world—a world of children engaged in play and learning. It's a magical place and having her there made my work and personal life feel so much more connected and in sync. I will always be indebted to the University of Washington for providing this amazing facility and for helping support student-parents like myself in the way that matter most—by supporting our children.

Finally, I dedicate this dissertation to my father, Dr. Michael Wheeler, who was my first, most hands-on, most dedicated, most consistent academic advisor. I have visions of watching him, sitting at his desk, carefully combing through the enormous hard copy University of North Carolina course catalog. He would scan, make notes, and synthesize what he had learned from his reading, and report back to me with a strategic plan for not only the upcoming semester, but for the year, explaining how these class choices fit into and supported my overall undergraduate goals and experiences. He was always thinking three or four or five steps ahead, working hard to make sure he understood the boring, dry topics of degree requirements and credit accrual, so that all I had to do was show up to class, work hard, and try to enjoy the experience (well, except Organic Chemistry!). How lucky and privileged I was.

Because of the time he invested in understanding the range of options, my college curriculum was well-rounded, balanced, and appropriately challenging. Exactly what we want for all students. I still remember when he found a modern dance class that he thought I would enjoy, which met not only my Physical Education graduation requirement, but also an Arts requirement. He was so proud of himself. And I ended up loving that class so much. I sincerely doubt I would have found that class, and its amazing instructor, without his hard work and insight. There are multiple additional examples I could share just like this one. In the end, I think he enjoyed setting me up for success in college, and he did the same for me in high school, and for my brothers as well. Although I didn't realize it at the time, I am now aware of how rare it is for high schoolers and undergraduates to have someone like this in their lives. One person who is truly dedicated to providing a deeply personal, rewarding curricular experience for that student. Someone who helps you see that schooling can be an experience, a well-planned progression of learning, and not just a set of credits to get through or a checklist to cross off. One person that makes it their mission to ensure as many doors remain open for as long as possible, until that student is ready to settle on a particular career pathway or field.

I never felt like my options were limited, instead, I felt like I could do almost anything I wanted, if I worked hard enough. This is what I wish for all our nation's students, but especially for our immigrant-origin students, who deeply depend on and trust our schools, and the teachers, counselors, and leaders in them, to lead them toward, and certainly not away from, opportunity and hope. I believe in public schools and the people who work in them—I know how much they give and how much they sacrifice for their students—I used to be one of them. At the same time, I also believe in critical, reflective, systematic analysis in service of regular improvement for students. Our English learner, immigrant-origin students desperately need and deserve improvements in the rigor of their high school science course-taking, and learning environments that not only respect, but sustain, who they are and the gifts and experiences they bring into the classroom, and it's up to the adults in the system to ensure that this happens. In whatever tiny way possible, I hope my dissertation might contribute to this mission.

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>
> *-Flores, Batalova, and Fix, 2012, p. 19*

> "Given the variation in EL services and the curricular streams into which ELs are placed, much remains to be learned about the factors impacting course-taking among ELs in different state and local contexts."
>
> *-Thompson, 2015, p. 6*

> "…EL status itself can function as a gatekeeper to more rigorous curriculum and instruction, particularly as ELs enter upper elementary and secondary levels. Prolonged EL classification…may itself lead to (or reflect) lower expectations, a deficit orientation, tracking, marginalization, stigmatization, and inferior learning opportunities. These concerns are particularly relevant in the current period of implementation of challenging college- and career-ready standards and corresponding ELP standards that reflect more rigorous language uses needed to carry out content-area practices."
>
> *-Linquanti, Cook, Bailey, and MacDonald, 2016, p. 93*

> "…ELLs' underachievement will persist, not because they are incapable of learning but because they are not given the opportunity to learn. The concept of opportunity to learn suggests that students should not be held accountable for the material they have not had a chance to learn…However, this is exactly what is happening to ELLs: They are denied opportunities to take advanced college-preparatory courses, which in turn results in the lack of opportunity to receive rigorous academic preparation that will qualify them for college entrance and the likelihood of survival and success in college."
>
> *-Kanno and Kangas, 2014, p. 27*

CHAPTER 1

INTRODUCTION

Educational Opportunity, Demographic Changes, and Reclassification

One of the primary responsibilities of the public education system in the United States is to provide an equal opportunity to learn for all students, regardless of family social class, geographic location, sex, religion, disability status, race or ethnicity, citizenship status, or home language (U.S. Department of Justice, Civil Rights Division, 2018). Unfortunately, in practice, there are many barriers that stand in the way of meeting this responsibility. Scholar Sonia Nieto described the challenge this way: "A child's zip code is still almost a sure indication of the kind of education he or she will receive…rather than being a paragon of educational equality, U.S. schools have consistently ranked among the most unequal in the industrialized world in terms of spending, curricular offerings, and teaching quality" (2005, pp. 60-61). Until this predictable relationship between zip code and educational opportunity and performance can be consistently disrupted, much more work remains for those committed to the ideals of public schooling.

This dissertation examines educational equity of one important student population: Students who have experienced English learner (EL) classification and services. Educational equity for students who have ever been categorized as "English learners", or "Ever ELs", can be conceived of as the "opportunity to receive an education that is comparable in quality and scope to that of their English background peers" (Rumberger & Gándara, 2004, p. 2048). The entitlement of students attending U.S. public schools who come from a home where a language other than English is spoken to such academic quality and access was mandated by our nation's highest court more than four decades ago in the 1974 Lau v. Nichols case. In fact, this Supreme Court case focused specifically on the right of language minority (LM) students to a "meaningful education", and, in effect, defined educational equity by the lack of long-term tracking or predictably poor academic outcomes of LM students relative to non-LM pupils (U.S. Department of Justice & U.S. Department of Education, 2015).

This issue of educational inequality experienced by LM students is not unique to the United States. From an international perspective, the OECD argues that, "The successful integration of the children of immigrants is a key benchmark of success for social, education and migration polices", calling the educational outcomes of this population "a litmus test for how well education systems and indeed the broader society address social and educational disadvantage" (2012, p. 11). A combination of excellence and equity, it is posited, are characteristics of equitable educational systems “that allow all students to achieve their potential” (OECD, 2012, p. 3). Along the same lines, Callahan and Shifrer, two scholars who have conducted many studies on ELs’ educational equity and academic outcomes in U.S. schools, argue that academic preparation, as opposed to English proficiency, “will likely be the lynchpin by which to measure ELs’ academic and professional integration as young adults” (2012, p. 33).

In addition to this ideological, rights-based perspective, there is also an economic and democratic case to be made for the provision of equitable, high-quality education for our nation’s EL and immigrant-origin student population. An oft-cited statistic is that immigrants and children of immigrants are the fastest-growing group in the U.S. For instance, between 1997 and 2007, children of immigrants comprised 77 percent of the increase in the total number of U.S. children (Fortuny & Chaudry, 2009). One of the fastest-growing immigrant populations in the U.S. can be found in Washington State, which experienced 51 percent growth between 2001 and 2010 in the number of young people identified as first- or second-generation immigrants, compared to national average growth of 14 percent (Hooker, McHugh, Fix, & Capps, 2013). It is critical for the future of our national and state economies that this vast and growing immigrant-origin population be educated well. In the words of Núñez, Rios-Aguilar, Kanno, and Flores, “realizing the potential of EL students can increase the quantity and quality of human capital in the U.S. and prepare these students to become more active participants and contributors to a healthy democracy and government” (2016, p. 42).

Directly related to the growth in the population of LMs and immigrants is the six-fold growth from 1998 to 2008 in the U.S. EL student population—increasing 51 percent, from 3.5 million to 5.3 million students (Batalova & McHugh, 2010, p. 2). It has been estimated that within the next six years, almost one in every four public school students will be an EL, compared to one in ten students in 2008 (NEA, 2008; Batalova & McHugh, 2010, p. 1). Additionally, an oft-overlooked fact is that the majority of this ever-growing population of students initially designated as ELs, particularly those who began their U.S. academic careers at the elementary level, will eventually be “reclassified” as fully proficient in English.

For example, longitudinal work based on eight waves of data from Massachusetts demonstrated that almost three out of four EL students (74%) were reclassified at some point between kindergarten and 7th grade, with the majority of students who entered kindergarten as ELs reclassifying by 3rd grade (Slama, 2014). Likewise, recent research from Washington State on EL reclassification within the seven “Road Map” school districts of the Seattle metropolitan area revealed that 82 percent of elementary ELs studied were reclassified within the study’s seven-year data window, taking an average of 3.8 years to reach this milestone (Greenberg Motamedi, 2015). These results are consistent with work by Kim and Herman that find that, “a good proportion of ELL students do exit from ELL stats or get reclassified as fully proficient in English and are mainstreamed by the time they finish elementary school” (2012, p. 23).

This act of reclassification marks the point at which a student has been deemed by the state or school district as no longer in need of additional instructional and assessment modifications and support, and therefore “mainstreamed” to participate in the regular, non-EL curricula experienced by her non-EL peers. In the past and still today in many cases, reclassification was perceived as the ultimate goal of EL services—the point at which a state or district EL program could release this student from their care, feeling confident that they had met their responsibility to prepare these students for the mainstream setting. However, a new line of thinking has emerged that conceptualizes reclassification as an intervention, or the cause of future academic effects, rather than simply a goal in and of itself (Linquanti, 2001; Robinson, 2011). In other words, this body of research focuses on reclassification as cause rather than reclassification as effect, attempting to isolate the consequences of reclassification on later academic outcomes such as test scores, course-taking, success in graduating from high school, and even post-secondary enrollment (Robinson, 2011**;** Kim & Herman, 2012; Carlson & Knowles, 2016).

Shift in Workforce Demands and K-12's "College and Career Readiness" Response

While these demographic changes have been unfolding, there have also been shifts in workforce demands, highlighting the attractiveness of careers that require not only a post-secondary education, but deep knowledge of and comfort with the fields of science, technology, engineering, and mathematics (STEM). In Washington State, for example, it is estimated that the rate of job growth between 2014 and 2024 will be almost three times the national average, with 740,000 job openings expected in the next five years, the majority of these requiring post-secondary education or training (Janda et al., 2017). However, with less than a third (31%) of Washington high school students going on to earn a post-secondary credential by age 26 (Janda et al., 2017), there is clear misalignment between these lucrative, in-demand positions and students' K-12 experiences and outcomes. Additionally, although Washington State ranks first in the nation in regard to the concentration of STEM-related jobs and third in the nation in regard to STEM job growth, it sits at the bottom of the rankings (47^{th} overall and last among the most high-tech-intensive states) in terms of the percentage of students who enroll in directly in college following high school graduation (Washington State STEM Education Innovation Alliance, 2017).

These shifts in workforce demands have inspired federal, state, and local legislation and initiatives like the 2015 Every Student Succeed Acts (ESSA), the Common Core State Standards (CCSS), and the Road Map Project, in which policymakers and others have attempted to reconceptualize the role and responsibility of the K-12 system from one of graduating students from high school to preparing them to not only enroll, but succeed, in college and career, with an emphasis on four-year college preparation. The "college and career readiness" narrative has led to changes in areas that shape the academic experiences and trajectories of all secondary students, including testing, graduation requirements, and curricular offerings (e.g., Advanced Placement courses, International Baccalaureate programs, dual credit opportunities, etc.).

Study Focus and Document Structure

My dissertation explores the intersection of the areas described above by analyzing the course-taking outcomes and patterns of the often overlooked and not fully understood sub-group of reclassified EL students in college preparatory science—an area of great policy interest and attention and one that has received relatively less attention than math. Figure 1 offers a visual representation of the relationship between these broad areas of influence and my study's focus on the role of reclassification in the college preparatory science curricular outcomes of EL students. Broad societal forces are represented on the left side of the figure, while areas applicable to the K-12 educational system are represented on the right. These areas of influence play out within the reality that most EL students will, in fact, reclassify out of EL status before the end of their K-12 career.

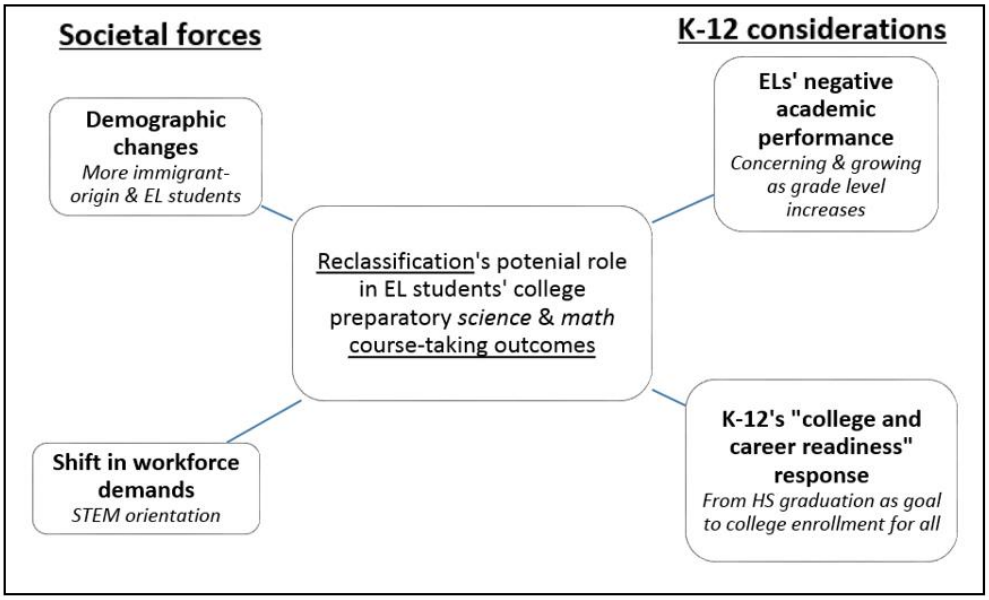

Figure 1. My Dissertation Topic in Context

More specifically, this dissertation seeks to better understand the relationship between EL reclassification before high school and science course-taking in one Washington State urban district, which I refer to as Spruce School District (SSD). Inspired by the question, "Does reclassification matter for high school science course-taking?", I designed and conducted a quantitative study using panel data on one cohort of SSD students (*N* = 2,477), utilizing both descriptive and inferential statistical techniques to explore three mutually-exclusive student subgroups: Reclassified ELs (*N* = 362), Still ELs (*N* = 227), and Never ELs (*N* = 1,888). The larger Ever EL subgroup is comprised of Reclassified ELs and Still ELs. For the purposes of this study, I defined these groups in the following ways:

Ever ELs were students who had any evidence of ever receiving EL services.

> **Reclassified ELs** were Ever ELs who had successfully reclassified out of EL services before the beginning of Grade 9 (2012-13). In either elementary or middle school, these students met or exceeded the level required for exit on the statewide annual English language proficiency exam. As a result of this test score, these students were deemed fluent in English and no longer in need of language development and support services.

Still ELs were Ever ELs who entered Grade 9 as currently-served EL students. As of the beginning of Grade 9, these students were deemed to be in need of English language development and support services.

Never ELs were students who had no evidence of ever receiving EL services. The vast majority of Never ELs were English-only speakers (96%).

In particular, I aimed to answer four research questions that compared the subgroups across demographics, academic experiences and achievement, and access to and performance in their high school science-course taking trajectories. Of most interest to my study were the subgroups' descriptive rates and predicted probabilities of achieving two science course-taking milestones in high school, and of enrolling in a college or university within one year of high school graduation

In the next chapter, I review relevant literature, state the particular problem I plan to address, and present my study's research questions. In Chapter 3, I discuss the theoretical terrain and guiding concepts anchoring my dissertation, before presenting the study's methods and research design in Chapter 4. In Chapters 5 and 6, I present the results of the descriptive and multilevel model analyses I conducted to answer my research questions. I close with Chapter 7, which offers a discussion of the results within a broader context, implications, limitations, and areas for future research.

CHAPTER 2

LITERATURE REVIEW, PROBLEM STATEMENT, AND RESEARCH QUESTIONS

Literature Review

Rigorous Course-Taking in U.S. School

Beginning in earnest in the 1970s and spanning a variety of research methodologies and contexts, course-taking has been the subject of countless studies in the U.S. and abroad. Comparative in nature, this field has typically focused on identifying, describing, and explaining inequalities by race, gender, and socioeconomic status, both within and across schools, in terms of access to and performance in rigorous, college preparatory high school courses and curricula. Although written twenty five years ago, and complicated and extended by, among other things, the development of more sophisticated and nuanced longitudinal data sets, statistical techniques, and demographic and programmatic categories, Oakes and Guiton, referencing Oakes (1990) and Braddock (1990), summarize a consistent finding across course-taking literature: "On the academic side of the curriculum, low-income and non-Asian minority students disproportionately take low-level and remedial courses, while Whites and Asians tend to dominate enrollments in advanced and honors classes" (1995, p. 4).

Beyond such reporting of differential access to such coursework, more recent studies have addressed the correlational and causational links between high school course-taking and subsequent academic and professional outcomes, such as postsecondary enrollment, major selection, persistence, and careers and future earnings. For instance, a 2012 study by Long, Conger, and Iatarola (2012) highlighted the effects of rigorous course-taking in high school on college enrollment. Using quasi-experimental propensity score matching techniques with longitudinal, student-level data from Florida, the authors found that enrollment in at least one rigorous math course during the first two years of high school resulted in an increased likelihood of enrolling in college, while also promoting enrollment in four-year, rather than two-year, postsecondary institutions. Also employing propensity score matching, work by Attewell and Domina found “statistically significant disparities in access to demanding courses that cannot be explained by prior academic performance” and which “operate primarily via SES rather than via race or ethnicity or gender” (2008, p. 65).

Linking students’ high school science course-taking to the selection of a STEM major, Wang (2013a) found that students’ readiness for the rigors of college-level science was, as we might expect, significantly and positively associated with the number of high school math and science course credits earned. In this same study, for students attending four-year colleges and universities, readiness for college-level science was also linked to majoring in a STEM field, thereby connecting more exposure to science in high school to an increased likelihood of STEM major selection (Wang, 2013a).

Course-Taking as Evaluation of Academic Equity and Excellence for EL Students

Standardized achievement scores in reading and math, plentiful and relatively easy to collect and analyze, have often been used as the primary outcome of interest when investigating the disparate levels of academic equity and excellence commonly experienced by traditionally marginalized and underserved student groups, including ELs. While important to highlight and understand such differences in achievement levels, the summative, often distal nature of these tests to the both the everyday lived schooling experiences of students and the influence exerted by districts, schools, administrators, and teachers, does not provide a clear path forward for improving the inequitable schooling outcomes of many EL students. Moreover, the discouraging lack of progress in closing the “achievement gap” between ELs and their non-EL peers highlighted by these types of outcomes can be seen as promoting commonly-held deficit views of immigrant-origin, language minority students, which holds these students, rather than the systems responsible for serving them, accountable for relatively lower levels of academic achievement.

In place this "achievement gap" perspective, the concept of an "opportunity gap"[1] provides the potential for a more fruitful way forward in serving EL students by putting the onus on states, districts, and schools to thoughtfully and accurately assess how their policies and practices set these students up for success or struggle. This reframing toward an "opportunity gap" approach is taken up in a concrete way in recent work by Callahan and Shifrer, who argue that, "Examination of high school course taking by linguistic status can offer evidence of equity in access and EL program effectiveness", noting that, "EL students can and should enroll in rigorous coursework; their transcripts ultimately attest to the effectiveness of programs in which they enroll" (2016, p. 465). Using course-taking indicators as a tangible way of evaluating the long-term success of EL students' academic experiences can inform the everyday work of district- and school-level educators by encouraging "discussions about the causes and consequences of local EL placement processes" (Callahan & Shifrer, 2016, p. 464). This is especially relevant because, perhaps more so than standardized achievement scores, course-taking enrollment patterns and performance are inextricable from and sensitive to the particular contexts in which the students receive their education (state, district, school), the specific subject

[1] Alternatives to the "achievement gap" concept, which highlights current disparities in achievement without providing context for those differences in achievement, include the "opportunity gap" concept and the "education debt" concept (Ladson-Billings, 2006). The most robust of these three concepts, the "education debt", centers historical and structural disparities and their relationships to educational outcomes. In particular, Ladson-Billings argues that such an "education debt" has been created by "the historical, economic, sociopolitical, and moral decisions and policies that characterize our society" and emphasizes that it has compounded over time for those from underserved, overlooked communities of color and those who have experienced poverty (Ladson-Billings, 2006, p. 5). "Opportunity gap" is recognized as more structural in nature than "achievement gap" and is more easily operationalized for quantitative studies than "education debt".

areas (English language arts, math, science, social studies) and grade levels (middle school grades, high school grades) under examination, and the methods employed (descriptive, correlational, causal inference).

Science and math are especially important subject areas to investigate, as we know that math course-taking outcomes are strong and reliable predictors of post-secondary enrollment and success (Adelman, 2006), and that the earlier students are exposed to high-level science classes in high school, the more interest they tend to exhibit in pursuing an education, and potentially a career, in well-remunerated and ever-growing STEM fields (Wang, 2013b). At the same time, research has demonstrated large disparities in science knowledge and achievement even before the high school grades, likely the result of differential access and exposure to science during earlier grades and early childhood. For example, nationally representative studies indicate that the 50^{th}-percentile scores of EL students on eighth grade science achievement tests are lower than the 10^{th}-percentile scores of their non-ELs peers, a disparity that is greater than both the difference in average science achievement between Black and White eighth grade students, and between students experiencing poverty and those from higher socioeconomic households (Morgan, Farkas, Hillemeier, & Maczuga, 2016).

While most studies focused on reclassification and course-taking have included math outcomes, few have investigated the content area of science in detail. An exception to this trend is work by Callahan, Wilkinson, and Muller (2010), who used nationally representative data to estimate logistic regressions that controlled for a host of individual- and school-level factors and found that language minority students who had experienced EL service were 45% less likely to enroll in college preparatory science coursework than their statistically matched language minority peers who did not participate in an EL program. The study did not identify a statistically significant difference in likelihood of enrollment in college preparatory math coursework between these two similar student groups (Callahan, Wilkinson, and Muller, 2010).

Another of the few inquiries linking EL status and reclassification to science and math course-taking is Umansky's second (of three) 2014 dissertation studies on EL equity. Focused on the middle school level, the author described two types of limited course access experienced by ELs: 1) "Leveled tracking", related to ELs' underrepresentation in upper-level, advanced courses, and 2) "Exclusionary tracking", related to ELs' exclusion from core area content classes (2014, p. 12). Descriptively, she found that ELs were in lower leveled classes, on average, and were "more likely to lack enrollment in all three core subject areas" (science, math, and English language arts) as compared to their English-only, initially fluent English proficient (IFEP), and reclassified EL peers (Umansky, 2014, p. 103).

Umansky also found that ELs were the least likely group to have taken algebra by the 8th grade and that, compared to their English-only peers, ELs were four times as likely to not be enrolled in science (8% of ELs not enrolled) and twice as likely to not be enrolled in math (4% of ELs not enrolled) (2014). She also noted that exclusion from science and math was not dependent on the student's level of English proficiency, suggesting that the "EL" category itself, rather than the individual achievement of the student, determined access to the core content areas of science and math (Umansky, 2014).

While the studies mentioned above begin to illuminate our understanding of the relationship between reclassification and college preparatory science and math course-taking, they are based on nationally-representative data in one case, and middle school records from one California district in another. Course-taking—which is known to be a strong predictor, if not a determinant of future academic and career opportunity and success—offers a rich and relatively unexplored area for more state- and district-level reclassification research, especially given its relatively policy-malleable and local nature. In particular, a deep, longitudinal investigation into the college preparatory science course patterns and outcomes of students who reclassify before high school can provide important insight into the levels of access and rigor experienced by EL students—one of the most underserved K-12 student populations.

Variation in Reclassification Policies

The research gap addressed in this proposed study relates to a lack of understanding regarding if, to what extent, and under what circumstances, reclassification in the years directly before high school is related to the long-term, college preparatory science course-taking access and performance of former EL students, especially within the broader context of a state-level single-criterion reclassification policy. I focus on science course-taking because of its link to preparation for and access to four-year colleges and universities, and to the large and growing STEM economy in the Puget Sound area of Washington State. Needed are science course-taking analyses that are more nuanced and context-specific than what is currently available from studies based on nationally representative samples or samples from states with different policies and populations.

EL reclassification is a particularly important and timely area of study at the moment, as Title III of the federal 2015 Every Student Succeed Act (ESSA) now requires states to standardize classification and reclassification procedures across school districts (August & Haynes, 2016; National Center for English Language Acquisition, 2016; **U**.S. Department of Education, 2016). This type of reclassification policy has been in place in Washington State for over a decade, making it a fruitful context to conduct such research using a longitudinal approach.

Even prior to ESSA-induced EL-related changes, many states have begun to standardize their reclassification procedures—opting to use a single, uniform criterion to determine which students were to be redesignated out of EL status. For example, in 2006, 14 states relied on only one criterion to determine reclassification, a number that had increased to 29 states plus the District of Columbia by 2015 (Linquanti, Cook, Bailey, & MacDonald, 2016). In this way, with its reclassification policy based solely on a single state English language proficiency (ELP) assessment, Washington represents the most common reclassification policy profile in the U.S.

In comparison, California, where many of the limited number of reclassification and course-taking studies originate, has historically exhibited extensive variation in reclassification criteria across school districts, including not only student performance on a state ELP assessment, but also academic content assessment scores, teacher evaluations, and parental opinion (Linquanti, Cook, Bailey, & MacDonald, 2016). Requiring EL students to meet minimum levels of proficiency in these four areas, California is representative of only a handful of other states who require multiple pieces of evidence to determine reclassification (Linquanti, Cook, Bailey, & MacDonald, 2016). Therefore, while informative to reclassification research in general, and notwithstanding important potential differences in the demographic compositions of EL populations across states, findings from the unique state of California may not be as relevant to the outcomes of EL students residing in single criterion states, like Washington, which, as previously mentioned, represent the most common reclassification policy nationwide.

