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Succeeding freshman year: rise up connectedness and science learner identity study

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BOSTON UNIVERSITY

SCHOOL OF EDUCATION

Dissertation

SUCCEEDING FRESHMAN YEAR:

RISE UP CONNECTEDNESS AND SCIENCE LEARNER IDENTITY STUDY

by

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Dedication

To my parents, my kids and my wife.

Mom and Dad. You are my foundation. Thank you for always pushing me to strive to be the best person that I can be. Thank you for valuing education so highly and impressing that value on me. Mom, thank you for helping me see the value of hard work and tenacity along any arduous journey. Thank you for helping me try and see the good in all persons, give 110% and not look for anything in return. Dad, thank you for fostering a sense of wonder about the world in me and the instilling the confidence to know that we can figure it out. From the farm, to bookshelves, to Kator, thank you for giving me the drive, focus, curiosity, and compass to along my adventure.

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family sayings: falling means we're learning, we can fix it, do good, be positive, learn, love and laugh.

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SUCCEEDING FRESHMAN YEAR:

RISE UP CONNECTEDNESS AND SCIENCE LEARNER IDENTITY STUDY

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ABSTRACT

This study focuses on at-risk students entering 9th grade in Cambridge, MA and ways to increase their connectedness and science learner identity. At-risk students were invited to participate in a research-based, summer intervention program called Rise Up for four weeks prior to entering 9th grade in the fall. Students were grouped into three categories, at-risk students who participated in the program, Rise Up Participants (RUPs), at-risk students who were Eligible Non-Participants (ENPs), and students who were not considered at-risk based on their 7th grade MCAS scores, Proficients.

The study found the RUPs were performing lower on standardized tests compared to the ENPs prior to the intervention. Secondary measures of academic success such as attendance and behavior showed no significant difference. By the end of the first semester freshmen year, the RUPs were statistically the same as the ENPs in terms of grades. RUPs' attendance and behavior records were found to fall in between the higher-achieving Proficients and the lower-level ENPs. Science grades for RUPs during the first semester were higher than the ENPs but any degree

of higher achievement was diminished by the end of the year.

RUPs demonstrated consistent to increasing degrees of academic connectedness from the summer through freshmen year. ENPs and Proficients showed decreased academic connectedness from the beginning to the end of freshmen year. One posited explanation for the RUPs steady connectedness scores may be adjusted expectations for freshmen year. This theme emerged from the focus group interviews with RUPs and ENPs in the fall and in the spring.

All three groups, RUPs, ENPs, and Proficients, showed a strong correlation between academic connectedness and science learner identity. Similar to attendance and behaviors, RUPs started freshmen year demonstrating science learner identity in between the Proficients and the ENPs. RUPs with higher scores than ENPs diminished throughout the course of freshmen year.

Other demographic variables were investigated. Science learner identity in the fall showed no significant difference based on race regardless of participation in the summer intervention. However, by the end of freshmen year, interest in science showed stratification between overrepresented and underrepresented populations. Grades showed a widening divide between Proficients and at-risk groups throughout freshmen. Possible causes and recommendations are discussed.

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CHAPTER ONE

Rationale and Statement of the Problem

Success in Freshmen Year: Key Components and Barriers

Success in freshmen year is paramount to success in high school. Early success lays a foundation for a positive pattern of behavior for the student to follow throughout the rest of high school. Likewise, underperforming during freshmen year digs a metaphoric hole that the student must climb out of without the benefit of established positive behaviors. The importance of early success has reverberating repercussions economically, cognitively, socially, academically, and self-conceptually. The transition to high school provides a key opportunity to optimize prospects of success. Possessing a sense of connectedness and understanding one's self as a learner may be the keys to ensuring success early in high school. Before exploring the research to support these claims, two short vignettes may help in framing the larger issues. Both of these stories are true with the exception of the names of those involved.

Vignette 1

Ted came into his freshmen year for the second time with an IEP and a team of teachers and social workers advocating for him. He'd failed some classes in 8th grade but was promoted to high school so that he could stay with his cohort of peers. Now that cohort had passed him by and progressed to sophomore year.

Academically Ted was strong enough that he could keep up with the peers in his class when he wanted. However, not turning in assignments or taking up his teachers on offers for extra help had caused him to fail the majority of his classes during his first freshmen year. Worse still, Ted had begun showing up to school high and rumors that he was regularly smoking up began to circulate.

Ted noticeably withdrew from his classmates and teachers in school despite repeated attempts to get him to personally connect to the classroom climate or connect with his peers. By the time he reached the spring of his third year of high school he had barely accumulated enough credits to be considered a second semester freshmen. At an IEP meeting with his frustrated mother, he was asked what he'd like to do with his life. He vaguely responded that he wanted to keep living at home and playing video games – maintaining the status quo.

A few weeks later, Ted's grandmother was due for a life-saving operation due to a heart condition. Ted's mother had been saving for months and pulled out what little savings she had for the operation. When his mother was at work, Ted took the money from the house and bought a substantial amount of pot along with a few pairs of sneakers. He denied all of it until the dean of students was able to return the shoes and get most of the money back.

Ted was outplaced for a period of time to get more support but shortly thereafter, Ted stopped coming to school.

Vignette 2

Mike had a track record of disruptive behavior and low academic achievement. The transition from 8th grade to 9th was particularly tough for him since he was leaving Mr. Maxwell, his science teacher during 7th and 8th grade with whom he had a strong relationship. Mr. Maxwell looked out for Mike for two years and anytime he had an outburst in a class, Mr. Maxwell was there to help Mike calm down and think through his actions and their future repercussions. Mr. Maxwell talked to Mike's mother nearly every day even without Mike knowing.

During the spring of Mike's 8th grade year, Mr. Maxwell suggested that Mike take part in a summer program to help students prepare for freshmen year. Mike begrudgingly agreed. With Mr. Maxwell not there any more, Mike's trepidation made him perceive much of what teachers said to him as an attack. His behavior had become much worse and he was spending a lot of time out of the classroom in the office for discipline reasons. His outbursts came to a hilt one day when he told his teacher, "I hope you die," and "You should just go kill yourself." One of the program administrators, Mr. Sanders, reached out to his mother again but this time, she mentioned Mr. Maxwell. The next day, Mr. Maxwell came to the summer program and sat down with Mike and Mr. Sanders. Mr. Maxwell, who knew Mr. Sanders for years, was able to vouch for him and explain that he was going to be a great advocate at the high school.

By the fall, Mike talked to Mr. Sanders regularly and started connecting with some of the other teachers at the school. Several of those teachers had also taught

Mike that previous summer and came in with the rapport from the small-class-sized summer program as opposed starting to build a relationship in the large high school. Plus, Mike told Mr. Sanders that he had learned some of the things they were doing in class during the summer. Mike's behavior improved dramatically from the summer to the regular school year and his mother reported that he's more talkative at home.

First semester, Mike passed all of his classes with C's. By second semester he started to slip and failed history class during the 3rd quarter. Mike told Mr. Sanders about his trouble in history and Mr. Sanders responded by giving up part of his free period everyday to check in or tutor Mike. Mr. Sanders just recently reported back to Mr. Maxwell that Mike is on track to graduate high school on time.

Anecdotal Lessons from the Vignettes

Some stark contrasts between Ted and Mike are clear in the two vignettes. Strongest amongst the contrasts is the degree to which the two students are willing to connect to the world around them. Ted repeatedly withdrew from his classes, his peers and even his family. Despite attempts by all the people in his life, Ted did not engage or take ownership of the direction of his life. "It is not enough to feel as if teachers care about you – the real question is: Are you turning to them for support? Do these feelings of caring or belonging lead you to take action and engage the person or place?" (U.S. Department of Education, 2009, 2). Ted's answer to the question about what he wants to do with his life is informative. His desire to maintain the status quo suggests that Ted has not yet developed enough of a sense

of self to fully comprehend himself in the future. The drug use and video games suggest that he is seeking escape from in his day-to-day life. The tragedy about the story is a combination of not being connected to others in his life and not being connected to his self in the present or future.

Mike's story begins with at least one strong connection with Mr. Maxwell. Through a small intervention during a potentially tough transition, that connection is expanded to Mr. Sanders and other teachers. The connection with his home life also seems to be strengthened. Most telling though about Mike's story is that when he failed a class in the third quarter, Mike brought it to the attention of Mr. Sanders. Clearly Mike's degree of connectedness is significantly higher than Ted's and as a result, Mike has been much more successful than Ted during freshmen year and later in high school.

Defining Success

As seen in the vignettes, Mike was more successful than Ted in multiple contexts and his connectedness was a key factor. Increasing connectedness to teachers and to school has been an indicator of higher academic performance (Karcher, 2011). However, success can be defined in a myriad of ways from passing classes, to graduating high school on time, to securing gainful employment in a field of the individual's choosing. Long-term success may be perceived as the ability to support a family, a future family of kids yet to be born or a current family trying to get by.

Regardless of these options, all of them contain the constant that success has a temporal aspect innately associated with it. Attained success requires a reflection on accomplishments. Future success requires the ability to see far enough into the future to explore possibilities. When a student is being successful, that student is acting in a way towards an end goal.

One measure of success is academically through coursework. Comparing student grades in the same or similar classes provides a quantifiable, objective measure to compare academic success or academic achievement. However, even within academic success, the mechanisms contributing to that success are complicated. At least one obstacle is clear. Research has shown that students from lower socioeconomic status (SES) backgrounds are more likely to be academically at-risk (Lee & Burkham, 2002).

SES status is not the only factor contributing to academic success. Roeser & Eccles (1998) conducted a longitudinal study of 7th to 8th graders and their perceptions of their classroom environment. They concluded that students who felt their efforts were valued by teachers, responded with increased confidence in themselves as learners. Further, as students developed a higher perception of their academic competency, behavior issues and truancy declined leading to an overall increase in academic achievement. Similar findings are supported by research. Bryk and Thum found, "Absenteeism is less prevalent in schools where faculty are interested in and engaged with students and where there is an emphasis on academic pursuits" (Bryk & Thum, 1989, 375). These studies suggest that there are

significant indicators of success regarding student learner identity, behavior and attendance.

Since success is defined in so many ways, multiple measures of success should be concurrently explored. Factors measuring success during freshmen year can be described in terms of academic outcomes, non-academic outcomes and secondary academic outcomes. Respectively, those metrics can be described as grades, behavior/disciplinary records and attendance records. The research suggests that these metrics are influenced by perception of the self as a learner and degree of connectedness, all of which will be explored in chapter two.

For the purposes of this study, success has a distinct temporal aspect. Students' degree of success is a continual fluctuating spectrum factoring academics, behavior, and attendance. Success is further determined by connectedness to the self in the present and future, as well as connectedness to school, family and friends. Being successful is multifaceted with interweaving components. This study will view success as a dynamic state of being successful, or succeeding, at any one point in time in regards to academics, behaviors, attendance, connectedness and learner identity.

The Importance of Freshmen Year

Freshmen year represents a confluence of transitions in the life of an adolescent. Success, aided by connections during this pivotal year, will have a lasting impact on the trajectory of a student's life. The next five sections outline the

importance of being successful in the face of five key areas: economic, cognitive, academic, social, and individual. After exploring these complicated areas, some of the barriers to success will be addressed and an intervention plan will be explored. The chapter will close with research questions to be explored throughout the remainder of the study.

The Importance of Freshmen Year – An Economic Argument

Transition to high school for under-achieving students is one of the most important academic transitions in their life. "Negative effects in freshmen year put students at high risk of not graduating, which later prevents them from participating in the mainstream economy and larger society" (Allensworth & Easton, 2007, 4). As of 2011, 6.7 million youth, aged 16-24 years old, were not in school or in the job market often for lack of learning employable skills. Belfield, et al. define this "disconnected" cohort as "opportunity youth" because of the missed economic opportunity for the country by not "accumulating human capital in school or college nor accumulating labor market skills by working" (2012, 5). One of these students who drop out shortly after his freshmen year causes "an immediate taxpayer burden of $13,900 per year and an immediate social burden of $37,400 per year (2011 dollars)" (Belfield, et al., 2012, 2). Aggregated for the lifetime population of 6.7 million youth amounts to a taxpayer burden of $1.56 trillion with an additional $4.75 trillion in social costs (Belfield, et al., 2012, 2). The economic repercussions linked to academic progress are felt far beyond the individual student.

A mere 68% of rising 9th graders graduate high school on time (Wiles and Bondi, 2011, 239). Allensworth and Easton report that remaining academically "on-track" during freshman year is the primary indicator of high school completion. "Inadequate credit accumulation in the freshman year, which usually results from course failures, is highly predictive of failing to graduate four years later" (2007, 1). In the urban district studied by Allensworth and Easton, a "bottleneck" (2007, 4) effect occurs during freshmen year. More than 50% of freshmen received at least one F in a class causing them to be significantly less likely to graduate on time (Allensworth & Easton, 2007). In *The Pivotal Year*, Black argues 9th grade is the most important year of high school but a "bulge" in the student enrollment in 9th grade indicates that more and more students are being forced to repeat this year rather than earning promotion to 10th grade (2004, 43).

Lack of preparation for freshman year is a major problem. In the diverse, urban district of Cambridge, Massachusetts, approximately 53% of the incoming freshmen class for the 2014-15 school year received a score of needs improvement or warning on their 7th grade MCAS in math, English Language Arts (ELA) or both (Cambridge Public Schools Student Information System). In 2013, Cambridge Public Schools averaged $27,474 per pupil per year (MA DOESE, 2014). Considering the importance of staying "on-track" during freshmen year, freshmen high school teachers are tasked with bringing these underachieving students up to grade level or costing the district, the students, and society as a whole, exorbitant amounts of money.

The Importance of Freshmen Year – Cognitive Development and Dissonance during Freshmen Year

Piaget noted that as children begin high school, they are moving from a concrete operational to formal operational stage. Most importantly, this stage is a transition toward increased abstract thought while being able to identify with a platonic ideal state of right and wrong (Woolfolk, 2004). This transition is supported by cognitive research that states during this phase of development, students pass through a period of rewiring of the frontal lobe. Throughout junior high, ages approximately 11-14 years old, the adolescent brain undergoes major reorganizing (Sousa, 2006; Feinstein, 2009). Investigating the rewiring in the brain helps contextualize and explain seemingly irrational teenage behaviors. In particular, the emotional and rational centers within the brain have differing developmental rates, which may explain some heightened emotional reactions combined with only the beginning of rational arguments.

Some of the key components operating in the brain are the limbic system and the frontal lobe of the cerebrum. The limbic system, among other functions, controls the majority of the emotional aspects of the brain. This was once thought of as a separately functioning part of the brain because of its deep internal structure, but a recent study has shown significant interaction between the limbic system and the rest of the brain. Comprised of the thalamus, hypothalamus, hippocampus and amygdala, the limbic system is frequently oversimplified and called the old mammalian brain. Particularly relevant, these four components play a key role in

processing new information as it enters the brain. The thalamus sorts new sensory information into the appropriate region of the brain for processing while the hippocampus converts information from working memory into long-term memory (Sousa, 2006, 18-19). The hippocampus plays a major role in education since this part of the brain is directly responsible for filing information into long-term memory. The amygdala controls much of the emotional programming of the brain and makes distinct connections between heightened emotional states and memory. This is particularly useful for recall of significant emotional moments and lessons throughout one's lifetime. Altogether, the limbic system has an important dual role in education, processing information for long-term storage while earmarking emotional connections (Sousa, 2006).

The frontal lobe of the cerebrum is a different story altogether. This region of the brain is the last to fully develop and is not mature until near the age of 30. Most importantly, this region provides the groundwork for abstract and rational thought processes. Starting around the time of entrance into high school, the teenage brain begins an intensive process of pruning unused neurons. Cells that are being underutilized are signaled to undergo a process called apoptosis, or cellular suicide. This clears room for the remaining cells to make more dendritic connections (Feinstein, 2009, 9). In other words, since the frontal lobe plays such a crucial role in the expression of one's personality, this period of time is pivotal in establishing an identity. Erickson identified this as the adolescent stage of identity versus role confusion (Woolfolk, 2004). As the pruning continues, new neural

pathways develop and an enhanced sense of rationality gradually emerges. The redesign and new pathways occurring in the frontal lobe will continue to increase neural plasticity for several years beyond high school (Sousa, 2006).

Juxtaposing the developmental paces of the limbic system and the frontal lobe provides remarkable insight into the teenage brain. While the limbic system is fully functional around the age of 14 years old, the frontal lobe is just beginning its own overhaul (Sousa, 2006, 26). Since the limbic system is the emotional center of the brain and the frontal lobe controls rationality, the teenage brain becomes exaggerated in favor of emotion with genuine lack of temperance through rational thought. Oversimplified, emotion trumps rationality. Different stages of development between these two brain regions help explain why a teenager may overreact to a personal situation. Anecdotally sometimes teenagers react to seemingly minor situations as if it's the end of the world because to them, there is not much difference.

The cognitive dissonance created during this rewiring has ethical repercussions also. In an ethical sense, "teenagers will climb the moral ladder only as their frontal lobes develop" (Feinstein, 2009, 49). In terms of pedagogy, the teachers and adults in the teenager's life play a fundamental role in modeling appropriate rationality. "Everything we do, then, as teachers, has moral overtones" (Noddings, 1984, 474). Structures, routines and logical consequences regimented with explanation to the teenager help the natural development of these rational and even ethical processes. Further, if the adolescent is explicitly taught what is

occurring within his or her own brain, the teenager can then recognize the importance of structures within the school.

The Importance of Freshmen Year – Academic Transition and Academic Records in High School

Academically, content naturally becomes increasingly more complex with abstract concepts to be processed in the frontal lobe. However, transitioning from grade school to high school is accompanied by a new stress on achievement . The local public high school is required to educate students at a secondary level regardless of performance in K-8 schooling. Meaning the actual letter grades earned in K-8 have no promotional repercussions for the vast majority of students. In regards to the gap summer between 8th and 9th grade, two important aspects need to be analyzed: the past and the future. First, social promotion policies potentially cause knowledge gaps for the students leaving 8th grade. Second, student grades are compiled into a permanent record that may have implications on post-secondary opportunities.

Grade retention is "the practice of requiring a student who has been in a given grade level for a full school year to remain at that level for a subsequent school year" (Jackson, 1975). Grade retention maintains accountability by ensuring that students can only move forward after mastering the knowledge and skills needed to be attained at that particular grade level. Alternatively, social promotion maintains that remaining as part of the cohort of students is better for the student

socially which will then translate into improved performance in school. In the extreme, this means that a student who actually failed all of his or her courses throughout elementary and junior high school could be promoted to high school with his or her age group.

The advantages and disadvantages of social promotion versus grade retention have been long debated with general public policy oscillating like a pendulum (Brophy, 2011). The proponents of social promotion argue the social stigma associated with being retained, coupled with only short-term academic improvement for the student, do not warrant grade retention. Retained students are also more likely to struggle with identity issues (Holmes, 1989) and experience emotional distress (Resnick, et al., 1997). However, those in favor of grade retention, including Presidents Bill Clinton and George W. Bush (Brophy, 2011), claim that adherence to high standards mandate eliminating social promotion. School districts that have attempted to universally adhere to this find themselves spending exorbitant energy and resources on select students because those students are attending the same class more than once. Besides the obvious monetary expenditure of educating a student at the same level twice, these students may exhibit increased behavior problems (Jimerson, 2001). Often, these rigid districts are forced to either resort to a return of social promotion or a lowering of standards by grade level to ensure all students have met the lowest common expectations for promotion. Ironically, in this case, the lack of social promotion can cause a lowering of standards overall (Jimerson, 2001).