Apart from substantive policy differences across research contexts, differences in such policies could be expected to result in differences in the composition of the reclassified EL student population. For example, in Washington State, known for its more streamlined and straightforward single criterion policy, there appears to be less variation between the population of EL students who are eligible for reclassification and those who are, in fact, reclassified. In other words, the students in Washington State who exit EL status may more accurately represent the full population of EL students across the state who are eligible for reclassification. Given this, analysis of this group could offer a more complete picture of the effects of reclassification on the future academic outcomes of reclassified ELs.

This is not the case in California, where research based on two school districts revealed "many missed opportunities to reclassify all students meeting criteria" (Estrada & Wang, 2013, p. 38). It is reasonable to assume that such differences in reclassification requirements and outcomes, and the subsequent related differences in reclassified EL student populations, could have important consequences for or interactions with observed levels of access to and achievement in mainstream content area and college preparatory courses. In this way, Washington offers a more unadulterated context for examining the full academic effects of reclassification.

Instead of the act of reclassification leading to positive or negative outcomes, Robinson (2011) argues theoretically in favor of a "null effect" of reclassification—stating that the most desirable finding would be the lack of discernable long-term academic effects. He contends that this null finding would suggests a "smooth" transition from EL to former-EL or reclassified status, indicating that students did indeed shed the EL label and services at the appropriate time in their academic careers—the point at which they were no longer accruing more benefits as an identified EL student than as a former EL in the mainstream setting.

Empirical research that uncover no obvious positive or negative effects of reclassification on later academic outcomes appears to support this "null effect" perspective. For instance, Robinson's own 2011 study found that reclassification did not affect either course enrollment or successful completion in any subject studied, including science, math, English language arts (ELA), or overall college preparatory credits. More recently, Carlson and Knowles tested the effect of reclassification on a "sample of 9th graders who scored within 10 points of the automatic reclassification threshold", finding "no significant effect on student ACT scores or postsecondary enrollment outcomes" (2016, p. 24). Additionally, their results regarding the effect of reclassification on the likelihood of high school graduation were uncertain—with a linear fit specification showing no significant impact, while a quadratic fit specification indicated a positive and significant ($p < .05$), if small, impact (Carlson & Knowles, 2016).

However, we also have reason to believe that reclassification during the secondary grades, in the words of Carlson and Knowles, "has the potential to put students on an educational track that may differ greatly from the one they would have experienced had they remained classified as an ELL" (2016, p. 7). In fact, concern that recently reclassified ELs struggle after exiting EL status led to a unique, funded Washington State policy in 2013 aimed at supporting the content area academic achievement of this subpopulation (OSPI, 2015). In the first study to ever "examine reclassification effects in multiple districts simultaneously", Cimpian, Thompson, and Makowski found "a tremendous amount of heterogeneity in the effects of reclassification on later outcomes…even when considering students subject to the same state-level policy threshold", implying that, "policymakers and researchers should not default to a belief that reclassification is universally beneficial or detrimental" (2017, pp. 274S & 275S). For example, when investigating the relationship between high school graduation and reclassification, the authors found that in some districts, students just above the reclassification cut-off were 80 percentage points less likely to graduate ($p < .001$), while in other districts, this same group of students was 38 percentage points more likely to graduate ($p = .01$).

In a similar vein of conflicting or mixed results within the same study, Pope's 2016 investigation in the Los Angeles Unified School District (LAUSD), found benefits of reclassification for young ELs (2nd to 4th graders) in the form of "large gains in their English test scores and English GPAs" which persisted over seven years and were much larger for boys than girls (p. 30). At the same time, the author saw no evidence of reclassification benefits for older ELs (5th to 10th graders) when examining math test scores, math GPA, grade retention, and school attendance (Pope, 2016).

To summarize, research has not provided a conclusive answer as to the role of reclassification on later academic outcomes, in large part because of how much variation exists across contexts in EL-related policies and practices. It follows that because reclassification policies are determined at the state and local levels, it is impossible to assume that results from one context are applicable elsewhere. Instead, detailed, longitudinal research that connects a particular locale's reclassification policy and the academic outcomes that matter most to the long-term success of students in that setting is needed to empower local leaders and educators to make and implement the most informed and effective policies.

Prior Work in Washington State

Research that brings together college preparatory science and math course-taking and EL reclassification in the context of Washington State is limited, and in regard to my study's focal district—one of the largest and most linguistically diverse in the state—non-existent. One of the only such studies was conducting in 2016 by researchers at Education Northwest, who identified that while almost half (48%) of Never EL students across the state took at least one advanced course in a given school year, only about a third (36%) of recently reclassified or "monitored ELs", and approximately a quarter (26%) of current ELs, exhibited the same trend (Hanson, Bisht & Greenberg Motamedi, 2016). The differences between the percentages of Never ELs and recently reclassified ELs enrolled in advanced course-taking were greater in math (8% difference) than in science (3% difference), although a larger overall proportion of students from both groups took advanced courses in math as compared to science (Hanson, Bisht & Greenberg Motamedi, 2016).

While this report presents important and previously lacking information regarding how EL and home language status are related to advanced course taking patterns and the number of advanced courses offered in schools serving demographically different student populations, percentages of students taking a certain number of advanced courses do not provide information about students' entire course-taking *trajectories*—an approach that would offer more actionable information to pinpoint where or under which conditions students fall off the path towards successful college preparation. Additionally, this report's focus on "advanced courses" is not identical to my proposed study's focus on college preparatory science and math courses, which may, but do not necessarily, include "advanced" courses like honors and Advanced Placement (AP) classes. Rather, my own work aims to provide the proportion, as well as the likelihood, of reclassified ELs meeting the clear, pre-specified, state-level metric of eligibility to apply to a public, four-year college or university by the end of 12th grade —a milestone with tangible implications for students' post-secondary opportunities and lives.

Problem Statement

This study focuses on what Estrada and Wang (2013) refer to as, "the instructional placement and core curricular access consequences of being reclassified or not" (p. 9). This focus on educational tracking is based on the belief that the "EL" label, and relatedly, the act of reclassification, have the potential to shape students' current and future academic trajectories and outcomes. More specifically, and as mentioned above, the research gap addressed here relates to a lack of understanding regarding if, to what extent, and under what circumstances, reclassification in the years directly before high school influences the long-term, college preparatory science course-taking access and performance of former EL students, especially within the broader context of Washington State EL policy, which represents a state-level single-criterion reclassification policy applied uniformly across districts.

The question is, in such a policy context—does reclassification before high school, when educational tracking and progression through content areas are in full swing, play an important role in shaping EL students' access to and success in high school science curricula? In particular, I plan to test Callahan, Wilkinson, and Muller's claim that EL students "do best when they transition out…before the high school years" (2010, p. 106).

As noted in the review of literature above, prior work in this area has drawn mixed conclusions and has not often emphasized the content area of science. For example, Painter and Flores found that reclassification during middle school has, "considerable potential to keep students in high school through graduation" (2013, p. 125). On the other hand, Robinson (2011) found "no evidence that reclassification affected either enrollment opportunities or successful completion of such courses, in any subject studied", suggesting that "reclassification alone does *not* always open doors" to college preparatory coursework (p. 282).

It is likely that such contradictory findings are a direct result of a combination of the heterogeneity of not only EL reclassification policy and how it is implemented across contexts, but also variation in how and by whom course-taking decisions are ultimately determined. If this is the case, then research from other contexts, including other states and districts, can be only so illuminating for a setting like Washington State, which has its own unique combination of EL student populations, and policies and practices related to both course-taking and reclassification. In the words of Thompson, "much remains to be learned about the factors impacting course-taking among ELs in different state and local contexts" (2015, p. 6), and I investigate these factors in depth, and with nuance, drawing on a quantitative data set representing six consecutive years (2012-13 through 2017-18) of student-level records from a large, urban, public school district in Washington State. The detailed and extensive longitudinal nature of my data set means that I am able to provide insight into where along the high school pathway, if at all, students, especially Ever ELs, "fall off" the college preparatory track in science, with a special focus on if reclassification before beginning high school influences science course-taking.

The ultimate intention of my dissertation is to identify whether reclassified EL students exhibit significantly different probabilities, as compared to their Still EL and Never EL peers, of successfully completing the science courses required to apply for admission to in-state, four-year colleges and universities. I hope that focusing on such a distinct, dichotomous, and consequential outcome will promote urgency and offer actionable information to local policymakers and practitioners seeking to improve the rigor of Ever ELs' high school experiences. More broadly, the results of this study have the potential to inform decisions in other states working to comply with ESSA's mandate of EL reclassification standardization, which often takes the form of a single-criterion policy like the one in place in Washington State for over a decade.

Research Questions

Given the review of relevant literature and problem statement described above, I conducted a quantitative study to assess Ever English learner (EL) students' levels of educational equity and excellence in the content areas of science, looking particularly at whether reclassifying out of EL status before entering high school influenced high school science course-taking and college enrollment. The four research questions that guided this study are listed below.

Research Question 1: How did the Reclassified EL, Never EL, and Still EL student subgroups compare to one another across observed individual background characteristics and academic experiences and achievement?

Research Question 2: How did these subgroups' observed high school science course-taking trajectories compare to one another in rates of access to and performance in different course tracks?

Research Question 3: Was entering high school as a Reclassified EL associated with a significantly higher probability of achieving two important science course-taking milestones by the end of high school and enrolling in college within one year of high school graduation?

Research Question 4: Was entering high school as Still EL associated with a significantly lower probability of achieving two important science course-taking milestones by the end of high school and enrolling in college within one year of high school graduation?

CHAPTER 3

GUIDING THEORETICAL TERRIAN AND CONCEPTUAL FRAMEWORK

Figure 2 offers a visual of the theoretical anchors of this study, and the guiding concepts I draw on in this study to investigate the relationship between EL reclassification and students' college preparatory science course-taking patterns and outcomes. This combination of terrain and concepts comprise my study's theoretical and conceptual framework. The broad theoretical foundations of my study rest at the bottom of the triangle—educational stratification, tracking, and inequity—phenomena that have been explored and theorized for decades across multiple contexts and using an array of methodological approaches, often through a sociological lens. The top level of the triangle, "opportunity to learn (OTL)", represents the primary concept I plan to investigate—one that grows from and is rooted in the broader educational tracking literature. A research paradigm that inspires my work, "critical quantitative inquiry", rests outside the triangle and represents the nuanced analytic stance I employee while exploring OTL within the content area of science. Next, I describe these three framework components in more detail.

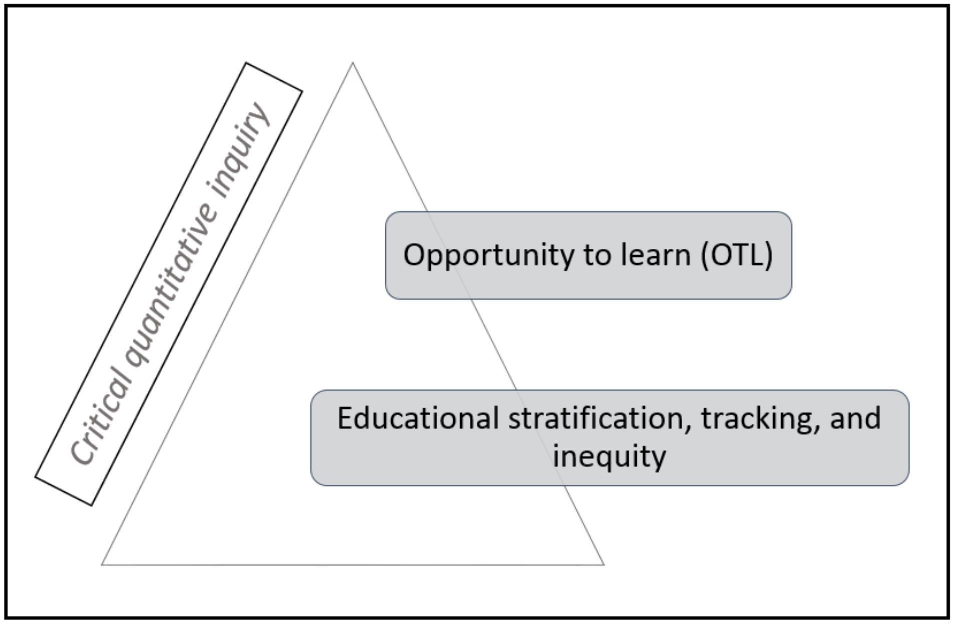

Figure 2. Anchoring Theoretical Terrain and Guiding Concepts

Educational Stratification, Tracking, and Inequity

Philosophers and theorists have long discussed the role of schools and schooling in creating and perpetuating inequity through the related concepts of cultural and social reproduction (Bourdieu, 1977). In essence, it has been theorized that schools, schooling, and their related processes have been structured to serve a particular role in society—to ensure that the dominant, ruling class retains power, thus maintaining the status quo that tends to educate those in minority groups in ways that channel them into lower wage, lower status work, while promoting the continuing elevated status of those in power. In order to accomplish this, it is argued that school systems more broadly, and individual schools in particular, often exert control over who has the opportunity to take advantage of high-quality learning opportunities, including exposure to high-status curricula, courses, experiences, peers, and teachers.

This "gatekeeper" role of school systems and schools then leads to stratification of opportunity, often based on social class and race and ethnicity, which at the school level manifests as tracking. Oakes defines tracking as, "the practice of dividing students into separate classes for high-, average-, and low-achievers; it lays out different curriculum paths for students headed for college and for those who are bound directly for the workplace" (1986, p. 13). Further specifying the relationship between school level practices and the access experienced by different student groups to higher- or lower-status educational opportunities, Domina and colleagues describe tracking as "systems" which represent "the culmination of an array of school-level processes related to the provision of differentiated academic course work and the allocation of students among the available courses" (2019, p. 296).

Tracking often serves to further exacerbate existing inequities in educational opportunities and outcomes. For example, in regard to the tracking of EL students, work by Dabach (2015) demonstrated that novice, rather than experienced teachers, were more likely to be assigned by school leaders to teach sheltered courses, potentially constraining EL students' educational opportunities.

Oakes (2005) argues that tracking of students into higher or lower classes is a primary way that schools contribute to the current and future inequalities experienced by certain student populations:

> This sorting continues to disadvantage those in lower-track classes. Such students have less access to high-status knowledge, fewer opportunities to engage in stimulating learning activities, and classroom relationships less likely to foster engagement with teachers, peers, and learning. The sorting and differentiated opportunities promote gaps in outcomes of every sort: achievement, graduation rate, college going, and so one. Low-income students and students of color still suffer disproportionately from these negative effects…Thus, through tracking, schools continue to replicate existing inequality along lines of race and social class and contribute to the intergenerational transmission of social and economic inequality" (p. xi).

Critical Quantitative Inquiry

As noted above, the research paradigm known as "critical quantitative inquiry" inspires this study and represents the nuanced analytic stance I use while exploring OTL for Ever ELs within the content area of science. My study aims to highlight how EL status, and the accompanying benefits and challenges of this label, intersect with college preparatory science curricular progression and course-taking in the high school years.

Recognizing that the immense heterogeneity and diversity within the Puget Sound region's EL population, where my study is based, calls for a critical, precise, and nuanced scholarly approach. Migration Policy Institute researchers have noted that Washington State's public schools are more diverse than the national average (Hooker, McHugh, Fix, & Capps, 2013). In addition to the variety of students' home languages, cultures, countries, races and ethnicities, immigration statuses, and prior schooling and academic achievement levels, it is important to keep in mind the numerous sub-categories of what it means to have been or still be an "EL" (e.g., former EL, reclassified EL, current/still EL, newcomer EL, long-term EL, students with limited or interrupted formal education (SLIFE), etc).

Such variation within a category that is often perceived and quantitatively treated as one monolithic group ("EL") requires an analytic lens that allows the identities and experiences of the individuals under study to be recognized as fully as possible, taking into consideration the imbalances of power represented in structures such as schooling. This type of approach is based on an intention to use research results to not only inform policy and practice, but to do so in a way that, "has the transformative ability to expose and create space for altering rather than reproducing problematic institutional stratifications and inequities" (Metcalf, 2014, p. 77).

While dominant lines of quantitative research have not historically been considered "critical", there are scholars whose work falls under the "critical quantitative analysis" umbrella. Metcalf (2014, p. 80) describes this type of inquiry in this way:

> "Critical quantitative research takes into deep consideration the variables and their underlying measures, contexts (social, political, historical, etc.), and potential interpretations and the implications of each of these for respondents, researchers, policy makers, communities…(it)…allows us to see and acknowledge the limitations in our data sets, construct new measures, *and* find ways to engage with and contextualize the data, despite these limitations, in critical ways."

Stage, who has written extensively on this critical approach to quantitative research notes that one of the primary tasks of "the critical quantitative researcher" is to, "use data to represent educational processes and outcomes on a large scale to reveal inequities and to identify social or institutional perpetuation of systematic inequities in such processes and outcomes" (2007, p. 10). Inspired by this approach to quantitative research, I ask, "How will I ensure that my dissertation maintains a critical quantitative focus?"

Metcalf (2014) offers one model of how this can be accomplished in practice. For example, in her study predicting the relationship between the K-12-to-higher-education STEM "pipeline" and the STEM workforce, she presents three sets of logistic regressions—one that follows, "the traditional pipeline model assumptions that tend to oversimplify identity characteristics by focusing dichotomously and mutually exclusively on women and minorities", another that more fully disaggregates identity characteristics (e.g., rather than a "minority" category, individuals are categorized into their particular racial and ethnic categories), and a third that interacts the disaggregated identity characteristics with the individual's gender identification (e.g., female or male) (Metcalf, 2014, p. 86). Presenting and interpreting the results for each of the three models, we see that when the more traditional assumptions are followed, the results are as would be expected, based on previous research that also follows these same assumptions:

Minorities and women are more likely to fail to successfully make it to the end of the STEM "pipeline". However, when more nuanced levels of disaggregation and interaction of variables are employed—the results become more complex and can vary greatly across different racial and ethnic groups in general, and across different combinations of race/ethnicity and gender.

In essence, one of the major dangers in quantitative research, which relies on averages across large numbers of individuals, is that the more simplified our variable categories are—the more likely it may be to come to conclusions that are themselves oversimplified, inaccurate, or that mask true and important differences between groups of individuals who share some traits (e.g., the "EL" label), but who exhibit great variety in other critically important areas of their identities and experiences. Making visible differences in study results that result from decisions made by the researcher, such as how categories were defined, is one way that I can engage in critical quantitative inquiry.

Such a critical lens shapes not only the ways in which quantitative data are organized and analyzed, but also the overall conceptualization and design of my study. In particular, it is from a critical perspective that I selected "opportunity to learn" (OTL) as the guiding conceptual framework for my dissertation work. OTL can be conceived of as a way of flipping the question from a focus on individual responsibility—"Why are high school EL students not well prepared in the area of college preparatory science?"—to one that focuses on accountability of the system and the adults in the system to prepare these students well—"Why are high schools not preparing EL students well in the areas of college preparatory science?" Next, I describe in more detail what OTL is, how this concept guides my work, how I operationalize it within the context of my quantitative dissertation, and note two important limitations of the OTL perspective.

Opportunity to Learn

Recognizing the broad notions of educational stratification, tracking, inequity, and schools as sites of cultural and social reproduction as the theoretical space in which my study unfolds, and identifying my stance as a critical quantitative researcher, I now move to discussing, "opportunity to learn" or OTL—the guiding concept I will use to investigate the relationship between EL reclassification and students' access to college preparatory science and math course-taking patterns and outcomes. OTL serves as a readily quantifiable and already extensively-employed construct that I, and others, contend links inequitable school practices like tracking and restriction of access to upper-level, academically rigorous courses to poor academic outcomes and experiences for ELs, and in doing so, constrains their future career and life trajectories, including the ability to apply to and enroll in a four-year university directly after high school.

Opportunity to learn (OTL) measures have been conceived of as systemic, equity-based, accountability-driven indicators (often used in conjunction with standards-based assessments) in that they provide concrete measures of how well schools have provided students with "an adequate opportunity to learn" the material on which they would be tested (McDonnell, 2005, p. 29; McDonnell, 1995, p. 306). Proponents of using OTL standards as process indicators of the larger educational system have argued for indicators of not only "school- and grade-level organization, course offerings and student course-taking patterns", and "curriculum content", but also "how…content was presented" (e.g., "instructional materials availability and usage, and instructional strategies") and who presented the content (e.g., "teacher background and experience") (McDonnell, 1995, p. 309).

While we have known for decades that, on average, EL students lag behind their non-EL peers on academic assessments across grade levels and subject areas, there has been less research and discussion regarding exactly why these disparities exist and what can be done to improve the situation. In the words of Aguirre-Muñoz and Boscardin, two researchers who have conducted OTL research on EL students' schooling experiences and performances, "Simply disaggregating the performance data to show potential disparities between groups of students does not provide policymakers and other stakeholders a complete picture of student achievement. Nor does such an approach provide information that leads to targeted areas for improvement" (2008, p. 203). In fact, taking a critical approach, we could argue that such results serve to reinforce the notion of ELs as deficient and lacking, placing the blame on the students and their marginalized identities as "language learners" who are, perhaps, unable to achieve at the same levels as the monolingual English-speaking peers and in need of remediation. Needed is a research approach that prioritizes the creation of actionable information and recommendations, based on large-scale, longitudinal, student-level data that provides a contextualized overview of academic trajectories over time. It is this type of study that I aim to undertake through my dissertation work.

Connection to Course-Taking and Academic Preparation

At its heart, OTL is an accountability measure—concerned with explicitly attending to the opportunity students have had to learn the subjects and gain mastery of the knowledge, skills, and dispositions expected of students at particular grade levels. Herman, Klein, and Abedi defined OTL as, "the opportunities which schools provide students to learn what is expected of them", and, drawing on work by Brewer and Stacz (1996), they list three areas of OTL: 1) Curriculum content, 2) Instructional strategies, and 3) Instructional resources (2005, p. 16).

I focus on the first area of OTL—curriculum content—which these authors describe as, “the extent to which students have been exposed to the specific subjects and topics which are essential to attaining particular standards or which are directly assessed” (Herman, Klein, & Abedi, 2005, p. 16). In my study, I specify this notion of “curriculum content” as pertaining specifically to the college preparatory science curricular patterns of reclassified EL students. In essence, I am interested in quantifying reclassified EL students’ level of exposure to the science courses that determine four-year college admission eligibility.

Arguably, the most critical milestone of one’s K-12 academic career is high school graduation, and more broadly, the accumulation and development of the academic knowledge and skills necessary to access and navigate a wide variety of post-secondary options. A measure of the academic preparation and experiences students have across the grades, especially from middle school and above, can provide critical insight into the process by which a student comes to achieve important milestones like graduation. Like Callahan and Shifrer, I contend that, “Examining disparities in the completion of both graduation and college preparatory course taking offers a very tangible measure of academic development”, and that the, “Identification of course taking benchmarks and common academic trajectories has the potential to improve EL programs’ ability to provide equitable academic access” (2016, pp. 487 & 489).

Instead of simply reporting academic outcomes like standardized test scores, GPAs, graduation rates, and enrollment in higher education, which implicitly emphasize what students have or have not accomplished by a certain point in time, OTL reflects the ways in which and the educational system may have failed to adequately prepare students. According to Porter, a widely cited researcher in the area of OTL, proponents of the concept argue that it has, “the potential for helping to solve the problem of providing equality of educational opportunity to all students", in particular, "students, who, through no fault of their own, attend schools that provide an inferior education" (1995, p. 21). If we agree that, "Students' learning opportunities do vary, and variation in learning opportunities matter", it naturally follows that we need empirical measures of, and actionable plans to then address, such inequities in opportunities to learn. This is especially true given that these inequalities are known to disproportionately affect economically disadvantaged, racial, ethnic, cultural, and linguistic minority students—the very pupils who may be most dependent on the educational system to prepare them for future academic and career opportunities with which their immediate families or communities may be unfamiliar (Wang, 1998, p. 138).

It is important to identify which "slice" of the broad OTL construct I expect to use, and the justification for this decision. I drew on McDonnell's description of the OTL concept (1995, p. 309) to create Figure 3, which visually depicts the many levels and elements of OTL. As seen in the graphic, OTL can be thought of as a nested concept, where state and district policies and practices form the broad context within which the organization of the school, specifically the school levels and grades (e.g., high school, 9^{th} grade), content areas (e.g., science, math, etc.), and the related academic standards, policies, and practices associated with these school levels and content areas, directly shape the courses offered to particular groups of students. Within the "course offerings" level of the OTL concept, we can think of how typical course sequences are structured within schools. This structuring occurs both horizontally, or across subject areas (e.g., "advanced" or honors courses, grade level courses, EL-specific courses, remedial courses, special education courses, etc.), as well as vertically, or within particular subject areas (e.g., Algebra 1 as a prerequisite for future high school math classes, or Chemistry as a prerequisite for Advanced Placement Biology, etc.).

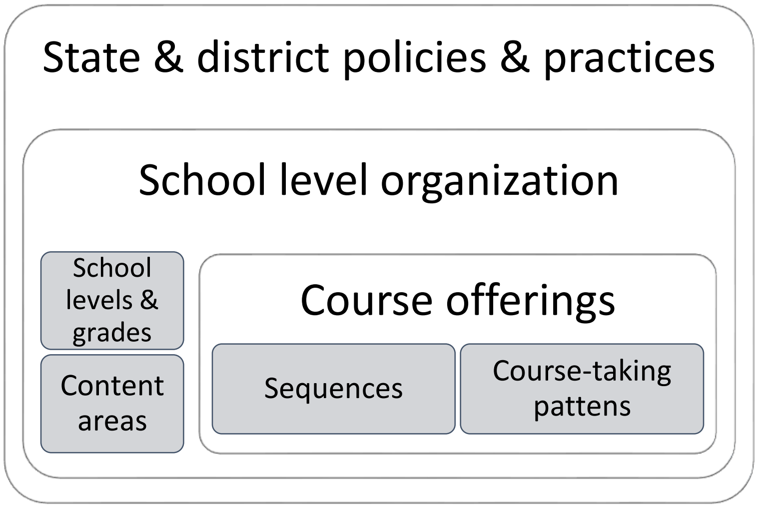

Figure 3. Nested Structure and Elements of Opportunity to Learn (OTL) Concept (inspired by McDonnel, 1995)

Acknowledging the variation across schools in available course sequences, analysis of course-taking patterns provides insight into which particular types and sequences of courses tend to be taken by different student populations. For example, researchers have investigated course-taking patterns with an eye to a wide variety of demographic, social, and academic characteristics, such as ethnicity and race, gender, socioeconomic status (SES), prior academic achievement and preparation, and, of most interest to my work, EL-related indicators such as EL category (e.g., current EL, reclassified EL, never-EL, etc.), EL proficiency level (e.g., beginner, intermediate, advanced, etc.), and immigrant or generational status. In studies most aligned with my work, EL equity-focused researchers have conceptualized and empirically analyzed the intersection of course sequences and student enrollment and achievement patterns, focusing in particular on how EL students are impacted by school and district policies, practices, and procedures, whether formal or more informal in nature.

Operationalizing Opportunity to Learn

In this study, OTL is operationalized quantitatively by exploring two concepts: science course access and science course performance. Access is measured by examining students' course enrollment records, while performance is measured by examining students' course marks or grades and credits earned, as well as the timing of earning particular credits. More detail on these concepts is provided in the next chapter.

Limitations of the OTL Perspective

While OTL is a generative concept to draw on in beginning to make sense of the scale of inequities in course-taking access and performance, a primary limitation is that it has not traditionally concerned itself with race, gender, or intersectionality. Intersectionality (Crenshaw, 1989) requires moving beyond "one-dimensional or single-axis analyses that focus on a specific category (e.g., race, class, gender, or ability)", to instead consider how the many facets of identity, including race and ethnicity, class, gender, sexuality, age, citizenship status, ability, among others, shape and interact with existing power dynamics and structures (Tefera, Powers, & Fischman, 2018, p. viii). In this study, I prioritize a focus on the potential effects of EL status, or the "EL" label, on science course-taking outcomes, which results in less attention on the other identities also embodied in students and captured by an intersectional perspective.

Additionally, the OTL perspective could be interpreted as suggesting that simply providing EL students, in the case of this study, with more frequent, higher quality, and/or more rigorous opportunities to learn should lead to a disappearance in course-taking inequities. Rather, even if OTL were truly equalized for all students throughout the K-12 system—a feat that has never been accomplished on a large scale in U.S. history—inequities would likely still exist in student performance and learning experiences, among other factors. In response, I envision OTL as a starting place for engaging policy and practice to reduce the unjust inequities experienced by EL students, but recognize that much more work and reform would remain necessary to reach the time when educational outcomes are not reliably predicted by factors like race and ethnicity, socioeconomic status, and EL status.

CHAPTER 4

METHODS AND RESEARCH DESIGN

This chapter outlines and describes the study's methods, data, and descriptive analysis plan. I focus here on the key conceptualizations and decisions made in regard to the first and second research questions, which were descriptive in nature, and the results of which are presented in Chapter 5. Chapter 6 presents the specific variables and multilevel modeling analysis plan used to answer the third and fourth research questions, which were inferential in nature.

Methods

I employed quantitative methods including descriptive statistical techniques and, as described in Chapter 6, multilevel modeling techniques, to assess the high school science course-taking access and performance levels of one cohort of SSD students. I was especially interested in comparing whether Reclassified ELs exhibited higher levels of enrollment and performance in college preparatory science courses, as compared to their Still EL and Never EL peers. The majority of my study's descriptive analyses are based on summaries and comparisons of the proportions of students from different subgroups who: 1) enrolled in a certain science track (e.g., "typical" track in Grade 9, 2) achieved a certain outcome (e.g., met the science CADRs). To describe certain measures, I also relied on measures of central tendency (e.g., medians) and ranges.

Data

In the following sections, I provide context for and details about the administrative, student-level, panel dataset from a large, urban, public school district in Washington State. As mentioned in Chapter 2, I relied on a dataset that focused on six consecutive years of data (2012-

13 through 2017-18). Although the high school years for my study's cohort of interest occurred from 2012-13 through 2015-16, I also considered 2016-17 and 2017-18 data, since we know that some students, especially ELs, may take more than four years to graduate high school, and thus, would have course-taking records that extend beyond the 2015-16 year. Additionally, our dataset also included prior years of data for students who had been enrolled in the district before the 2012-13 school year. For instance, our dataset included EL, school enrollment, demographic, and standardized test score records for 2009-10 through 2011-12 for students who attended a SSD middle school for Grades 6, 7, and 8. Since EL placement and exit dates were recorded across the state, EL data for students who transferred to SSD from other Washington districts was also available, although there was some missingness.

History of Project

The data for this study come from a larger, ongoing, multi-method Researcher-Practitioner Partnership (RPP) project funded by the U.S. Department of Education's Institute of Education Sciences (IES). This larger project is focused on exploring, identifying factors, and crafting context-specific policy recommendations related to EL students' access to and achievement in middle and high school math and science in SSD. The Principal Investigator (PI) for this project, Dr. Manka Varghese, is my advisor and the chair of my doctoral committee, and one of the co-PIs, Dr. Elizabeth Sanders, is a member of my doctoral committee. I have served as the Research Assistant (RA) for the entirety of this two-year project, which officially began in the summer of 2017, with data collection concluding in June 2019.[2]

[2] The "EL Pathways Project", a precursor research study to the RPP, began in the spring of 2015, when Dr. Varghese was awarded a grant through the Road Map Project's ELL Work Group and the Aligned Funders Group. This multi-method project intended to provide information about the high school-to-college trajectories and outcomes of EL students enrolled in a local public school district. I also served as the Research Assistant (RA) for this EL Pathways Project.

This policy-oriented RPP is comprised of a core team of nine researchers, practitioners, and leaders, including our research team from the University of Washington's College of Education (CoE), and key staff in the SSD Department of Research and Evaluation (R&E) and Department of English Language Learners (ELL). The RPP's primary objectives are to: 1) confirm or disconfirm the existence of a gap in rigorous math and science course-taking between the school district's EL students and non-EL students, 2) assuming a gap exists, identify factors, including school-specific course-taking and EL policies and practices linked to EL student's lower levels of access to and performance in math and science in SSD middle and high schools (Grades 6-12), and 3) use findings to co-construct actionable policy recommendations for SSD to consider, which are aimed at improving ELs' rates of enrollment and success in rigorous math and science courses.

Although primarily quantitative in nature, the RPP also includes a substantial qualitative component, based on case study work in two purposefully-selected district high schools. As the RA, I helped design, organize, and lead the individual and focus group interviews at both schools with counselors, math and science teachers, and currently-served EL students, reclassified EL students, and Never EL students. I also conducted a handful of observations of one head counselor as she presented information and advised students during her school's end-of-year course registration period. These interviews and observations took place during the same months as I was preparing and analyzing the quantitative dataset used for my dissertation, and I am sure that my case study data collection experiences shaped and informed my quantitative analysis.

As one of the largest school districts in Washington State, with one of the highest numbers of EL students, SSD was a logical choice for this RPP. In addition to the high numbers of EL students in the district, there were several other contributing factors that led to the formation of this partnership: 1) The SSD and UW teams had a shared interest in improving the performance of ELs in our local schools, 2) SSD was experiencing a still-in-progress shift in the district's science curriculum, and, 3) Careers and fields of study in the Puget Sound region that require expertise in math and science are plentiful and growing in number—a fact that aligns our project focus with that of our local economy and institutions of higher learning.

Dataset

Following the execution of a data-sharing agreement (DSA) between SSD and the CoE, as well as University of Washington Institutional Review Board (IRB) approval, the SSD Department of R&E provided our CoE research team with four major data files, linkable via unique student "proxy identification" numbers. In this way, individual students were not personally identifiable by the UW research team, protecting students' individual right to privacy under the Family Educational Rights and Privacy Act (FERPA), while at the same time, allowing a thorough and longitudinal examination of students' academic experiences within the district.

The final dataset used in my study is a single, integrated file that was constructed by selecting and computing necessary variables from data elements provided in the four primary data files. These data files and a description of their respective data elements are listed in Table 1. Most data elements were available for each school year for which an individual student was enrolled in SSD. For example, a student enrolled continuously in SSD from Grade 6 to Grade 12 would have seven distinct years of school enrollment (listing which school the student was enrolled in during each year). In addition, if the student changed schools during a particular school year, there could be multiple school enrollment records for that student in that particular school year.

Table 1. *Primary Data Files Used for Dataset Construction*

Data File	Focus	Description
1	EL and other program participation/entitlements, demographics, and enrollment (K-12 and post-secondary)	Records related to students' EL program participation, other programmatic participation/entitlements (Special Education, academically gifted, etc.), demographics (gender, race, home language, etc.), and K-12 and post-secondary school enrollment
2	Science course-taking	Enrollment and performance records for all middle and high school classes labeled as "science"
3	Math course-taking	Enrollment and performance records for all middle and high school classes labeled as "math"
4	Standardized assessments	Standardized test records

To organize this student-level data into meaningful groups, it was decided that SSD would pull data for every student ever enrolled in the district, organized by expected high school graduating class, beginning with the Class of 2008. High school graduating class is a student-level variable reported by districts to the state, defined as the year for which the student is held accountable for meeting the requirements for high school graduation. To be precise, it is the spring of the school year that is four years after the students enters Grade 9 for the first time. Such a cohort-based structure was the most logical for our project, since we were explicitly interested in course offerings and requirements which, we know from individual schools' course handbooks and state policy, could vary across years and schools (Washington State Board of Education, 2018). This cohort structure allowed us to hold constant a group of students as they moved through high school, while still recognizing the dynamic nature of the "EL" category, with students entering and exiting EL classification each year.

Sample

My study's analytic sample was limited to students who met three important criteria: 1) Were members of the Class of 2016, 2) Were continuously enrolled in the district for each of the four high school years (2012-13, 2013-14, 2014-15, 2015-16), and 3) Attended one of the district's ten comprehensive high schools or the one EL newcomer secondary school.

I focused on the Class of 2016 because, at the time the data was shared with our CoE team, this was the most current cohort that would still allow for at least one year of post-secondary enrollment data. The sample was limited to students who were enrolled for all four years of high school because this group represented those expected to have complete high school science course-taking records, and were the students for whom the district had full responsibility to adequately prepare for post-secondary academic opportunities. If I had included students in the sample who were not enrolled in the district for the entirety of their high school careers, it could downwardly bias my results, like in the case of students who were missing a year of data (perhaps because they transferred to another district), and who would have, therefore, potentially been categorized as not having met the college admission eligibility requirements for science course-taking, even if they may have met some of the requirements while enrolled in a different district.

In other words, the nature of my research questions, which emphasize a holistic, longitudinal assessment of whether students had achieved important course-taking milestones by the end of their high school career, required a stable sample of students who remained in the focal school district from Grade 9 through Grade 12 and who attended the high schools known to follow traditional course-taking sequences (and, therefore, not alternative high schools).

One of the disadvantages of creating the sample using these criteria was accompanying decrease in sample size. Each time another criterion was added, more students were excluded from the sample. More than the overall drop in sample size, however, is the concern that Ever EL students might be disproportionately represented in the group of students excluded from the final analytic sample. For example, research suggests that EL students may be more mobile than other student groups, moving from school-to-school, within and across districts and states as their family circumstances dictate (Fong, Bae, & Huang, 2010). If this is true in SSD, then EL students would be omitted at disproportionally higher rates than their Never EL peers. At the same time, because my sample represents the most stable type of student, who attended all four years of high school in the district, I expect my descriptive results and multilevel model estimates for Ever EL subgroups to potentially be upwardly biased, meaning that the rates for more mobile EL students would likely be even lower. In other words, the results from my study likely indicate a “best case scenario”, compared to results that would have included more mobile EL students.

Variables

In this section, I define variables in the order they appear in the descriptive results presented in Chapter 5. All variables are at the student-level, unless otherwise specified. The full sample included 2,477 students and the Ever EL subsample included 589 Ever EL students.

Ever ELs were students who had any evidence of ever receiving EL services (N = 589 or 24% of the full sample).

Reclassified ELs were Ever ELs who had successfully reclassified out of EL services before the beginning of Grade 9 (2012-13) (N = 362 or 15% of the full sample and 61% of the Ever EL subsample). In either elementary or middle school, then, these students met or exceeded the level required for exit on the statewide annual English language proficiency exam. As a result of this test score, these students were deemed fluent in English and no longer in need of language development and support services.

Still ELs were Ever ELs who entered Grade 9 as currently-served EL students (*N* = 227 or 9% of the full sample and 39% of the Ever EL subsample). As of the beginning of Grade 9, these students were deemed to be in need of English language development and support services.

Never ELs were students who had no evidence of ever receiving EL services (*N* = 1,888 or 76% of the full sample). The vast majority of Never ELs were English-only speakers (96%).

I selected five demographic variables of most interest to include in my study's analyses. All demographic variables were binary or categorical in nature.

Female refers to students who had "female" recorded as their "student gender".

First generation status refers to students who were born outside the U.S.

Language minority (LM) status refers to students who ever had a home language or primary language record that listed a language other than English.

Primary language or language family refers to one of six possible language categories: Spanish, an East African language, an "Other" language, Vietnamese, Chinese, and English. This variable was created from home language and primary language variables. Students were assigned to their most frequently listed language. "East African" refers to Somali, Tigrinya, Amharic, and Oromo. "Chinese" refers to Cantonese, Mandarin, and Toishanese. Due to small numbers, the 42 languages that did not belong to the five major language categories were combined into the "Other" category.

Race or ethnicity refers to one of five possible racial or ethnic categories: Asian, Black, Hispanic, Other, and White. Due to small numbers, the "Other" category was created by combining students identified as American Indian, Pacific Islander, and Multiracial.

After creating current EL-by-year flags to indicate which Ever ELs were currently served ELs during which school years, a number of variables were created to capture students' participation in and exposure to EL services and other districtwide programs related to opportunity to learn.

First grade as EL is a continuous variable that was based on the school year, translated into the student's expected grade level, during which an Ever EL first received EL services.

Initial English language proficiency level is a categorical variable and refers to the Ever ELs' English level, as measured by a standardized Washington State proficiency placement exam. The EL data records included in our administrative dataset dated as far back as 2001-02 for some students and as recently as 2017-18 (for students who remained in the district past their expected graduation year of 2015-16). During this time period, the EL proficiency test in use shifted from the Washington Language Proficiency Test (WLPT-II) prior to 2011-12, to the Washington English Language Proficiency Assessment (WELPA) from 2011-12 through 2014-15, to the English Language Proficiency test for the 21st Century (ELPA21) as of 2015-16 (OSPI, 2016). Regardless of the test being used, once a student scored at the "Transitional" level (Level 4), they were reclassified out of EL services. Generally speaking, Level 1 represented a beginning level of English proficiency, Level 2 represented an intermediate level, and Level 3 represented an advanced level. Students scoring at or below Level 3 were to receive EL services.

Last grade as EL is a continuous variable that was based on the school year, translated into the student's expected grade level, during which an Ever EL last received EL services and was, thus, last classified as a current EL. The grade level following this "Last Grade as EL" was the student's first year as a no-longer-served, Reclassified EL.

Total Years as EL is a continuous variable representing the total years a student experienced EL services, from their first known record of enrollment to their last known record of enrollment. This variable was calculated using the student's first and last grades as an EL.

Total Years as EL by Grade 9 is a continuous variable representing the total years a student experienced EL services as of the end of Grade 8 (2011-12 school year). This variable was calculated using the student's first and last grades as an EL, stopping at Grade 8. This variable was used to inform my analysis of LTEL status and newcomer EL status as of the beginning of high school.

Long-term EL (LTEL) is a binary variable that flags Ever EL students who entered Grade 9 (2012-13) with six or more total years as an EL. This concept is described in further detail in the next section.

Newcomer EL was a concept that I explored in Chapter 5, but due to lack of a necessary criterion in the dataset, was not used as a formal classification. This concept is described in further detail in the next section.

Academically Gifted is a binary variable that flags individual students who ever met the requirements for the district's "highly capable" program and services. Students must have scored within a pre-specified top percentile range on cognitive screeners and math and reading achievements exams to be eligible for this program.

Special Education is a binary variable that flags individual students who ever met the requirements for the district's Special Education program and services.

To provide a comprehensive understanding of the academic performance of the sample and student subgroups, several measures of academic access and performance were explored.

Grade Point Averages (GPA) are continuous variables representing students' cumulative, end-of-year Grade 9 and Grade 12 GPAs.

Honors Science is a binary variable that flags individual students who ever enrolled in at least one honors science class during high school (Grades 9 – 12).

AP or IB Science is a binary variable that flags individual students who ever enrolled in at least one Advanced Placement (AP) or International Baccalaureate (IB) science class during high school (Grades 9 – 12).

Chemistry is a binary variable that flags individual students who ever earned credit (with a mark of a "D" or above) for the second semester of a class that counted for "Chemistry" credit.

Advanced Math in Grade 9 is a binary variable that flags individual students who were enrolled in an "advanced" math class during Grade 9. "Advanced" here was defined by district norms as any math course content at or above the level of Geometry (e.g., Algebra II, PreCalculus, etc.). This variable was included to capture students' individual levels of prior achievement in math and their high track status upon high school entrance. Based on our case study work, we know that students assigned to an advanced math class in Grade 9 would have likely been placed in this track based on a number of Grade 8 factors, including enrolling and succeeding in Algebra 1, their math standardized test performance, and the recommendation of their middle school math teacher.

High School Graduation is a binary variable that flags students who successfully graduated from a SSD high school, indicating that the student met the requirements for a SSD high school diploma.

Met High School Graduation Requirements in Science Course-Taking is a binary variable that flags students who successfully met the science course-taking requirements for high school graduation. This is one my study's three milestones of most interest, and is analyzed descriptively in Chapter 5 and estimated via regression-based models in Chapter 6.[3]

Met the College Admission Distribution Requirements (CADRs) in Science Course-Taking, also referred to as the "science CADRs", is a binary variable that flags students who successfully met the minimum science course-taking requirements to be eligible for admission to one of Washington's six public four-year colleges and universities. This is one my study's three milestones of most interest, and is analyzed descriptively in Chapter 5 and estimated via regression-based models in Chapter 6.[4]

[3] I calculated this variable as of the end of the 2015-16 year (Grade 9), and also as of the last year of the dataset (2017-18), and there was very little difference. Therefore, I decided to use the 2017-18 version of the variable.
[4] I also calculated this variable as of the end of 2015-16 and 2017-18, and with little difference between the outcomes, decided to use the 2017-18 version of the variable.

As Table 2 demonstrates, there was a gap between the minimum requirements for college admission eligibility and the minimum requirements to graduate from high school for the Class of 2016, based on the fact that the science CADRs required two lab sciences (one of which had to be either Biology, Chemistry, or Physics).[5] However, if a student met the science CADRs, they would have automatically also met the less stringent science course-taking requirements for high school graduation.

Table 2. *Minimum science course-taking requirements for high school graduation versus minimum college admission eligibility for the Class of 2016* (based on information Washington Higher Education Coordinating Board, 2011 and Washington Student Achievement Council, 2014).

	High school graduation minimum course-taking requirements for science	**College admission eligibility minimum course-taking requirements for science (CADRs)**
1 =	2 science credits (1 of which must be a lab science)	2 science credits (both of which must be lab sciences and 1 of which must be either Biology, Chemistry, or Physics)
0 =	Less than 2 total science credits *or* 2 or more science credits, but none of which are a lab science	Less than 2 lab science credits *or* Lack of at least 1 credit in either Biology, Chemistry, or Physics

In practice, the most typical science course-taking sequence for the first two grades of high school (Physical Science in Grade 9 and Biology in Grade 10) would have resulted in a student meeting both the high school graduation science course-taking requirements and the science CADRs, even if no additional science courses were taken during Grades 11 and 12. In other words, meeting these two course-taking milestones across four years of high school was not overly demanding. On the other hand, imagine a student who was part of the 23% of the Still EL subsample who was not enrolled in a science class in Grade 9, and then took Biology in

[5] This gap, or misalignment, between minimum requirements in science course-taking for college admission eligibility and high school graduation will be resolved beginning with the Class of 2019. From that point onward, students graduating from public high schools in Washington State must earn three science credits, two of which must be lab sciences (Washington State Board of Education, 2018).

Grade 10, and Anatomy (not a lab science) in Grade 11, and no additional science class in Grade 12. With two science credits, only one of which was a lab science (Biology), this student would have met the high school science course-taking requirements, but not the science CADRs.

It is important to keep in mind that these two course-taking milestones represent my best estimate, based on the records available, of who met the high school graduation and college admission eligibility requirements. It is the stated responsibility of the school district "to determine which of its high school courses meet CADR guidelines", and to ensure that these courses are designated as such on the students' transcripts (Washington Student Achievement Council, 2014, p. 1). Thanks to our partnership with the district, we requested and received a file indicating which classes counted for "lab science" course credits, and which classes counted for "science CADR" course credit, and this information was utilized in the creation of these two milestone variables. In the end, though, it is up to the admissions office of colleges and universities as to exactly how they interpret students' course-taking records (Washington Higher Education Coordinating Board, 2011).

College Enrollment is a binary variable that flags students who enrolled in any higher education institution (public, private, in-state, out-of-state, four-year, two-year) within one year of high school graduation. This variable was produced by the National Student Clearinghouse (NSC), which links students' individual K-12 and higher education enrollment records across the U.S. Only students who successfully graduated from high school were tracked. It is also important to note that this variable does not include information about whether students enrolled in degree-based programs, certificate programs, or even continuing education classes.

Key Concepts and Data Preparation

Determination of English Learner (EL) Status

I used a generous perspective to guide determination of individual students' annual EL classifications. In other words, my philosophy was to throw as wide a "net" as possible in assigning status as a "current EL". In practice, this meant that if there was suggestive evidence that a student was an EL, I erred on the side of over assigning, rather than under assigning, EL status. Because my study considered individual students' classifications and academic experiences over time, it was important that I took a holistic view of their data over time. It would not have been logical, for example, for a student to exit out of EL services at the end of Grade 7, and then re-enter the "Still EL" pool in Grade 9, since once students in Washington State reclassify, less than 1% re-enter the EL program (OSPI, 2017). In the end, the goal was to create variables like the following, which would serve as the foundation of all other EL-related variables: "Current EL in Grade 6", "Current EL in Grade 7", "Current EL in Grade 8", "Current EL in Grade 9", etc.

Even if this approach resulted in more students being classified as current ELs for more years than would have been the case with the raw data shared with us by the district, this would likely underestimate the association between EL status and my outcomes of interest. In effect, if some students were mistakenly labeled as current ELs in certain years, this would increase the number of mainstreamed, non-EL students in my study's "EL" category, and since mainstreamed students tend to perform at higher rates than current ELs, we could expect a rise, rather than a drop, in the overall achievement of the current EL group.

The mutually exclusive student subgroups of interest were: 1) Ever ELs (which included both Reclassified ELs and Still ELs), and 2) Never ELs. These variables were determined by inspecting and making sense of two sources: 1) Demographic records that included a flag indicated if a student was served by the EL program during a particular school year, and 2) Test score records that indicted students' EL placement and exit dates and test scores. All available information was used to make determinations about students' most likely EL status-by-year. All EL student subgroup variables are binary in nature.

An important caution to keep in mind is that the EL data in our project's dataset was not always complete, and, at times, EL variables conflicted with one another. For example, records found in the demographic file might have indicated that a student received EL services during Grade 9 and Grade 11, but not during Grade 10. In another instance, the dates of a student's EL proficiency exam results could have been in conflict with the dates of EL service for that student. This happen when, for example, the exam date was at the end of Grade 7, indicating that the student should have reclassified out of EL services before Grade 8, but demographic file records showed that the same student received EL services during Grade 9. Again, I used a generous perspective to guide decisions, meaning that when there was conflict in EL data for a particular student, I erred on the side of assigning EL status, within reason.

"High Need ELs"

Although not a key focus of my study, as descriptive data analysis progressed, I became interested in identifying how much of my sample's Still EL subgroup was comprised of "high need ELs". I explored this "high need EL" concept by calculating how many Still ELs entered Grade 9 either as "long-term ELs" (LTELs) or "newcomer ELs". My thinking was that if such "high need ELs" represented 50% or more of this subgroup, for example, this might help explain any potential findings of Still ELs' lower relative achievement. Below, I describe the "newcomer EL" and LTEL concepts and define them within the SSD context.

Newcomer ELs are typically described as students who recently arrived to the U.S., speak a home language other than English, and have a beginning level of English proficiency. Definitions for LTELs vary, but generally refer to students who: 1) Have received EL services for six or more years without achieving reclassification, and 2) Exhibit relatively high levels of proficiency in English used in social situations, but low levels of academic literacy in English and in their home language. It is widely accepted that these two subgroups, especially in the secondary years, have specific profiles and needs that differentiate them their Ever EL peers who followed the more traditional profile of receiving EL services in Kindergarten or Grade 1, and transitioning out of EL programming by middle school. A Center for Applied Linguistics (CAL) report describes the challenges facing secondary newcomer ELs in this way: "Not only do these newcomers have to master complex course content, usually with incomplete background knowledge and little understanding of the way that U.S. schools are structured and operate, but they have fewer years to master the English language than do students who enter at elementary grades" (Short & Boyson, 2012, p. 2).

SSD required a student to meet three criteria to be eligible for "newcomer EL" status: 1) Born abroad and arrived to the U.S. within the past year, 2) Home language other than English, 3) Scored at the "Beginning" or "Advanced Beginning" levels on the state's EL proficiency placement exam. The combination of these criteria was supposed to be captured in our dataset in the form of a variable called "BOCeligible". This flag indicated whether a student was eligible to attend a district "Bilingual Orientation Center" site—a school with a program designed specifically for newcomer ELs. For newcomer ELs in the middle or high school grades, the district traditionally served these students at its EL newcomer secondary school, but students could, and sometimes did, opt to attend their neighborhood schools instead.