E.D. Hirsch fervently argues that the non-grounded standards surrounding the "endemic" (Hirsch, 1999, 4) of social promotion are a "metastasis" (Hirsch, 1999, 4) of progressivist ideals that have led to an overall decline in American education. By not holding students stringently accountable for learning particular facts in particular grades, the doorway is opened for holes in the education system. Therefore grade level is no longer indicative of academic ability in this educational pluralism, and graduation no longer yields meaningful diplomas (Hirsch, 1999).

Hirsch presents a convincing and powerful argument but overall the research shows that grade retention does not work and social promotion is more effective in the long-term. A meta-analysis of the 20 studies from 1990-1999 concludes that 16 (80%) of the authors find that "grade retention is ineffective as an intervention for academic achievement and socioemotional adjustment" (Jimerson, 2001). In a follow up study appropriately entitled *Winning the Battle and Losing the War*, Jimerson et al. (2002) explored the relationship between grade retention and dropout status and determined students who are retained are at greater risk of dropping out in high school. "Several studies reported that grade retention was found to be the strongest predictor of later dropout status" (Jimerson, et al., 2002). After grade retention, excessive absences and then frequent school changes were the next two strongest indicators of later potential dropout. Grade retention increased the chances of dropping out by 30%-50% (Jimerson et al., 2002). Freshmen year of high school is rendered even more important since the research concludes that grade retention is not an effective approach.

Of course, reasonable alternatives to the long-standing debate between social promotion and grade retention have been suggested in the middle ground, such as redesigned school structures, concentrated student interventions, and augmented teacher professional development including enhanced assessments for informed practice (Darling-Hammond, 1998). Hirsch lambasts the notion of redesigning school structure as a fallacy of developmentalism saying "multiaged education" neglects accountability by slowing down the rigor during critical cognitive developmental stages (Hirsch, 1999, 91). Hirsch harangues restructuring schools and logically this would be the most difficult approach out of Darling-Hammond's suggestions.

Darling-Hammond's (1998) two other suggestions seem more reasonable. A combination of targeted teacher training for intense student interventions to increase content knowledge ameliorates a lack of "intellectual capital" (Hirsch, 1999, 20). "Learning builds on learning" (Hirsch, 1999, 89). One possible way of creating concentrated student interventions is during the transition-to-high-school summer. A program designed with curriculum especially for those students with less "intellectual capital" (Hirsch, 1999, 20), needs to have an intense content component that should be clearly linked to the curricula during the school year for maximum effect (McCombs, et al., 2011). Such a program will be the focus of this study and will be described in more detail later.

Being cognizant of the repercussions of social promotion without Darling-Hammond's interventions, a significant number of students are ill equipped to

function at a high school level. By lacking the "intellectual capital" (Hirsch, 1999, 20) to be successful, these students quickly fall behind and do not make sufficient connections to prior knowledge. Staggeringly, "Ninth graders were almost five times as likely to receive failing grades (26%) as 8th graders (6%)" (Black, 2004, 43). Unfortunately for this population of students, high school grades are carried into the future. These grades will be reviewed after graduation for many post-high school programs. Many of these students have aspirations of attending college but lack the ability to receive acceptance because of poor GPAs. A hole that is dug freshmen year reflects ¼ of the GPA throughout high school. These same students may not possess the cognitive foresight to connect the value of GPA with future planning since that part of their brain is yet to fully develop (Willingham, 2009). Hence the notion of a "bottleneck" is created during freshmen year increasing the likelihood of not graduating on time (Allensworth & Easton, 2007, 4).

Social promotion is not going away and nor should it according to the research (Jimerson, 2001; Jimerson et al. 2002). The summer prior to 9th grade affords an opportunity to employ Darling-Hammond's (1998) suggestion and help students become aware of their studentship responsibilities while bringing them closer to grade level. The targeted intervention must include a future-oriented component so that students can understand the temporal nature of success.

Motivation for students to work with rigor during the summer months is another issue. A possible incentive is to pay students to participate in a summer program. Connecting payment to schooling may assist the student to internalize the

skills needed to be successful. Dewey (1997) speaks of the importance of motivating students and providing real world opportunities to practice. Since one major component of the math curriculum would include concepts such as number sense and operations with fractions, the students' own paycheck provides opportunities to discuss such numbers in a very real way.

The Importance of Freshmen Year – Social Transition – Renaissance of Identity

"Education is essentially a social process" (Dewey, 1997, 58) and even social promotion stresses the individual as part of a larger community. The notion speaks to the individual's development within that community as an important aspect of adolescent growth. Clearly each individual needs to develop mechanisms to relate to peers both as a member of society and to form healthy interpersonal relationships. Through a balance of "social needs" and "integrative needs" (Tyler, 1949, 8), the adolescent strives to reconcile his or her own place within a larger society. In terms of cognitive development, "adolescence is when the brain begins to develop templates for adult relationships" (Feinstein, 2009, 49). Regardless of whether the benefits of being part of a grade school cohort is more beneficial than curriculum comprehension, the social transition between 8th and 9th grade is a significant jump in the life of the adolescent.

This social transition into high school is supported by cognitive research as well. During this period, the teenage brain passes through a period of increased "novelty-seeking" (Spears, 2000; Sousa, 28, 2006). Teens are more likely to

encounter a variety of new experiences by associating with their fellow novelty-seekers rather than continuing to associate with their established family. Karcher (2011) classifies established family and social norms as conventional forms of connectedness whereas activity engaging with friends as unconventional connectedness. Conventional and unconventional connectedness are both healthy and necessary parts of adolescence (Karcher, 2011). Finding ways to increase unconventional forms of connectedness is effectively hardwired into the teenage brain.

Possibly as an evolutionary mechanism, the teenage brain overemphasizes the neurotransmitter rewards received from peer approval and acceptance during this time period (Dobbs, 2011, 55). Roughly, the adolescent brain is addicted to peer approval and actively seeks out the novelty that comes from being around peers. Moving forward, this future adult's success in the world will be determined in large part by the ability to interact with peers. An augmented practice run during this identity stage is incredibly valuable later in life. Not only are teenagers social creatures, they are literally neurologically demanding increased novel interactions. The transition into high school is a key time to encounter a new cohort of individuals who are also trying to accomplish the same end goal.

Including and extending beyond the peer cohort, the adolescent needs a context within which to try out this new identity. The teenager must feel a sense of belonging and ownership with the group. Teachers frequently call this student buy-in (Crawford, 2008). Buy-in has the capacity to transform a classroom or program

from a combative teachers-versus-students atmosphere to a collaborative teamwork of youths and adults working together towards a common purpose. Buy-in is one of the most elusive elements within a classroom but perhaps the most powerful. Beginning on day one by meeting students at the door, buy-in is an ongoing process of making interpersonal connections within the classroom (Wong & Wong, 2004). As students are making a social transition to high school, creating buy-in extends an invitation for students to be welcomed into another form of conventional connectedness (Karcher, 2011).

Student buy-in is facilitated by the teacher (Crawford, 2008). The importance of the student-teacher relationship is fundamental and the role of the teacher as "one-caring" (Noddings, 1984, 469) is the most important role the teacher offers. The teacher demonstrates this "one-caring" (Noddings, 1984, 469) through relationships both on the individual level and the collective whole for the group. Establishing a positive classroom culture is quintessential to the success of any classroom and extends beyond the 8th-9th-grade summer.

Social exploration and varying rates of the frontal lobe and the limbic system (Sousa, 2006) produce a unique combination of possibilities. Buy-in to the cognitively-needed social structure within the classroom, affords the adolescent an environment to fail and try again safely. As previously suggested, when the teenager begins to buy-in and believes the teacher is there to help, the outcomes can be extremely positive (Roeser & Eccles, 1998).

The Importance of Freshmen Year – Individual Transition – Self-Efficacy as the Active Agent of Self Identity

Leaving 8th grade, the adolescent departs from established identity norms within their old school. Entering that summer and into the following school year, the student is surrounded by a different composition of peers. The significant change in the group dynamic provides the opportunity to try out a new identity. Erickson looks at this stage as an important period where the adolescent tries out several different identities and explores various roles within the community. The healthy individual uses this time period to emerge with a strong sense of self in terms of beliefs, independence and control (Woolfolk, 2004). With the convergence of a new peer cohort and the stage of psychological challenges occurring within teenagers, this time is an opportunity for self-reinvention. Research shows, "an individual's understanding of their identity is actually a complex set of interconnected identities that are malleable and relevant in guiding attitude formation in different settings" (Fraser & Ward, 2009, 4). Harnessing a sense of connectedness during the transition is crucial to later success. This idea of connectedness will be fully explained later as a conceptual framework for this research study.

Unlike other key transitions in the teen's life, such as beginning school for the first time, this is one of the earliest periods when the student develops a sense of self-efficacy that can be directed from within. The adolescent's sense of the self as a learner is developing and the student assigns meaning to successes and failures

(Fraser & Ward, 2009). In other words, the teenager develops internalized views of the self as a learner with respect to both peers and to content. In particular, emerging research in the field of science learner identity is exploring how conceptualizations of the self, in relation to using and thinking about science, impact potential career choices (Fraser & Ward, 2009). Science learner identity, like connectedness, is not a fixed property within an individual. More about science learner identity will be discussed in chapter two.

Increased self-efficacy in transitioning to high school is a crucial developmental step. Understanding of one's self as a learner has implications for current and future achievement (Eccles, et al., 1983). The internalized understanding of the self as a learner is accompanied by an increased desire for independence and self sufficiency (Feinstein, 2009). Feinstein found "seventeen- and eighteen-year-olds are about seventy percent more independent than twelve- and thirteen-year-olds" (Feinstein, 2009, 59).

This transition, which provides adolescents with more independence and "emotional autonomy," (Feinstein, 2009, 59) comes at a time when students are decreasing conventional forms of connectedness, such as family and school, and increasing unconventional connectedness, such as relationships with friends and the neighborhood (Karcher, 2011). While unconventional connectedness is certainly a part of development, maintaining conventional connectedness can mitigate some of the risk factors associated with the seventy percent increase in independence from pre-teen to mature teen (Karcher, 2011; Feinstein, 2009).

Conventional connectedness relationships foster self-efficacy (Karcher, 2011; Roeser & Eccles, 1998) and those important relationships have implications down the road (Fraser & Ward, 2009). Buy-in is a social scaffold that provides an inroad to build those relationships while making students feel they have a more autonomous role in the classroom (Crawford, 2008). Therefore buy-in meets the adolescent's desire for independence (Feinstein, 2009) while still supporting conventional connectedness (Karcher, 2011). In other words, the more a student can build conventional relationships, the more likely that student is to have a deeper understanding of the self as a learner (Karcher, 2011; Roeser & Eccles, 1998; Eccles, et al., 1983; Fraser & Ward, 2009). As seen in the vignettes in the beginning, Ted withdrew during the transition while Mike increased his degree of connectedness. Through his high degree of connectedness, Mike developed a healthy sense of self-efficacy for both his present and future self.

Addressing the Transition Barriers – A Plan for Intervention

As discussed, the transition summer between 8th and 9th grade provides a significant opportunity to help students prepare for high school, which increases their chances of success thereafter. Specifically targeting at-risk students before high school also combats the likely academic regression during the summer. Commonly termed summer slide, summer academic regression has been well studied and generally has been found to have a larger impact on students from lower SES backgrounds (Cooper, et al., 1996; McCombs, et al., 2011; Allington, et al.,

2010).

In Cambridge, the Rise Up program is designed to be a comprehensive strategy to reach these at-risk students. The program claims to make strides towards high-school readiness but to date has very limited quantifiable evidence. Research shows that significant gains can be made through targeted intervention in the summer (McCombs et al., 2011). However the literature is lacking in determining the correlation between summer programs and "secondary academic outcomes, such as school attendance and graduation rates and non-academic outcomes, such as reductions in juvenile delinquency, improved nutrition, and increases in exercise" (McCombs et al., 2011, xv). Among the factors suggested, behavior and school attendance has a direct correlation to academic success (Roeser & Eccles, 1998; Allensworth & Easton, 2007).

Slightly more than half of the incoming freshmen during the summer of 2014 were eligible for the program based on their 7th grade MCAS scores in math and ELA, SES background, and IEP status. Given the importance economically, cognitively, academically, socially, individually of starting high school on a positive note, actively reaching out to eligible students is nearly a moral imperative for a comprehensive school district interested in the success of all students.

Rise Up Program Synopsis

The Rise Up program is designed to help at-risk students during the gap summer between 8th and 9th grade. For four weeks in July, students focus on

connecting with peers and teachers with whom they will work in the fall. The program provides both remediation of skills and a preview of the content for the upcoming school year. The curricula of the academic classes are closely linked with the regular school year and taught by many of the same teachers that the students will have for class.

The program consists of four periods throughout the day, not counting free breakfast and free lunch. Fitness is the first period of the day for one hour, which introduces the students to a variety of sports available at the high school that the students may have not previously considered. Several of the high school coaches assist with the program to introduce sports such as rugby, crew, football, and track.

Students attend three 65-minute academic classes throughout the day including math, science and ELA. Class size is capped at a 10:1 student to teacher ratio to help differentiate instruction. Math and English classes utilize summer work packets provided by the academic department chairs to help build the skills needed to be successful and align with the fall curricula. In 2016, the English class included reading current events using the website newsela.com, which adjusts the news articles to the students' lexile scores. Science class is problem-based and also previews the content that students will encounter during their freshmen physics class.

Imagine the Future is the final component of the Rise Up curriculum. This one-hour class invites students to reflect on where they and their classmates come from, in order to gain greater understanding and respect for the wide range of

diversity within the school community. Imagine the Future connects students with the numerous opportunities available at the high school and promotes students becoming involved early in the fall. Further, the class explicitly teaches students positive study skills and organizational strategies and provides an additional form of buy-in for the students in the program overall.

Rise Up students can either earn 10 elective credits at the high school for participation or may use Rise Up as a worksite for the Mayor's Summer Youth Employment Program, MSYEP. Students enrolled in MYSEP during the summer of 2016 earned $10/hour for up to 120 hours during the summer. Both options provide extra incentive for students to enroll in Rise Up. Credits and pay are directly linked to attendance and active participation in the program and are prorated accordingly. All sections of Rise Up will be explained and linked to the research in greater detail in chapter two.

Summary Statement of Problem and Hypothesis

Given that freshmen year is so crucially important economically, cognitively, socially, academically, and self-conceptually, failing to maximize opportunities for success of at-risk students is a problem. This study hypothesizes that targeted intervention prior to freshmen year can increase students connectedness and enhance science learner identity.

Research questions for this study include:

1. ***What effect does Rise Up have on at-risk students grades, sport participation, attendance and behavior?***
2. ***How does a summer intervention program prior to freshmen year impact connectedness in high school for at-risk students?***
3. ***Does the degree of connectedness in the academic ecological world correlate to science learner identity?***
4. ***If Rise Up is having an impact, what mechanisms may be contributing to that impact?***

CHAPTER TWO

Establishing Conceptual Frameworks and Exploring the Research Supporting Rise Up

Connectedness Conceptual Framework

Lerner, Fisher & Weinberg (2000) identify 5 C's to target as outcomes for successful youth development programs: competence, connection, character, confidence, caring/compassion. Connection in particular is useful as a predictor of numerous, "developmental competencies as well at risk behaviors" (Karcher, et al., 2008). The conceptual framework of connectedness can be measured to explain several aspects of adolescent life relating to "belongingness and relatedness" (Karcher, 2011, 5) but extends beyond those notions.

Connectedness is multifaceted and includes activity and perception of the self in the present and the future, relationships with family, social interactions and academic pursuits. In order to explain how connectedness is useful, this chapter will explore the ecology of connectedness, the origins of connectedness and multiple facets of connectedness, and the Hemingway Measure of Adolescent Connectedness.

Reason to use Connectedness scale

As discussed in chapter 1, some of the barriers to students being successful freshmen year involve individual reinvention as well as changing social dynamics. Becoming connected to a new academic environment is much more complicated

than Noddings' notion of the "one-caring" (1984, 469) from the teacher's end of a relationship. Connectedness extends past any one relationship into the entire adolescent ecological environment. Connectedness cannot be gauged by a sense of feeling but rather an active engagement on the part of the adolescent. Connectedness is the, "giving back to, being involved with, and investing in oneself in an effective manner in places activities as well as in relationships with other people" (Karcher, et al., 2008, 651).

Roth and Brooks-Gunn (2003) looked at multiple youth development programs that addressed risk-behaviors in youth. They concluded that all of those programs addressed connections in one way or another. Most aimed to improve connections with family or peers. Only 17% specifically targeted connections to school. Resnick, et al. (1997) found that connectedness to school is "one of the strongest predictors of adolescent health and risk-taking behaviors in studies using ad hoc measures of connectedness" (Karcher, 2017).

Family, peers and school are all parts of the Hemingway survey (Karcher, 2011). "The Hemingway Measure of Adolescent Connectedness is the only (or one of very few) measures of adolescent connectedness in the published literature that have been empirically tested and found to demonstrate validity evidence beyond face validity" (Karcher, 2017). Given the importance of connectedness (Roth & Brooks-Gunn, 2003; Resnick, et al., 1997), use of a comprehensive validated (Karcher, 2003) scale to measure connectedness may provide a tool to assist at-risk youth with a quantifiable language to gauge progress.

Connectedness & Psychology - Background of Connectedness Development

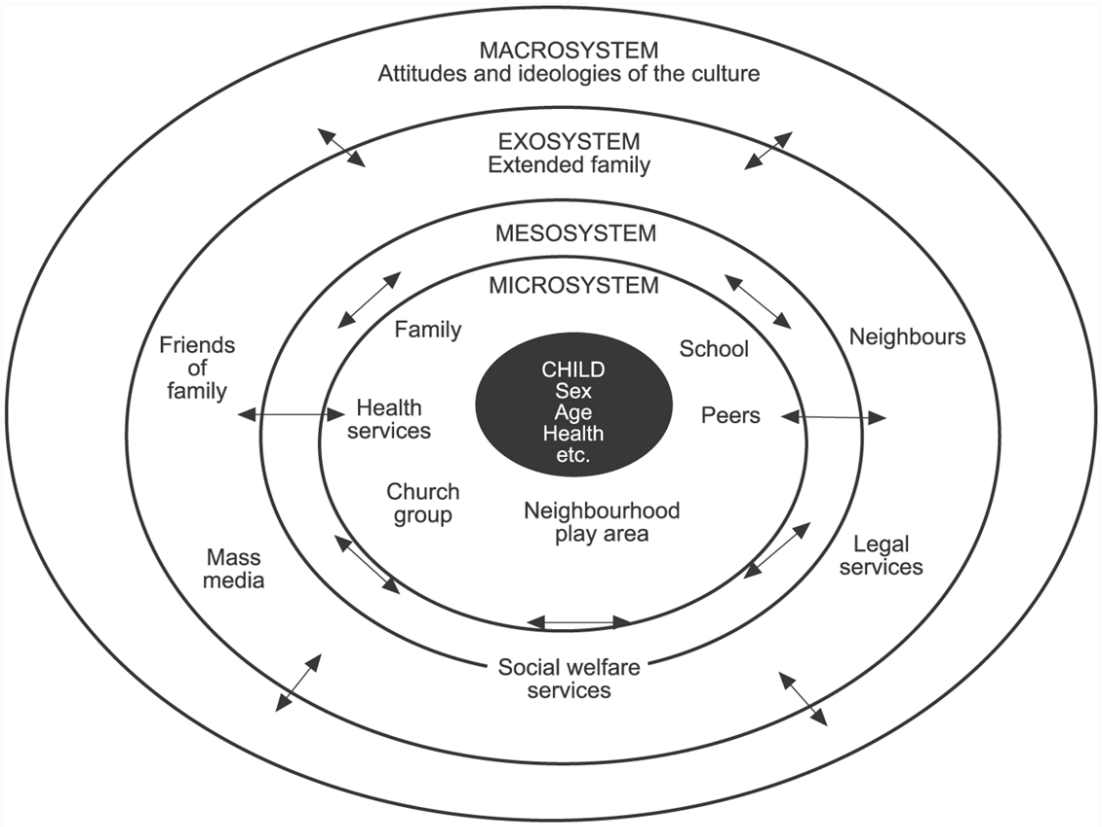
Before delving into connectedness theory and defining the conceptual framework, a background leading up to this framework will be explored. This background is meant to explore some of the psychological underpinnings leading to the conceptual framework and discusses three different schools of psychology. Humanism, developmental psychology and psychoanalysis have all broached related topics in writings from Maslow, Bronfenbrenner and Kohut respectively. The discussion in this section is meant to highlight some of the similarities and differences between connectedness theory and preceding psychology.