Long-term ELs also face significant, but often less-visible, challenges at the secondary level. Drawing on other research showing that this subgroup makes up approximately a third of secondary ELs in New York City and Chicago and 59% of secondary ELs in 40 California districts, Menken, Kleyn, and Chae point out that, "The educational experiences of the majority of LTELLs are characterized by inconsistency and transience across programs, schools, and countries" (2012, p. 127). SSD did not have an explicit definition of LTELs, so I drew on the Migration Policy Institute's "Fact Sheet" on English Learners in Washington State, which describes this subgroup as students who have been classified as an EL for six years or more (Sugarman & Geary, 2018). As already mentioned in the "Variables" section, I estimated LTEL status as of the beginning of high school, by flagging Ever ELs who entered Grade 9 with six or more total years as a currently-served EL.

Access and Tracks

Simply put, I operationalized the concept of "access" to a rigorous, college preparatory science curriculum by examining the highest track science class in which a student was enrolled during a given school year. To do this, I categorized students' individual science course enrollment records into mutually exclusive "tracks" by school year/expected grade. To simplify coding and analysis, and given that a student could potentially be enrolled in more than one science class in a given year, track placement was determined using a hierarchy of assumed course rigor, based on the science courses taken during the last semester or quarter each school year. Explained more below, this meant that science courses were evaluated in terms of content (e.g., during Grade 10, taking Chemistry was viewed as more rigorous than taking Biology; at the same time, taking Biology in Grade 10 was viewed as more rigorous than taking Physical Science in Grade 10).

The only exception to this was that classes intended for student populations with special needs (sheltered ELL science courses and science courses modified for Special Education students) were viewed as less rigorous than a course focused on the same content but intended for general education/mainstream students. For example, a course labeled "Modified Biology" (intended for students with Special Education needs) was not considered to be as rigorous as a course labeled “Biology” course. This decision was based on the fact that the district did not appear to give science CADR or lab science credit for many of these sheltered ELL science courses or Special Education science courses.

I defined course tracks in relation to the grade a student was in during a particular year, and I viewed these track placements as dynamic, meaning a student’s science track could, and often did, change from one grade level to the next. For example, Student A might have been in the “typical” science track in Grade 9, the “other” science track in Grade 10, the “typical” science track in Grade 11, and the “no science” track in Grade 12. Student B might have been in the “other” science track in Grades 9 and 10, and the “no science” track in Grades 11 and 12. Student C might have been in the “advanced” science track in Grades 9 and 10, the “other” science track in Grade 11, and the “no science” track in Grade 12. After individual student records were categorized into pre-specified course-tracks, the idea was to compare the proportions of the full sample and the student subgroups enrolled in different science course tracks during each grade level.

This categorization of science classes into course tracks was a complex, lengthy, and iterative process. For instance, the course-taking data file shared by the district with our UW research team included a list of approximately 75 distinctly titled high school science courses. To create this course-taking data file, a district data analyst used SSD’s data system to pull any and all student-level course-taking records labeled “science” for members of the Class of 2016. In other words, this broad designation as a “science” class was the primary selection criterion used in crafting the original course-taking data files. This lack of pre-specified structure provided both a challenge and an opportunity, which we tackled by first exploring, qualitatively and iteratively, the course titles, while relying on state-, district-, and school-level documents related to science course-taking requirements, including course catalogs created by each high school.

The concept of *progression through a core science curriculum* of Physical Science, Biology, Chemistry, and Physics motivated my conceptualization of course tracks. Empirical analysis of the dataset also informed this concept in that I calculated frequencies to identify which courses were most typical or common, at the district level, during each high school grade level, in addition to using the information I gleaned through my tasks as the project's Research Assistant, like conducting interviews with school staff and students and reading the annual course "handbooks" published online by the individual high schools.

After identifying the most frequent science course taken in each grade (which represents the Typical core science class taken during that grade), I was then able to flag Advanced courses (the most frequent core science course taken by students in higher grades), and "Other" courses (science courses that were typically taken during an earlier grade, science electives or non-core science classes, and courses designated for particular student populations, including sheltered EL-only classes and "modified" classes for special education students). In the end, the Typical core science classes by grade level were: Physical Science (Grade 9), Biology (Grade 10), Chemistry (Grade 11), and Physics or "other rigorous science"[6] (Grade 12).

Finally, I made sure to flag students who, while enrolled in a SSD high school each year, were not enrolled in a science course in any particular year. This decision to highlight a lack of access or exposure to any science content was inspired by Umansky's concept of "exclusionary tracking" (2016), which is known to be especially common and detrimental for EL students, whether as a result of intentional or unintentional consequences of EL status (Umansky, 2018). I

[6] "Other rigorous science" was defined as any AP or IB science course, as well as any "out-of-district" science honors courses.

was especially interested in examining the magnitude of exclusionary tracking of Still EL students as compared to Never ELs, based on findings from literature on this topic, as well as indications from our qualitative case study work that it was not unheard of for current EL students, especially newcomer ELs, to not be enrolled in a science class, especially if other course requirements were more pressing (English language arts, English language development, math), or if they had already earned the minimum science course credits required for high school graduation.

Performance

Performance measures were assessed based on the one highest track science class in which the student was enrolled during a given year.

Success was defined as earning credit in one's highest track science class. According to district policy, credit was earned by passing a class with a mark of "D" or above.

Excellence was defined as earning an "A" or "B" mark in one's highest track science class.

Total Core Science Credits Earned is a continuous variable representing the total credits a student earned in core science classes by the end of high school. This variable was a proxy over time to assess how well positioned a student was to meet the science CADRs milestone by the end of high school. A class was categorized as a "core" science course if, by passing the class, students would earn credit for either Physical Science, Biology, Chemistry, Physics, or an "other rigorous science", which in this dataset referred to any AP and IB science courses, as well as "out-of-district" science honors courses. "On track" core science credit performance was defined as earning at least a total of: 1) One core science credit by the end of Grade 9 (or Grade 10), and 2) Two core science credits by the end of Grade 11 (or Grade 12).

Overall Research Approach and Guiding Hypotheses

I investigated whether EL reclassification before high school in one large Washington State school district was a direct and unique predictor of achievement of two important science course-taking milestones by the end of Grade 12: 1) Meeting the high school graduation requirements for science course-taking, 2) Meeting the college admission eligibility requirements for science course-taking (science CADRs), and 3) Enrolling in any college or university within one year of high school graduation. These three variables represent important, policy-relevant milestones in a student's preparation for and access to higher education, and the two course-taking variables serve as cumulative measures of individual students' exposure to differing levels of rigor across the science curriculum.

Before examining these milestones, thought, I searched for evidence of observable gaps between my study's student subgroups of interest, first in demographics and overall academic performance and experience, then in science course-taking access and performance. Using prior reclassification and course-taking studies as my guide, I expected to find relatively higher proportions of Reclassified ELs enrolled and earning credit for higher track science courses, as compared to their Never EL and Still EL peers. I also expected Never ELs to have higher rates of enrollment and performance than Still ELs.

I hypothesized that insight into the course-taking access and performance exhibited by the subgroups might help explain or illuminate the descriptive and multilevel model results focused on my outcomes of most interest—the two science course-taking milestones. In this way, the analyses conducted as part of my second research question could connect students' end-of-high-school science course-taking outcomes with the level levels of science course access and performance they experienced during the high school years.

In essence, I intended to test the hypothesis found in prior literature that, the sooner a student sheds the "EL" label, the better their long-term academic outcomes will be, on average. This assumption implies that EL status functions, in many cases, as a gatekeeper to opportunity to learn, specifically through the way the EL label may obstruct students' access to rigorous, higher level courses. By calculating and presenting aggregate rates of access to and performance in high school science for my three student subgroups of interest, I also inquired into systemic equity, at a district level, for students who ever received EL services. This perspective was inspired by Callahan and Shifrer's concept of course-taking as "evidence of program effectiveness and equity" (2016, p. 463).

CHAPTER 5

DESCRIPTIVE ANALYSIS RESULTS

This chapter presents the descriptive analysis results for my first and second research questions. By answering the two descriptive research questions, I intended to provide an overall portrait of each student subgroups' individual backgrounds and observed academic experiences and achievement, especially in terms of access to and success in different tracks of science course-taking. Such an examination serves to highlight inequities in students' academic experiences and contexts, some of which may be malleable to district- or school-level policy or practice reforms or initiatives. The goal of the first research question's detailed analysis was to explore variation across the subgroups, in large part to: 1) Establish if Reclassified ELs differed in fundamental ways from their Still EL peers, and 2) Identify variables that may be important to include as predictors or controls in the subsequent regression-based analyses (Chapter 6). The second research question offers a "deep dive" into the science course trajectories experienced by student subgroup across all four years of high school.

I relied primarily on the Stata (version 14.2) statistical software package, and at times, SPSS (version 19), to compute descriptive results. The sample included 2,477 students in the Class of 2016 cohort who met the two previously described criteria of: 1) having been enrolled in the district for each of the four high school years (2012-13, 2013-14, 2014-15, 2015-16), and 2) having attended one of the district's ten comprehensive high schools or the EL newcomer secondary school.

Research Question 1: Background Characteristics and Overall Academic Performance

My study's first research question was, "*How did the Reclassified EL, Never EL, and Still EL student subgroups compare to one another across observed individual background characteristics and academic experiences and achievement?* To answer this question, I examined, compared, and described the subgroups' demographics, rates of participation in and exposure to EL services and other programs, and a number of academic performance measures, including achievement of my study's three milestones of interest, which are estimated via regression-based, multilevel models in Chapter 6.

Demographics

Table 3 summarizes descriptive statistics for five student-level demographic variables: gender, first generation status (defined as being born outside the U.S.), language minority status, primary language or language family, and race or ethnicity. Because of the school district legal counsel's interpretation of appropriate use of individual students' Free or Reduced-Price (FRP) Meal status, this student-level variable was not able to be included in the dataset. However, the aggregate, school-level FRP measure was publicly available, and, although not included in the final models presented in Chapter 6, it was explored during preliminary modeling.

Table 3. *Demographics of Full Sample and Three Student Subgroups*

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Female	1191	48%	920	49%	168	46%	103	45%
Born Abroad	364	15%	49	3%	154	43%	161	71%
Language Minority	657	27%	82	4%	359	99%	216	95%
Primary Language/Language Family								
English	1824	74%	1810	96%	3	1%	11	5%
Spanish	143	6%	21	1%	74	20%	48	21%
East African	142	6%	18	1%	67	19%	57	25%
Other	136	5%	25	1%	72	20%	39	17%
Chinese	119	5%	6	0%	76	21%	37	16%
Vietnamese	113	5%	8	0%	70	19%	35	15%
Race								
Caucasian	1072	43%	1065	56%	5	1%	2	1%
Asian	561	23%	253	13%	205	57%	103	45%
Black	409	17%	277	15%	70	19%	62	27%
Hispanic	277	11%	152	8%	76	21%	49	22%
Other	158	6%	141	7%	6	2%	11	5%

Note. Due to rounding, percentages may not add up to 100%. East African language family includes Somali, Tigrinya, Amharic, and Oromo. Chinese language family includes Cantonese, Mandarin, and Toishanese. "Other" language family includes 42 languages. "Other" race includes American Indian, Pacific Islander, and Multiracial.

With no singular racial majority, the full sample ("All Students") tended to be U.S.-born (85%), speak English as their primary language (74%), and lean slightly male (52%). Of the approximately quarter of the sample who were a linguistic minority (27%), students were almost equally divided over the five primary languages or language families, with 6% speaking either Spanish or an East African language, and 5% speaking either Chinese, Vietnamese, or one of the 42 languages included in the "Other" category.

It is worth noting the heterogeneity within the overall sample's Black and Asian subgroups. Of all Black students, just over a third spoke an East African language (35%), and a quarter were born abroad (24%). A slightly larger proportion of Asian students were born abroad (30%), and this subgroup was the most linguistic diversity, with about 40% coming from English-speaking households, and almost equal proportions coming from Chinese (21%), Vietnamese (20%), or "Other" (19%) households. Hispanic students tended to be born in the

U.S. (71%) and were almost equally split between Spanish (51%) and English (48%). In regard to first generation status and linguistic diversity, the Caucasian and "Other" subgroups were relatively monolithic, with more than 95% speaking English as their primary language and more than 98% born in the U.S.

When examining the Never EL subgroup, which comprised 76% of the overall sample, there was, unsurprisingly, an almost complete dominance of English as the primary language (96%), with almost all Never ELs born in the U.S. (97%), and a majority identified as Caucasian (56%), followed by almost equal proportions of Black (15%) and Asian (13%).

Turning our attention to the Ever EL subgroup, which made up approximately a quarter of the overall sample (24%), we see that close to three of every five Ever ELs in the sample was a Reclassified EL (61%), with the remaining two of five classified as a Still EL (39%). On the whole, the Ever EL subgroup leaned even more male than the overall sample. One of the most striking differences within the Ever EL subgroup was found when examining first generation status: Less than a third of Still ELs were U.S.-born (29%), compared to just over half of Reclassified ELs (57%). In terms of the relationship between race or ethnicity and primary language in the Ever EL subsample, the most diversity was found within the Asian population. Asian Ever ELs were split almost evenly across Chinese (36%), Vietnamese (34%), and one of many "Other" language (30%). On the other hand, virtually all Black Ever ELs were speakers of an East African language (96%), while virtually all Hispanic Ever ELs (96%) were Spanish speakers.

Disaggregating the Ever EL subgroup by reclassification status made apparent differences in primary language. While Reclassified ELs were almost evenly split across the five primary languages or languages families (ranging from 19% speaking an East African language or Vietnamese to 21% speaking Chinese), almost half of the Still EL population spoke an East African language (25%) or Spanish (21%), followed by smaller proportions of speakers of "Other" languages (17%), Chinese speakers (16%), Vietnamese speakers (15%), and even English speakers (5%)[7]. The majority of Reclassified ELs were Asian (57%), followed by Hispanic (21%) and Black (19%). For Still ELs, there was no singular racial majority, with Asian students comprising just under half of this subsample (45%), followed by Black students (27%) and Hispanic students (22%).

Participation in EL Services and Other Programs

Next, I present descriptive results for several program participation variables, with a special focus on EL variables. Naturally, only Ever ELs (*N* = 589) are included in the analyses of EL variables, where I explored variation between the Reclassified EL and Still EL subgroups in terms of EL service experience and exposure.

First grade as EL. Table 4 examines the grade level when students in the sample were first classified, to the best of our knowledge, as "current ELs", which represents the year that students received EL services for the first time.[8] For the larger Ever EL subgroup, the median first grade as a "current EL" was kindergarten (2003). Reclassified ELs' median first grade as an

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[7] Unexpectedly, a handful of Ever ELs had English listed as their primary language (*N* = 14). Further investigation revealed that ten of the 14 students were American Indian, three were Multiracial, and one was Hispanic. Six of the ten American Indian students, two of the three Multiracial students, and the single Hispanic student were recorded as eligible for Title III, the federal program that, like Washington State's TBIP, supports, "the unique needs of eligible students, who come from linguistically and culturally diverse backgrounds" through the development of "language proficiency that enables meaningful access to grade level curricula and instruction" (OSPI, 2018). Official guidance from the Washington State Office of the Superintendent of Public Instruction (OSPI) states that Native American students whose primary language is English and who are deemed "academically at risk" can be tested using the state's English language proficiency exam, and if they score below "Proficient", they are eligible for Title III services (OSPI, 2017). In any case, each of these 14 English speakers were recorded in the district's dataset as having received EL services, and so, they were included in the Ever EL subgroup for the purposes of this study.

[8] For Ever EL students who transferred into SSD directly from another state, it is possible that these students may have been classified as an EL earlier than what is recorded in this study's dataset.

EL was one year earlier (suggesting that students' EL proficiency was tested as part of their enrollment in the district during the spring before kindergarten), while Still ELs' median first grade as an EL was much later—in Grade 6 (2009).

Table 4. *First Grade Classified as an English Learner*

	Ever ELs				
	Reclasified ELs			Still ELs	
	N = 362			*N* = 227	
	N	%		*N*	%
PreK or K (2001-03)	244	67%		51	22%
Grds 1 - 5 (2004-08)	102	28%		56	25%
Grd 6 (2009)	5	1%		16	7%
Grd 7 (2010)	9	2%		40	18%
Grd 8 (2011)	2	1%		19	8%
Grd 9 (2012)	0	0%		45	20%

Note. Due to rounding, percentages may not add up to 100%.

Virtually all Reclassified ELs first received EL services during the pre-kindergarten, kindergarten, or elementary years (95%), compared to just under half of Still ELs (47%). This timing makes sense, given that being categorized as a "Reclassified EL" for the purposes of my dissertation meant a student had to exit EL services no later than the end of Grade 8, and, as data presented later in this section will show, Reclassified ELs experienced a median of four total years in EL services, compared to Still ELs' median of seven total years. Because Reclassified ELs tended to be first classified as ELs early in their K-12 academic careers, combined with the fact that they spent, on average, fewer total years in EL services, it is not surprising that students in this subgroup met the English proficiency level required for reclassification before high school. Conversely, it is also unsurprising that Still ELs, who not only entered the EL system later than their Reclassified EL peers, but who also received, on average, three more years of EL services, failed to meet the English proficiency level required for reclassification by the end of Grade 8.

Initial English language proficiency level. Next, I examine Ever ELs' initial levels of English proficiency, as measured by their placement exam. As seen in Table 5, there were relatively small differences between the Reclassified ELs and Still ELs in terms of their initial English proficiency levels, with most students scoring at the lowest level of English proficiency (Level 1: Beginning/Advanced Beginning). A slightly larger proportion of Reclassified ELs scored at the lowest level (69%), as compared to their Still EL peers (61%), but the proportions who scored at the Intermediate level or below were similar for both subgroups (85% of Reclassified ELs and 82% of Still ELs). Unexpectedly, there were three students in the Ever EL sample who scored at Level 4 (Transitional), which indicates these students were not in need of EL services and means they should not have been classified as English learners (Pearson, 2011). However, since district records indicated that these three students did, in fact, receive EL services, they are considered to be Ever ELs for my study purposes.

Table 5. *Initial English Proficiency Level*

	Ever ELs				
	Reclasified ELs			Still ELs	
	N = 362			*N* = 227	
	N	*%*		*N*	*%*
1 (Beginning/Advanced Beginning)	248	69%		139	61%
2 (Intermediate)	58	16%		47	21%
3 (Advanced)	52	14%		28	12%
4 (Transitional)	1	0%		2	1%
Missing	3	1%		11	5%

Note. Due to rounding, percentages may not add up to 100%.

Last grade as EL. Now that we know more about when Ever ELs began receiving EL services and their initial levels of English proficiency, we move on to identifying when students exited from, or reclassified out of, EL services. In order to reclassify and shed the "EL" label, a student must score at a "Transitional" level on their annual English language proficiency exam—a test which is required of all current EL students and which is typically administered near the end of each school year (Malagon, McCold, & Hernandez, 2011). Once a student reached the required level, he or she would be considered a “Reclassified EL” as of the start of the following school year.

Table 6 examines the last grade students were classified as “current ELs”, which represents the last grade when students received EL services. Close to three quarters of Reclassified ELs exited EL services by the end of elementary school (71%), with just over quarter of the group exiting during the middle grades (28%). On the other hand, as we would expect based on the way in which the category was defined, no Still ELs exited EL services before high school. About a third of Still ELs reached the English proficiency level required to exit EL services by the beginning of their Grade 12 year (32%). Half of Still ELs exited EL services at the end of Grade 12 (N = 114), and exiting at the end of this grade level was achieved either by successfully meeting the required level on the annual English language proficiency exam, or as a result of graduating from high school and exiting the K-12 system, or a combination of these two factors. There were 40 Still EL students (18%) who did not exit EL services by the end of Grade 12 (2015-16). Of these 40 Still ELs, 43% did eventually graduate from high school, but did so after 2015-16. On the other hand, 58% of these 40 Still ELs did not successfully graduate from high school.

Table 6. *Last Grade Classified as an English Learner*					
	Ever ELs				
	Reclasified ELs			Still ELs	
	N = 362			*N* = 227	
	N	%		*N*	%
PreK or K (2002-03)	4	1%		0	0%
Grds 1 - 5 (2004-08)	257	71%		0	0%
Grd 6 (2009)	40	11%		0	0%
Grd 7 (2010)	42	12%		0	0%
Grd 8 (2011)	19	5%		0	0%
Grd 9 (2012)	0	0%		20	9%
Grd 10 (2013)	0	0%		21	9%
Grd 11 (2014)	0	0%		32	14%
Grd 12 (2015)	0	0%		114	50%
Did Not Exit By End of Grd 12	0	0%		40	18%

Note. Due to rounding, percentages may not add up to 100%.

Total Years as EL and "High Need ELs". After identifying the first and last grades that Ever ELs received EL services, I calculated two measures of exposure to EL services: 1) students' total years as an EL, according to the full set of records available in our dataset, which concluded with the 2017-18 school year, 2) students' total years as an EL as of the beginning of Grade 9. The first measure provides a comprehensive snapshot of Ever ELs' total amount of exposure to EL services, and the related "EL" label, across their entire K-12 experience. Of more interest, perhaps, is the second measure, which is intended to serve as a proxy for "long-term EL" (LTEL) status, and also informs my estimate of who may have been a newcomer EL at the start of high school. In essence, this measure of students' total years as an EL as of the beginning of Grade 9 helped me confirm if, as I suspected based on prior literature, my sample's Still EL subgroup was comprised of a high percentage of "high need ELs". As described in Chapter 4, I operationalized this "high need ELs" concept by examining the proportions of Still ELs who entered Grade 9 either "long-term ELs" (LTELs) or "newcomer ELs".

Table 7 presents the results of the first measure of exposure to EL services: Total number of years classified as ELs, up to and beyond students' expected Grade 12 year (2015-16). In essence, this table captures not only the total amount of time students in the district spent in EL programming, but it also represents the total number of years for which the district and its schools were legally responsible for actively developing and monitoring Ever ELs' English development, and ensuring that they could "participate meaningfully and equally in educational programs" (p. 1, 2015, U.S. Department of Justice & U.S. Department of Education, 2015). On the whole, the Ever EL subgroup had a median of five total EL years (*N* = 589), compared to Reclassified ELs' median four total EL years (*N* = 362), and Still ELs' median seven total EL years (*N* = 227).

Table 7. *Total Years as an English Learner*

	Ever ELs				
	Reclasified ELs			Still ELs	
	N = 362			*N* = 227	
	N	%		*N*	%
1 - 5 years	273	75%		74	33%
6 - 9 years	81	22%		80	35%
10+ years	8	2%		73	32%

Note. Due to rounding, percentages may not add up to 100%.

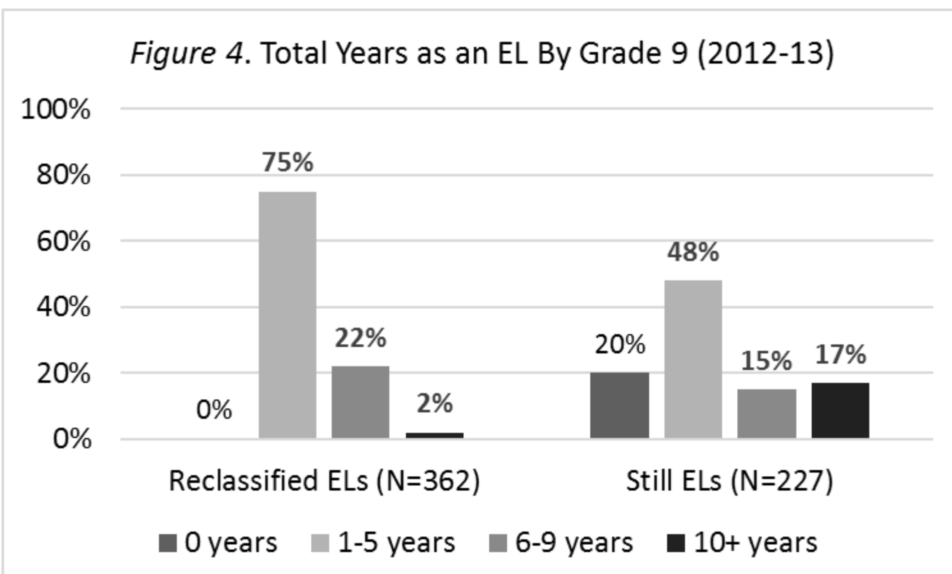
As we can see, the majority of Reclassified ELs experienced a total of one to five years as an EL (75%), followed by under a quarter with six or more years as an EL (24%). On the other hand, Still ELs were evenly distributed across the three ranges, with a third experiencing one to five years as an EL (33%), slightly more than a third with six to nine years as an EL (35%), and almost a third with ten or more years as an EL (32%).

Next, I explored the second measure of exposure to EL services: students' total years as an EL as of the beginning of Grade 9. These results are presented in Table 8 and Figure 4. As we would expect, there is no difference between Tables 7 and 8 for the Reclassified EL subgroup, since by definition, students in this category would not have gained additional EL years after Grade 8. However, new insight into the Still EL subgroup emerges, as see that 20% of students in this subgroup entered Grade 9 with zero recorded total EL years, almost half entered Grade 9 with between one and five total EL years (48%), and almost a third entered Grade 9 already as LTELs—with six or more total EL years (32%).

Table 8. *Total Years as an English Learner by Grade 9 (2012-13)*

	Ever ELs				
	Reclasified ELs			Still ELs	
	N = 362			*N* = 227	
	N	*%*		*N*	*%*
0 years	0	0%		45	20%
1 - 5 years	273	75%		109	48%
6 - 9 years	81	22%		34	15%
10+ years	8	2%		39	17%

Note. Due to rounding, percentages may not add up to 100%.