Maslow's hierarchy of human needs (1968) places love as third above physiological and safety needs. However in his paper years earlier outlining what would become the hierarchy of needs, Maslow originally talked about "belongingness" (1943, 380) as third (Maslow, 1968). Maslow's paper was intended to "formulate a positive theory of motivation" (1943, 371) aligning with the psychological understandings of humanity at that time. He explains each of the levels of motivation including physiological, safety, belongingness, esteem, and self-actualization. As each level is satisfied, a new higher level emerges. The process of addressing each of the needs is cyclical. As soon as one is met, that level is dismissed in search of the next level. "This is what we mean by saying that the basic human needs are organized into a hierarchy of relative prepotency" (Maslow, 1943, 375). Maslow's humanistic approach states that "belongingness" (1943, 380) is only one step on an inherent drive towards self-actualization. Connectedness theory

recognizes belonging as a need but goes beyond the dismissive, next-level searching that Maslow originally suggested. As will be expounded upon later, an individual's degree of connectedness extends beyond belonging and is in constant flux on multiple fronts. Connectedness is more fluid and more active than belonging to a group but belonging to social and familial groups is part of being connected.

Beyond the cyclical motivation of Maslow and the humanists, developmental psychology helps place connectedness into a larger context or "ecological environment" (Bronfenbrenner, 1979, 3). Bronfenbrenner imagined this "as a set of nested structures, each inside the next, like a set of Russian dolls (see figure 2.1). At the innermost level is the immediate setting containing the developing person" (1979, 3) [see diagram]. The notion of self, as Bronfenbrenner suggests, is at the core of being. All levels moving outward have degrees of interconnectedness relating back to the self (Bronfenbrenner, 1979).

Figure 2.1 - Bronfenbrenner's Ecological Environment Logic Model



Source: Dockrell and Messer (1999, p. 139)

The levels are categorized as the microsystem, the mesosystem, the exosystem and the macrosystem. The mesosystem is designed as the links between the microsystems. Since the self is the core, interventions are often targeted on the individual working within particular microsystems (Dockrell & Messer, 1999, 138-9).

Revisiting Maslow through the lens of developmental psychology helps provide a fuller picture of the self. Maslow's need for love is better understood in Bronfenbrenner's context as the first interaction between the self and others in the

nested Russian dolls analogy (Bronfenbrenner, 1979). The need for love is explained as a need for affection and belongingness both romantically and as a "hunger for affectionate relations with people in general, namely, for a place in his group, and he will strive with great intensity to achieve this goal" (Maslow, 1943, 381). Connectedness theory is interested in measuring the results of that "striving with great intensity" (Maslow, 1943, 381). Striving is a much more active process than belonging, just as connectedness involves active engagement (Karcher, 2011).

Psychoanalysis provides a framework to explain how the self comes to understand the world, which is particularly helpful in flushing out the notion of belongingness. Psychoanalysts heavily weight childhood as having long-lasting impacts on an adult. Kohut's theories on self psychology (1971, 1977, 1984) claim that the self initially comes to understand the world through the two constructs of grandiosity and idealization (1971, 1977). These constructs are pivotal in developing the child's sense of self-esteem through the relationship with the "omnipotently perceived caretakers" (Patton, et al., 1982). Relationships with family, initially parents but later siblings too, are therefore crucial in properly developing the self. Patton, et al. examine Kohut's notion of grandiosity and idealization in their study seeking to help understand the development of a "nuclear self" (1982). They developed a series of scales useful in measuring the cohesiveness of the self for counseling purposes and argue that the reliability of these scales supports Kohut's theory (Patton, et al., 1982).

The framework of understanding the world through grandiosity and

idealization are interesting but Kohut's later addition of belongingness is most useful in understanding connectedness theory. Kohut adds a key component to his theory suggesting that a third self need should be added to the initial two, a need for belongingness (1984). This sense of belongingness is needed to combat loneliness and is composed of three aspects, companionship, affiliation and connectedness (Kohut, 1984).

Lee and Robins (1995) explain Kohut's theory that developmentally children first attain companionship, affiliation and finally a sense of connectedness. Lee and Robbins define connectedness as a stage beyond companionship and affiliation. Companionship is established in childhood usually through relationships with parents as children begin to identify a sense of likeness. Affiliation is the next stage occurring in pre-adolescence where children begin to feel part of a group of similar individuals within a social group. Connectedness, however, occurs as individuals "feel comfortable and confident within a larger social context than family and friends" (Lee & Robbins, 1995, 233).

Lee & Robbins use this backdrop to explore the notion that "loneliness and social support reflect opposite poles of a psychosocial construct of personal attachment or human connectedness" (Newcomb, 1990, 482). Lee & Robbins' study (1995) seeks to determine the reliability and validity of two scales measuring belongingness, a social connectedness scale and a social assurance scale. The goal is to investigate potential measures of belongingness and loneliness within Kohut's framework. Using questionnaires given to undergraduates, Lee & Robbins measure

and support Kohut's theory. Specifically looking at their social connectedness scale, they use measures of "connectedness (4 items), affiliation (3 items), and companionship (1 item). The items portray a general emotional distance between the self and others that may be experienced even among friends or close peers" (Lee & Robbins, 1995, 236). They conclude "social connectedness appears to be related to one's opinion of self in relation to other people" (Lee & Robbins, 1995, 239).

These early attempts to quantify connectedness are helpful in understanding the background in which connectedness theory developed. The underpinnings of connectedness can be understood through the confluence of different schools of psychology. To synopsize, Maslow explains belonging as a fundamental need of all people (1943). Bronfenbrenner contextualizes that need in his "ecological environment" (1979, 3). Kohut demonstrates the development of the need for belongingness and in particular explains companionship, affiliation and connectedness (1984). Altogether, a more complete picture of connectedness emerges with the self firmly positioned at the center needing and seeking a range of social relationships.

Hermeneutic Approach

Keeping in mind the background of connectedness, another key aspect to explore is the temporal nature of connectedness. In order to fully understand the conceptual framework of connectedness, hermeneutics should first be explained.

Hermeneutics is an analytical approach to literature that considers the

moment in time in which it was written. Originally hermeneutics was used to analyze the Bible to discover God's message, which was thought to be hidden over time in the creation of the texts ("the term refers to Hermes, messenger of the Greek gods, and himself god of eloquence and cunning as well as of roads and theft") (Packer, 1985, 1082). Later this same approach was more widely applied to other literary texts (Packer, 1985). Since preceding publications potentially influence a piece of literature and a piece of literature has the capacity to affect later publications, analyses of texts as seen within a moment of time help provide insightful context (Nakkula & Selman, 1991).

In developing connectedness theory, Karcher (2011) draws on the work by Nakkula and Selman (1991). Nakkula and Selman (1991) are utilizing the theories put forth by Heidegger (1926/1962). In *Being and Time*, Heidegger (1926/1962) relates hermeneutical concepts of analysis at a moment in time to the idea that human beings function in the same manner. "Being is one's *interpretation* of one's *connectedness* to the *world* over *time*" (Nakkula & Selman, 1991, 186). A hermeneutic approach, therefore, means that the findings to any study are nested into the larger context of the ever-changing psyche of the human being.

As seen in Lee & Robbins (1995), relationships with others and the concept of self are key to understanding the notion of connectedness. Using Heidegger's "time-oriented concepts," to understand "developing or changing relationships with significant others" (Nakkula & Selman, 1991, 181), connectedness should be approached in a hermeneutic manner.

To help understand hermeneutics and connectedness, looking at an example may be helpful. In one study, Nakkula and Selman (1991) applied a hermeneutic approach to pair therapy to look at the development of interpersonal relationships. They were particularly interested in exploring the changing dynamic of the self while connecting to a peer. Nakkula and Selman drew from Heidegger explaining "development occurs…as one 'reveals' or 'unconceals' progressively more aspects of one's being through connection with others in the activities of living in the world" (Nakkula & Selman, 1991, 187). The degree of revelation of the self suggests that time must be considered when looking at any connection. Time is the context used to explain connections and provide a mirrored glimpse back upon the self. "One's self is most fully understood though intimate and varied connections with another or others in the world" (Nakkula & Selman, 1991, 188).

Nakkula and Selman (1991) describe a variety of connections in their study to help their subjects gain a better understanding of themselves and peers through interpersonal development. The pair therapy uses two 14-year-old boys who are at or above grade level cognitively but are limited by the socio-emotional side. The boys' backgrounds significantly differ and they ascribe attributes to themselves with initially seemingly fixed notions of their identities. Over the course of the first year of therapy, the two boys are placed in a variety of situations together. Eventually progress is made in the therapy as each of the boys takes steps to progress in relating to their peer. Nakkula and Selman (1991) draw on previous work (Selman, 1980; Selman and Schultz, 1990) to establish a scale that quantifies those steps in

more detail. Important to note in the hermeneutical framework is, "Interpretations were at all times historical, never based on discrete momentary interactions; each moment of connectedness was related to those that came before and colored interpretations of connection to follow" (Nakkula & Selman, 1991, 210). Both boys move towards a more complete understanding of themselves by working with a peer.

Nakkula and Selman's study (1991) is particularly useful in its explanation and application of Heidegger's work. "The world, as Heidegger construes it, is the ground from which all data on the self are uncovered, reflected, and at all times, interpreted. It is comprised of the people, tools, and activities through which we connect" (Nakkula & Selman, 1991, 187). Heidegger is suggesting that connection is made in a variety of ways with the world not just with other people as has already been seen but also through the activities that are undertaken.

The historical context for interpretation is important because for Heidegger, being "is inseparable from time" (Nakkula & Selman, 1991, 187). The self retains the past, exists in the present, and holds perceptions of possibilities for the future (Heidegger, 1926/1962). All three states of time need to be considered as part of any human being. To establish a harmonious vision of one's self, an individual must connect the past, present and future.

Connectedness Theory

The goals of the discussions from the previous sections were to explore the background in which connectedness theory was developed and to emphasize the importance of the temporal component of connectedness. Michael Karcher, from the University of Texas San Antonio, has written extensively on connectedness and has developed an empirical (Karcher, 2003) definition explaining connectedness "as the degree of activity and positive affect youth report that they direct toward people, places and things" (Karcher, 2011, 20). The definition takes into account Heidegger (1926/1962) and Nakkula and Selman's (1991)

> hermeneutical ideas that 'human being' is best understood as reflecting youths' interpretations of connectedness to the world over time. Their interpretive framework suggests that researchers and prevention program developers should attend to adolescent worlds and how experiences in these worlds are shaped by time – the past, present, and future (Karcher, 2011, 5).

Karcher's definition is concise and demanding, claiming that connectedness is an active process tied into the youth's subjectively experienced emotions from the youth's perspective. Further, the youth's worlds contain a temporal aspect that needs to be kept in mind during any interpretation.

The world of the youth itself is a multifaceted realm. As seen in Patton, et al., (1982), the youth's developing world begins with the family and eventually expands to peers (Nakkula & Selman, 1991; Selman, 1980; Selman & Schultz, 1990) and other social dimensions such as school (Lee & Robbins, 1995). The interconnected worlds

of the youth could be better described as an ecological landscape (Bronfenbrenner, 1979) in flux at any moment in time (Heidegger 1926/1962). "Connectedness reflects actions, which can be increased or decreased through intervention and attitudes, which can be shaped or developed through intervention" (Karcher, 2011, 8).

Measuring Connectedness

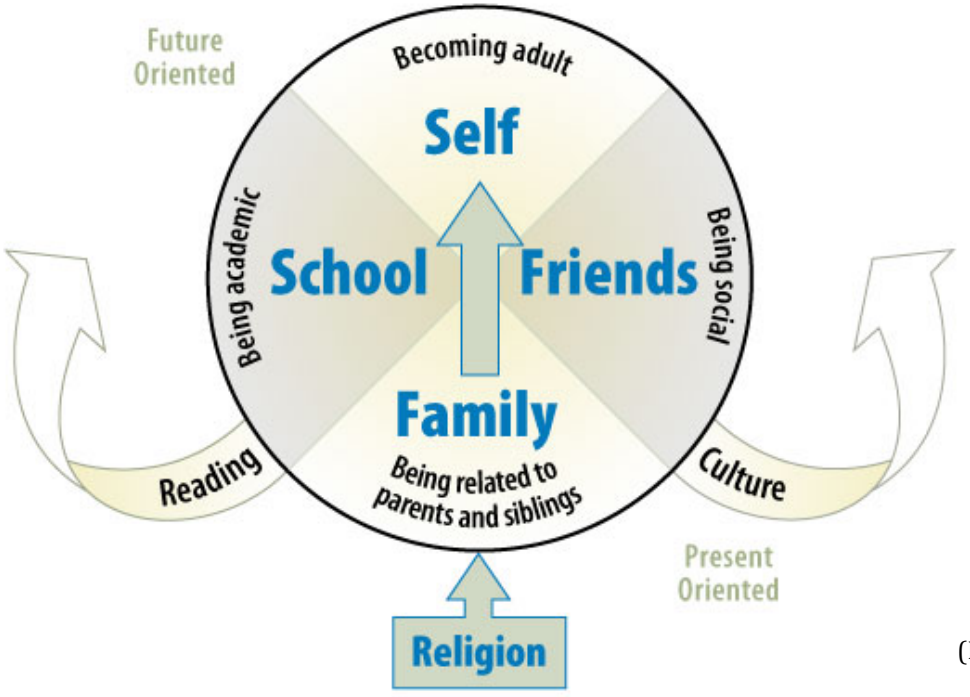
Working in the parameters of connectedness theory, Karcher has developed a scale to help measure the connectedness of an adolescent to all of the differing stakeholders. The Hemingway Measure of Adolescent Connectedness uses 15 subscales categorized into four overarching worlds of connectedness. The four broad categories of connectedness include "being social, being academic, being related, and becoming" (Karcher, 2011, 11). The 15 subscales include "neighborhood, friends, self-in-the-present (self-esteem; identity), parents, siblings, school, peers, teachers, self-in-the-future, reading, kids from other cultures, romantic partner, religion, mother, and father" (Karcher, 2011, 12-14). During this research study, only ten of the subscales will be considered omitting, kids from other cultures, romantic partners, religion, mother, and father. Since the main focus of this study will center around academics, these five subscales are less informative towards the goal of this study.

The four broad categories of connectedness correspond into what Karcher envisions as the four major worlds of the adolescent: friends, school, family, and self.

The subscales can be placed within the domain of these four major ecological worlds of connectedness. The social connectedness ecological world includes the subscales neighborhood and friends. The academic domain includes the subscales school, peers, teachers and reading. The family ecological world contains parents and siblings. The world of self perception includes self-in-the-present and self-in-the-future (Karcher, 2011).

Each of the four worlds is depicted in the figure 2.2 (Karcher, 2011) as a piece of the whole circle. The orientation in the diagram with the arrows moving upward incorporates the temporal aspect of development while being reminiscent of Maslow's hierarchy (1943). Several of the subscales, or affiliated questions, are included in the diagram as well.

Figure 2.2 - Connectedness Logic Model



(Karcher, 2011)

The Hemingway Scale is derived from many of the aforementioned sources including Nakkula and Selman, Bronfenbrenner, Heidegger, Lee & Robbins among others and is therefore theoretically aligned with the conceptual framework established. The subscales address the aspects mentioned about the self, in both the present and future, as well as addressing the various people and structures that interact with the youth. These interactions are categorized into quantitative schemas to describe a moment in the youth's life. After all, connectedness is "a state not a trait, and it is both determined experientially and as a reflection of one's time orientation (e.g., present vs. future)" (Karcher & Lee, 2002). The scale also provides enough flexibility to use particular subscales to focus on particular aspects of connectedness at any point in time.

Increasing connectedness to teachers and to school has been an indicator of higher academic performance (Karcher, 2011) and reduced risk-taking behaviors (Resnick, et al., 1997; Jessor & Jessor, 1977). A longitudinal study using the Hemingway has not yet been conducted to determine long-term outcomes of increased connectedness during freshmen year of high school. However, the Hemingway has been shown to serve as a predictor of positive longitudinal outcomes for college students (Karcher, et al., 2015).

In their longitudinal study following youth from middle school to college, Jessor and Jessor (1977) found growth trends that showed an increase in youth independence, decline in traditional ideology related to achievement value and society as a whole, assumption of a more relativistic and tolerant

morality, attenuation of conventional norms and religious beliefs, increase in peer influence, and increase in problem behavior itself (Jessor & Jessor, 1977).

Not surprisingly as discussed in chapter 1, youth are entering a cognitive developmental phase of "novelty seeking" (Spears, 2000; Sousa, 28, 2006) and are desirous of increased autonomy (Feinstein, 2009). This shift corresponds to Jessor and Jessor's observations.

Relating these findings to the ecological domains of connectedness, the shift observed by Jessor and Jessor can be categorized as either conventional or unconventional forms of connectedness (Karcher, 2017). Conventional behaviors include connections fostered through the academic domain and the familial domains of connectedness. These behaviors are "usually mediated by parental or adult sanctions and governance (Karcher, 2017). Unconventional behaviors are more associated with the social ecological world of connectedness and are more associated with risk-taking. These unconventional behaviors are more likely to occur in the neighborhood with the encouragement of friends when conventional influences are absent. "This distinction between conventional and unconventional connectedness is important because it suggests connectedness may have both protective and risk-promoting properties depending on to whom or to what place the connectedness refers" (Karcher, 2017).

Several validation studies of the Hemingway have taken place (Karcher, 2003; Karcher & Lee, 2002; Karcher & Sass, 2010). Hierarchical arrangements of

the subscales have been suggested as possibility for further exploration but the subscales still provide an appropriate and adequate gauge of connectedness. More importantly, the Hemingway provides insight into how to increase connectedness. Effective interventions should address a broad range of topics, which can be related to the various aspects of the Hemingway's connectedness scales (Karcher, 2011).

Karcher explains the very nature of connectedness is mutable. Intervention programs can have a direct influence on "the degree of activity and positive affect youth report that they direct toward people, places and things" (Karcher, 2011, 20). Keeping that in mind, using the research to design the most effect intervention program for the summer between 8th and 9th grade holds promise to increase conventional connectedness and the associated benefits that come along with it.

Focusing on the Science Classroom

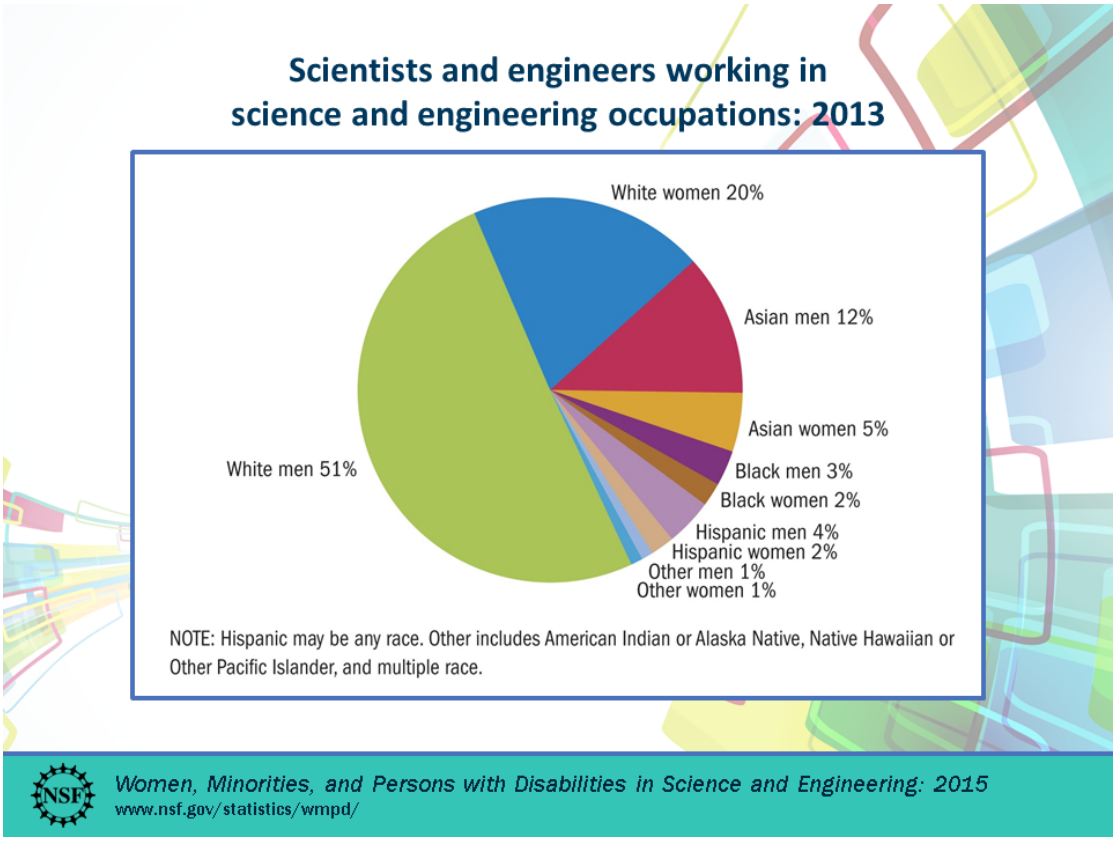
In order to look at students' self-perceptions as a learner, this study will focus on the science classroom specifically. If connections forged in the summer have an impact during the school year, then all classes would likely be affected. Narrowing in on one class may provide insight in a broader context and opportunity for further research. To increase understanding of connectedness and views of the self, student science learner identity will be explored.

This is particularly relevant since the population of this study is largely comprised of minorities. Overwhelmingly, there are glaring racial disparities in the demographics of scientists and engineers. In 2013, 71% of the scientists and

engineers in the United States were white while only 5% were black and 6% Hispanic (National Science Foundation, 2015). The full breakdown is shown in the pie chart.

Addressing this disparity goes beyond equity and social justice. In fact, increasing the diversity in STEM (science, technology, engineering and math) fields may increase the United States' global competitiveness (Anderson & Kim, 2006). The scope of racial inequities is not the main focus of this study but should be at least recognized as one factor that may play out in the results of the study.

Figure 2.3 - Scientists and Engineers Working In Science and Engineering Occupations in 2013



(National Science Foundation, 2015)

Science Learner Identity – Conceptual Framework

Based on Aschbacher, Li and Roth's (2010) work, this paper will discuss the concept of *identity* as "informed by situated learning, a model of practice theory that sees learning as taking place through everyday social interactions within, 'communities of practice' such as those found at school, home, or work" (Aschbacher, Li, Roth, 565, 2010; Lave & Wenger, 1991; Wenger, 1998). Identity is therefore defined by membership and participation in communities. Lave and Wenger stress that there are, "multiple, varied, more- or less-engaged and inclusive ways of being located in the fields of participation defined by a community… [but]…participation is about being located in a social world" (36, 1991).

In this sense, identity is parallel to the notion of connectedness. Connectedness by definition is "the degree of activity and positive affect youth report that they direct toward people, places and things" (Karcher, 2011, 20). Aschbacher, Li and Roth (2010) define identity within a social context just as Karcher (2011) quantifies connectedness as activity and affect to a group as reported by adolescents. Identity should show a correlation to connectedness and this correlation will be explored in this study.

Science identity is the connection and view of the self within the context of the scientific community. Connections with the scientific community can be manifested in a variety of ways including scientific literacy, relationships with science teachers, ability to discuss science with peers, and success in scientific endeavors, which would include science classwork. Brickhouse (2001) defines

science identity as, "the sense of who students are, what they believe they are capable of, and what they want to do and become in regard to science." Keeping within the conceptual framework started with situated learning for identity, science identity is "informed by students' lived experiences and social interactions at home, in school and in the larger world" (Aschbacher, Li, Roth, 566, 2010). Students' understanding of their science identity is directly created and influenced by the multiple worlds through which adolescents move.

Just as Bronfenbrenner's "ecological environment" (1979, 3) shows the individual at the center of the nested circles, science identity is nested within larger social structures. A person adapts and changes their identity based on the multiple communities through which they move (Aschbacher, Li & Roth, 2010). Each social world in which adolescents live varies with respect to the value placed on science identity and these worlds vary with respect to time. Therefore, the nature of science identity has a temporal aspect that can change over time (Aschbacher, Li, Roth, 2010). Since science identity and connectedness can both change, asking students to project a vision of a college major and a career path provides insight into science identity at various points in time.

Just as science identity can be expressed as the connection with the scientific community in regards to scientific literacy, relationships with science teachers, ability to discuss science with peers, and success in scientific endeavors, the domain of academic connectedness includes the subscales reading, teachers, peers and school (Karcher, 2011). A correlation can be drawn between science identity and

academic connectedness. Collecting data on both science identity and academic connectedness should show a correlation which will be explored further in this study.

Neither connectedness nor science identity are static and both evolve over time. Therefore communities in which students live would have a direct impact on students' ability to discuss and think about themselves as academically connected and as scientists (Brickhouse, 2001). As shown previously, white Americans overwhelmingly dominate science and engineering careers in the U.S. (National Science Foundation, 2015). This suggests that minorities have less access (Hanson, 1996) to be a part of a community that could enhance science identity.

Aschbacher, Li and Roth (2010) specifically address the racial disparities in science today discussed in the previous section. "Modern science as we have come to know it, and as it is viewed in many families and schools, has been and still is largely shaped by the ideas, experiences, and biases of European middle class males (Aschbacher, Li, and Roth, 566, 2010). Therefore for students outside the dominant demographic, developing science identity has more complex overtones. "Student science identity involves how one sees oneself in relation to this culturally based and biased science, which is generally accepted and reproduced in schools and society" (Aschbacher, Li, and Roth, 566, 2010). This is particularly relevant to this study since the majority of the students eligible for the summer intervention program are not white males.

Important to note, "no students were found to develop a strong interest in

science after 10th grade" (Aschbacher, Li, Roth, 2010). The transition summer entering 9th grade is therefore one of the last opportunities to have a direct impact on STEM career pursuit. The notion of pursuing a career in science can be described using the metaphor of the "science pipeline," which represents, "the successive training experiences necessary for students to consider a career in science" (Aschbacher, Li, Roth, 2010; Berryman, 1983). This metaphor was enhanced by Hanson (1996) with the addition of four components of the pipeline: access, activity, achievement, and attitudes. All four components of the pipeline can be connected back to the science teacher (Aschbacher, Li, Roth, 2010). An accessible summer program that supports active engagement with opportunities for student success employs the teacher as the direct connection to the students to embrace a positive approach to science. In other words, an effective summer program can intentionally target access, activity, achievement and attitude for the participants in the program. Science learner identity, like connectedness is mutable (Aschbacher, Li, Roth, 2010; Karcher, 2011).

Aschbacher, Li and Roth (2010) have developed a survey to gauge student interest in pursuing a career in science and have given permission to use that tool for the purposes of this study. The survey directly asks students what college majors and careers they would like to pursue as a direct measure of students' attitudes about how they view themselves as scientists in the future.

Learning Science

Brickhouse (2001), in a discussion on epistemology, argues that learning is not an isolated knowledge-acquiring event or activity that occurs through effort in a specific schooling context. Learning is inevitable, occurs at all times when an individual engages with the world, and is fundamentally a part of becoming a person (Brickhouse, 2001). Learning cannot be separated from being. "Learning… conceives of the person as an acting being, engaged in activity in the world. Learning is, in this purview, more basically a process of coming to *be*, of forging identities in activity in the world" (Lave, 1993).

Learning science is certainly no exception to this confluence of learning and coming to be. Learning science extends far beyond any rote memorization of scientific information into the realm of the individual's belief structure about the self, in the present and in the future. In other words, science learner identity is the ability to "think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science" (Fraser & Ward, 2009). The last part of this definition brings in the idea that the individual is not alone in the pursuit of science. "The concept of identity focuses attention on the individual, but expands our view of the individual to include social structures" (Brickhouse, 2001; Wenger, 1998).

Increasing exposure to the scientific community affords opportunity for students' self-concept of ability to increase. Conversely, with decreased self-concept of ability, expectations for current and future achievement diminish (Eccles, et al.,

1983). Research suggests that the stronger the connection between the student and the science teacher, the more likely the student will have a desire to pursue a STEM career (Aschbacher, Li, Roth, 2010). Students persisting in their pursuit of science reported, "it was their science teachers who most inspired their interest in science" (Aschbacher, Li, Roth, 2010, 575).

Roeser & Eccles (1998) discuss how classroom environment and students' perceptions of teachers valuing student efforts plays a role in students being successful. A summer intervention program provides opportunities to show that student effort is valued in a different way than during the regular school year. The summer curriculum is a project-based approach to prepare students for the fall. Teachers praise student efforts during the summer program continuously since the entirety of the curriculum involves one large project that is contingent on student effort. More details about the Rise Up summer program will be discussed next.

Summer intervention aims to increase connectedness and science identity. The summer program also exposes students to multiple careers in science so that students can think about themselves as scientists (Brickhouse, 2001) and become part of the social community of scientists. Combining increased connectedness and keeping in mind that science learner identity is fluid, there is a potential to propel students into STEM professions later in life.

Rise Up Mission Statement

Rise up is committed to enhancing the cognitive, social, academic and

personal growth of its students. Through a collaborative environment of academics, physical fitness and social activities, students will reflect on their own goals within and beyond the classroom, as an individual learner and as a member of the Cambridge community. Rise Up will ask the students to imagine the future, become invested in their vision, and outline a roadmap to achieve goals along that path. The overarching goal of Rise Up is to increase students' connectedness prior to entering freshmen year to their school, community, classmates, teachers, and themselves in the past, present and future.

Eligibility and Recruitment – Intervention During the Gap Summer

Approximately 200 students each summer are eligible for Rise Up based on their 7th grade MCAS scores in math or ELA. Beginning in 2015, the program expanded eligibility parameters to include three factors: ELA or math MCAS scores, SES status and special education status. Preference was given to students meeting multiple criteria.

During the summers of 2014 and 2015, the program serviced approximately 65 students each year. Recruitment for the program takes place throughout the winter and spring including visits to the 8th grade classrooms to talk to the eligible students, speaking at 8th grade parent information night, the Rise Up website (http://crls.cpsd.us/activities/rise_up_program), Rise Up recruitment video with testimonials from previous Rise Up students, and with the encouragement from 8th grade teachers.

Much of the recruitment is framed to encourage students to get to know their future classmates and teachers before the first day of high school and to enhance student skills for high school. By framing recruitment as an opportunity to get to know future classmates and teachers, Rise Up is intentionally aligning with Connectedness Theory. Recruitment and enrollment have substantially increased in the past six years.

Since participation in the program is voluntary, more than half of the eligible students elect to opt out of participating in the program for a variety of reasons including, but not limited to, employment opportunities at other worksites, sport commitments, and family vacations. Recruitment and incentivizing the program, without mandating attendance, are key factors to maximize participation and maintain regular attendance (Borman, et al. 2005; Borman & Dowling, 2006; McCombs, et al., 2009).

Rise Up Program Details – Comprehensive, Research-based Strategies to Prepare Students for Freshmen Year

The Rise Up program is a four-week summer program during the gap summer between 8th and 9th grade for students who are academically at risk. The program is research based with special consideration given to the comprehensive study conducted by the RAND Corporation comparing and analyzing the strengths of effective programs (McCombs et al., 2011). The typical student day begins with fitness followed by breakfast. Afterwards, students enter one of three possible

academic classes, math, science or ELA. Two consecutive academic classes are followed by lunch. After lunch students have a course called Imagine the Future. Subsequently, students attend their third academic class of math, science or ELA so that they will have taken all three subjects by the end of the day.

The day runs from 7:50 AM – 2:30 PM totaling 133.3 contact hours, which substantially exceeds the minimum recommendation of 80 hours of sufficient duration for effective impact (McLaughlin & Pitcock, 2009). Throughout the program a student to teacher ratio of 10:1 is the maximum encountered. Smaller class size has been shown to be more effective for instruction (Cooper, et al., 2000).

Participants begin their day with a one-hour fitness session where they engage in a range of sports. During the first two weeks, the students rotate through the different sports to gain exposure. Coaches of several of the high school sports teams come to meet the students and practice with them. The last two weeks of the program allow for student choice in a sports activity. By bringing in the coaches from the high school, Rise Up fosters effective partnerships (McCombs, et al. 2011) and provides more opportunity to enhance connectedness. Fitness is based on research suggesting being physically active prior to entering the classroom stimulates neurogenesis through the release of brain-derived neurotrophic factor, BDNF, which helps the hippocampus sort through new information (National Institute of Health, BDNF, 2011; Ratey & Hagerman, 2008).

Fitness helps build positive relationships with the students since the teachers participate with the students. "In these [student-adult] relationships, teens prefer

the team approach with all participants on equal footing… [to] make decisions together" (Feinstein, 2009, 59). Physical activities provide an excellent venue for a collaborative approach to the overall program. When the adults are able to interact in this light, a new component of both the teen and adult are revealed and a stronger relationship can be forged.

Imagine the Future is designed as an academic support to promote general studentship skills necessary to be ready to learn. Students target writing, inquiry, collaboration, reading, note taking and organization as being utilized in their courses. Imagine the Future mirrors the high school motto of Opportunity, Diversity and Respect with one week dedicated to each topic. By design, Imagine the Future aligns with the future-oriented aspects of Connectedness Theory promoting a sense of the self in the future. Further, Imagine the Future provides multiple opportunities to enhance adult-sanctioned conventional connectedness (Karcher, 2017).

Imagine the Future, asks students to investigate their pasts as well as potential future pathways. Some explorations include visits to colleges, vocational awareness training, and even resume writing and job application skills. This component is a significant differentiator for Rise Up compared to other summer programs. Imagine the Future is fundamental in establishing a sense of empowerment within the students during this one-hour daily time slot and promotes a culture of social-emotional strategies for success. Through interactive team-building activities, students will be asked to accomplish tasks that can be

extrapolated into a larger context. For example, a scavenger hunt may steer teams to a choice of particular cultural locations around Cambridge. Teachers are asked to let the students take the lead in developing a strategy. Specifically, the scavenger hunt may send groups to the John Harvard statue in Harvard yard and asks students to learn about the history of Harvard University. This quest, which has teams problem solve on travel dynamics and access to information, makes connections to the past and shows students possibilities for their future. Such a task unites teams in a common purpose while teaching historical relevance and maintaining focus on the future. Significantly, these kinds of events empower the students to take control their own success.

The academic classes are taught by highly-qualified teachers from the high school, many of which will be the freshmen teachers for the Rise Up students in the fall. The English and math classes help students complete the summer assignments as a preview of the upcoming academic workload. By aligning the math and English classes specifically with the school year curricula, the overall effectiveness of the program is enhanced (Boss & Railsback, 2002; McLaughlin & Pitcock, 2009; Beckett, 2008). The science class is a project-based course designed to help students preview some of the concepts that they will encounter during freshmen physics. Some projects have included planting a green roof on the school, building a large Rube-Goldberg machine, or creating a scale model of the school to investigate energy saving approaches and then presenting their findings to the mayor and a panel of city officials. High-quality instruction has been shown to be a contributing

factor to an effective summer program (McCombs et al., 2011).

Important to note, Rise Up students who are 14 years old by the start of the program in July are eligible to apply to the Cambridge Mayor's Summer Youth Employment Program, MSYEP. Students who qualify can count Rise Up as their primary worksite and receive payment for participating in Rise Up at $10/hour for up to 6 hours per day. Students not meeting the age requirements or choosing to not apply to MSYEP may receive 10 high school credits towards graduation for participation. Payment and credits are based on attendance and active engagement.

The 8th-9th-grade intervention program needs to draw some conclusions and set some parameters prior to describing a curriculum. Since the program is designed to close the gap between the at-risk students and peers operating at proficient or advanced, the program is called Rise Up. This appropriate name mirrors the attempt to raise the standards and expectations for these students.

Hirsch (1999) proclaims that a strong curricular spine is required. Learning begets more learning. This is accomplished by studying both the 8th grade curriculum and the 9th grade curriculum. Gaps in student proficiency leaving 8th grade need to be addressed. While on the other side, to establish early success, students should have a preview of the upcoming 9th grade curriculum. Rise Up is both a remediation program and a preview preparedness program that links to the school-year curricula to augment effectiveness (Boss & Railsback, 2002; McLaughlin & Pitcock, 2009; Beckett, 2008). The CRLS math department provides incoming 9th graders with a packet of practice problems that outline skills the students should

possess coming into 9th grade. The CRLS English department assigns a summer reading book about which students will write an essay on day one of English class. Currently the CRLS science department does not require the students to complete any summer content/skill reinforcement. This is one more example of a widening gap between students from affluent backgrounds whose parents seek out science programs, and sometimes pay for their children to participate in science activities, versus parents who do not have the means for additional summer science activities causing a de facto regression.

Given the math and English department's summer requirements as a starting point, the summer curriculum can be more clearly defined. While there is no existing summer science assignment, Cambridge has previously established an 8th-9th-grade transition team that has produced a skills document. The transition team was comprised of 8th and 9th grade teachers, the district science coordinator and science department chair. The skills document produced by this team outlines specific skills and content expectations for the incoming 9th graders to possess to begin 9th grade physics. This is an excellent starting point for later curriculum writing. To assist in the alignment of these skills while maintaining high-quality instruction (Bell & Carrillo, 2007; Boss & Railsback, 2002; Denton, 2002; McLaughlin & Pitcock, 2009), Rise Up has employed at least three teachers from the freshmen science team every summer since 2010.

Further, the freshmen science class at CRLS is a heterogeneous class, meaning that both college prep and honors students take the same non-tracked

course. Because of the need to differentiate instruction during the regular school year, the science teachers in Rise Up have substantial experience in differentiated instruction. McCombs, et al. (2011) found that differentiated instruction is another hallmark of effective summer programming (McCombs, et al., 2011; Cooper, et al., 2000).

Overall, the academic rigor of a summer program must be high to be effective (Bell and Carrillo, 2007; Boss & Railsback, 2002; McLaughlin & Pitcock, 2009; Beckett, 2008). Since the target audience of this summer program is a student population that is already behind academically, this intervention must fill in gaps in K-8 education to put the student on the best path academically in high school.

One cause of academic gaps seen in the population is a lack of student skills. Frequently, these students do not know how to be successful not necessarily because of cognitive delays but rather because of a lack of organizational, studentship strengths. This includes the ability to take effective notes to later be used to study, the use of a planner to stimulate frontal-lobe, long-term organization, and a binder system to organize materials. Instead of reinventing the wheel on these strategies and others, Rise Up can draw on successful programs that have accomplished these goals in the past. In particular, AVID, Advancement Via Individual Determination, is a nationwide program started in 1980 designed to increase school-wide academic performance. The mission of AVID is to "hold students accountable to the highest standards, provided academic and social support, and they [students] will rise to the challenge" (What is avid?, 2011).