Were the 20% of Still ELs who entered Grade 9 with zero recorded total EL years (*N* = 45) newcomer ELs as of the beginning of Grade 9? As we might expect, virtually all of these students were newly enrolled in the district as of Grade 9 (N = 45), with no enrollment records during the prior three school years (2009-10 through 2011-12).

According to the “BOCeligible” variable (described in Chapter 4), the Class of 2016 cohort had no newcomer EL students during Grade 9 (2012-13). However, our project’s case study work and knowledge of the district, along with the complexity of how this flag is calculated, suggested this could be a data error. For example, eight students in the dataset were listed as being enrolled at the district’s newcomer EL secondary school for all four years of high school—which strongly suggests that at least these eight students entered Grade 9 as newcomer ELs.

Therefore, to more accurately assess newcomer ELs’ presence in the Still EL subgroup, I calculated that 71% of these 45 students (N = 32) met two of the three newcomer EL criteria (was born abroad and scored at the “Beginning” or “Advanced Beginning” levels on the Washington State EL proficiency placement exam). However, as our dataset did not include information on how long students had been in the U.S. (the third criterion), I cannot know how many of these 32 students were, in fact, newcomer ELs. The fact that three were no prior EL records for these students could be a result of them moving to Washington from another state or directly from another country.

Our case study work revealed that one of the district high schools had two Grade 9 newcomer ELs during the 2018-19 school year. If we assume that each of the ten comprehensive high schools had the same number of Grade 9 newcomer ELs, and we add an estimated eight students from the district’s newcomer EL secondary school, this would result in approximately 28 Grade 9 newcomer ELs districtwide in any given year. This suggests that Grade 9 newcomer ELs comprised a relatively small proportion, perhaps 10%, of all Still ELs.

To summarize these analyses on the proportion of “high need ELs” in the Still EL subgroup: It appears that about a third of the Still EL subgroup was already a LTEL as of Grade 9 (32%), while around 10% of the Still EL subgroup was a likely newcomer EL as of Grade 9. This means that a little under half (~40%) of the Still EL subgroup, at least as of Grade 9, was comprised of “high need ELs”.

Academically Gifted and Special Education. Turning away from EL variables, Table 9 explores the Class of 2016’s participation in two programs: 1) Academically gifted (referred to in SSD as “highly capable”), and 2) Special education. Of note, when compared to the full sample (All Students) and Never ELs, lower proportions of Reclassified ELs were identified for both programs (2% as academically gifted and 6% as special education), while not a single Still EL was identified as academically gifted, just over a quarter were categorized as in need of special education services (26%). When considering the EL status of all who were identified as academically gifted (*N* = 145), 94% were Never ELs (*N* = 137), 6% were Reclassified ELs (*N* = 8), and 0% were Still ELs (*N* = 0). In practice, participation in these two programs tended to be mutually exclusive, with only six of the 145 academically gifted students also identified as in need of special education services.

Table 9. *Participation in Academically Gifted Program or Special Education Services*

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		*N* = 1888		*N* = 362		*N* = 227	
	N	%	*N*	%	*N*	%	*N*	%
Academically Gifted	145	6%	137	7%	8	2%	0	0%
Special Education	347	14%	266	14%	23	6%	58	26%

Academic Performance

In this section, I present descriptive results of academic performance during high school, reviewing cumulative grade point averages (GPAs) at the end of Grade 9 and Grade 12, enrolling in or earning credit for a handful of noteworthy science and math courses, and successfully graduating from high school. I conclude the section with descriptive results for the three key, binary student-level outcomes that will be modeled in a subsequent section using hierarchical linear modeling (HLM): 1) Meeting (or failing to meet) the CADRs in science course-taking, 2) Meeting (or failing to meet) the high school graduation requirements in science course-taking, and 3) Enrolling in any post-secondary institution within one year of high school graduation. To provide further insight into the third outcome, I also offer qualitative information about the type of post-secondary institution in which students in the sample first enrolled. The purpose of presenting these measures is to compare overall high school academic achievement across my study's three primary student subgroups of interest: Reclassified ELs, Still ELs, and Never ELs.

Grade Point Average (GPA). Tables 10 and 11 show the cumulative, end-of-year Grade 9 and Grade 12 GPAs of the full sample, Never ELs, Reclassified ELs, and Still ELs. Almost three quarters of all Never ELs ended Grade 9 with an "A" or "B" average (74%), only slightly higher than 71% of Reclassified ELs, but noticeably higher than the 60% of Still ELs. However, three years later, we see that Reclassified ELs were more similar to their Still EL peers in terms of the proportion ending Grade 12 with an "A" or "B" average (60% and 59%, respectively), compared to their Never EL peers (72%). Between the end of Grade 9 and the end of Grade 12, the proportion of Never ELs with an "A" or "B" average remained fairly consistent (from 74% in Grade 9 to 72% in Grade 12), as did the proportion of Still ELs (from 60% to 59%), but the proportion of Reclassified ELs with top grades dropped nine percentage points (from 71% to 60%).

Table 10 . Grade 9 Cumulative Grade Point Average (GPA)								
	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
"A" (4.00 - 3.70)	735	30%	606	32%	90	25%	39	17%
"B" (3.69 - 2.70)	1051	42%	788	42%	165	46%	98	43%
"C" (2.69 - 1.70)	626	25%	448	24%	96	27%	82	36%
"D" (1.69 - 1.00)	53	2%	38	2%	9	2%	6	3%
Missing	12	0%	8	0%	2	1%	2	1%
Note. Due to rounding, percentages may not add up to 100%.								

Table 11 . Grade 12 Cumulative Grade Point Average (GPA)								
	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
"A" (4.00 - 3.70)	541	22%	466	25%	47	13%	28	12%
"B" (3.69 - 2.70)	1165	47%	888	47%	170	47%	107	47%
"C" (2.69 - 1.70)	617	25%	429	23%	117	32%	71	31%
"D" (1.69 - 1.00)	73	3%	48	3%	15	4%	10	4%
Missing	81	3%	57	3%	13	4%	11	5%
Note. Due to rounding, percentages may not add up to 100%.								

Noteworthy science and math courses. Broken out by student subgroup, I next consider who enrolled in or earned credit for a number of noteworthy science and math courses, including honors courses, Advanced Placement (AP) or International Baccalaureate courses, and Chemistry. I highlight Chemistry, in particular, because of the empirical relationship in my dataset between this course and meeting the science CADRs. I found that regardless of subgroup, over 99% of students who successfully passed Chemistry by the end of high school also met the science CADRs, suggesting a potential role for this specific course in policy discussions about college preparatory science course-taking patterns. In addition, knowing the important role that math achievement and prerequisites can play in shaping access to science courses, I also examine enrollment rates in advanced math classes during Grade 9, defined by district norms as any class at the level of Geometry or above (e.g., Algebra II, Precalculus, etc.).

Table 12 . Noteworthy Science and Math Courses

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Honors Science Course (*enrolled*)	753	30%	630	33%	96	27%	27	12%
AP or IB Science Course (*enrolled*)	678	27%	507	27%	132	36%	39	17%
Chemistry (*passed*)	1465	59%	1152	61%	219	61%	94	41%
Grade 9 Advanced Math Class (*enrolled*)	1226	49%	1045	55%	154	43%	27	12%

Table 12 presents the numbers and proportions by subgroup for four variables: 1) If the student ever enrolled in at least one high school honors science course, 2) If the student ever enrolled in at least one high school AP or IB science course, 3) If the student successfully passed Chemistry, by earning a “D” or above, by the end of high school (by 2015-16), and 4) If the student was enrolled in an advanced math class during Grade 9. As we might expect, a slightly higher proportion of the full sample (All Students) enrolled in a high school honors science course (30%), as compared to an AP or IB science course (27%). However, we see the opposite pattern within the Ever EL subgroup, with higher proportions of students having enrolled in an AP or IB science course (36% for Reclassified ELs and 17% for Still ELs) than an honors science course (27% for Reclassified ELs and 12% for Still ELs). When it comes to Chemistry, around 60% of All Students, Never ELs, and Reclassified ELs passed this course by the end of high school, compared to only 41% of Still ELs. Just over half of Never ELs had the opportunity to be enrolled in an advanced math class during Grade 9 (55%), as compared to 43% of Reclassified ELs, and only 12% of Still ELs.

High school graduation. What proportion of students in this sample successfully graduated from high school? Before answering this question, it is important to keep in mind the criteria used to construct my study's sample and how this likely upwardly biases the rates presented below. Because my course-taking outcomes of interest can only appropriately be assessed by looking at the entirety of a student's high school records, those individuals who remain in the Class of 2016 cohort are, by definition, less transient than those who lacked records for all four years of high school. They are also, of course, the students who failed to drop out before reaching the 2015-16 school year. As Table 13 indicates, the overall graduation rates of the full sample (All Students), Never ELs, and Reclassified ELs were very similar (86%, 88%, and 86%, respectively). In contrast, the Still EL subgroup exhibited an overall graduation rate of 71%, which was approximately 15 points lower than that of the full sample. To reiterate, this means that approximately three out of every ten Still ELs in the district did not graduate from high school, even in this sample of students who were continuously enrolled in the district for all four years of high school.

Table 13 . High School Graduation Rates

	All Students		Never ELs		Ever ELs: Reclasified ELs		Ever ELs: Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Graduated High School	2129	86%	1656	88%	312	86%	161	71%
Did Not Graduate High School	348	14%	232	12%	50	14%	66	29%

Note. Due to rounding, percentages may not add up to 100%.

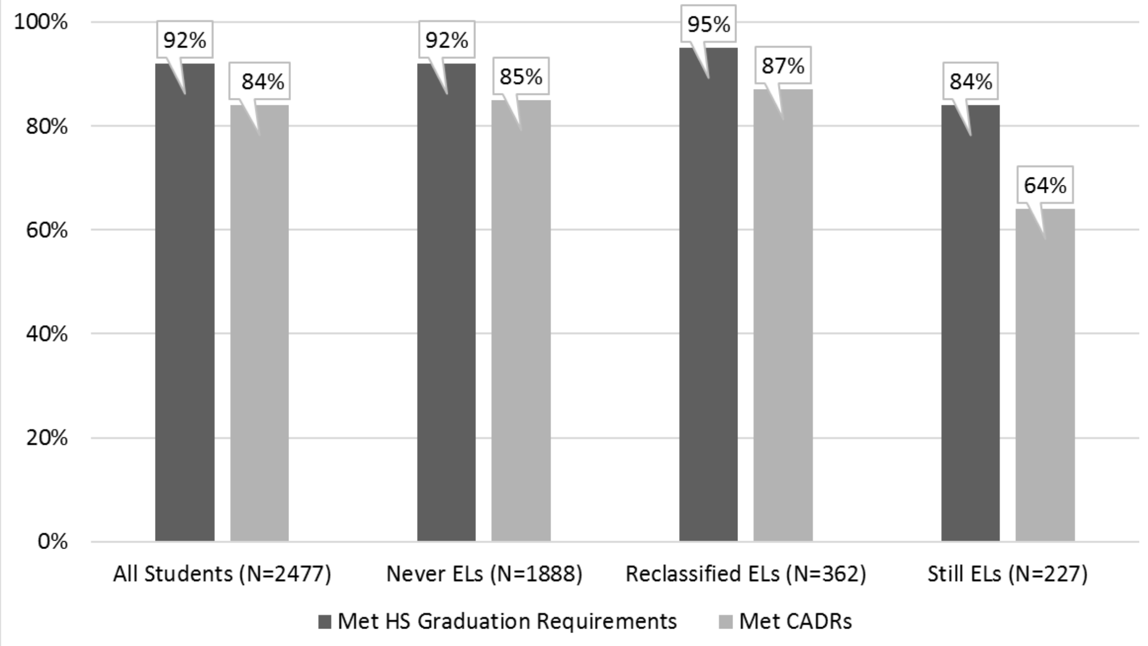
Three milestones of interest. I now present the observed rates of achievement of my study's three key milestones, which will be estimated with controls via regression models at the end of this chapter. I begin first with an examination of the two science course-taking milestones, followed by an analysis of the post-secondary enrollment milestone, including data on the numbers and proportions of students who enrolled in a post-secondary institution within one year of high school graduation, as well as the type of institutions where they first enrolled.

Table 14 . Met Science Course-Taking Milestones by the End of High School

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Met High School Graduation Requirements	2279	92%	1746	92%	343	95%	190	84%
Met CADRs	2072	84%	1611	85%	316	87%	145	64%

Science course-taking milestones. Table 14 provides the observed numbers and rates of achievement by student subgroup of the two science course-taking milestones: 1) Meeting the high school graduation requirements in science course-taking and, 2) Meeting the College Admission Distribution Requirements (CADRs) in science course-taking. Based on prior research and knowledge of what it means to meet these course-taking milestones, I expected to find the two general relationships demonstrated in Figure 5: 1) Within each subgroup, a higher proportion of students met the high school requirements than met the slightly more rigorous college admission requirements, and 2) Across the subgroups, Reclassified ELs outperformed both their Never EL and Still EL peers, and their achievement levels were more similar to Never ELs than Still ELs. When comparing the within subgroup difference between those meeting the high school versus college admission requirements, Still ELs exhibited a gap of 20 percentage points—a difference two and a half times larger than that of the Never EL (gap of seven percentage points) and Reclassified EL subgroups (gap of eight percentage points).

Figure 5. Met Science Course-Taking Milestones by the End of High School



To summarize, while the Reclassified EL and Never EL subgroups exhibited similar levels of achievement on these two course-taking milestones, the Still EL subgroup not only lagged furthest behind on both measures, but also experienced the largest gap between the proportion of students achieving both milestones. The proportion of Still ELs who met the less rigorous high school requirements (84%) was approximately the same as the proportion of Never ELs who met the more rigorous college admission requirements (85%), suggesting that expectations of currently-served EL students may have been meaningfully lower than expectations of those who have never experienced EL services or the EL label.

In contrast, the percentage of each student subgroup who failed to meet these two science course-taking milestones by the end of high school is presented in Table 15. As can be surmised from the description above, across the board, a higher proportion of students failed to meet the science course-taking requirements for college admission eligibility, although there was considerable variation across the subgroups (from 13% of Reclassified ELs to 36% of Still ELs).

Still, between 8-16% of students failed to meet the less rigorous science course-taking requirements for high school graduation. While these numbers can be easily calculated from Table 14, a critical quantitative inquiry approach reminds us of the importance of explicitly highlighting these less desirable outcomes, especially for the more than three of every ten Still ELs (36%) who attended all four years of high school in the district, successfully made it to Grade 12, but who were nonetheless ineligible, at least in terms of science course-taking requirements, to even apply for admission to any of the state's four-year public colleges or universities.

Table 15 . Did Not Meet Science Course-Taking Milestones by the End of High School

	All Students		Never ELs		Ever ELs: Reclasified ELs		Ever ELs: Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Did Not Meet High School Graduation Requirements	198	8%	142	8%	19	5%	37	16%
Did Not Meet CADRs	405	16%	277	15%	46	13%	82	36%

Further investigation into science course enrollment records of the 82 Still EL students who did not meet the science CADRs revealed high levels of exclusion tracking in Grade 9 (when 33% were not enrolled in any science course), Grade 11 (when 36% were not enrolled in any science course), and Grade 12 (when 65% were not enrolled in any science course). In comparison, the rates of exclusionary tracking of Still ELs who met the science CADRs was much lower: Grade 9 (18%), Grade 11 (8%), and Grade 12 (32%).

I also briefly explored whether Still ELs' LTEL status as of Grade 9 happened to reveal greater observed disparities in course-taking milestone achievement than Still EL status alone. In other words, I wanted to test the "high need EL" concept by identifying whether Still ELs who were also LTELs performed at a lower level on science course milestone achievement than their Still EL non-LTEL peers. The data revealed this to be the case for the college admission eligibility milestone, with almost half of Still EL LTELs failing to meet the science CADRs

(48%), compared to 36% of the overall Still EL subgroup. However, there was very little difference between the rates of Still EL LTELs who failed to meet the science course-taking requirements for high school graduation (18%), compared to the overall Still EL subgroup (16%).

College enrollment. Finally, I consider enrollment in any post-secondary institution within one year of high school graduation, according to National Student Clearinghouse (NSC) data. As seen in Table 16, of the students who successfully graduated from high school, 71% of the full sample (*N* = 1,572) enrolled in a post-secondary institution within one year of high school graduation. Never ELs (73%) and Reclassified ELs (71%) were within two percentage points of the full sample's rate of enrollment, compared to only 58% of Still ELs. It is worth noting, however, that between 3-10% of each subgroup was apparently unable to be tracked by the NSC.

Table 16 . High School Graduates' Rates of College Enrollment Within One Year of Graduation

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N = 2203		N = 1701		N = 323		N = 179	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Enrolled	1572	71%	1240	73%	229	71%	103	58%
Not Enrolled	553	25%	413	24%	82	25%	58	32%
No Data	78	4%	48	3%	12	4%	18	10%

As with the course-taking milestones, I also briefly explored whether Still ELs' LTEL status as of Grade 9 happened to reveal greater observed disparities in college enrollment than Still EL status alone. Interestingly, a slightly higher proportion of Still EL LTELs enrolled in college within one year of high school graduation (62% or *N* = 38), as compared to the overall Still EL subgroup (58%).

Thanks to the district's contract with the NSC, our project also had access to the names of the institutions in which students first enrolled. Using my own knowledge and colleges' websites, as needed, I qualitatively coded institutions into several categories, including public, private, in-state (Washington), out-of-state (any state other than Washington), traditionally four-year institutions, and traditionally two-year institutions. Table 17 shows that the majority of students attended an in-state, public institution, regardless of subgroup. Ever ELs, in particular, were overwhelmingly located in the state's system of public higher education (95% of Reclassified ELs and 94% of Still ELs, as compared to 62% of Never ELs). Of these students who enrolled in public colleges and universities in Washington, a higher proportion of Reclassified ELs and Never ELs attended four-year institutions (54% and 38%, respectively), than two-year institutions (41% and 24%, respectively). On the other hand, Still ELs exhibited the opposite relationship, with 61% first enrolled in two-year colleges, and 33% first enrolled in four-year colleges and universities. Less than 5% of Ever ELs enrolled in private colleges or universities, compared to just over a quarter of Never ELs (26%).

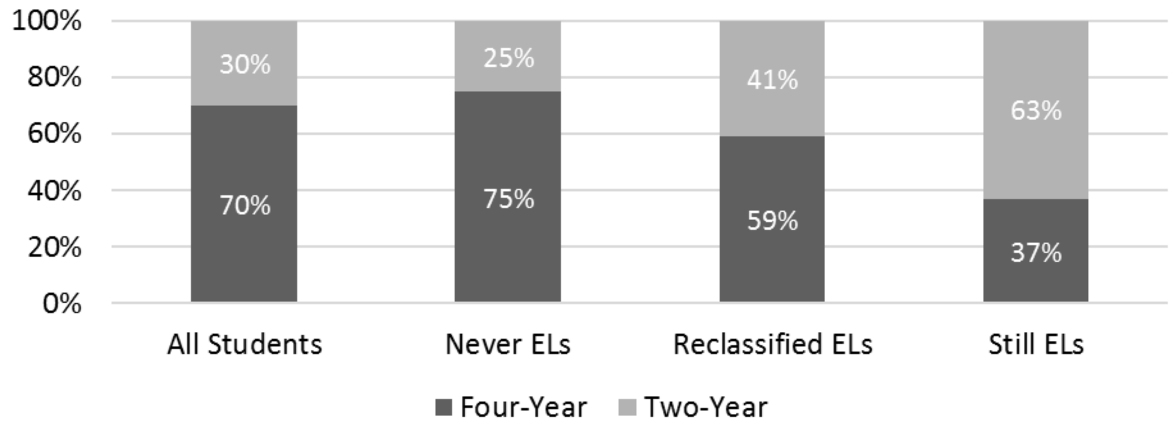
Table 17 . Type of First College or University

	All Students			Never ELs			Ever ELs				
							Reclasified ELs			Still ELs	
	N = 1572			N = 1240			N = 229			N = 103	
	N	*%*		*N*	*%*		*N*	*%*		*N*	*%*
In-State Public (4 year)	624	40%		467	38%		123	54%		34	33%
In-State Public (2 year)	452	29%		295	24%		94	41%		63	61%
Out-of-State Public (4 year & 2 year)	166	11%		159	13%		3	1%		4	4%
Private (4 year)	330	21%		319	26%		9	4%		2	2%

Note. Due to rounding, percentages may not add up to 100%.

Figure 6 offers another perspective, focusing on enrollment in four-year versus two-year institutions, regardless of in-state or out-of-state status. As we can see, the proportion of Still ELs enrolled in a two-year institution was two and a half times greater than the proportion of Never ELs (63% versus 25%) enrolled in two-year colleges, with the proportion of Reclassified ELs falling about halfway between these two subgroups (41%). Conversely, only about half the proportion of Still ELs first enrolled in four-year institutions (37%), compared to their Never EL peers (75%). Again, Reclassified ELs fell about halfway between these two subgroups, with 59% of students in this subgroup first enrolling in a four-year institution.

Figure 6. Four-Year and Two-Year Post-Secondary Institution Enrollment Rates



Research Question 2: Science Course-Taking

Table 18 offers an example of three science course tracks over time: A Typical track, an Advanced track, and an "Other" track. However, in practice, it was more likely that students changed tracks from one year to the next, rather than remaining in a single track over the course of all four years of high school. For example, it was not uncommon to see students enrolled in Physical Science in Grade 9 (Typical track), Biology in Grade 10 (Typical track), an elective science of some kind in Grade 11 (Other track), and no science class in Grade 12 (exclusionary tracking). In any case, the Typical track listed below—Physical Science in Grade 9, Biology in Grade 10, Chemistry in Grade 11, and Physics in Grade 12—was, in effect, the yardstick by which I evaluated the sample's science course-taking.

Table 18. *Example of Science Course Tracks*

	Grade 9 (2012-13)	**Grade 10 (2013-14)**	**Grade 11 (2014-15)**	**Grade 12 (2015-16)**
Typical	Physical Science	Biology	Chemistry	Physics
Advanced	Biology	Chemistry	Physics	AP Environmental Science
Other	Oceanography	Physical Science	Biology	Marine Science

There are certainly limitations to this decision, a primary concern being that a student could have followed a relatively rigorous overall science course-taking trajectory, such as no science in Grade 9, Physical Science in Grade 10, Biology in Grade 11, and Chemistry in Grade 12, yet be labeled in each grade as "other" (and not "typical" or "advanced"). However, as stated above, my choice to classify course-taking in this way was guided by my interest in assessing student progress through the full, four course sequence of the most rigorous core science curriculum (Physical Science, Biology, Chemistry, Physics).

Given that the vast majority of courses in the district were year-long classes, the fact that there were only four years of high school, and the empirical evidence in the dataset that each of these four courses was the most frequently taken during its respective grade level (e.g., Physical Science in Grade 9), it made sense to categorize the data based on these expectations. To counter concerns that this yardstick of measuring science course-taking may have been overly demanding or too narrow in scope, I also conducted assessments of course-taking rigor based on other metrics, like performance in the courses taken, total credits earned in core science courses, and of course, descriptive and inferential analyses of my study's two course-taking milestones (meeting science course-taking requirements for high school graduation and for college admission eligibility).

Access

To begin, I examine the Class of 2016's access to rigorous, college preparatory science curriculum by calculating the proportions of students in each subgroup in each grade who were enrolled in one of the three mutually exclusive course tracks: Typical or Advanced, Other, Not Enrolled in a Science Class. By definition, the majority of the sample followed the "typical" course track, except during Grade 12, when the largest single proportion of students enrolled in an "other" science class (a category that combines all science courses other than Physics).

Table 19 presents this grade-by-grade snapshot of science course enrollment as based on the highest track science class attempted by a student during that school year. One of the most noticeable overall patterns is the drastic drop in enrollment in a Typical or Advanced science course between Grade 10 and Grade 11. This drop is evident across all three student subgroups, with the proportion of Never ELs and Reclassified ELs dropping 32 percentage points, and Still ELs dropping 26 percentage points. This finding is, perhaps, less surprising once we remember that students in the district were typically only required to earn two years of science credits to graduate from high school.

Table 19 . Highest Track Science Course Enrollment by Grade

	All Students		Never ELs		Ever ELs			
					Reclasified		Still ELs	
	N = 2477		N = 1888		N = 362		N = 227	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Grade 9 (2012-13)								
Typical or Advanced	2116	85%	1624	86%	340	94%	152	67%
Other	141	6%	113	6%	6	2%	22	10%
Not Enrolled in a Science	220	9%	151	8%	16	4%	53	23%
Grade 10 (2013-14)								
Typical or Advanced	2208	89%	1701	90%	351	97%	156	69%
Other	142	6%	81	4%	5	1%	56	25%
Not Enrolled in a Science	127	5%	106	6%	6	2%	15	7%
Grade 11 (2014-15)								
Typical or Advanced	1417	57%	1086	58%	234	65%	97	43%
Other	705	28%	532	28%	83	23%	90	40%
Not Enrolled in a Science	355	14%	270	14%	45	12%	40	18%
Grade 12 (2015-16)								
Typical	632	26%	530	28%	77	21%	25	11%
Other	1082	44%	805	43%	175	48%	102	45%
Not Enrolled in a Science	763	31%	553	29%	110	30%	100	44%

Note. Due to rounding, percentages may not add up to 100%.
Following my coding scheme, there was no Grade 12 "Advanced" track.

A less obvious overall pattern is the slight uptick in the proportion of students enrolled in a Grade 10 Typical or Advanced science courses, as compared to Grade 9 enrollment. This rise in enrollment rates makes sense, given that Biology, the "typical" Grade 10 science course, was the only high school science standardized test required of students. The increase may suggest that schools paid attention to enrolling students in this course during this grade as a result of the course's accompanying standardized test.