AVID's success is well documented. In California, AVID's state of origin, students in AVID are more than twice as likely to attend college compared to those not in the program (Data & results, 2011). Further, AVID seeks out students who are from historically underserved populations, who are the first in their family to go to college, and who may be in academic jeopardy to start. Since there is a significant overlap in the described AVID student population and the incoming Rise Up population, adopting AVID best practices in the Rise Up program is a targeted strategy to increase Rise Up's impact.

During the 2015-16 school year, an AVID-like class was created to help the Rise Up students identified in the summer as most in jeopardy of potentially not graduating high school. The class is called Imagine the Future, as an extension of the component from the Rise Up program. The initial impact on student success appears highly positive. However the class did not run during the 2016-17 school year, which will be discussed in chapter 5.

Perhaps most pivotal to the success of Rise Up is assisting students to make connections to the high school community and conventional forms of connectedness (Karcher, 2017). Rise Up must create a community where students feel they are a part of something larger than themselves and they are contributing members to the direction of the program. Conventional connectedness has been shown to decrease risk-taking behaviors and contribute to greater academic success (Resnick, et al., 1997; Karcher, 2017) Employing high-quality teachers (Bell & Carrillo, 2007; Boss & Railsback, 2002; Denton, 2002; McLaughlin & Pitcock, 2009), who consistently set

up a positive classroom climate and who have been trained with targeted professional developments, as Darling-Hammond suggests (1998), is an effective way to increase buy-in. Specifically fostering relationships with science teachers promotes a stronger science learner identity (Aschbacher, Li, Roth, 2010). Making connections with these teachers in a positive classroom environment is consistent with the Connectedness Theory and science learner identity conceptual frameworks engulfing the program.

The Rise Up mission statement, previously listed, was written with the research in mind. There is a day-by-day plan of the 2014 Imagine the Future curriculum below. This transition summer is so crucially important to these incoming 9th graders, Rise Up aims to redouble efforts to ensure their success.

Figure 2.4 - Rise Up 2014 Imagine the Future (ITF) Day-by-Day Plan

Monday	Tuesday	Wednesday	Thursday	Friday
CRLS School Motto Intro Video, Brainstorm & Wordle	**Grit** Ted Talk 4 Corner Discussion Journal Write	**Goal Setting** Video MJ Article Write Short and Long Term Goals	**Goal Setting** Select Important Short/Long Goals Action Steps for Attaining Goal Puzzle Pieces	**Tour/ Organization** Rotate Between CRLS Tour & Falcon Folder Organizational Strategies
Defining Respect PPT Teacher/ Student Note Cards - Tree of Respect & Journal	**Life Maps** Intro List Main Events and Transitions Pick Format	**Life Maps** Final Draft & Presentations	**Etiquette** 10 Manners Article Train etiquette Skits	**College Visit** Half and half UMass Boston & Suffolk Law visits
Learning Styles Intro to different styles Rotated Classrooms Survey and Journal Write	**Income & Education** Article 4 Corner Journal Write Reality Check	**College/ Trade School** Finish Reality Check Research 3 schools/ programs PPT Template	**College/ Trade School** Finish PPT Presentations	**School Scavenger Hunt** Learning Communities, Zones Library/ Tutoring Centers
Guidance Counselors Transcripts Extracurriculars	**Social Media** Brainstorm Benefits & Deficiencies 4 Corners Article/Journal Write	**Extracurriculars** Brainstorm Research Effects Article	**Extracurriculars** Clubs/ Sports/ Arts Explanations Letters to Advisors	**Cambridge Scavenger Hunt**

The Imagine the Future curriculum map is designed to demonstrate how Rise Up and Imagine the Future invite students to buy in to CRLS (Crawford, 2008) through various inroads. Bringing in guidance counselors, coaches, and freshmen

teachers are all deliberate ways to promote conventional connectedness (Karcher, 2011). Activities such as life maps provide opportunities for students to connect with their peers as students, not just only on a social level. Life maps is an activity that invites students to share their prior experiences and use those to connect with other students. College visits help provide opportunities for students to connect with their future selves. Learning styles, grit, organization, and goal-setting are all activities intentionally trying to help students better understand the self in the present.

Rise Up utilizes the research from a multitude of the sources identified in this chapter to target at-risk students before they enter the most important year in high school. These strategies are designed to relieve some of the "bottleneck" (Allensworth & Easton, 2007, 4) that occurs during freshmen year and provide students with a sense of the connections available to them as they enter high school.

CHAPTER THREE

Methods

Chapter three begins with the hypothesis for this study. Next the chapter takes each of the four research questions and links them to the approach and analysis displayed as a summative grid. After the grid, terminology for the different groups with this study is defined. A brief description of each group follows. A more complete look at terminology can be found in the glossary at the end of the study. Finally, the bulk of this chapter goes through each research question in detail explaining methodologies.

Hypothesis

This study hypothesizes that a research-based, summer-intervention program, such as Rise Up, prior to freshmen year will have positive effects on academic outcomes, connectedness, and science learner identity for at-risk youth entering their freshmen year of high school.

Linking Research Questions to Methods

Each of these research questions have distinct methodologies, which are paired in the grid shown below. The entire study is a mixed-method approach with quantitative analysis used to determine the impacts of Rise Up on connectedness and science learner identity. The qualitative focus groups are designed to explore the possible mechanism of connectedness.

Research Questions:	Approach and analysis methods:
1. What effect does Rise Up (RU) have on at-risk students' grades, sport participation, attendance and behavior?	Quantitative analysis of Rise Up Participants (RUPs) vs. Eligible Non-Participants (ENPs) vs. Proficients • Used grades, attendance and behavior records from 8th and 9th grade. • Disaggregated science grades were investigated. • Participation in 9th grade sports considered between the groups.
2. How does a summer intervention program prior to freshmen year impact connectedness in high school for at risk students?	Hemingway Measure of Adolescent Connectedness (Karcher, 2011) survey given to RUPs, ENPs, and Proficients. • Compare the results of the survey in a table and statistically analyze differences. • Survey given to RUPs in the beginning of RU and at the end of RU, early summer and late summer. • Survey given to the entire freshmen class in the fall and again in the spring.
3. Does the degree of connectedness in the academic ecological world correlate to science learner identity?	Student science learner identity survey (Aschbacher, Li, Roth, 2010) to determine college major and career aspirations before and after participation in Rise Up. • Survey also explores perceptions of science learner identity. • Survey given at the beginning and end of Rise Up. • Survey given to the entire freshmen class in the fall and again in the spring.
4. If Rise Up is having an impact, what mechanisms may be contributing to that impact?	Student focus groups of RUPs and ENPs separately. • Focus groups took place in the fall 2016 and again in the spring 2017.

Terminology – Comparison Student Groups

There are three primary groups in this study. The three primary groups are as follows:

Eligible Non-Participants (ENPs) – Students who are eligible for Rise Up based on receiving a warning or needs improvement score on their 7th grade math or ELA MCAS but who have elected to not participate in Rise Up; this includes students who participated in 10% or less of Rise Up

Proficients – Students who are not eligible for Rise Up because they received a proficient or advanced score on both their math and ELA 7th grade MCAS

Rise Up Participants (RUPs) – Students who participate in at least 75%, 15 out of 20 days, of Rise Up during the gap summer between 8th and 9th grade

Two other groups that will be considered for further clarification will be the Others and the Repeaters.

Others - Students who participated in Rise Up but missed at least 7 days of the program and are therefore neither RUPs or ENPs.

Repeaters - Students who did not earn enough credits to advance to sophomore year and are repeating their freshmen year

Participants Descriptions

Approximately half the incoming freshmen class of 2016 were eligible for Rise Up based solely on their 7th grade MCAS scores, which means that they received needs improvement or warning on their math and/or ELA MCAS. Throughout the study, the primary groups of interest are the eligible students divided into two sub categories, Rise Up Participants and Eligible Non-Participants. Rise Up accepts students based on three criteria: ELA or math MCAS scores, SES status and special

education status. Students who receive free or reduced lunch are eligible based on their SES status. Being enrolled on any IEP also makes students eligible. However, the three criteria have a lot of overlap and almost all Rise Up Participants received low MCAS scores on math, ELA or both. For the purposes of this study, MCAS scores will be viewed as the primary eligibility factor.

All Rise Up Participants receive the benefits of the program including building relationships with peers and teachers as well as the Imagine the Future component. Therefore, RUPs will be maintained as a group. However, historically not all RUPs complete the full length of the program. Only students who attended at least 60% of the program will be categorized as RUPs. McLaughlin & Pitcock (2009) found that at least 80 hours of contact were needed for effective impact. 80 hours at Rise Up is 60% attendance. Further, at Cambridge Rindge and Latin, 60% is also the line between passing and failing a class. Students who attend Rise Up for more than a day but do not complete the program, cannot be fairly categorized as either RUPs or ENPs. These other students will have received some of the benefits of Rise Up but the quantity and quality of the benefits will vary an indeterminate amount. Since these students cannot be classified as RUPs or ENPs, they will be called the Others.

Data collected through the school's student information system, Aspen, includes all students classified as 9th graders. Almost entirely, the RUPs, ENPs, Proficients and Others comprise this group. One other group of students, although not targeted, is included in this data. These are the students who were repeating their freshmen year because of a failure to accumulate enough credits. Also known

as the students creating the "bottleneck" (Allensworth & Easton, 2007), this study will refer to them as the Repeaters. Repeaters are technically eligible for Rise Up but are not recruited so they cannot be placed in any other category. The two small categories of Others and Repeaters are not the main focus of this study but because data has been included, the interesting findings from these two groups will be explored in a later discussion.

Recruitment for Rise Up is conducted throughout the winter and fall preceding the program. The program directors visit the 8th grade classrooms, speak at the 8th grade parent information night, mail letters home to eligible students, and work closely with the 8th grade teachers. During this study, 57 students completed Rise Up with at least 60% attendance (RUP n = 57). Students who were Eligible Non-Participants numbered 144 (ENP n = 144). 171 students were considered Proficient (Proficient n = 171).

Question 1 – What effect does Rise Up (RU) have on at-risk students grades, sport participation, attendance and behavior?

This question was approached through a quantitative lens. Three different rounds of analysis were required. The first round was to investigate the differences prior to freshmen year. Round two was conducted in the fall after the fall sports rosters are set. Round three was completed the following summer after the year's grades, attendance and behavior records were completed.

Differences between the groups prior to Rise Up

The goal of the first round was to determine the differences between the RUPs, ENPs and Proficients prior to the gap summer between 8th and 9th grade. Data was collected from all three groups, RUPs, ENPs, and Proficients using the Cambridge Public Schools student information system, Aspen. In the final week of Rise Up, the RUPs were parsed out from the ENPs. At that time, the first data analysis was run on SPSS to look at 7th grade MCAS scores in math and ELA, 8th grade MCAS scores in science, attendance records and disciplinary referrals. 7th grade MCAS scores for math and ELA were used instead of 8th grade because the 8th grade scores were not released by the time Rise Up began. 7th grade MCAS scores in math and ELA directly impacted Rise Up eligibility for the summer of 2016.

With the statistical analysis tool, SPSS, a Chi Square test was run to determine the statistical independence of the MCAS score distribution. The Chi Square test is expected to show that the distribution is not independent of the three groups, especially considering the Proficients, by definition, scored higher than the other two groups. A second Chi square test could then be run to determine the distribution of MCAS scores between ENPs and RUPs.

Using SPSS, a one-way ANOVA was conducted to investigate other dependent variables. Since a one-way ANOVA only determines if there is a difference between the three groups but cannot determine which group differs from the others, a post hoc test was conducted to investigate the differences between the three groups. The dependent variables that were investigated are in Table 3.2 located below.

Reporting of the data includes all three groups' results along with p values.

The data was initially analyzed in late July by the PI, Andrew Miller, and were stored on a password protected computer. Students were assigned a random number for study ID purposes and then student names were removed from the file. Only the PI had access to the key between names and numbers.

The PI anticipated that the results from this section would show that the Proficients consistently have the highest MCAS scores, best attendance and fewest behavior referrals. Further, ENPs were predicted to have slightly higher MCAS scores than RUPs. Attendance and behavior were anticipated to be comparable between ENPs and RUPs. The reason for this conjecture was from pilot studies which have shown RUPs to have lower MCAS scores than the ENPs.

Short-term differences analysis

After the first quarter of 9th grade, a second round of quantitative analyses were conducted. Data was collected from all three groups, RUPs, ENPs, and Proficients using the student information system and by contacting the CRLS athletic department. The CRLS athletic department keeps records of all students involved in sports each season and had agreed to provide that information for fall sports participation.

The dependent variables analyzed at the end of the first quarter include fall sports participation, GPA and science class grades, attendance records and behavior referrals. A one-way ANOVA with a post hoc analysis was conducted by the PI to

determine the differences between the three groups for each of the dependent variables. Data was stored on a password protected computer and student names were once again removed using the numbering system mentioned previously.

Grades are broken down on the district's 100-point scale. The school district uses exact numeric grades assigned by the teacher when calculating grade point average (GPA). In the cases when a letter grade is given instead of a numeric grade, the chart below was used to normalize letter grades. This is the same system that has been used at the high school when determining (GPA).

Table 3.1 – GPA Conversion

Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
Points	98	94.5	92	88	84.5	82	78	74.5	72	68	64.5	62	50

The results established a baseline for the study. Further, after compiling the results from quarter 1, the differences were clear between the three groups, as will be explained in chapter 4. The full year difference analysis takes into account the results of the first quarter and groups those results with the complete year findings in terms of GPA, science grades, behavior records and attendance records.

Full year difference analysis

In the beginning of the following summer of 2017, one final comprehensive quantitative analysis was conducted by the PI. Looking at all three groups again, RUPs, ENPs and Proficients, similar dependent variables were analyzed. Specifically

a final one-way ANOVA with a post hoc analysis was conducted for GPA for freshmen year and grades in science courses, attendance records, and behavior referrals. The data was stored on the PI's password protected computer with names replaced by the numbering system.

After this final data collection was completed, an additional test was conducted. A repeated-measures ANOVA was conducted to compare the 8th grade year to the 9th grade year for all the factors shown in Table 3.2.

Data for all of these variables is available using the Cambridge Public Schools student information system. Approval to conduct this study has been granted by the Cambridge Public Schools IRB.

Table 3.2 – Dependent Variables for Investigation

Dependent variables for analysis
7th ELA MCAS
7th math MCAS
8th science MCAS
8th attendance records
8th disciplinary referrals
9th GPA Quarter 1
9th Sports participation
9th GPA Full year
9th science grades

The results from all the sections described above will be discussed in chapter 4. Covariates will be explored whenever the sample size can be justified to warrant an investigation. The PI conducted an ANCOVA at the end of freshmen year once grades were official using the same variables shown in Table 3.2. All post hoc analyses will include significance scores using both Bonferroni and Scheffe. Bonferroni is generally considered a high watermark for determining significance whereas Scheffe is used to see if there is a lesser degree of significance between variables being investigated that could be used to prompt deeper exploration.

Question 2 - How does a summer intervention program prior to freshmen year impact connectedness in high school for at-risk students?

Reliability

The Hemingway Measure Adolescent Connectedness is a survey that has been specifically designed to address the multi-faceted nature of connectedness. This validated survey (Karcher, 2003) was used to measure adolescent connectedness at different points throughout this study. Honoring the hermeneutical aspect of connectedness, surveys were administered four times: in the early summer of 2016, in the late summer of 2016, in the fall of 2016, and in the spring of 2017. Cronbach's Alpha was used to ensure the reliability of this survey. Cronbach Alpha scores below 0.6 were dismissed as unreliable. Further discussion of this statistical tool will be explored in chapter 4 when the tool is being employed.

As discussed in chapter 2, connectedness has a strong temporal component so fluctuations within connectedness scores are to be expected. Average Cronbach's Alphas with standard deviations are reported in chapter 4 to demonstrate any fluctuations. Since RUPs are taking the survey a total of four times, the reliability of their scores were expected to increase as they become more familiar with the survey. However, given that connectedness changes over time, reliability is not predicted to increase dramatically since students' degrees of connectedness changed throughout the course of this study.

Hemingway Survey

The most comprehensive measure of connectedness is the Hemingway Measure of Adolescent Connectedness. As discussed in chapter 2 in greater detail, there are four ecological worlds of connectedness including "being social, being academic, being related, and becoming" (Karcher, 2011, 11). The 15 subscales include "neighborhood, friends, self-in-the-present (self-esteem; identity), parents, siblings, school, peers, teachers, self-in-the-future, kids from other cultures, romantic partner, religion, mother, and father" (Karcher, 2011, 12-14).

The full long-version of the Hemingway Measure of Adolescent Connectedness includes 78 questions gauging all 15 subscales. For the purposes of this study, the short version of the Hemingway was administered with 57 questions addressing only 10 subscales. The five subscales that were omitted include religion, romantic partners, mother, father, and kids from other cultures, since they are less relevant to the Rise Up intervention.

The Hemingway was administered to the RUPs on four separate occasions: during the first week of Rise Up, during the last week of Rise Up, during the first weeks of the school year and in the spring near the end of the school year. If Rise Up is increasing the degrees of connectedness, then the Hemingway should help in determining which ways students are feeling more or less connected. Since connectedness is constantly in flux, the scale is conducted multiple times to determine how connectedness changes over time. Further, administering the Hemingway to the entire freshmen class provides a comparison between the RUPs connectedness trends relative to the ENPs and the Proficients.

A repeated-measures ANOVA (MANOVA) was conducted to determine if the RUPs' scores significantly changed during the four administrations of the survey. Wilk's Lambda was used to determine the percent difference in variance for each of the subscale scores. Wilk's Lambda and p values were reported. To support the results of the repeated-measures ANOVA, pairwise comparisons were run for each of the academic domain subscale scores to determine the significance between any two administrations of the survey.

ENPs and Proficients also took the Hemingway. These groups took the Hemingway during the first weeks of the school year and again near the close of the academic year in the spring. Survey administration for the ENPs and Proficients was at the same time that the RUPs took the survey the last two times. Surveys were given during community meeting time at school so as not to disrupt academic classes. This means that all freshmen took the Hemingway at least twice.

Cambridge Public Schools and the Boston University IRB granted permission to ask parents or students to opt out of taking the survey by mailing home an informational packet with opt out procedures explained.

The Hemingway asks students to rank connectedness on each question using a scale from 1 – 5, with 5 being the most connected. The results can be tabulated into an average connectedness score for each of the 10 subscales being measured. Those 10 subscale scores fall within the four domains or ecological worlds of connectedness: academics, self perception, social connectedness, and family. RUPs, ENPs, and Proficients results are divided separately for the four worlds as well as the separate subscale scores. A section of a sample data chart is provided in Table 3.3 showing anticipated results and how the scores will be reported in chapter 4.

An ANOVA with post hoc analysis was conducted for the RUPs, ENPs, and Proficients for the fall and spring results. Both Scheffe and Bonferroni p values were reported. Bonferroni is generally viewed as a stricter standard of significant difference whereas Scheffe will help determine if the findings warrant further investigation.

Table 3.3 - Anticipated Results

	RUPs (n = 57)				ENPs (n = 170)		Proficients (n = 230)	
Connectedness Domain	Early Summer 2016	Late Summer 2016	Fall 2016	Spring 2017	Fall 2016	Spring 2017	Fall 2016	Spring 2017
Academics Ecological World								
Teacher	3.2	3.5	3.4	3.6	3.2	3.4	3.6	3.8
School	3.1	3.5	3.3	3.5	3.2	3.3	3.5	3.6
Reading	2.5	2.7	2.6	2.7	2.6	2.7	3.1	3.2
Peers	2.8	3.2	3.1	3.3	2.7	3.1	3.2	3.6
Self Perception Ecological World								
Self-in-the-Future	2.7	3.0	2.9	3.0	2.7	2.9	3.3	3.6
Self-in-the-Present	3.0	3.2	3.1	3.2	3.0	3.1	3.1	3.3
Social Connectedness Ecological World								
Friends	3.2	3.4	3.3	3.5	3.2	3.3	3.2	3.4
Neighborhood	3.2	3.4	3.3	3.4	3.2	3.3	3.1	3.2
Family Ecological World								
Parents	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Siblings	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9

The full results for this section can be found in Table 4.15. in chapter 4.

The main focus for the analysis in this section was within the academic ecological domain comprised of reading, teachers, peers, and school subscales. The reason for this narrowed focus is because the intervention, Rise Up, targets these areas more so than any other other ecological domain. As discussed in chapter 2, these subscales are also most parallel to components of science learner identity

including scientific literacy, relationships with science teachers, ability to discuss science with peers, and success in scientific endeavors. Science learner identity is explored more in question 3 but a thorough analysis of the results of the academic ecological world comparing trends across the target groups was explored.

Question 3 - Does the degree of connectedness in the academic ecological world correlate to science learner identity?

In this section, the survey, Is Science Me? (Aschbacher, et al., 2010), was used to determine students' science learner identity. The survey is designed to gauge student views of what science encompasses, student interactions with scientific communities, and the process of learning and experiencing science as an individual (Aschbacher, et al. 2010, 566).

Exploring the nature of science is one component of the survey. The survey inquires about what students believe that scientists do. Further, questions are asked about the activities that students engage in that are related to science such as reading a books about science, visiting science museums or taking things apart (Aschbacher, Li and Roth, 2010). Determining this degree of active engagement relates to Hanson's (1996) pipeline of science activity as one component of science learner identity.

Another major component of the survey is looking into how students interact with the scientific community. The survey tackles this through inquiring about

education levels and careers of family members, contact with individuals in science fields and peers interested in science. The survey goes so far as to ask about the scientific interest of close friends, the school community and students' romantic interests. The survey also inquires about ethnic background and whether student's believe that ethnic background plays a role in entering science fields. This supports the notion of access and activity in regards to science identity.

Finally the survey addresses the most complex components of science learner identity that feed into the attitude and achievement pipeline (Hanson, 1996). Comfort with learning about and doing science is a more nuanced component than identifying whether students engage in science activities or have contact with scientists. Aschbacher, Li and Roth (2010) utilize an "expectancy-value model of achievement-related choices, linking students' educational and career decisions to their expectations for success and the value they ascribe to the options they perceive as available" (Aschbacher, Li, and Roth, 2010, 566; Eccles, 1983). In other words, the survey seeks to gauge future engagement or activity in science regarding college majors and careers in science fields based on past achievement, attitudes and perceived access (Hanson, 1996). This last complex task of the survey addresses attitude and achievement while factoring in access and activity.

The survey addresses this final component by offering a variety of Likert scale choices for interest in future college majors and careers. Further, the reasons for entering science-related fields are addressed, such as cost of training, working with people of the same ethnicity, as well as respect and salary earned from working

in a science field (Aschbacher, Li, and Roth, 2010).

Aschbacher, Li, and Roth have made available two versions of the survey. One is a comprehensive, 10-page survey that fully explores three components of science learner identity: perceptions of science, interactions with the scientific community and comfort with learning and doing science. As a full description, Aschbacher, Li and Roth describe the survey as exploring,

> perceptions of science and scientists; interest in SEM (science, engineering and medicine), SEM-related, and other popular college majors and careers; family and peer expectations related to science interest and activities; perceptions of science classes and teachers…self-confidence in science and math; science-related activities and behaviors in and outside of science class since childhood (Aschbacher, et al., 2010, 568).

For the main part of their study, Aschbacher, Li, and Roth (2010) utilized the comprehensive long-version of the study.

The second version of their survey is abridged and focuses on interactions with the scientific community, ability beliefs and expectations of pursuing science fields. The abridged version is used in this study. Science learner identity, as discussed in chapter 2, focuses on the attitude, achievement, access, and activity of a student possibly interested in entering the STEM pipeline (Hanson, 1996). Since the focus of this question is about academic connectedness and science learner identity,

the abridged study is able to encapsulate the aspects of science learner identity associated with the academic connectedness domain. In particular, the components of science learner identity that this study is investigating involve developing a sense of one's self as a scientist within a larger connected community.

The abridged version of the survey was selected for practical reasons too. The student population had time constraints for survey administration. The longer version would have required altering the school day schedule to accommodate the survey. This research study strived to not disrupt any student learning opportunities. Further, some of the information gathered from the longer version of the survey, such as ethnic background, would have been redundant with information provided through the student information system. The abridged survey can be found in Appendix B.

The survey was administered to the RUPs during the first week of Rise Up and again to the RUPs on the last day of classes for Rise Up. The same survey was given to the entire freshmen class in the fall and again in the spring. The PI invited students to participate in the surveys and explained that their participation was optional. A letter explaining the participation in the surveys was mailed home asking for parents to opt out of the survey if so desired.

Two aspects of these surveys can be used for analysis. First, since the surveys were administered multiple times, a temporal component can be demonstrated. Second, since these surveys were given at nearly the same time as the Hemingway, relationships between science learner identity and connectedness

can be explored. The survey information was used to look for a correlation between students interested in majoring in or pursuing a career in STEM fields specifically compared to their degree of academic connectedness. Each of the pairs of surveys were compared for the correlations. For example, the Hemingway survey given in early July to the RUPs will be compared to the Is Science Me? survey given in early July to the RUPs.

Before getting into survey specific correlations, the general question of connectedness and science learner identity was explored. Prior to disaggregating the three target groups, RUPs, ENPs, and Proficients, results for science learner identity were compared to the academic connectedness domain as a large group. First, interest in STEM (science, technology, engineering, and math) careers and STEM majors were confirmed for correlation using Pearson's correlation. Second, independent sample t-tests were conducted for the subscales of the academic connectedness domain to determine if students self-identifying as interested in STEM also score higher in academic connectedness fields.

Also explored in this section was the racial demographics of the entire study population compared to Cambridge Rindge and Latin School as a whole. This is pertinent information because of the disparity in demographics currently working in STEM fields, as previously discuss in chapter 2 (National Science Foundation, 2015). Chi square tests were conducted to determine if race is related to science learner identity. The Chi square tests compared race with interest in STEM careers and STEM majors.

Further analysis of science learner identity was explored with the specific survey questions asking about engagement, or activity in science, as well as how students perceived their teachers supporting them in science.

Once RUPs, ENPs, and Proficients have been disaggregated, Chi square tests were run again to determine the distributions of interest in STEM fields. For the temporal aspect of the study, a one-way ANOVA was conducted to determine the significance of any fluctuation in interest in STEM fields. The ANOVA is needed because the RUPs took the survey a total of four times.

Multiple ANOVAs with post hoc analyses were needed to determine how the three subgroups compare to academic connectedness subscale scores, for school peers, teachers, and reading. In terms of expected results, the Proficients were expected to show the highest degree of connectedness that correlates with science learner identity. The RUPs were expected to show higher academic connectedness scores than the ENPs and also higher interest in STEM. The results will be discussed in greater detail in chapter 4 but were as anticipated only in the beginning of the school year. By the end of the school year, results were surprisingly different.

Question 4 – If Rise Up is having an impact, what mechanisms may be contributing to that impact?

The multidimensional components of Rise Up are difficult to parse out using only quantitative data and survey research. The final component of the study was to conduct interviews with RUPs and ENPs in small focus groups of 4-5 students with the intention of exploring the mechanisms through which Rise Up is having an impact, if at all. Meetings were held at lunchtime during the school day and students were provided with pizza as compensation for their participation.

The focus groups met during the first few weeks of the school year. A follow up meeting took place at the end of the school year in the spring with the same focus groups. An audio recording of the sessions was made and then transcribed.

Students for these focus groups were randomly selected from the lists of RUPs and ENPs. Both RUPs and ENPs were assigned numbers alphabetically. Using a random number generator, the first five RUPs and the first five ENPs who have a common lunch period were selected to participate in the focus groups. If any students or their parents declined the invitation to participate, more students were drawn using the random number generator until five from each group were willing to participate. Students were first asked if they would like to participate. If the student agreed, then the guardians were contacted and given the appropriate consent form for the focus groups.

Focus groups consisted of 4-5 students. Focus groups with less than four

students were rescheduled until a minimum of four participants could attend. Since the PI had met the RUPs over the summer, the PI could not conduct the interviews in case of introducing unintended bias. A Citi research assistant conducted the interviews.

Questions centered on ways the students feel they have become connected to the school, their teachers, their peers, their classes, and their future. The following script was used for the interviews:

Welcome and thanks for coming today. My name is Ms. Borrelli and I'm here to help conduct the discussion. We're here to talk about your transition to high school. I want to hear about your experiences, good or bad, so far moving from 8th grade into high school. I'll ask you several open ended questions. There are no right or wrong answers. You opinion is important so feel free to speak up.

The conversation will be recorded on audio tape. The purpose is only so that I can accurately capture your thoughts and comments later. Only Mr. Miller and I will listen to the tape. No names or personal information will be used in the research study. Please keep anything that is discussed here to yourself and don't share other's thoughts outside of this group.

We'll be here for this lunch period. Feel free to help yourself to the food that's here for you. I appreciate you giving up your lunch period to have this discussion. For the discussion today, please switch off your cell phone so that we can focus on the discussion in the room. Please try to give everyone a chance to express their thoughts.

I'm only here to assist the discussion. Are there any questions about how this focus group will work?

- *How many of you decided to join a sport or club?*
    - *If no one is involved in sports/clubs, the questions would need to change to focus on why students have decided not to play/join.*
- *Why did you decide to join a sport or club?*
- *How did you first hear about playing your sport or participating in the club?*
- *Do you have classes with other students from your team/club?*
- *Does that help you in classes or distract you? How?*
- *How are you enjoying your classes?*
- *How about your teachers? Can you tell me about how you get along with them?*
- *Which classes are your favorites? Why?*
- *What kinds of careers do you think you might want to go into?*
- *How did you learn about that career?*
- *Did you participate in any programs in the summer?*
- *How did those programs help you to feel prepared for 9th grade?*

*Thank you for your thoughts and opinions. If you have any questions, please contact Mr. Miller in his classroom 4408 or at ***-***-****. You can also contact his advisor Don DeRosa at ***-***-**** [phone numbers were provided at time of focus

group but removed in this document]. *Both numbers and their emails are on the information sheet that you and your parents received.*

Students were reminded when they were first invited and again on the day of the focus groups that their participation was optional. Students were informed of the audio recording and the privacy procedures. All aspects of the focus groups, as well as the surveys, followed all BU IRB guidelines to the letter.

Post Focus Group

After each of the focus groups met, the research assistant and the PI had a brief summative conversation noting the overall feel of the room and any observations about interactions between the students that may pertain to a sense of connectedness. This type of observation included body language about particular questions that would not come through in the audio tape.

The focus group audio tape was transcribed by the PI and kept on a password protected computer. The names of the participants and names of teachers discussed during the focus group were coded and removed from the transcript. Pseudonyms for all the students and teachers were added.

Transcripts of the focus group discussions were analyzed for emergent themes. The focus groups were compared between RUPs and ENPs in the fall and then again in the spring. Focus groups were also compared longitudinally between the RUPs' initial interview in the fall to the RUPs' follow up interview session in the

spring. Similarly, the ENPs were looked at longitudinally. The overall mood of the interview sessions substantially changed from the fall to the spring, especially for the ENP group. These results will be discussed in greater detail in chapter 4.

CHAPTER FOUR

Results

This chapter addresses each research question and explains the various analytical tools that were used to explore the questions. Overarching patterns are noted and they are explained with more comprehensive detail in chapter 5.

Research Question Number 1 - Effect of Rise Up on at-risk students' grades, sport participation, attendance and behavior

Academic Comparisons Prior to High School

The first comparison between groups is with MCAS (Massachusetts Comprehensive Assessment System) scores prior to the intervention summer of 2016. Appendix G shows the breakdown of students scoring Warning (W), Needs Improvement (NI), Proficient (P), and Advanced (A) on the 7th grade English, 7th grade Math and 8th grade Science MCAS exams. The 7th grade MCAS scores were used because they determine eligibility for the Rise Up program. There is no science MCAS taken in 7th grade, so the 8th grade MCAS is used here for comparison.

Some students did not take one or more of the MCAS exams. Students might not take an MCAS exam for a variety of reasons including being absent, having a medical doctor's note, possessing limited English proficiency (LEP), being excused by a parental decision not take the standardized test, or submitting an alternative portfolio assessment. Submitting an alternative portfolio assessment is generally

reserved for students on IEPs who would not reasonably be able to complete the MCAS. For the purposes of this study, all students who did not take the MCAS are grouped together in Appendix G in the Did Not Take row.

Chi Square results for the MCAS score distribution are shown in Appendix H. Chi Square is a test of statistical independence. The expected number of students who fall into the categories, advanced, proficient, needs improvement, warning, should be proportionally distributed within each group of students, Proficients, ENPs, RUPs. If the Chi Square value is high, that means there is a large difference from an expected independent distribution. A large Chi Square means the two categories have a difference that can be measured. The p value associated with the Chi Square will show the significance of the difference.

Mathematically, Chi Square is calculated as the standard deviation over the entire grid: (Expected - observed)^2/expected. The degrees of freedom is the number of columns minus one, multiplied by the number of rows minus one. In this Chi Square comparison, the Chi Square value was high and significant.

Proficients drastically outperformed the other groups. The certainty from the Chi Square test is not surprising considering that the Proficient category of students by definition do not have any students scoring in the warning or needs improvement categories for the 7th grade MCAS tests. Scoring in those ranges would mean that the Proficients would have been eligible for Rise Up and would therefore be in either the ENP or RUP categories.

To further investigate the results, a Chi Square test of only ENP vs. RUP is

required. Table 4.1 shows the results from that Chi Square test.

Table 4.1 - MCAS Comparison - Chi Square Results - ENPs vs. RUPs

		Value	df	Asymptotic Significance (2-sided)
English MCAS 7th grade	Pearson Chi-Square	23.887	8	.002
	Likelihood Ratio	23.394	8	.003
	N of Valid Cases	200		
Math MCAS 7th grade	Pearson Chi-Square	30.563	7	.000
	Likelihood Ratio	30.195	7	.000
	N of Valid Cases	200		
Science MCAS 8th grade	Pearson Chi-Square	15.938	8	.043
	Likelihood Ratio	16.591	8	.035
	N of Valid Cases	200		

In all three MCAS tests, the ENPs scored higher than the RUPs with a $p < 0.05$. To help in understanding the distribution, Table 4.2 shows the percentages of students in each category.

As illustrated in Table 4.2, every MCAS exam shows a higher percentage of RUPs in the warning range than ENPs. Using the MCAS as a metric for academic performance, RUPs consistently underperform ENPs prior to entering high school. In other words, out of the cohort of students eligible for Rise Up during the summer of 2016, the RUP group was a higher needs group, as determined by MCAS outcomes, than the ENPs.

Table 4.2 - MCAS Comparison by Percentage

		RUPs	ENPs	Proficients
English MCAS 7th grade	Advanced	0%	0%	18.2%
	Proficient	35.7%	49.3%	69.4%
	Needs Improvement	33.9%	39.6%	0%
	Warning	10.7%	6.3%	0%
	Did not take	19.6%	4.9%	12.4%
	Total	100%	100%	100%
Math MCAS 7th grade	Advanced	7.1%	2.1%	44.1%
	Proficient	12.5%	12.5%	42.4%
	Needs Improvement	17.9%	45.1%	0%
	Warning	44.6%	38.2%	0%
	Did not take	17.9%	2.1%	13.5%
	Total	100%	100%	100%
Science MCAS 8th grade	Advanced	0%	1.4%	10.6%
	Proficient	12.5%	9.0%	54.1%
	Needs Improvement	32.1%	54.9%	24.7%
	Warning	44.6%	31.9%	3.6%
	Did not take	10.7%	2.8%	7.6%
	Total	100%	100%	100%

Academic Comparisons During Freshmen Year

MCAS scores were used as an academic metric for this study because MCAS scores determined eligibility for Rise Up. Freshmen do not take the math or English MCAS, so a direct comparison using the same tool is not available. In lieu of MCAS scores, grades and grade point averages (GPAs) were used to compare academic progress between the groups during freshmen year.

Five groups are shown in this comparison. RUPs, ENPs, and Proficients are the first three groups. Two additional groups, Others and Repeaters, were included. The Others group was comprised of students who came to Rise Up for part of the time but missed more than seven days or 40% of the program. Repeaters were students repeating freshmen year.

Missing seven days of Rise Up means students in the Others category did not attend at least 60% of Rise Up. Since they attended part of the program but not the entirety, they cannot be classified as RUPs or ENPs. Students in the Others category had inadequate participation in Rise Up and therefore had an inadequate dosage of the intervention. Just as scoring less than 60% in a CRLS class during the school year means failing the class, attending less than 60% of Rise Up is equivalent to failing to adequately attend Rise Up. Boston University has a similar policy. Students missing five classes in a semester are considered for withdrawal from the class. Research also supports that at least 80 contact hours are needed for meaningful impact in a summer program (McLaughlin & Pitcock, 2009). Attending 80 hours of Rise Up is 60% attendance. In keeping with the research and the policies of CRLS and BU, 60% attendance was used for this study as the threshold for being included in the RUP group.

The fifth category, Repeaters, are repeating freshmen year. All of these students (n = 9) met the eligibility requirements for Rise Up and were entering 9th grade in the fall of 2016. However, as Repeaters, these students were not recruited for Rise Up. Both the Others category and the Repeaters category provide a more

complete picture of the different possible paths and outcomes during 9th grade.

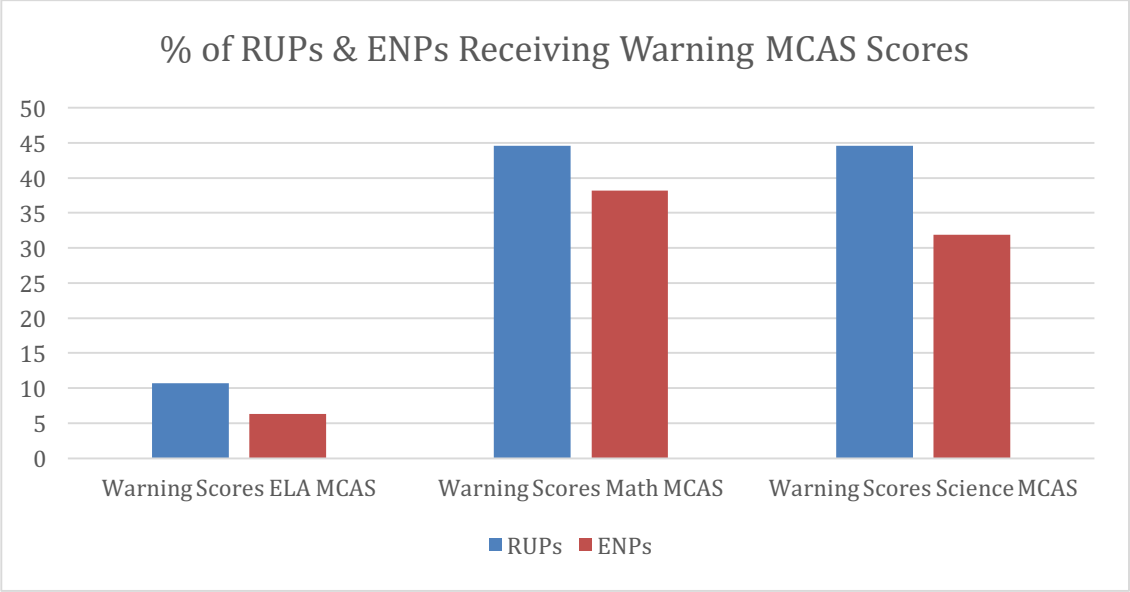
Appendix I shows the ANOVA results for each quarter as well as the cumulative GPA for the year. The F values substantially exceed the requirements from the statistical F distribution tables given (F of 3.76 minimally required). This means there is a statistically significant difference between the groups. However, since this is an ANOVA, a post hoc analysis is needed to determine which groups differ from each other.