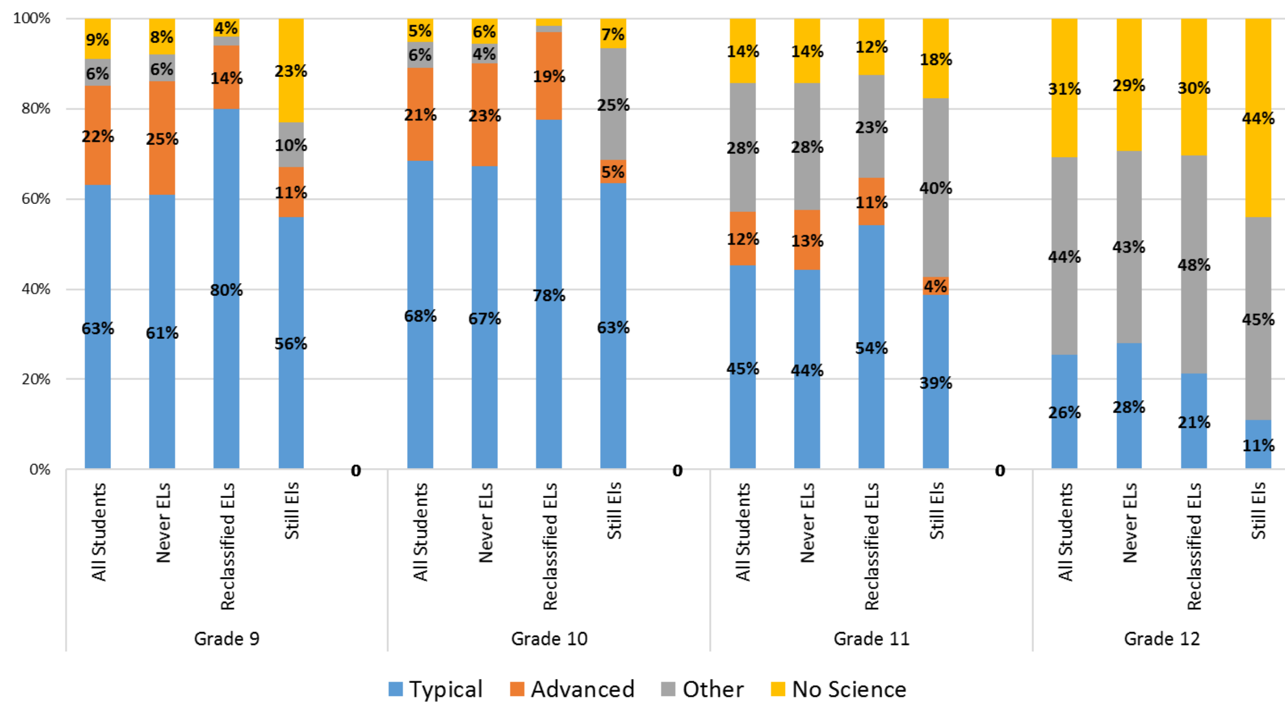
Comparing across the three subgroups of interest, we see that a relatively higher proportion of Reclassified ELs than Never ELs or Still ELs enrolled in the combined science course category "Typical or Advanced" in Grades 9, 10, and 11. In fact, the differences between the Reclassified EL subgroup and the Never EL subgroup remained constant across the first three years of high school, with the Reclassified group outperforming the Never EL group by between seven to eight percentage points. Likewise, the difference between the Reclassified ELs and the Still ELs also remained fairly constant, with the Reclassified group outperforming the Still EL group across by between 27 and 27 percentage points during Grades 9, 10, and 11.

When we focus specifically on access to advanced science courses, however, we see that Reclassified ELs' course-taking lagged behind that of their Never EL peers. However, Still ELs remained far behind both their Reclassified EL and Never EL peers in access to advanced science courses. For example, in Grade 9, 14% of Reclassified ELs were enrolled in an advanced science course, compared to 25% of Never ELs and 11% of Still ELs. This pattern continued in Grade 10 and Grade 11, with between 13-23% of Never ELs enrolled in an advanced science course, compared to between 11-19% of Reclassified ELs and only 4-5% of Still ELs.

Figure 7 visually represents, in yellow, the magnitude of exclusionary tracking experienced by the Class of 2016 student subgroups. As mentioned in Chapter 4, I defined exclusionary tracking (Umansky, 2016) as the default "track" of students who were enrolled in a school, but were not enrolled in any science class—in essence, such students were excluded from accessing science content during that particular school year. Given that students only needed two years of science to graduate from high school, we might expect to see higher rates of exclusionary tracking during the later grades than the earlier grades. We see evidence in favor of the hypothesis that Ever EL students who failed to exit EL services before beginning high school experience the highest relative levels of exclusionary tracking. For example, in each grade, Still ELs have the highest relative rates of "No Science", as compared to their Reclassified EL and

Never EL peers (although Grade 10 differences are trivial). Most striking, in Grade 9, almost a quarter of Still ELs in the district were not enrolled in any science class (23%), compared to 8% of Never ELs and only 4% of Reclassified ELs. In Grade 12, 44% of Still ELs were not enrolled in any science course, followed by 30% of Reclassified ELs and 29% of Never ELs.

Figure 7. Highest Track Science Course Enrollment by Grade



Performance

Success. Next, I examine science course-taking performance by subgroup by looking at rates of success in the highest track science course in which a student enrolled during each grade. I operationalize "success" broadly, using earning credit as the benchmark of "success" in the course. According to district policy, a student earned credit for a course if they passed the class, which is determined by a grade of "D" or higher (Spruce School District, 2017). Therefore, students who earned at least a "D" or a "Pass" mark in their highest track science course were categorized as earning credit, while those who received a "F", a "No Progress" mark, or withdrew from the course were categorized as not earning credit. My objective for this analysis is simply to explore whether there are lower rates of success in science courses in particular grades or for any of the three student subgroups of interest. This analysis does not examine success rates in particular science courses, but rather, success rates are calculated based on whatever the highest track science course the student was enrolled in during that grade.

As seen in Table 20, the proportion of "All Students" (full sample) who earned credit in their highest track science class ranged from a high of 95% in Grade 9 to a low of 86% in Grade 11. Never ELs followed a similar pattern and range, with a high of 95% earning credit in Grade 9 to a low of 87% earning credit in Grade 11. Reclassified ELs, on the other hand, exhibited a larger range, with 94% of students earning credit in their Grade 9 science class, compared to 77% in their Grade 12 science class. Still ELs experienced a slower but still evident drop in the proportion of students earning science credit each year—from 91% in Grade 9 to 80% in Grade 12.

Table 20 . Rates of Success in Highest Track Science Course Enrolled

	All Students		Never ELs		Ever ELs			
					Reclasified ELs		Still ELs	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Grade 9 (2012-13)	N = 2257		N = 1737		N = 346		N = 174	
Earned Credit	2133	95%	1649	95%	325	94%	159	91%
Failed to Earn Credit	124	5%	88	5%	21	6%	15	9%
Grade 10 (2013-14)	N = 2350		N = 1782		N = 356		N = 212	
Earned Credit	2169	93%	1663	93%	322	90%	184	87%
Failed to Earn Credit	181	8%	119	7%	34	10%	28	13%
Grade 11 (2014-15)	N = 2122		N = 1618		N = 317		N = 187	
Earned Credit	1822	86%	1412	87%	250	79%	160	86%
Failed to Earn Credit	300	14%	206	13%	67	21%	27	14%
Grade 12 (2015-16)	N = 1714		N = 1335		N = 252		N = 127	
Earned Credit	1507	88%	1211	91%	194	77%	102	80%
Failed to Earn Credit	207	12%	124	9%	58	23%	25	20%

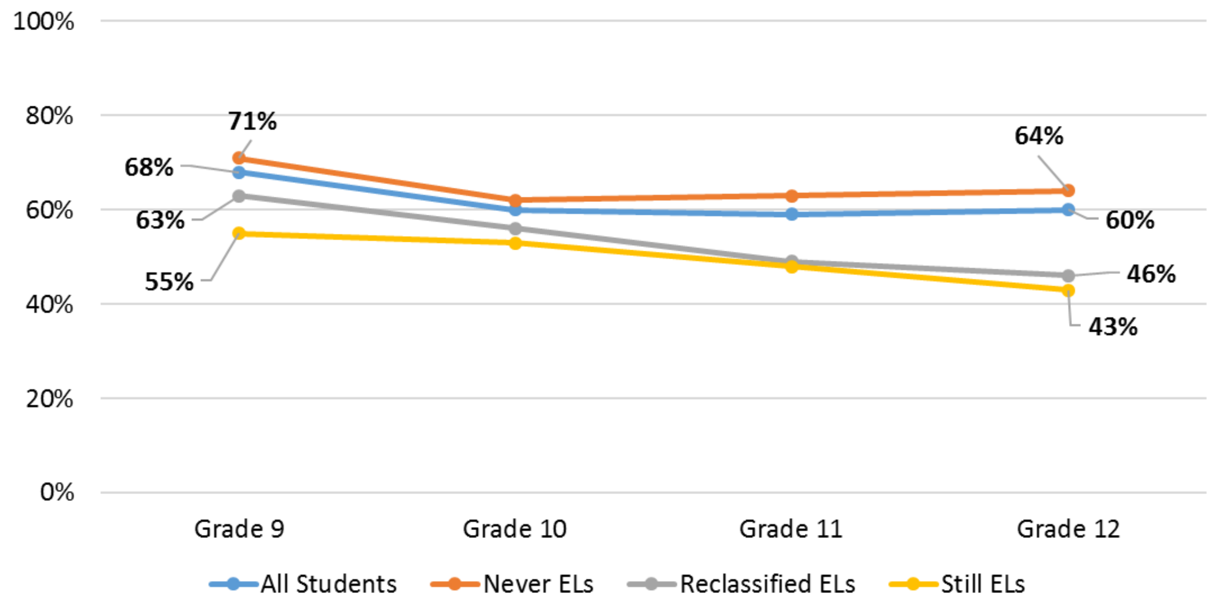
Note. Due to rounding, percentages may not add up to 100%.

While the majority of students earned credit for the highest track science class in which they were enrolled, regardless of grade or subgroups, drops in success rates appear in Grade 10 and Grade 11, in particular. Further analysis revealed relatively higher rates of struggle for the 45% of the Class of 2016 (N = 1,120) enrolled in Chemistry during Grade 11. For example, 18% of the overall sample enrolled in Chemistry in Grade 11 failed to pass it (N = 198), with even higher rates of failure among the Reclassified EL subgroup (24%). Comparing these results to Grade 10's most frequent science class, we see that only 9% of the overall sample enrolled in Biology in that grade failed to earn credit, with higher rates of failure among the Still EL subgroup (16%). Of those enrolled in a science class during Grade 12, 12% of the overall sample failed to earn credit, with higher rates of failure among Reclassified ELs (23%) and Still ELs (20%).

Excellence. I also examine students' science course performance beyond the relatively low bar of simply passing a class with a "D" or above. To do this, I calculate what proportion of the subgroups excelled in science courses, which I defined as earning a mark of "A" or "B". While recognizing the inherent subjectivity and variation in teachers' grading practices, it is probable that students who excelled in earlier science courses may have been more likely to enroll in subsequent science courses, and, just as importantly, that students who failed to excel in earlier science courses may have been less likely to enroll in subsequent, often unrequired, science courses. In this way, it is important to analyze not only whether a student passed a science course, but also, whether he or she was perceived, at least by the course instructor, as excelling in that course. I am especially interested in comparing the proportions of Reclassified EL and Still EL students who excelled with those of their Never EL peers.

As Figure 8 demonstrates, the proportion of students who excelled in science courses dropped from a high in Grade 9 to lower or stagnant levels in later grades. Of all students enrolled in a science class (blue line), 68% received an "A" or "B" in Grade 9, compared to 60% in Grade 12. Never ELs (orange line) were the highest performing, with 71% of students in this subgroup receiving an "A" or "B" in their Grade 9 science course, dropping to 64% in their Grade 12 science course. Never ELs' largest drop in rates of excellence occurred between Grade 9 and Grade 10, and then remained constant at around 63% from Grade 10 to Grade 12. On the other hand, 63% of Reclassified ELs exhibited excellent science course performance in Grade 9, compared to only 46% by Grade 12. Finally, just over half of Still ELs received an "A" or "B" in their Grade 9 science class (55%), with 43% receiving the same high grade in their Grade 12 science class.

Figure 8. Proportions of Students Who Excelled in Their Science Courses



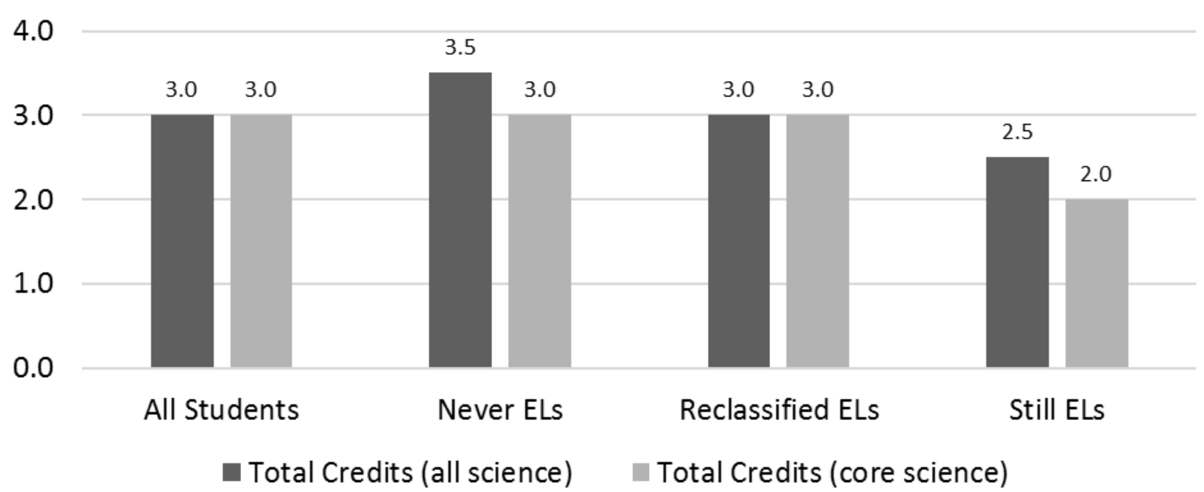
To summarize, smaller proportions of Reclassified ELs and Still ELs, as compared to their Never EL peers, begin their high school careers earning “As” and “Bs” in science, and this pattern remained constant through Grade 12. If we compare the two subgroups with the most disparate outcomes, we see a gap in Grade 9 rates of excellence in science courses between Never ELs and Still ELs of 16%. This gap shrunk to 9% in Grade 10, grew again to 15% in Grade 11, and expanded further to 21% in Grade 12. It is worth pointing out that the highest proportion of Still ELs achieving rates of excellence (55% in Grade 9), was still lower than the lowest proportion of Never ELs achieving rates of excellence (62% in Grade 10).

Total Core Science Credits. The final analysis conducted to answer my study’s second research question about the subgroups’ high school science course-taking trajectories centered on total core science credits earned. A class was categorized as a “core” science course if, by passing the class, students would earn credit for either Physical Science, Biology, Chemistry, Physics, or an “other rigorous science”, which in this dataset referred to any AP or IB science course, as well as any “out-of-district” science honors course. The purpose of this analysis is to provide a nuanced examination of performance in rigorous, college preparatory science courses across my study's student subgroups of interest. I do this by exploring both how many core science credits students earned by the end of high school and the timing of when these core credits were earned. By comparing the median total of all science credits earned (which includes non-core and elective science courses, in addition to core science courses) to the median total of core science credits earned (Physical Science, Biology, Chemistry, Physics, and "other rigorous science" courses), we can better understand whether students did indeed earn science credits, but not in the "core science curriculum". For instance, it's possible that Reclassified EL or Still EL students were accessing and succeeding in science courses, but, we might wonder whether these were the courses perceived, especially by colleges and universities, to be the most rigorous available.

Students in this cohort and district typically took Physical Science before Biology, which was taken before either Chemistry, Physics, or another science subject. For students earning at least two but less than three core science credits, then, we can assume their first core credit was likely Physical Science, followed by Biology as their second core credit. Therefore, it's probable that most of these students earning at least two but less than three core credits would either have had no exposure to Chemistry or would have failed to pass it. This assumption seems to be on target, as analysis indicates that only a third of students who earned at least two but less than three core science credits also earned credit for Chemistry by the end of high school (33% or 210 students out of 635 students). We can compare this to the students in the cohort who earned at least three core science credits, 87% of whom earned credit for Chemistry by the end of high school (1,238 students out of 1,427 students). In effect, then, students who earned a total of at least two core science credits (assuming these credits were in Physical Science and Biology) would have almost certainly achieved the science CADRs, which was defined as earning a minimum of two laboratory science credits (Washington Student Achievement Council, 2014). This assumption also bears out in the data, as 97% of students who earned a total of at least two core science credits did, in fact, meet the science CADRs by the end of high school (1,991 students out of 2,062 students).

Figure 9 presents the median total of all science credits earned (including non-core and elective science course, in addition to core science courses) to the median total of core science credits earned. As already mentioned, the "all science" category included non-core and elective science courses, in addition to core science courses. Some examples of non-core and elective science courses were anatomy, astronomy, botany, horticulture, and marine biology. I opted to use the median total as the measure of central tendency, rather than the mean total, after histograms for the two total credits variables (all science variable and core science variable) indicated positively skewed, non-normal distributions.

Figure 9. Median Total Science Credits Earned
(all science vs. core science)

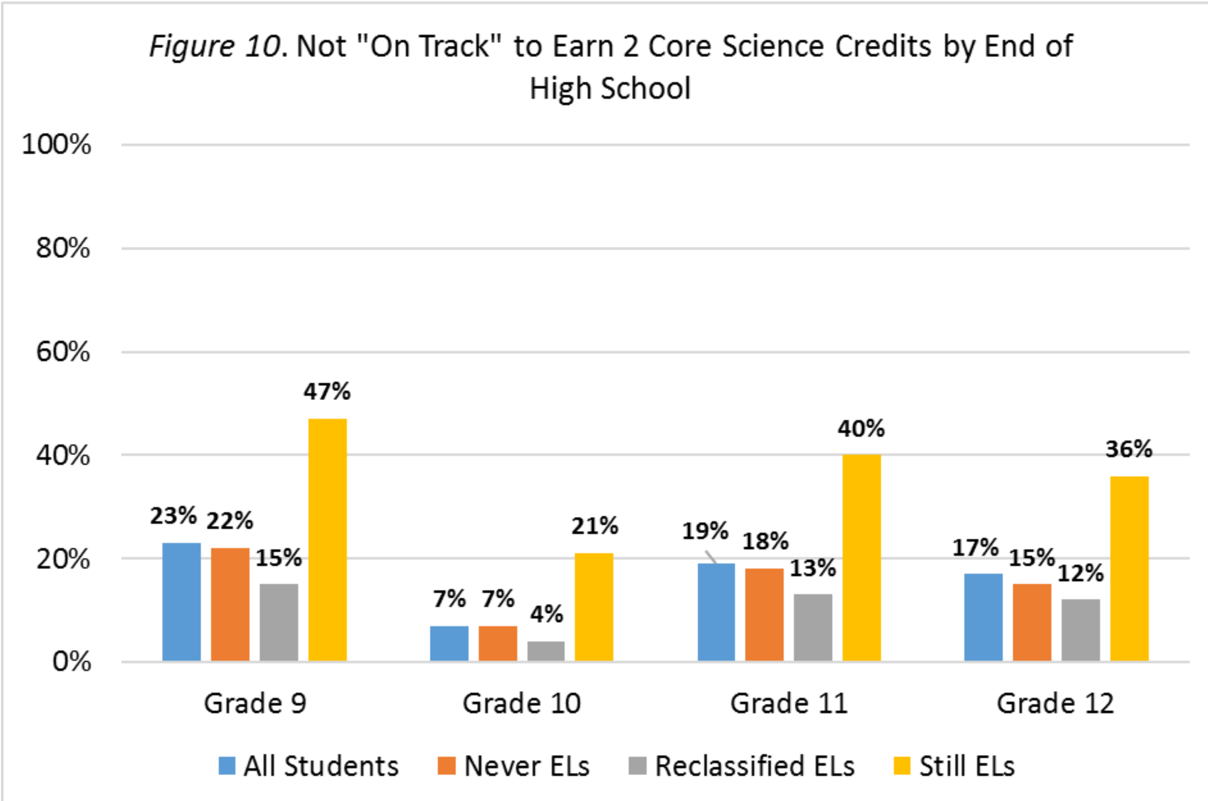


As we can see, Reclassified ELs' median total credits earned in all science courses (3.0) was the same as their median total credits earned in core science courses (3.0). This alignment seems to suggest that the science credits earned by Reclassified ELs came from core science courses, and not from non-core or elective science courses. On the other hand, for both Never ELs and Still ELs, we see a difference of 0.5 when comparing all science credits versus core science credits. This suggests that these subgroups earned a half a credit (equivalent to one semester) more of non-core or elective science courses. However, Never ELs exhibited a full credit more (equivalent to one year) of science across both types of science credits than their Still EL peers, pointing to a serious disadvantage in science course-taking access and/or performance for Still ELs.

In addition to this investigation into all science credits earned versus core science credits earned, I also examined what I refer to as "on track core science credit performance", which can be thought of as a proxy for earning, over time, the credits needed to meet the science CADRs. In this thought experiment, I analyze and compare the proportion of each subgroup that were "on track" to earn at least two core science credits by the end of high school. I selected two core science credits because students who met this benchmark would have had exposure to and succeeded in half of the four primary subjects that comprised the "core science curriculum" and would also have, in the vast majority of cases, met the science CADRs by the end of high school. By engaging in this "on track" analysis, we will have more insight into when, if at all, the student subgroups achieved the science CADRs—my study's course-taking milestone of highest interest.

I defined being "on track" as earning at least one total core science credit by the end of Grade 9 and Grade 10 and earning at least two total core science credits by the end of Grade 11 and Grade 12. As a result of this definition, we expect to see a rise in the proportion of "on-track” students in Grade 10 (as compared to Grade 9) and in Grade 12 (as compared to Grade 11). It was helpful to keep the same benchmark for two grade levels (e.g., one total credit for Grades 9 and 10 and two total credits for Grades 11 and 12) because it allowed us to clearly see how many students were able to “catch up” between the first year and second year of the same benchmark.

The results of this “on track core science credit performance” analysis are presented in Figure 10. As I expected, Reclassified ELs had the highest “on track” proportions, followed by Never ELs. This pattern remained constant across all four grades. Clearly standing out from their peers, Still ELs had the highest proportions of students not “on track”, and this pattern held across each grade, ranging from a low of 21% in Grade 10 to 47% in Grade 9. In Grade 12, more than one out of every three Still ELs (36%) was not “on track” in terms of their core science credits earned. Compare this to 12% of Reclassified ELs and 15% of Never ELs who were not “on track” by the end of Grade 12. These Grade 12 results align almost perfectly with the proportion of each subgroup who did not meet the science CADRs by the end of high school, indicating the appropriateness of using this “on track core science credit performance” measure as a proxy for student progress over time in earning the credits needed to meet the science CADRs.



As expected, we see a drop across all subgroups between the Grade 9 and Grade 10 proportions of students not "on track", as well as between the Grade 11 and Grade 12 proportions of students not "on track". Of note, the drops were much larger between Grade 9 and Grade 10 than between Grade 11 and Grade 12. In fact, Grade 10 represents the most "on track" grade for all students, regardless of subgroup. For example, only 7% of Never ELs were not "on track" in Grade 10, which was a third of the 22% of this subgroup who was not "on track" in Grade 9. We see a similar reduction for Reclassified ELs, only 4% of whom were not "on track" in Grade 10, compared to 15% in Grade 9. Almost half of Still ELs (47%) were not "on track" in Grade 9, which reduced by half to 21% in Grade 10. In combination with a prior section's finding on an uptick in the proportion of students enrolled in a Grade 10 Typical or Advanced science course, this outcome provides further support for the hypothesis that schools may have paid extra attention to enrolling Grade 10 students in Biology, perhaps as a result of the course's accompanying required standardized test.

As already mentioned, there was only a slight drop from Grade 11 to Grade 12 in the proportions of students not "on track". This seems to suggest that the total number of core science credits a student earned by the end of Grade 11 was likely to be close to the same as the what he or she had earned by the end of Grade 12. In other words, an extra year of school (Grade 12) did not appear to make much difference for earning additional core science credits, at least as far as the two core credits benchmark was concerned.

CHAPTER 6

MULTILEVEL MODEL RESULTS

The purpose of my study's inferential, multilevel statistical analysis was to determine if EL reclassification prior to high school (by the start of Grade 9) was *significantly and positively* associated with three important outcomes: 1) Meeting the science course-taking CADRs by the end of high school, 2) Meeting the science course-taking requirements for high school graduation by the end of high school, and 3) Enrolling in any post-secondary institution within one year of high school graduation. At the same time, I also used these regression-based analyses to confirm if entering high school as "Still EL" was *significantly and negatively* associated with achieving these outcomes. These hypotheses are represented in the form of my study's third and fourth research questions*:*

Research Question 3: Was entering high school as a Reclassified EL associated with a significantly higher probability of achieving two important science course-taking milestones by the end of high school and enrolling in college within one year of high school graduation?

Research Question 4: Was entering high school as Still EL associated with a significantly lower probability of achieving two important science course-taking milestones by the end of high school and enrolling in college within one year of high school graduation?

I ran the same multilevel models, described in more detail below, on two samples—the full sample and the Ever EL subsample. As with the descriptive analyses presented in Chapter 5, the full sample included 2,477 students in the Class of 2016 cohort, all of whom had four years of high school enrollment records in the district and who attended one of ten comprehensive high schools or the newcomer EL secondary school. The Ever EL subsample included 589 students, all of whom were part of the full sample, but who also met the additional criterion of having been an EL at some point in their schooling.

All multilevel hierarchical generalized linear models (HLGM) were run using HLM 7.03 software. All models were two-level, with individual students (level 1 units), nested within schools (level 2 units). There were 2,477 level 1 units for the full sample, 589 level 1 units for the Ever EL subsample, and 11 level 2 units. HLM was selected as the analytic method because of its ability as an advanced regression technique to account for relationships within and across nested levels of data (e.g., students grouped in schools) (Raudenbush & Bryk, 2002; Woltman, Feldstain, Mackay, & Rocchi, 2012).

After identifying the specific variables included in the models, I describe the sequential, modeling-building process and results, which began with intercept-only models, followed by direct effects models, and concluding with unique effects models. I present results for the full sample first, followed by the Ever EL subsample.

Variables

School-Level Variables

% EL Enrolled: A standardized (z-scored) continuous, averaged measure of the proportion of a school's student body comprised of currently-served EL students. In my sample, this measure ranged from 2% - 24% for the ten comprehensive high schools, to 83% for the district's newcomer EL secondary school.

% Biology Met or Exceeded Standards: A standardized (z-scored) continuous, averaged measure of the proportion of a school's student body that met or exceeded standards on a Biology standardized test. In my sample, this measure ranged from 42% - 91% for the ten comprehensive high schools, to 17% for the district's newcomer EL secondary school.

Student-Level Variables

Reclassified EL: An effect coded categorical EL variable where Reclassified ELs were represented by 1, Still ELs by 0, and Never ELs by -1. (In the Ever EL subsample, however, while Reclassified ELs were still represented by a 1, Still ELs were represented by a -1.)

Still EL: An effect coded categorical EL variable where Still ELs were represented by 1, Reclassified ELs by 0, and Never ELs by -1. (Only used in full sample)

Never EL: An effect coded categorical EL variable where Never ELs were represented by 1, and all other students (i.e., Ever ELs) were represented by a -1. (Only used in full sample.)

Female: An effect coded categorical gender variable where students identified as female were represented by 1, and all other students (i.e., students identified as male) were represented by a -1.

URM: An effect coded categorical racial/ethnic variable where underrepresented minorities (URM), or students identified as Black, Hispanic, or Other (which included American Indian, Pacific Islander, and Multiracial) were represented by 1, and all other students (i.e., students identified as Caucasian and Asian) were represented by a -1. (Only used in full sample.)

Black: An effect coded categorical racial/ethnic variable where students identified as Black were represented by 1, and all other students (i.e., Caucasian, Asian, Hispanic, Other) were represented by a -1. (Only used in Ever EL subsample.)

Hispanic: An effect coded categorical racial/ethnic variable where students identified as Hispanic were represented by 1, and all other students (i.e., Caucasian, Asian, Black, Other) were represented by a -1. (Only used in Ever EL subsample.)

Grade 9 Advanced Math Enrollment: An effect coded categorical prior achievement variable where students enrolled in Geometry or above (e.g., Algebra II, Precalculus, etc.) during

Grade 9 were represented by a 1, and all other students (those enrolled in Algebra I, a sheltered EL math course, a math course modified specifically for students receiving Special Education services, etc.) were represented by a -1.

Full Sample Analysis

The full sample results described below are presented in Tables 21 – 24, located in Appendix A.

Intercept-Only Models

To begin, I conducted two-level intercept-only models for each of my study's three outcomes of interest, with individual students (Level 1) nested within schools (Level 2). The intercept in the intercept-only model represents the sample's overall average probability in logits of achieving the outcome of interest, controlling only for school membership (without the inclusion of any independent variables). However, logits can be translated into predicted probabilities mathematically as the reciprocal of (1 + exp((-1)*(intercept))).

These intercept-only results are found in Table 21 (Model 1). Translating the intercept estimates (in logits), the mean probability for students in the sample of meeting the science college academic distribution requirements (CADRs) was found to be 82%; this can be compared to a 91% probability of meeting the high school graduation science course-taking requirements, and a 72% probability of enrolling in any college or university within one year of high school graduation.

In addition to estimating the overall probability of each of the three outcomes, intercept-only models also offer a way to quantify how much variation in student outcomes is due to school membership. [In the model above, the outcome for *i*th student in the *j*th college is equal to its grand mean (intercept, γ_{00}), plus the residual error between the *j*th college's mean and the grand mean (U_{0j}), and the residual error between the *i*th student's outcome and his/her college's mean (r_{ij}). A significant intercept would indicate that the outcome mean across colleges is greater than zero, and a significant college variance component (U_{0j}'s) indicates that colleges significantly differ from each other on the outcome. The intercept-only model results indeed revealed that schools varied significantly on each of the outcomes. For the science CADRs intercept-only model, 28% of the variance was explained by students' school membership ($p < .001$). Similarly, 29% of the variance in high school graduation science course-taking was explained by students' school membership ($p < .001$). For the outcome of enrolling in any college or university within one year of high school graduation, only 10% variance was accounted for by students' school membership ($p < .001$).

Direct Effects Models for Course-Taking Outcomes

After conducting the intercept-only models, I ran three sets of direct effects models—one for each of the three outcomes. Accounting only for school membership (as a random factor), direct effects models test the one-to-one (direct) relationship between each predictor and each outcome before factoring in overlap among predictors, while still controlling for school membership dependencies in the data. With two school-level predictors and five student-level predictors, there were seven direct effects models per outcome. For brevity, the results are reported in a combined fashion in Table 22 (Model 2).

The results revealed that the pattern of relationships among predictors and outcomes for the two course-taking outcomes (CADRs and high school graduation requirements) were almost identical, except that one additional predictor (percent of the student body who were currently-served ELs) was found to be statistically significant for high school graduation science course-taking. This similarity in predictors is to be expected, given that both outcomes capture students' cumulative high school science course-taking, with the science CADRs outcome being slightly more rigorous or demanding.

The directions of the predictors' associations with the outcomes aligns with prior research. Of most importance to my research questions, EL reclassification before high school was found to have a positive association with both course-taking milestones, while entering high school as a Still EL was negatively associated with both course-taking milestones. In other words, compared to both their Never EL and Still EL peers, students who exited EL services before Grade 9 had a higher likelihood of meeting science course-taking requirements, whereas students who entered high school as currently-served ELs had a lower likelihood of meeting course-taking requirements, as compared to their Never EL and Reclassified EL peers. In terms of other student-level demographic predictors, female status and Grade 9 advanced math enrollment were positively associated, whereas URM status was negatively associated, with science course-taking.

In regard to school-level predictors, the proportion of a school's students who met or exceeded standards on the state-mandated Biology test was positively related to science course-taking, whereas the percent of students identified as currently-served ELs was negatively related to high school graduation science course-taking, but was not significantly related to science CADRs (p = .099).

Direct Effects Models for College Enrollment Outcome

Also included in Table 22, the results of the direct effects models for the post-secondary enrollment outcome differed somewhat from those of the two science course-taking outcomes. Of most importance, entering high school as a Reclassified EL was not associated with college enrollment (p = .110), nor was female status (p = .982). However, just as was observed with the course-taking outcomes, entering high school as a Still EL had a negative relationship with college enrollment ($p = .037$), as did URM status ($p < .001$). Conversely, enrollment in advanced math in Grade 9 was a positive predictor of college enrollment ($p < .001$). Last but not least, both school level predictors had the same relationship patterns as observed with the course-taking outcomes: percent of students meeting or exceeding the Biology test standards was positively related ($p = .001$), whereas the percent of EL students was negatively related ($p = .012$), to college enrollment.

Unique Effects Models for Course-Taking Outcomes

Following the intercept-only and direct effects models, I conducted a final set of models (two for each outcome) incorporating student and school level predictors together simultaneously in order to test the unique, non-overlapping relationships among predictors and outcomes, with special attention to Reclassified EL, Still EL, and Never EL status. More specifically, I ran unique effects models with (Model 4) and without (Model 3) the Grade 9 advanced math predictor. The rationale for this was that EL-related effects on the three outcomes could be washed out by the strong correlation between EL status and Grade 9 math course-taking. In other words, the observed disparity in Grade 9 advanced math course-taking could mask EL effects, since, across the sample, 43% of Reclassified ELs, 12% of Still ELs, and 55% of Never ELs were enrolled in an advanced math class during Grade 9. This said, I also wanted to test a model that controlled for math achievement, to confirm if my sample exhibited the same pattern found in prior research on EL reclassification and course-taking, where including a proxy for prior achievement meant EL status was no longer a significant predictor of some academic outcomes.

The results of the unique effects models (Models 3-4) for the two course-taking outcomes can be found in Tables 23 and 24. Results for these models were very similar in terms of the significance and direction of the unique predictors. For brevity, I focus on what I refer to as my "final model", which included Grade 9 advanced math enrollment (Model 4).

Results showed that the same three positive student-level variables in the direct effects models remained significant, and also, unique, predictors of the likelihood of meeting both types of science course-taking requirements: Reclassified EL status, female status, and advanced math enrollment. In a similar vein, the same two negative student-level predictors in the direct effects models also remained significant, and now, unique, predictors: Still EL status and URM status. However, in the final model, neither of the two school-level predictors were significantly, uniquely predictive of course-taking outcomes ($p > .05$).

Controlling for school membership, five student-level predictors and two school-level predictors, then, the predicted probability of meeting the science CADRs for students in the full sample was 91% for Reclassified ELs, 79% for Still ELs, and 86% for Never ELs. Controlling for the same characteristics, the predicted probability of meeting the high school graduation science course-taking requirements was 96% for Reclassified ELs, 91% for Still ELs, and 93% for Never ELs.

Unique Effects Models for College Enrollment Outcome

The same modeling procedure was used for testing unique predictor effects on college enrollment (two models: one with and one without advanced grade 9 math enrollment, Models 4 and 3, respectively, also found in Tables 23 and 24). In contrast to the course-taking results, the results for modeling unique effects on post-secondary enrollment differed from the post-secondary direct effects models. Although in the direct effects model, both school-level variables were significant predictors, these effects disappeared in the unique effects models. In addition, the significant relationship between Still EL status and college enrollment in the direct effects model disappeared once additional variables were included in the unique effects models. However, results of the two unique effects models were consistent, regardless of inclusion of Grade 9 advanced math enrollment. Therefore, I limit my discussion to Model 4, which includes this additional variable.

Final model results (Table 24) showed that, unlike the course-taking final models, only URM status (negative association, $p = .002$) and Grade 9 advanced math enrollment (positive association, $p < .001$) were predictive of college enrollment with one year of high school graduation. Of most relevance to my research questions, neither Reclassified EL status ($p = .272$) nor Still EL status ($p = .869$) were found to be unique predictors of college enrollment. This indicates that, after controlling for student- and school-level characteristics, there were no significant differences between Reclassified ELs, Still ELs, and Never ELs in the likelihood of attending college.

Ever EL Subsample Analysis

Even with less statistical power to detect meaningful effects, I investigated the considerably smaller Ever EL subsample (N = 589) separately from the full sample (N = 2,477) in order to more explicitly focus on the group students who had ever experienced EL classification. The models described in this section directly compared outcomes for Reclassified ELs with those of Still ELs, excluding Never ELs from the comparison group. In the full sample analyses, the comparison group for Reclassified ELs was the combined group of Never ELs and Still ELs, while the comparison group for Still ELs was the combined group of Reclassified ELs and Never ELs. It could be especially problematic to compare Reclassified ELs to the combined group of Never ELs and Still ELs, since we would expect the average of this combined group to be markedly different than the averages of each individual subgroup. In this way, even with less statistical power, isolating analysis to only Ever ELs could result in a more meaningful, and perhaps, accurate, interpretation of the association between EL reclassification and the three outcomes of interest. At the very least, analysis of the Ever EL subsample could confirm, or complicate, the full sample results.

The Ever EL subsample results described below are presented in Tables 25 – 28, located in Appendix B.

Intercept-Only Models

To analyze the Ever EL subsample, I followed the same process described above for the full sample. Running two-level intercept-only models for each of the three outcomes of interest resulted in the following findings for Ever EL students: A 78% mean probability of meeting the science CADRs, a 90% mean probability of meeting the high school graduation science course-taking requirements, and a 70% mean probability of enrolling in any college or university within one year of high school graduation. Compared to the full sample's intercept-only models shared above, and controlling only for school membership, the Ever EL sample exhibited very similar mean probabilities of meeting the high school science requirements (90% for Ever ELs and 91% for full sample) and of enrolling in college (70% for Ever ELs and 72% for full sample). However, Ever ELs exhibited a slightly lower mean probability of meeting the science CADRs (78%) than the full sample (82%). These intercept-only results are found in Table 25 (Model 1)

Additionally, the intercept-only model results revealed virtually no relationship in the Ever EL sample between school membership and two of the three student-level outcomes. According to the intercept-only model, less than 0% of the variance in both the high school outcome (p = .024) and college enrollment outcome (p = .269) was explained by Ever EL students' school membership. On the other hand, high school attended explained a larger proportion of variance (9%) in the science CADRs outcome (p = .027). In any case, these non-existent-to-small proportions of variance explained by school membership suggest weaker direct relationships between the high schools Ever ELs attended and my study's three outcomes of interest, as compared to the stronger direct relationships seen in the full sample. This is an unexpected finding and the causes of this weaker relationship within the Ever EL subsample, one of which could be decreased power due to a smaller sample size, could be further explored in future research.

Direct Effects Models for Course-Taking and College Enrollment Outcomes

Next, using the Ever EL subsample, I ran direct effects models, to estimate the individual relationship between each predictor and each outcome of interest, accounting only for school membership. For brevity, the results are reported in a combined fashion in Table 26 (Model 2).

The results of these direct effects models were similar for each of the three outcomes. Of most importance to my study, reclassifying out of EL status before high school was found to have a direct, positive association with all outcomes at the $p < .05$ level. In terms of non-EL student-level predictors, enrollment in advanced math in Grade 9 was directly and positively associated with all three of the outcomes at the $p \leq .001$ level. Hispanic status was directly and negatively associated with meeting the science CADRs ($p = .002$) and enrolling in a college or university ($p = .002$), but was directly and positively associated with meeting the high school science requirements ($p = .035$). Neither female status nor Black status was found to be a direct, significant predictor of any of the outcomes. Similarly, neither of the school-level variables was found to have a direct, significant relationship to any of the outcomes.

When comparing the results of the direct effects models for the Ever EL subsample and full sample, reclassification out of EL status was consistently a direct, positive, and significant predictor for meeting both science course-taking outcomes. EL reclassification was also found to be a direct, positive, and significant predictor for college enrollment in the Ever EL subsample, but not in the full sample. Grade 9 advanced math enrollment was also consistently found to be a direct, positive, and significant predictor for all outcomes across both samples at the $p \leq .001$ level. Female status functioned differently across the two samples—in the full sample, it was a direct, positive, and significant predictor of the course-taking outcomes, but, in the Ever EL subsample, showed no significant relationship with these outcomes. In the full sample, URM status was a consistently negative predictor of the outcomes. In the Ever EL subsample, this broad racial and ethnic category was disaggregated into Hispanic and Black, and only Hispanic status exhibited a direct, significant relationship with the outcomes.

Unique Effects Models for Course-Taking Outcomes

Finally, I ran unique effects models to estimate and test the unique relationships between focal predictors and outcomes of interest within the Ever EL subsample, after accounting for associations between the models' other, non-focal variables. The results of the unique effects models (Models 3-4) for the two course-taking outcomes can be found in Tables 27 and 28. After controlling for these other associations, these models assessed the unique association between student status as a Reclassified EL or a Still EL, and the three dichotomous outcomes of interest. As with the full sample, I ran two combined models for each outcome, the only difference being that the second unique effects model included the addition of an "Grade 9 advanced math enrollment" variable.

Of most importance to my research questions, reclassifying out of EL status before high school was consistently found to be a unique and significant predictor in each of the four course-taking unique effects models. Hispanic status was a unique, negative predictor in the first combined model for the high school outcome (p = .014), but this effect disappeared once Grade 9 advanced math enrollment was controlled for in the second combined model (p = .114), leaving reclassification status (p = .004) and advanced math enrollment (p = .005) as the only two uniquely significant predictors.

The Ever ELs' science CADRs combined models had twice as many statistically significant unique predictors than the high school combined models. In addition to the unique effects of reclassification status, female status and Grade 9 advanced math enrollment were also found to be unique, positive predictors of Ever ELs' probability of meeting the science CADRs. In the second combined model, or the "final model", there were four unique, significant predictors: EL reclassification ($p < .001$), advanced math enrollment ($p < .001$), female status ($p = .022$), and Hispanic status ($p = .004$). Hispanic status was the only negative unique predictor.

Controlling for school membership, five student-level predictors and two school-level predictors, then, the predicted probability of meeting the science CADRs for those in the Ever EL subsample was 87% for Reclassified ELs and 43% for Still ELs. Controlling for the same characteristics, the predicted probability of meeting the high school graduation science course-taking requirements for those in the Ever EL subsample was 96% for Reclassified ELs and 80% for Still ELs. The two overall patterns exhibited in the Ever EL sample, then, were the same as what was seen in the full sample: 1) Reclassified ELs outperformed their Still EL peers, and 2) A larger proportion of each subgroup met the high school outcome than the college admission eligibility outcome. However, the gap between Reclassified ELs and Still ELs in terms of the science CADRs outcome was surprisingly large—with Reclassified ELs exhibiting double the predicted probability of reaching this important milestone (87%), as compared to their Still EL peers (43%). In the full sample, this gap was much smaller, with a difference of only 12% in their predicted probabilities (91% for Reclassified ELs and 79% for Still ELs). The Ever EL subsample also showed a larger gap in predicted probabilities (16%) than the full sample (5%) in terms of the high school outcome.

Unique Effects Models for College Enrollment Outcome

Very few variables in the Ever EL subsample were found to be uniquely and significantly predictive of college enrollment. These results can also found in Tables 27 and 28. In the first combined model, Hispanic status was found to be a negative and unique predictor ($p = .002$), and this effect remained in the second, final combined model, even after the positive and unique predictor of Grade 9 advanced math enrollment was added ($p = .017$). No other predictors, school-level or student-level, were identified as having unique, statistically significant associations with college enrollment. This result of few unique predictors was consistent across both the full sample and the Ever EL subsample, and could suggest that models focused on college enrollment need to include different predictors than those included in models focused on course-taking outcomes.

Nonetheless, controlling for school membership, five student-level predictors and two school-level predictors, for those in the Ever EL subsample, Reclassified ELs had a 70% predicted probability, while Still ELs had a 59% predicted probability, of enrolling in any college or university within one year of high school graduation. As was noted for the Ever EL course-taking final models, these predicted probabilities were not consistent with those found for Reclassified ELs (75%) and Still ELs (71%) in the full sample analysis.

CHAPTER 7

DISCUSSION AND CONCLUSION

In this dissertation, I set out to better understand the relationship between EL reclassification before high school and science course-taking, especially within the context of a long-standing, stable EL reclassification policy applied uniformly across the state. Inspired by the question, "Does reclassification matter for high school science course-taking?", I designed and conducted a quantitative study using panel data on one cohort of SSD students (N = 2,477), using descriptive and inferential statistical techniques to explore three mutually-exclusive student subgroups: Reclassified ELs (N = 362), Still ELs (N = 227), and Never ELs (N = 1,888). In particular, I aimed to answer four research questions that compared the subgroups across demographics, academic experiences and achievement, and access to and performance in high school science-course taking. Of most interest were the subgroups' descriptive rates and predicted probabilities of achieving two science course-taking milestones in high school, and of enrolling in a college or university within one year of high school graduation.

Below, I highlight a handful of key empirical findings from my study and discuss how they relate to prior literature and potential implications for practice, policy, and research. Following this, I share a few overall implications that emerged. I then discuss limitations of my study and areas for future research. I close with a reminder about the importance of the U.S.'s immigrant-origin, EL student population, and the responsibility public schools have to translate ideals about opportunity for all into realities of high performance in rigorous curriculum, in order to promote the future success of the students who comprise this complex, dynamic, ever-growing group.

Review of Key Findings and Their Implications

Key Finding 1: Important Background Differences Within Ever EL Subgroup

My first research question explored the demographic and academic differences within my sample, with the goal of better understanding the composition of the three student subgroups and how empirically similar or dissimilar they were to one another. I was especially interested in examining whether the two subgroups that comprised the heterogeneous Ever EL population (Reclassified ELs and Still ELs) were fundamentally different groups, based on personal and academic measures. Indeed, I found that there were important differences between Reclassified ELs and Still ELs, especially in terms of first generation status and the need for Special Education services. I argue that these factors should be considered if policymakers and practitioners are to effectively support an increase in ELs' access to and performance in rigorous, high school science curriculum.

First, there were clear differences between the subgroups in first generation status. Close to three quarters of Still ELs in the sample were born abroad (71%), compared to less than half of Reclassified ELs (43%), and very few Never ELs (3%). Consequently, knowledge about how influential the particular high school classes one takes, or fails to take, are to one's future academic opportunities, including eligibility to apply and likelihood of acceptance to four-year colleges, is likely much lower for students who come from families that are new to the U.S. context. As a recent report about high school students in the Puget South region shows, students of color and students who would be the first in their family to attend college rely more heavily on schools and counselors to provide information about the college admission and application processes (Road Map Project, 2019). Ensuring that Still ELs, in particular, have regular and intensive time for this kind of advising and knowledge sharing, could raise first-generation students' awareness about the importance of rigorous course-taking.

Next, there were clear differences between the subgroups in the proportion of students in need of Special Education services. Although the proportions of Never ELs and Ever ELs identified as in need of Special Education services were identical in my sample (14%), there was a large difference once Ever ELs were disaggregated by reclassification status. Four times the proportion of Still ELs (26%) than Reclassified ELs (6%) ever received Special Education services. This matters because, while 84% of the full sample met the science CADRs by the end of high school, only 49% of students ever identified for Special Education services did so, resulting in a 35% science CADRs achievement gap between these groups. When examining this relationship within the Ever EL subsample, we see an even larger gap: 78% of all Ever ELs met the science CADRs by the end of high school, compared to only 32% of Ever ELs who were in need of Special Education services (a 46% gap).

These results mirror those of a Regional Education Laboratory Northwest study based on 2012-13 Washington State data, which found that 13% of Ever ELs and 13% of Never ELs across the state received Special Education services (Motamedi, Cox, Williams, & Deussen, 2016). This study also found that, when compared to Never ELs, students receiving EL services for five or more years without reclassifying were overrepresented in Special Education, while former ELs who had been reclassified for at least two years were underrepresented in Special Education (Greenberg Motamedi, Cox, Williams, & Deussen, 2016).

Using data from two school districts, one located in a traditional immigrant destination state and the other in a new immigrant destination state, Umansky, Thompson, and Díaz (2017) found that reclassification helped to explain this uneven outcome, noting, that "EL students with disabilities are far less likely than those without disabilities to exit EL services, resulting in large proportions of dually identified students at the secondary level" (p. 76).

These results bring up questions about what it means for a student to be "dually identified" as in need of both EL and Special Education services. What do services look like for these students and how might Special Education requirements, structures, and practices influence opportunities for rigorous science course-taking? Our project's case study work suggests that Special Education status typically takes priority over EL status, but the reasons for this and the ways in which this happens in the context of particular school settings were beyond the scope of our project. With one out of four Still ELs "dually identified", more research focused on the intersection of EL and Special Education is needed.

Key Finding 2: Important Academic Differences Within Ever EL Subgroup

My second research question descriptively examined the high school science course-taking trajectories of the three subgroups, focusing on rates of access to and performance in different course tracks. The goal of these analyses was to identify if, and to what extent, systematic inequities in science course-taking existed between the student populations. This was inspired by a belief that it was important to highlight and provide nuance for any such observed inequities in access and performance, before analyzing end-of-high-school course-taking outcomes using statistical controls. In the end, these observed differences represent students' true, lived academic opportunities and outcomes, which can inadvertently be obscured or overlooked in more technical analyses that rely on statistical controls. Additionally, as Loeb and colleagues contend in their guide for researchers, "When properly applied, description can help researchers understand a phenomenon of interest and use that knowledge to prioritize possible causal mechanisms, generate hypotheses and intervention strategies, interpret the findings of causal research, diagnose problems for practitioners and policymakers to address, and identify new issues to study" (Loeb et al., 2017, p. 1). Noting that, "good descriptive analysis is often challenging—requiring expertise, thought, and effort" these scholars also point to the growing potential of such research to inform "policy, practice, and research…given the recent availability of large and complex datasets that are relevant for understanding education issues" (Loeb et al., 2017, p. v).

The most critical finding related to my second research question was that Reclassified ELs in the district tended to perform very well academically, often better than Never ELs, and always better than Still ELs. The State of Washington has shown a commitment to recognizing the assets of its multilingual students through World Language Credits and the Seal of Biliteracy (OneAmerica, 2017), as well as an explicit interest in supporting Reclassified ELs' academic performance (OSPI, 2017). In this vein, the academic success of Reclassified ELs should be publicized and celebrated, giving credit to the students themselves, their families and communities, and the schools and teachers who serve them.

At the same time, analyses conducted for my second research question confirmed and quantified the struggle Still EL students experienced in terms of access to a rigorous, college preparatory science curriculum, particularly in terms of achievement of the CADRs milestone and "on-track" core science credit performance. As described in Chapter 5, more than three of every ten Still ELs (36%) who attended all four years of high school in the district and successfully made it to Grade 12, were nonetheless ineligible, at least in terms of my study's estimate of science course-taking, to even apply for admission to any of the state's four-year public colleges or universities (compared to 13% of Reclassified ELs and 15% of Never ELs), much less be offered admission to such an institution. Even if we only consider those who successfully graduated from high school, approximately one of every four Still ELs (26%) in the district apparently failed to meet the minimum college admission eligibility requirements for science course-taking, compared to 7% of Reclassified ELs and 9% of Never ELs.

Likewise, analysis of “on-track” core science credit performance in Chapter 5 indicated that the Still EL subgroup had the highest proportion of students not “on track” to earn at least two core science credits by the end of high school. This pattern held across each grade, ranging from a low of 21% of Still ELs not “on track” in Grade 10, to a high of 47% not “on track” in Grade 9. This is compared to the Reclassified EL subgroup, which ranged from 4% to 15% not “on track”, and 7% to 22% of the Never EL subgroup not “on track”, depending on the grade level under examination.