Upon post hoc analysis, Bonferroni and Scheffe yield no significant difference in any quarter or cumulative GPA between RUPs and ENPs. In fact, for each quarter and cumulative GPA, Bonferroni reported a significance level of 1.000. The most meaningful Scheffe significance was 0.990 during quarter one with ENPs having a mean GPA higher by 0.80 over the RUPs with a standard error of 1.47. Bonferroni and Scheffe post hoc analysis concludes that RUPs and ENPs are effectively the same group with respect to GPAs throughout freshman year. Appendix C shows the results from the post hoc analysis in table format.

To emphasize and summarize these comparisons, the MCAS results between the RUPs and ENPs are shown below. Figure 4.1 shows the percentage of students who received scores in the warning range on all three MCAS exams.

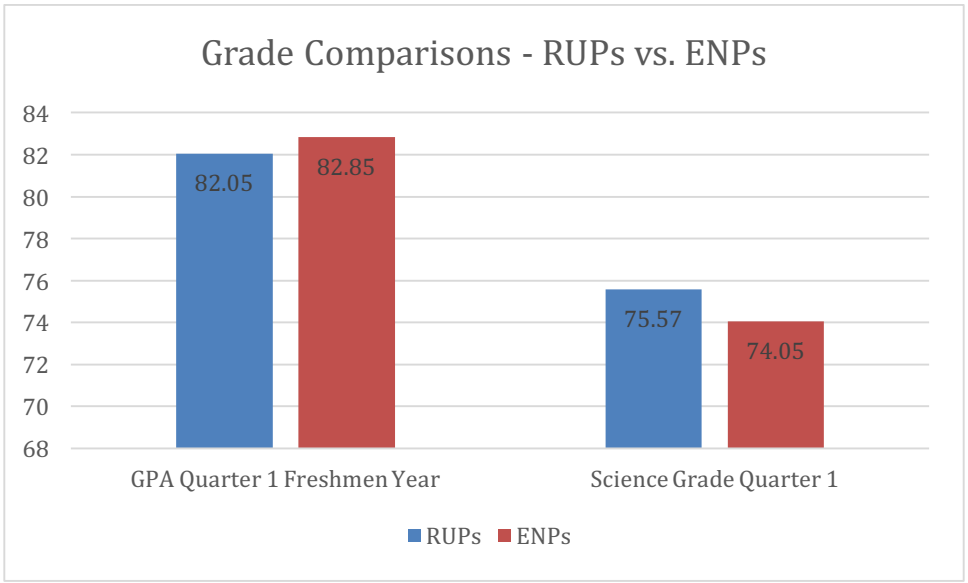
RUPs consistently have more students scoring lower than ENPs on every MCAS exam. The graphic above demonstrates that more RUPs score in the lowest category, warning, compared to the ENPs. Similar findings apply to the other possible MCAS scores (see Table 4.2 for full comparison).

Figure 4.1 – Percentage of RUPs and ENPs Receiving Warning MCAS Scores



In contrast, Figure 4.2 shows grade comparisons during the first quarter of freshmen year (see Appendix C for more detail).

Figure 4.2 – Grade Comparisons First Quarter Freshmen Year – RUPs vs. ENPs



The graphic shows that RUPs and ENPs were effectively equivalent at the start of high school. This is a graphical representation of same the findings from the previous page. RUPs entered high school lower academically than ENPs but after one quarter they were academically equivalent.

The Proficients group has significantly higher mean GPAs than the either RUPs or ENPs. RUPs and ENPs had mean GPAs that ranged, respectively, from 82.05 and 82.85 in quarter 1 to 76.59 and 77.32 in quarter 4. Interestingly both RUP and ENP GPAs consistently decreased each quarter while Proficients GPAs' remained fairly constant ranging from 89.62 during quarter 2 to 90.67 in quarter 3.

Considering the pre-high school MCAS scores of the RUPs were significantly lower than ENP scores, statistically equivalent GPAs may be viewed as a positive step for RUPs compared to ENPs. This is not to say that Rise Up was the only cause of relative academic gains but it may be one contributing factor.

Repeaters' mean GPAs consistently went down each quarter from 65.9 in quarter 1 to 46.6 in quarter 4. Even though the Repeaters are the smallest group ($n = 9$), the means were significantly different than RUPs and ENPs ($p<0.0005$). These low grades mean that at least some of these students did not accumulate enough credits to pass freshmen year on their second attempt.

Students in the Others category also demonstrated significantly lower GPAs ($p<0.0005$) every quarter compared to RUPs and ENPs. The mean GPA for the Others category was expected to be similar to the RUPs and ENPs. However, that was not the case. Mean GPAs for the Others fell between the RUP/ENP range and

the Repeaters average. Chapter 5 contains a discussion of the groups known in this study as Others and Repeaters.

Behavior Comparisons During Freshmen Year

Discipline referrals are monitored by the school system and documented each time a student is sent to the office. These statistics are kept for both 8th grade and 9th grade and can be compared between groups. The records show substantially fewer middle school discipline referrals compared to high school discipline referrals. 3.8% of middle school students received at least one discipline referral during their 8th grade year compared to 21.7% of 9th graders who received a discipline referral.

There are five public schools with 8th grade in Cambridge that serve as feeder schools for Cambridge Rindge and Latin. Those schools are the Amigos (the only K-8 school), Vassal Lane Upper, Cambridge Street Upper, Rindge Avenue Upper and Putnam Avenue Upper School. The five schools did not show any difference in the frequency of discipline referrals. None of the 8th-grade schools showed higher or lower rates of disciplinary action for RUPs, ENPs, Proficients, or Others ($p = 0.204$). Further, 8th-grade school was not a predictor of high school behavior. An ANOVA yielded an F value of 1.330 with a p value of 0.251. In other words, the 8th grade from which a student came was not a predictor of the number of discipline referrals they received in high school.

Running an additional one-way ANOVA between RUPs, ENPs, Proficients,

Others and Repeaters considering both middle and high school discipline records, a significant difference was noted between the groups for high school only ($F = 16.3$, $p<0.0005$). Upon post hoc analysis (Appendix D) for the high school records using both Bonferroni and Scheffe, the Others showed a significant mean difference compared to RUPs, ENPs and Proficients (respectively, $p=0.001$, $p=0.001$, $p<0.0005$). The mean difference was also significant between Repeaters vs. RUPs, ENPs, and Proficients (all groups $p<0.0005$). The emerging similarities between Others and Repeaters will be discussed more in the final chapter. For now, the similarities between Others and Repeaters may speak to the importance of being successful freshmen year.

Comparing behaviors during freshmen year for the three main target groups, ENPs, RUPs, and Proficients, an interesting pattern emerges. Rise Up appears to have decreased the number of discipline referrals for RUPs relative to the ENPs using the Proficients as a baseline. In high school, there is no statistical difference between the RUPs and the ENPs (Bonferroni $p=1$, Scheffe $p=0.966$). There is also not a statistical difference between the RUPs and the Proficients (Bonferroni $p=1$, Scheffe $p=0.720$). However, comparing ENPs and Proficients, a reportable statistical difference is found (Bonferroni $p=0.027$, Scheffe $p=0.061$). The Proficients have the fewest number of discipline referrals and the ENPs have the most out of the three target groups. Even though RUPs are statistically the same as ENPs and Proficients, the number of RUP discipline referrals is actually somewhere in between the two groups. This must be true since Proficients and ENPs are found to be different with

the Proficients having the least. A larger sample size would be needed to support this finding with significance. However, the RUPs were observed to be trending towards the proficients whereas they were expected to remain the same as the ENPs without the intervention of Rise Up. This pattern of the RUPs falling in between Proficients and ENPs is not limited to behavioral issues.

Attendance Comparisons During Freshmen Year

Attendance can be used as another indicator leading to success during freshmen year. The three target groups, RUPs, ENPs, and Proficients were compared along with the fourth and fifth categories of Others and Repeaters. Again Others is comprised of students who failed to meet minimum attendance requirements for the Rise Up program and Repeaters are the students who were repeating freshmen year and therefore were not recruited for Rise Up. Total absences, unexcused absences, excused absences and total tardies were compared. Total absences was the sum of unexcused and excused absences.

The ANOVA yielded a statistically significant difference between the groups for each of the different attendance records, total absences, unexcused absences, excused absences and total tardies (respectively, $F=56.6, 53.8, 12.3, 20.4$ all with $p<0.0005$).

The post hoc analysis shows that total absences are not statistically different between RUPs, ENPs and Proficients; however, the Others and Repeaters groups were significantly different with mean differences of approximately 14 absences

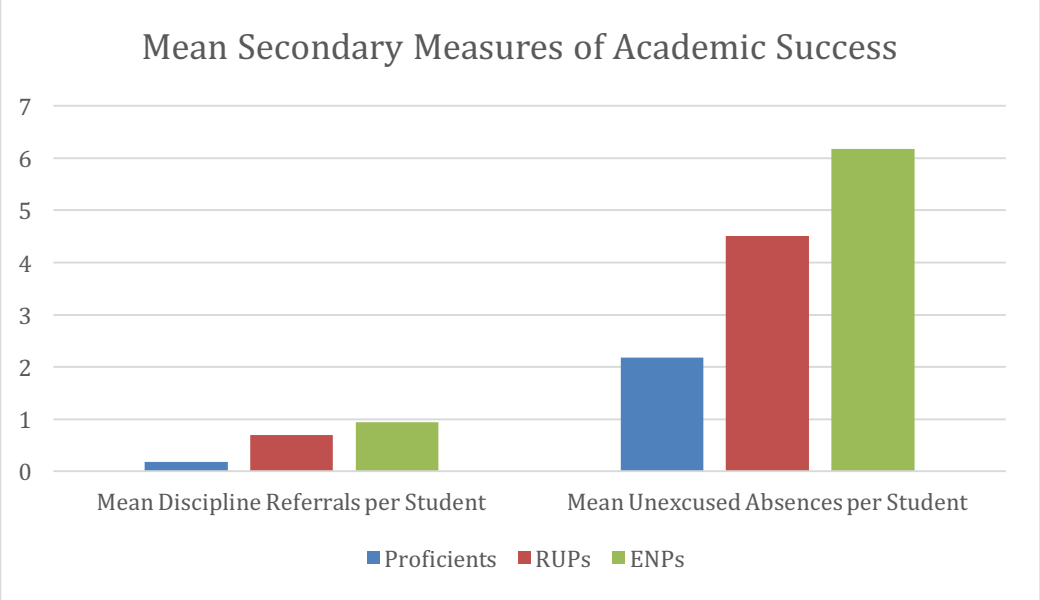
and 70 absences, respectively, greater than the three groups ($p<0.02$, $p<0.0005$, respectively). The full post hoc analysis Table is located in Appendix E.

The breakdown between unexcused and excused absences followed the same pattern as the total absences with one exception. With 90% confidence, the ENPs and Proficients had different unexcused absence rates, with the ENPs having a higher rate of unexcused absences (Bonferroni $p=0.033$, Scheffe $p=0.070$)

RUPs were in closer alignment with Proficients but were not statistically different from either group. While not statistically different than either group, RUPs have a mean number of unexcused absences in between Proficients and ENPs.

To provide a more visual way to represent RUPs falling in between Proficients and ENPS, Figure 4.3 shows the mean discipline referrals and mean unexcused absences for the three target groups.

Figure 4.3 – Mean Secondary Measures of Academic Success



RUPs consistently fall between the Proficients and ENPs but are not significantly different from either group.

Unless absenteeism is a chronic problem for a student, the difference between an unexcused absence and an excused absence can be as small as a call from a parent. The gradient from ENP to RUP to Proficient may be suggestive of a level of parental involvement. However, connectedness, which will be discussed and quantified later in this chapter in Table 4.15, cannot be used to explain any difference between excused and unexcused absences. RUPs, ENPs and Proficients all report no statistical difference in degrees of parental connectedness.

The post hoc analysis of tardies found no statistical difference between RUPs and ENPs. However, Proficients were tardy significantly less compared to both RUPs and ENPs at $p=0.012$ and $p=0.004$, respectively. Once again the Others and Repeaters had the most tardies. Others and Repeaters were significantly different than all three of the target groups ($p<0.0005$). Others averaged about 7.5 fewer tardies than Repeaters.

Fall Sports Participation Comparisons

RUPs were anticipated to participate more in fall sports than ENPs based on pilot studies; however, the data did not support these expectations. Anticipated results, actual results, and implications will be discussed here but not in chapter five since sports will not be strongly considered for this study.

Comparing fall sport participation across all three target groups, Proficients,

ENPs and RUPs, using a Chi square produces a value of 13.7 (p=0.003). However, upon further analysis across subgroups, no statistical difference was found between the RUPs and ENPs (Chi Square value 0.066). This is showing that the Proficients were the cause of the statistical difference between the three groups in the first Chi square test. 34.7% of Proficients, 19.4% of ENPs and 17.9% of RUPs participated in 2016 fall sports.

A pilot study from the 2014 summer cohort of RUPs (n=56) vs. ENPs (n=155) found that 38% of RUPs participated in a fall sport compared to 29% of ENPs. Chi Square analysis yields a value of 1.372 (p=0.241). While not a strong statistical correlation, this difference in RUPs vs. ENPs in fall sports participation has been consistent for the previous 4 years, 2012-2015. Unfortunately data from 2012, 2013 and 2015 is no longer available. No known bias is present in the absence of this data. 2014 data was available from the PI's pilot study. The PI requested and analyzed data each year from 2012 - 2016 for Rise Up funding purposes but only retained the data from the pilot study and the current study.

This year's data does not align with previous findings. Past years have shown a higher percentage of RUPs enrolling in fall sports. One possible explanation is that in previous years, 8-10 RUPs have played football, the largest fall sport. In 2016 zero RUPs played football for more than a single day and were therefore not counted as fall athletes. The freshmen football team was discontinued in 2016 for the first time in years. Major changes in the coaching staff likely contributed to this collapse. This major negative event affecting the RUP fall athlete

percentages were outside the control of the study.

Further investigation of differences in the level of sports participation is needed as part of a longer longitudinal study. The results from 2016 and the inadmissible results of the pilot from 2014 can not be used to establish a difference between RUP and ENP fall sports participation. This aspect of comparison between ENPs and RUPs will not be used moving forward.

Research Question Number 2 - Effect of Rise Up on at-risk students' Connectedness

The Hemingway survey was administered to the RUPs a total of four times: at the beginning Rise Up, at the end of Rise Up, in the fall and again the following spring. The rest of the freshmen class took the Hemingway twice: in the fall and in the spring.

This section is designed to demonstrate the results from the Hemingway first by looking at reliability and second by looking at the comparisons between student groups. This short version of the Hemingway measures ten different subscales of ecological worlds of the adolescent. The different ecological worlds are categorized into four larger domains. Each of the ten subscales has 5-6 questions or items on the survey. The ten subscales measure connectedness to neighborhood (6 items), friends (6 items), self-in-present (6 items), parents (6 items), siblings (5 items), school (6 items), peers (6 items), teachers (5 items), self-in-future (5 items), reading

(6 items). The four ecological domains (and their associated subscales) are academics (teacher, school, reading, peers), self perception (self-in-future, self-in-present), social connectedness (friends, neighborhood), and family (parents, siblings). Connectedness scores range from 1-5, 5 being the highest level of connectedness.

Reliability

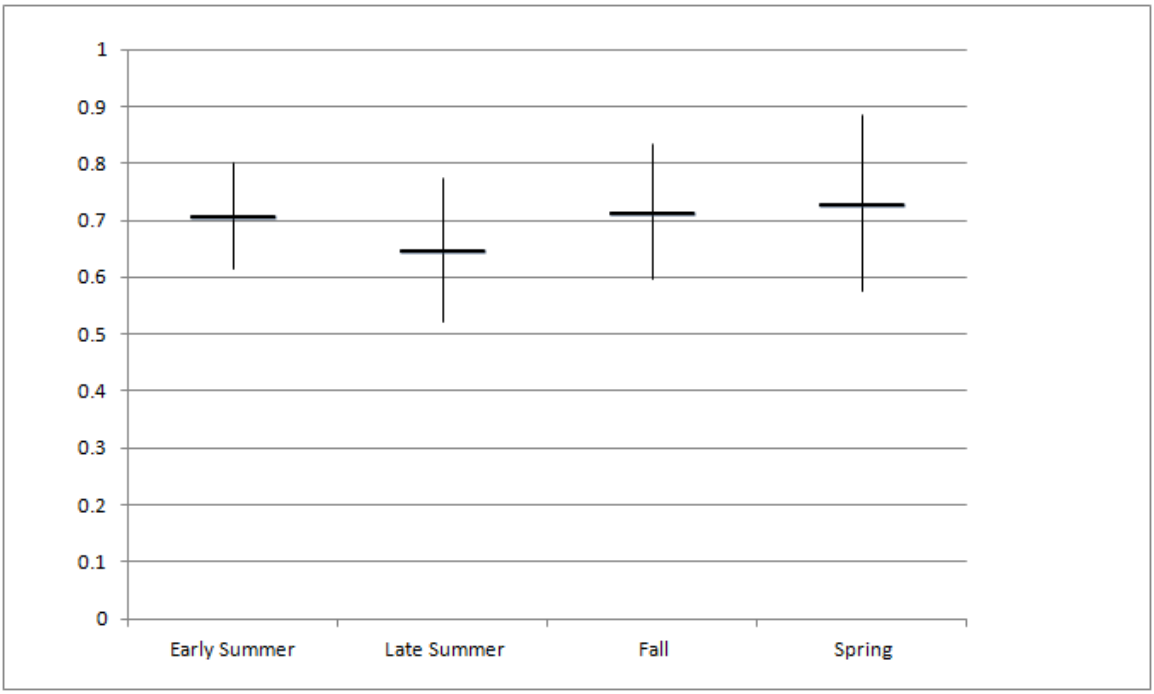
To determine the internal consistency of the surveys, Cronbach's Alpha was calculated. If each of the items that measure any particular subscale are similar, Cronbach's Alpha will be significantly higher. Internal consistency is determined with Cronbach's Alpha values below 0.5 being unacceptable, between 0.5-0.6 are poor, between 0.6-0.7 are questionable, between 0.7-0.8 are acceptable, between 0.8-0.9 are good and above 0.9 excellent. Generalizability is stronger with a higher value for Cronbach's Alpha.

Cronbach's Alpha is a test of statistical independence. If alpha is equal to one, then there is zero independence and 100% dependence. In other words in the Hemingway survey, each subscale has a similar question that is asked approximately five times. If the students answer the same way each of those five times, then Cronbach's Alpha will be 1. If students interpret the variations in questions slightly differently, then they may give slightly different values but those values should still show a strong relationship. That would indicate a relatively high Cronbach's Alpha value. If students gave random answers, in other words, they did

not take the surveys seriously, then Cronbach's Alpha should show that the surveys are not reliable with a low value. Cronbach's Alpha is a weighted average of correlation coefficients. For the purposes of this study, values of Cronbach's Alpha below 0.6 were dropped and deemed below an acceptable line of reliability.

Because the RUPs took the Hemingway survey a total of four times, a longitudinal trend for the Cronbach's Alphas can be shown. Appendix J shows the Cronbach's Alpha scores for each of the ten subscales during each of the four times the RUPs took the Hemingway. Figure 4.4 shows the average alpha along with the standard deviation for each time the survey was administered to the RUPs.