One important contributor to these lower rates of CADRs achievement and “on-track” core science credit attainment may have been the “exclusionary tracking” (Umansky, 2016) experienced by Still ELs. As noted in Chapter 5, Still EL students exhibited the highest relative rates of no science enrollment in each grade. Most striking, almost a quarter of Still ELs in the district were not enrolled in any science class during Grade 9 (23%), compared to 8% of Never ELs and only 4% of Reclassified ELs. In Grade 12, 44% of Still ELs were not enrolled in any science course, followed by almost identical proportions of Reclassified ELs (30%) and Never ELs (29%). My quantitative analysis cannot explain why one out of every four Still ELs was not enrolled in any type of science class during their Grade 9 year (although our project’s forthcoming case study analysis may suggest some potential contributing factors). Was it due to certain school-specific practices? Or were rates similar across each high school? Further investigation, quantitative and qualitative, could shed light on this critical issue of exclusionary tracking of Still ELs.

After my second research question confirmed that important differences in science course-taking existed by student subgroup, my third and fourth research questions inquired into the strength and significance of the relationship between EL reclassification before high school and students' predicted probability of achieving two important science course-taking milestones and of enrolling in college, after controlling for school membership, student demographics, advanced math enrollment, and two relevant school-level variables. Multilevel model estimates using the full sample confirmed that entering high school as a "Reclassified EL" was, in fact, significantly, positively, and uniquely associated with meeting two important high school science course-taking milestones ($p < .01$), even after including the controls described above. This relationship between EL reclassification and achievement of the two course-taking outcomes was also found in the Ever EL subsample analysis ($p < .01$).

Simultaneously, I found that entering high school as a "Still EL" was significantly, negatively, and uniquely associated with meeting these two science course-taking milestones ($p < .05$). Using these models, the predicted probability of meeting the science CADRs for students in the full sample was 79% for Still ELs, 91% for Reclassified ELs, and 86% for Never ELs. As we would expect, the predicted probabilities of meeting the science course-taking requirements for high school graduation were higher: 91% for Still ELs, 96% for Reclassified ELs, and 93% for Never ELs.

To summarize, the results of the final model for the full sample's course-taking outcomes final provide evidence in support of my study's hypotheses. Primarily, that entering high school as a Reclassified EL was, in fact, *significantly and positively* associated with meeting two important high school science course-taking milestones, even after controlling for student demographics and access to advanced math, as well as school membership, and two aggregated school-level measures (science achievement and the percent of the student body identified as currently-served ELs). Simultaneously, these results also support the hypothesis that entering high school as a Still EL was significantly and negatively associated with meeting these two science course-taking milestones, again, even after controlling for a number of student- and school-level characteristics.

These results show the same two patterns as what was found descriptively, mainly that: 1) Reclassified ELs outperformed Never ELs, who out performed Still ELs, and 2) Logically, a higher proportion of each subgroup met the high school graduation milestone than met the slightly more rigorous college admission eligibility milestone. Reclassified ELs in my study's sample were found to be higher performing not only than their Still EL peers, which we would expect, but also than their Never EL peers—a comparison that has yielded mixed results in prior studies.

In terms of college enrollment rate for high school graduates in the full sample, neither Still EL status (p = .869) nor Reclassified EL status (p = .272) were found to be unique predictors of college enrollment, suggesting that, after controlling for a number of student- and school-level characteristics, there were no significant differences in college enrollment across the three subgroups. Reclassified ELs exhibited a 74% predicted probability of enrolling in any college or university within one year of high school graduation, compared to Still ELs' predicted probability of 71%, and Never ELs' predicted probability of 70%. Interestingly, after adding the select controls, Still ELs exhibited a slightly higher probability of college enrollment than their Never EL peers—a finding that stands in contrast to the observed rates presented in Chapter 5, with 75% of Never ELs and 64% of Still ELs enrolling in a college or university.

It is important to note, however, that the sample used for the college enrollment outcome was somewhat different than the sample used for the course-taking outcomes. Specifically, only students who successfully graduated from high school were included in the college enrollment analysis. With this in mind, the finding of no statistical difference in college enrollment rates among the three student subgroups, once only high school graduates were considered, may be less surprising.

Additional Implications

In this section, I briefly describe a few of the implications that arose from this study, but were not directly tied to any of the research questions. In essence, here I offer a few important takeaways related to data and the opportunity to learn construct that are larger than any singular research question or set of findings.

Both EL data and course-taking data are exceedingly complex and messy. However, partnering with a school district, especially those who work with this data on a regular basis, can make a research study's design and results more credible and useful. For example, as previously mentioned, we were able to ask our district partners to share the "lab science" and "CADR science" course flags with us, which means that my estimates of who met the science course-taking milestones is likely more accurate than it would have been without our partnership.

At the same time, the many data issues and obstacles that came up during the dataset preparation of my study's dataset suggest that there is likely a better, more streamlined way for such data to be organized within the district's own databases and to be shared with external researchers. As it currently stands, research studies like this one require a significant amount of time and manpower, due less to the analyses conducted and more to issues related to data quality and organization. Given today's technology, it is possible to envision a cleaner, easy-to-follow course-taking database with accurate, up-to-date EL classifications that are automatically updated at regular intervals and are easily shareable between districts and external research partners. This would require substantial database infrastructure effort, and leadership from EL and course-taking experts, but could result in more efficient, timely analyses that could have a more immediate and nuanced influence on policy and practice.

Shifting away from practical database considerations to theory, I found that the concept of opportunity to learn offered a solid starting place for analyzing EL equity and rigor in science course-taking. At the same time, I argue that EL course-taking research can expand beyond a focus on opportunity as measured by enrollment numbers and courses available. Future work should aim to learn more about the conditions under which such opportunities are translated, or not, into higher levels of actual performance, especially at the district- and school-levels, where students interact directly and personally with educational systems and actors. For example, Chapter 5 results on science course-taking performance suggested that 18% of the full sample, and 24% of Reclassified ELs, who were enrolled in Chemistry during Grade 11 failed the course. Qualitative or mixed methods approaches could help explain why such a large proportion of students, especially of the Reclassified EL subgroup, struggled in this particular, and important, science course.

Finally, my study supports the continued use of the Ever EL framework promoted by Thompson, Umansky, the Oregon Department of Education, and others (Institute of Education Sciences; Umansky, Thompson, & Díaz (2017). This analytic approach provided a stable way to evaluate the academic progress over time of the dynamic EL student subgroup and, I argue, should become standard in EL reporting and research. However, there is still a need to disaggregate the heterogeneous Ever EL subgroup into smaller, meaningful categories that group students based on their particular needs and strengths. My study offers one such way to do this—by analyzing course-taking and college enrollment outcomes based on reclassification before the high school years. If future studies were also to use this same cutoff, the relationship between reclassifying before entering high school, or entering high school as a currently-served EL, and rigorous science course-taking could be further explored in connection to particular EL and course-taking policies and practices.

Limitations

One important limitation of my study is its quantitative nature. For example, I cannot answer questions about the mechanisms by which students were enrolled in or kept away from particular course tracks. If we are interested in interventions for improving the status quo, we need to know which areas to target. Although analysis of our RPP case study work is still in-progress, interviews and observations offer potential avenues for explorations that are not possible given the nature of my study's administrative dataset. For instance, does the limited opportunity to learn for Still ELs boil down to expectations and access to information? If so, is this at the school level, and related, perhaps to a need for more or better advising by counselors? Or, perhaps, EL students *do* have open access to a rigorous science curriculum, but might they be opting not to pursue this path, due in part to self-narratives that have developed over time, such as: "I'm just not a science person", or "I won't use or need this in my future"?

My quantitative study also cannot answer questions about how students actually experience the science courses in which they are enrolled. Are the classes appropriately challenging for students, especially for ELs? Are they interesting? Do students feel like they are learning and succeeding? Is certain science content especially challenging, perhaps due to linguistic or mathematical demands (e.g., Chemistry, Physics)? Do experiences in science courses encourage or discourage students, especially ELs, to continue studying science, even after they have met the basic high school graduation requirements?

A second limitation is that my study was not able to deeply investigate the role of prior achievement, which, in previous research has often “explained away” the unique effect of reclassification on course-taking outcomes. For example, in her recent dissertation work using longitudinal student-level data from a large, urban school district in California, while Johnson initially found “substantial heterogeneity in general and advanced course-taking based on ELs’ length of US residency and years-as-EL”, those differences disappeared after controlling for Grade 8 standardized test scores (2019, p. 1). Umansky found a similar pattern in her study of ELs’ middle school course-taking, noting that students’ school of attendance and their individual levels of prior achievement, as measured by Grade 5 standardized test scores, explained “much of the pattern of ELs enrolling in fewer upper level classes and more lower level classes”, while also emphasizing that prior achievement did not predict the exclusionary tracking experienced by ELs (2016, pp. 1815 & 1823). If Grade 8 science or math standardized test scores had been included in my final multilevel models, it is likely that the unique effect of reclassification on the two science course-taking milestones would have disappeared. What would this have implied? How early in schooling does this relationship between prior achievement, EL status, and course-taking begin, and how can this relationship be disrupted?

A third limitation is that my study analyzes only one cohort of students. It is possible that analysis of prior or future cohorts would result in different outcomes. Likewise, this study is based in one large urban district in Washington State, and we should not expect the results to necessarily generalize to non-urban districts within the state, or to districts in other states, which have different EL reclassification policies and science course-taking requirements for high school and college admission eligibility.

Future Research

Directly related to the limitations above, I propose a number of directions for future research in the area of EL reclassification and science course-taking. Although this study is not causal, and is, instead, descriptive and correlational in nature, I argue that existing literature has provided sufficient evidence, across multiple contexts, regarding the strong and consistent relationship, in most cases, between EL status in high school and less desirable academic outcomes. With this in mind, I recommend that future research in this area focus seriously on designing, exploring, and testing specific interventions to address one of more of the potential mechanisms described above, like expectations and access to information, or prior achievement and tracking, in an attempt to reduce the predictability of this association, or perhaps even reverse it.

As noted above, my study focused on one cohort of students from one district. Our project also has access to several prior cohorts. Conducting a similar study using these prior cohorts could confirm whether the patterns seen in my study generalize beyond this one cohort. Perhaps more interesting, though, a similar study could be conducted on future cohorts, especially after a new state policy that went into effect for Washington students in the Class of 2019 cohort, and, effectively, aligns the science course-taking requirements for high school graduation with those for in-state, four-year college admission eligibility (Washington State Board of Education, 2018). Our project's data agreement included only up to the Class of 2016 cohort, but future studies could examine the impact of this policy reform on Class of 2019 Still

ELs' rates of access to and performance in a rigorous, college preparatory science curriculum, as compared to pre-Class of 2019 cohorts.

Even with this upcoming alignment of science course-taking requirements for high school graduation and college admission eligibility, it would likely be naïve to expect an automatic improvement in rates of science course-taking milestone achievement. While we may very likely see a decrease in exclusionary tracking and an increase in core science class enrollment for Still ELs, this increase in enrollment alone would not guarantee Still ELs' successful course performance. As some research on "Algebra for All" initiatives has shown, pushing students into more rigorous classes without the necessary preparation or supports can lead to undesirable, unintended outcomes, such as an increase in failure rates, a lack of improvement in knowledge as measured by test scores, and no increased likelihood of college enrollment (Allensworth, Nomi, Montgomery, & Lee, 2009). If higher numbers of Still ELs are to enroll and succeed in a more rigorous science curriculum, they will need more systematic, high quality opportunities to learn science, not only in high school, but before. Of course, this also means that the schools and teachers involved in these moves towards increased rigor will need support too, likely in the form of well-designed, long-term, job-embedded professional development and coaching, and more one-on-one time with the students who have the most room to grow. Such professional development and coaching initiatives focused on increasing rigor in science for ELs could be another fruitful area of future research.

Conclusion

This study aimed to answer the question, "Does reclassification before high school matter for Ever EL students in terms of their science course-taking?" My results indicate that, yes, reclassification does indeed matter, at least within the context of my study's district and sample, and may function as gatekeeper to accessing a more rigorous, college preparatory science curriculum. Beginning high school as Reclassified EL was associated with better science course-taking outcomes, even when compared to Never EL students, while beginning high school as a Still EL was associated with worse science course-taking outcomes.

ELs are a dynamic, heterogeneous, ever-growing student population, and they bring to school a wealth of knowledge, skills, expertise, and interest in succeeding in school. It is the responsibility of public schools, in partnership with students, families, and communities, to find the best ways to take advantage of these assets, in order to eliminate the all-too-common research finding of high school EL's "undereducation" (Gándara, 2013, p.157) and to realize our commonly held belief in equality of educational opportunity for all.

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Appendix A

Table 21. Full Sample Model 1 (Intercept Only)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	1.53	0.18	8.73	(10)	<.001	2.33	0.18	12.65	(10)	<.001	0.96	0.11	8.59	(10)	<.001
School Predictors															
% EL Enrolled (Z)															
% Biology Met or Exceeded Standard (Z)															
Student Predictors															
Reclassified EL (1 = yes)															
Still EL (1 = yes)															
Female (1 = yes)															
URM (1 = yes)															
Enrolled in Geo in Grd 9 (1 = yes)															
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.28		95.85	(10)	<.001	0.29		56.29	(10)	<.001	0.10		45.79	(10)	<.001

Note. N = 2,477 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 2,125 students. All values in logits. All predictors standardized or effect coded.

Table 22. Full Sample Model 2 (Direct Effects)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
School Predictors															
% EL Enrolled (Z)	-0.44	0.24	-1.84	(9)	.099	**-0.60**	**0.24**	**-2.46**	**(9)**	**.036**	**-0.71**	**0.23**	**-3.13**	**(9)**	**.012**
% Biology Met or Exceeded Standard (Z)	**0.57**	**0.17**	**3.41**	**(9)**	**.008**	**0.63**	**0.18**	**3.52**	**(9)**	**.007**	**0.53**	**0.12**	**4.62**	**(9)**	**.001**
Student Predictors															
Reclassified EL (1 = yes)	**0.53**	**0.12**	**4.48**	**(2464)**	**<.001**	**0.56**	**0.17**	**3.34**	**(2464)**	**.001**	0.17	0.11	1.60	(2112)	.110
Still EL (1 = yes)	**-0.77**	**0.11**	**-6.95**	**(2464)**	**<.001**	**-0.65**	**0.15**	**-4.40**	**(2464)**	**<.001**	**-0.25**	**0.12**	**-2.09**	**(2112)**	**.037**
Female (1 = yes)	**0.12**	**0.05**	**2.25**	**(2465)**	**.024**	**0.28**	**0.07**	**3.88**	**(2465)**	**<.001**	0.00	0.05	-0.02	(2113)	.982
URM (1 = yes)	**-0.45**	**0.06**	**-7.87**	**(2465)**	**<.001**	**-0.39**	**0.07**	**-5.22**	**(2465)**	**<.001**	**-0.30**	**0.05**	**-5.69**	**(2113)**	**<.001**
Enrolled in Geo in Grd 9 (1 = yes)	**0.86**	**0.07**	**12.76**	**(2465)**	**<.001**	**0.75**	**0.09**	**8.37**	**(2465)**	**<.001**	**0.44**	**0.05**	**8.67**	**(2113)**	**<.001**
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	--		--	--	--	--		--	--	--	--		--	--	--

Note. N = 2,477 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 2,125 students. All values in logits. All predictors standardized or effect coded.

Table 23. Full Sample Model 3 (Unique Effects, No Math)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	1.46	0.14	10.20	(8)	<.001	2.37	0.16	15.15	(8)	<.001	0.79	0.10	8.28	(8)	<.001
School Predictors															
% EL Enrolled (Z)	0.77	0.45	1.69	(8)	.129	0.41	0.47	0.87	(8)	.412	0.07	0.36	0.20	(8)	.849
% Biology Met or Exceeded Standard (Z)	0.77	0.35	2.20	(8)	.059	0.70	0.36	1.94	(8)	.089	0.44	0.22	2.04	(8)	.076
Student Predictors															
Reclassified EL (1 = yes)	**0.55**	**0.12**	**4.58**	**(2462)**	**<.001**	**0.58**	**0.17**	**3.40**	**(2462)**	**.001**	0.16	0.11	1.51	(2110)	.132
Still EL (1 = yes)	**-0.73**	**0.11**	**-6.38**	**(2462)**	**<.001**	**-0.57**	**0.15**	**-3.78**	**(2462)**	**<.001**	-0.18	0.12	-1.45	(2110)	.146
Female (1 = yes)	**0.14**	**0.06**	**2.45**	**(2462)**	**.014**	**0.31**	**0.08**	**3.94**	**(2462)**	**<.001**	0.01	0.05	0.23	(2110)	.815
URM (1 = yes)	**-0.42**	**0.06**	**-7.13**	**(2462)**	**<.001**	**-0.36**	**0.08**	**-4.57**	**(2462)**	**<.001**	**-.277**	**0.05**	**-5.15**	**(2110)**	**<.001**
Enrolled in Geo in Grd 9 (1 = yes)															
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.12		56.10	(8)	<.001	0.11		32.33	(8)	<.001	0.01		12.73	(8)	.121

Note. N = 2,477 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 2,125 students. All values in logits. All predictors standardized or effect coded.

Table 24. Full Sample Model 4 (Unique Effects, Math)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	1.84	0.15	12.51	(8)	<.001	2.70	0.17	15.97	(8)	<.001	0.92	0.10	8.93	(8)	<.001
School Predictors															
% EL Enrolled (Z)	0.77	0.45	1.73	(8)	.122	0.41	0.48	0.85	(8)	.418	0.11	0.38	0.28	(8)	.786
% Biology Met or Exceeded Standard (Z)	0.76	0.34	2.23	(8)	.056	0.67	0.36	1.85	(8)	.101	0.44	0.23	1.92	(8)	.091
Student Predictors															
Reclassified EL (1 = yes)	**0.50**	**0.12**	**4.08**	**(2461)**	**<.001**	**0.52**	**0.17**	**3.06**	**(2461)**	**.002**	0.12	0.11	1.10	(2109)	.272
Still EL (1 = yes)	**-0.50**	**0.12**	**-4.31**	**(2461)**	**<.001**	**-0.38**	**0.15**	**-2.48**	**(2461)**	**.013**	-0.02	0.13	-0.17	(2109)	.869
Female (1 = yes)	**0.14**	**0.06**	**2.36**	**(2461)**	**.018**	**0.31**	**0.08**	**3.87**	**(2461)**	**<.001**	0.01	0.05	0.29	(2109)	.774
URM (1 = yes)	**-0.26**	**0.06**	**-4.20**	**(2461)**	**<.001**	**-0.22**	**0.08**	**-2.66**	**(2461)**	**.008**	**-0.17**	**0.06**	**-3.05**	**(2109)**	**.002**
Enrolled in Geo in Grd 9 (1 = yes)	**0.77**	**0.07**	**10.52**	**(2461)**	**<.001**	**0.68**	**0.10**	**6.83**	**(2461)**	**<.001**	**0.40**	**0.05**	**7.25**	**(2109)**	**<.001**
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.11		48.64	(8)	<.001	0.10		31.21	(8)	<.001	0.01		15.14	(8)	.056

Note. N = 2,477 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 2,125 students. All values in logits. All predictors standardized or effect coded.

Appendix B

Table 25. Ever EL Subsample Model 1 (Intercept Only)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	1.25	0.14	8.70	(10)	<.001	2.25	0.14	15.80	(10)	<.001	0.86	0.10	8.57	(10)	<.001
School Predictors															
% EL Enrolled (Z)															
% Biology Met or Exceeded Standard (Z)															
Student Predictors															
Reclassified EL (1 = yes)															
Still EL (1 = yes)															
Female (1 = yes)															
URM (1 = yes)															
Enrolled in Geo in Grd 9 (1 = yes)															
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.09		20.24	(10)	.027	0.00		20.57	(10)	.024	0.00		12.24	(10)	.269

Note. *N* = 589 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, *N* = 472 students.

Table 26. Ever EL Subsample Model 2 (Direct Effects)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	--		--	--	--	--		--	--	--	--		--	--	--
School Predictors															
% EL Enrolled (Z)	-0.12	0.24	-0.51	(9)	.622	-0.03	0.03	-1.17	(9)	.272	-0.19	0.25	-0.77	(9)	.461
% Biology Met or Exceeded Standard (Z)	0.17	0.19	0.88	(9)	.403	0.03	0.02	1.24	(9)	.245	0.04	0.19	0.20	(9)	.846
Student Predictors															
Reclassified EL (1 = yes)	**1.34**	**0.21**	**6.41**	**(577)**	**<.001**	**0.11**	**0.02**	**4.53**	**(577)**	**<.001**	**0.45**	**0.21**	**2.17**	(460)	**.030**
Still EL (1 = yes)	0.19	0.10	1.86	(577)	.063	0.02	0.01	1.38	(577)	.168	-0.03	0.10	-0.28	(460)	.782
Female (1 = yes)	-0.21	0.11	-1.81	(577)	.071	-0.02	0.01	-1.16	(577)	.246	0.02	0.12	0.16	(460)	.871
URM (1 = yes)	**-0.35**	**0.12**	**-3.05**	**(577)**	**.002**	**0.03**	**0.01**	**-2.11**	**(577)**	**.035**	**-0.38**	**0.12**	**-3.19**	**(460)**	**.002**
Enrolled in Geo in Grd 9 (1 = yes)	**0.85**	**0.16**	**5.39**	**(577)**	**<.001**	**0.06**	**0.01**	**4.40**	**(577)**	**<.001**	**0.39**	**0.11**	**3.46**	**(460)**	**.001**
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	--		--	--	--	--		--	--	--	--		--	--	--

Note. N = 589 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 472 students.

Table 27. Ever EL Subsample Model 3 (Unique Effects, No Math)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	0.21	0.18	1.16	(8)	.280	1.35	0.22	6.13	(8)	<.001	0.30	0.20	1.52	(8)	.167
School Predictors															
% EL Enrolled (Z)	0.38	0.39	0.97	(8)	.362	0.10	0.47	0.22	(8)	.835	-0.39	0.42	-0.93	(8)	.378
% Biology Met or Exceeded Standard (Z)	0.35	0.32	1.07	(8)	.318	0.23	0.41	0.55	(8)	.599	-0.26	0.31	-0.83	(8)	.431
Student Predictors															
Reclassified EL (1 = yes)	**1.36**	**0.22**	**6.27**	**(574)**	**<.001**	**1.21**	**0.30**	**4.01**	**(574)**	**<.001**	0.40	0.21	1.85	(457)	.065
Still EL (1 = yes)	**0.23**	**0.11**	**2.09**	**(574)**	**.037**	0.24	0.15	1.56	(574)	.119	0.01	0.10	0.05	(457)	.959
Female (1 = yes)	**-0.33**	**0.13**	**-2.52**	**(574)**	**.012**	-0.28	0.18	-1.59	(574)	.112	-0.07	0.13	-0.55	(457)	.586
URM (1 = yes)	**-0.52**	**0.13**	**-3.97**	**(574)**	**<.001**	**-0.43**	**0.17**	**-2.48**	**(574)**	**.014**	**-0.40**	**0.13**	**-3.11**	**(457)**	**.002**
Enrolled in Geo in Grd 9 (1 = yes)															
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.01		12.91	(8)	.115	0.00		15.06	(8)	.058	0.00		9.28	(8)	.318

Note. N = 589 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, N = 472 students.

Table 28. Ever EL Subsample Model 4 (Unique Effects, Math)

	WA College Admission Distribution Requirements Met (Science Credits)					WA High School Graduation Requirements Met (Science Credits)					Post-Secondary Enrollment within One Year of HS Graduation				
Fixed Effects	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*	*Coeff*	*SE*	*t*	*(df)*	*p*
Intercept (Mean)	0.83	0.25	3.34	(8)	.010	2.26	0.39	5.77	(8)	<.001	0.61	0.24	2.57	(8)	.033
School Predictors															
% EL Enrolled (Z)	0.43	0.38	1.12	(8)	.297	0.17	0.48	0.35	(8)	.735	-0.37	0.42	-0.87	(8)	.410
% Biology Met or Exceeded Standard (Z)	0.43	0.32	1.37	(8)	.208	0.32	0.42	0.77	(8)	.465	-0.21	0.31	-0.67	(8)	.521
Student Predictors															
Reclassified EL (1 = yes)	**1.11**	**0.23**	**4.92**	**(573)**	**<.001**	**0.90**	**0.31**	**2.90**	**(573)**	**.004**	0.23	0.22	1.03	(456)	.303
Still EL (1 = yes)	**0.25**	**0.11**	**2.29**	**(573)**	**.022**	0.26	0.15	1.72	(573)	.087	0.03	0.10	0.24	(456)	.810
Female (1 = yes)	-0.20	0.13	-1.48	(573)	.138	-0.14	0.18	-0.76	(573)	.449	0.02	0.14	0.11	(456)	.912
URM (1 = yes)	**-0.39**	**0.13**	**-2.91**	**(573)**	**.004**	-0.28	0.18	-1.58	(573)	.114	**-0.31**	**0.13**	**-2.33**	**(456)**	**.020**
Enrolled in Geo in Grd 9 (1 = yes)	**0.61**	**0.17**	**3.57**	**(573)**	**<.001**	**0.88**	**0.31**	**2.81**	**(573)**	**.005**	**0.30**	**0.13**	**2.39**	**(456)**	**.017**
Random Effect	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*	*Var*		*Chi*	*(df)*	*p*
Intercept															
Between Schools	0.00		11.79	(8)	.160	0.00		15.88	(8)	.044	0.00		9.63	(8)	.291

Note. *N* = 589 students from 10 comprehensive high schools and 1 newcomer EL secondary school in Spruce School District for high school science credit outcomes; for post-secondary enrollment, *N* = 472 students.