Figure 4.4 - RUPs Cronbach's Alpha Average with Standard Deviation



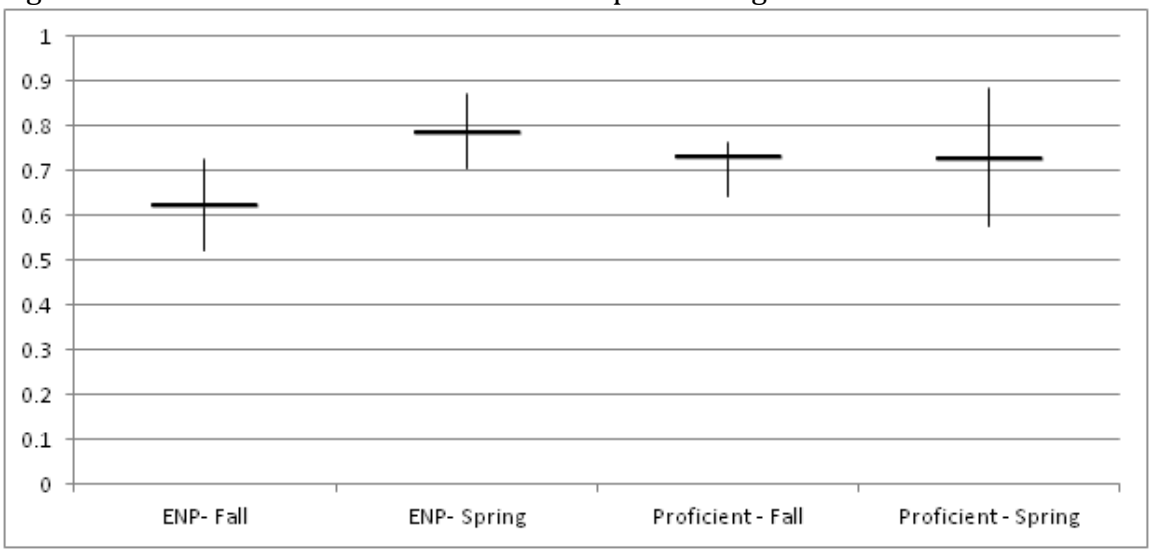
The overall trend for the alphas shows an increasing internal consistency which suggests that as the RUPs took the surveys multiple times, they became

slightly more consistent in their answers. Using Cronbach's Alpha values, at least in the 0.6-0.7 range, analysis of the connectedness scores can be compared across populations. Alphas lower than 0.6 do not show enough internal consistency to warrant further exploration.

The lowest alpha scores across the board were concerning the subscale for the self-in-the-future. This suggests that students' vision of themselves is the most variable. The highest alphas are seen with reading and neighborhood. As seen in the next section, a high alpha does not correspond to high connectedness values. While neighborhood connectedness values are high, reading subscale scores are lower.

Appendix K shows the Cronbach Alphas for ENPs and Proficients by subscale. Figure 4.5 shows the alpha means with standard deviations.

Figure 4.5 - ENPs & Proficients Cronbach's Alpha Average with Standard Deviation



ENPs showed the largest average increase in internal consistency as the alpha for every subscale increased or stayed constant except for the peers subscale. Proficients' average alpha stayed approximately the same but the standard deviation increased. Proficients' alphas on the two subscales, teachers (0.482) and self-in-future (0.489), dropped off to unacceptable levels. While the drop off does not indicate how strongly connected the proficients are to teachers and to self-in-future, it does indicate that the proficients' opinions about those subscales became less consistent.

Connectedness Comparisons Within RUPs

Since the RUPs took the Hemingway four times, a repeated-measures ANOVA (MANOVA) will show if the scores significantly changed for each of the subscales. The following RUP Hemingway subscales will be excluded due to $\alpha < 0.6$ results for internal consistency:

- Parents fall,
- School late summer,
- Peer late summer,
- Teachers spring,
- Self-in-Future late summer, fall and spring.

Table 4.3 shows the results of the repeated measures ANOVA for each subscale.

Table 4.3 – RUP Repeated Measures ANOVA Results

Subscale	Wilk's Lambda (Λ)	Hypothesized df	Error df	F	p
Neighborhood	0.71	3	9	1.213	0.36
Friends	0.87	3	9	0.444	0.72
Self-in-Present	0.85	3	8	0.469	0.71
Parents	0.96	2	17	0.400	0.68
Siblings	0.66	3	8	1.406	0.31
School	0.79	2	12	1.610	0.24
Peers	0.89	2	12	0.751	0.49
Teachers	0.98	2	25	0.299	0.74
Self-in-Future	No MANOVA possible. Only 1 reliable data point.				
Reading	0.89	3	9	0.371	0.78

Wilk's Lambda measures the percent difference in variance of the dependent variable. The lower the value for Wilk's Lambda, in combination with a significant p value, shows a stronger change for the repeated measures. For example, RUPs' view of parents (Λ=0.96) remained almost exactly the same throughout the three reliable surveys. The mean value for connectedness to parents ranged from 3.94 at the beginning of the summer to 3.83 in the spring (p=0.456). This minor decline in the parental connectedness score suggests that students' degree of connectedness to their parents did not significantly change from the summer of 2016 to the spring of 2017. Similarly, RUPs connectedness to teachers (Λ=0.98) only saw a minor increase from early summer to the fall, 3.39 to 3.5 (pairwise comparison between early summer to fall, p=0.744). Statistically these values are almost exactly the same which means there is no significant difference in connectedness to parents or

teachers between RUPs and ENPs.

Pairwise analysis shows fluctuations within the subscale scores across the different administrations of the Hemingway. School connectedness values increased for RUPs slightly from the early summer to the fall, 3.52 to 3.72 ($p=0.168$). The late summer school score was not reliable so the trend cannot be determined. However, reading connectedness scores for RUPs trended upward from the early summer to the fall with means 2.34, 2.48, 2.65 (pairwise $p=0.294$ for early summer to fall). School and reading are forms of conventional forms of connectedness (Karcher, 2011, 19) because they are directly, "condoned and governed by adults and mainstream society" (Karcher, 2011, 22).

In addition to school and reading, parents and teachers are also forms of conventional connectedness (Karcher, 2011, 19). However, RUPs demonstrate little to no change in connectedness with parents or teachers. Overall, Rise Up appears to be neutral to perhaps slightly beneficial with respect to conventional domains of connectedness during the gap summer into the fall.

Significance levels throughout the connectedness analyses were lower than anticipated. Trends were looked at to observe emergent patterns. Significance levels are still reported even at the lower levels.

More dramatic changes in connectedness scores were observed for connectedness to neighborhood and siblings. Neighborhood connectedness scores steadily increased from the late summer to the spring ($\Lambda=0.71$, $p=0.36$). Means increased from 3.27 to 3.47 to 3.65. This trend was confirmed in the pairwise

comparisons. The difference in means from late summer to spring was significant at p = 0.083.

Siblings connectedness also trended upwards (Λ=0.66, p=0.31) with an increase in means from 3.41 in the fall to 3.78 in the spring (pairwise p=0.09). Summer connectedness means to siblings were slightly higher but statistically the same as the fall.

Similarly, but with less statistical significance (Λ=0.87, p=0.72), connectedness to friends increased from 3.52 in early summer to 3.70 in the fall and 3.76 in the spring (p=0.287 and p=0.339, respectively). Neighborhood, siblings and friends are all linked more to unconventional connectedness which correlates with greater risk-taking behavior (Karcher, 2011).

Because connectedness has a strong temporal component, the conventional connectedness gains made in the fall seem to show a slight decline by the spring, whereas the unconventional domains show a consistent rise. Figure 4.6 and Table 4.4 shows all the RUPs mean connectedness scores by subscale and season of survey. Figure 4.6 is included to help visualize the trends while Table 4.4 is included to more closely analyze the exact means.

Figure 4.6 – RUPs Mean Connectedness Scores by Subscale and Season of Survey

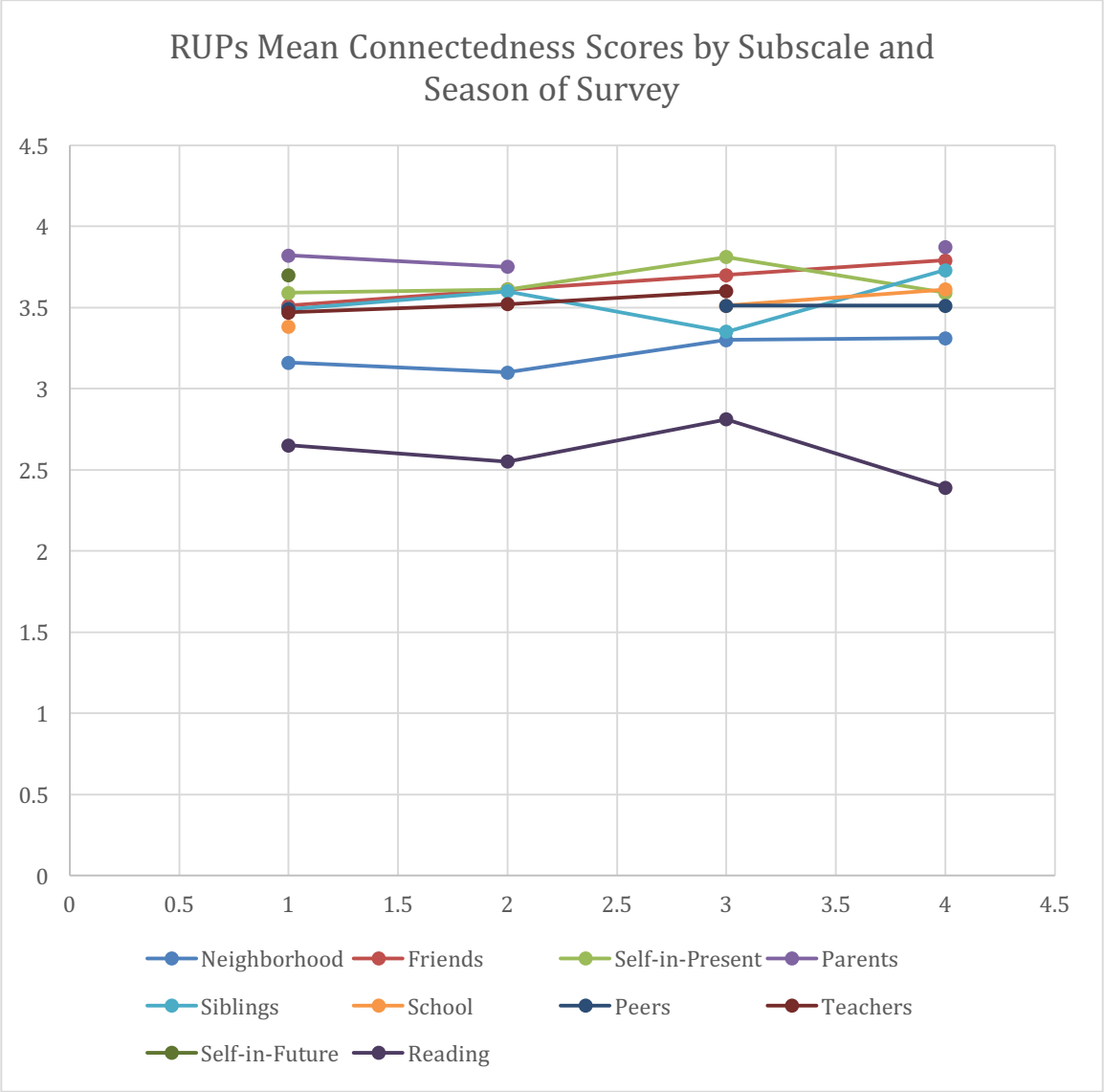


Table 4.4 - RUPs Mean Connectedness Scores by Subscale and Season of Survey

Connectedness subscale	Early Summer 2016	Late Summer 2016	Fall 2016	Spring 2017
Neighborhood°	3.16	3.10	3.30	3.31
Friends°	3.51	3.61	3.70	3.79
Self-in-Present	3.59	3.61	3.81	3.59
Parents†	3.82	3.75	3.71*	3.87
Siblings°	3.49	3.60	3.35	3.73
School†	3.38	3.40*	3.51	3.61
Peers	3.49	3.55*	3.51	3.51
Teachers†	3.47	3.52	3.60	3.53*
Self-in-Future	3.70	3.84*	3.82*	3.92*
Reading†	2.65	2.55	2.81	2.39

*Cronbach's alpha <0.6 and therefore not reliable
†Conventional Domains of Connectedness
°Unconventional Domains of Connectedness

The next comparison of ENPs and Proficients will look to see if similar declines in conventional connectedness and increases in unconventional connectedness from fall to spring are consistent across groups. If conventional connectedness declines are expected across all groups, slight increases just before the school year might mitigate losses. While this study does not have survey data from ENPs and Proficients during the summer to support such a claim, slight increases in RUPs from the start of the intervention to the fall are encouraging.

Connectedness Comparisons Across Student Groups RUPs, ENPs, Proficients

Table 4.5 shows the mean connectedness score for each subscale for all three groups, RUPs, ENPs and Proficients for every administration of the Hemingway.

Table 4.5 - Mean Connectedness Scores, RUPs, ENPs, Proficients

	RUP				ENP		Proficients	
Connectedness subscale	Early Summer 2016	Late Summer 2016	Fall 2016	Spring 2017	Fall 2016	Spring 2017	Fall 2016	Spring 2017
Social Connectedness Ecological World								
Neighborhood°	3.16	3.10	3.30	3.31	3.30	3.13	3.31	3.26
Friends°	3.51	3.61	3.70	3.79	3.90	3.83	4.00	4.00
Self Perception Ecological World								
Self-in-Future	3.70	3.84*	3.82*	3.92*	3.86*	3.73	3.88	3.83*
Self-in-Present	3.59	3.61	3.81	3.59	3.63	3.66	3.70	3.71
Family Ecological World								
Parents†	3.82	3.75	3.71*	3.87	3.80*	3.82	3.83	3.75
Siblings°	3.49	3.60	3.35	3.73	3.65*	3.83	3.66	3.61
Academics Ecological World								
School†	3.38	3.40*	3.51	3.61	3.58	3.42	3.64	3.58
Peers	3.49	3.55*	3.51	3.51	3.63	3.52*	3.65	3.49
Teachers†	3.47	3.52	3.60	3.53*	3.92	3.81	3.97	3.59*
Reading†	2.65	2.55	2.81	2.39	2.97	2.69	3.10	3.05

*Cronbach's alpha <0.6 and therefore not reliable
†Conventional Domains of Connectedness
°Unconventional Domains of Connectedness

Comparing RUP and ENP connectedness scores in the fall 2016, the ENPs scores are statistically the same or higher in every subscale except self-in-present

(RUPs are 0.19 higher with Scheffe p=0.489, Bonferroni p=0.697). For example, in the fall ENPs' friends score is 0.20 higher (Scheffe p=0.356, Bonferroni p=0.453), teachers' score is 0.31 higher (Scheffe p=0.066, Bonferroni p=0.060), and peers' score is 0.12 higher (Scheffe p=0.668, Bonferroni p=1.000). Overall, this seems to suggest that despite the RUPs being involved in the summer intervention program, the ENPs are actually starting high school with a higher degree of connectedness.

However, comparing RUP and ENP connectedness scores in the spring of 2017 the opposite is true. RUPs are statistically the same or higher in every subscale that has a reliable alpha to compare except reading (ENPs are 0.31 higher with Scheffe p=0.472, Bonferroni p=0.663). For example, the spring RUPs neighborhood score is 0.18 higher (Scheffe p=0.620, Bonferroni p=0.987), and school score is 0.18 higher (Scheffe p=0.450, Bonferroni p=0.621). While the RUPs enter the school year with significantly lower connectedness scores, their scores catch up to or surpass the ENPs by the spring. This is similar to the results seen in the previous section which showed RUPs entering high school with lower MCAS scores than ENPs but finishing with equivalent GPAs. Once again, the Rise Up program cannot claim responsibility for these gains but the program may be one contributing factor in increasing student connectedness.

For comparison purposes, the Proficients' scores have been analyzed alongside the RUPs and ENPs in an ANOVA with post hoc analyses. Unsurprisingly, the Proficients enter high school significantly more connected to the academic domain than either the RUPs or ENPs. Teacher, school, reading, peers are the four

subscales comprising the academic ecological world according to the connectedness conceptual framework. Entering the school year in the fall, the Proficients show higher connectedness scores for friends, siblings, school, peers, teachers, and reading.

Similar to the overall decline in the connectedness scores seen from the fall to the spring with the ENPs, the Proficients' scores also drop or remain flat in every category. Interestingly, the gains made by RUPs throughout the school year allow the RUPs to nearly catch up to the Proficients. In some cases, such as peers, scores remain consistent across each administration of the survey. Relative to the losses seen with ENPs and Proficients, a consistent score shows a more stable degree of connectedness.

In the academic ecological world, only school, peers and reading have scores that can be reliably compared (RUP Cronbach's alpha for teachers is too low). The RUPs slightly surpass but are significantly the same as the Proficients in the spring (Scheffe p_{school}=0.972, p_{peers}=0.993). The reading subscale scores for Proficients are significantly higher, by 0.67, than RUP scores (Scheffe p=0.017). Overall the Proficients remain more academically connected but the RUPs make encouraging strides towards increased connectedness.

Figures 4.7, 4.8, and 4.9 show the subscale scores for the RUPs, ENPs and Proficients, respectively.

Figure 4.7 - Academic Ecological World for RUPs

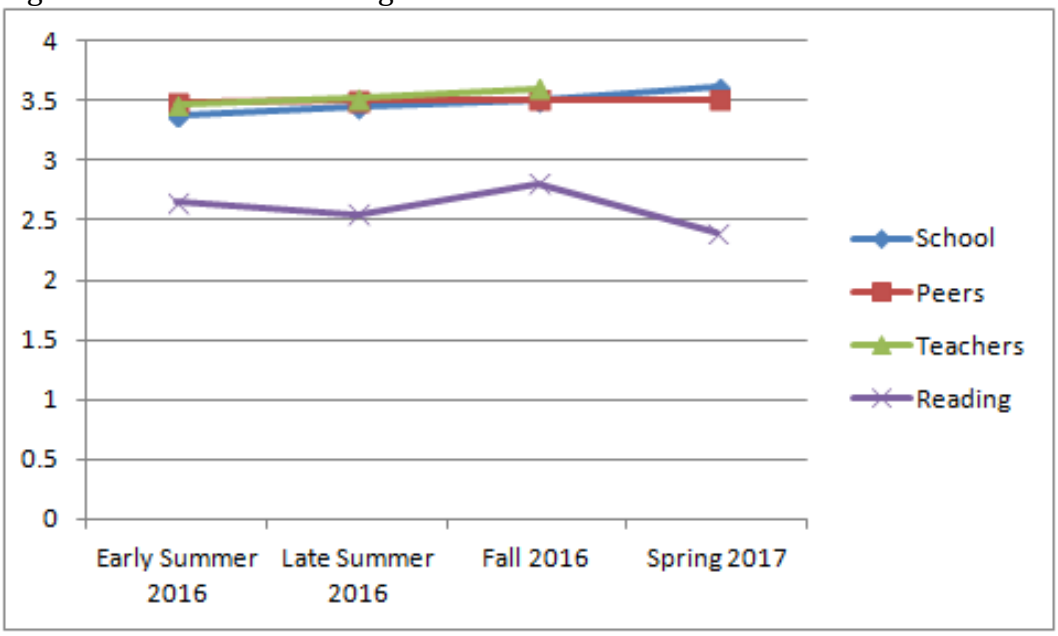


Figure 4.8 - Academic Ecological World for ENPs

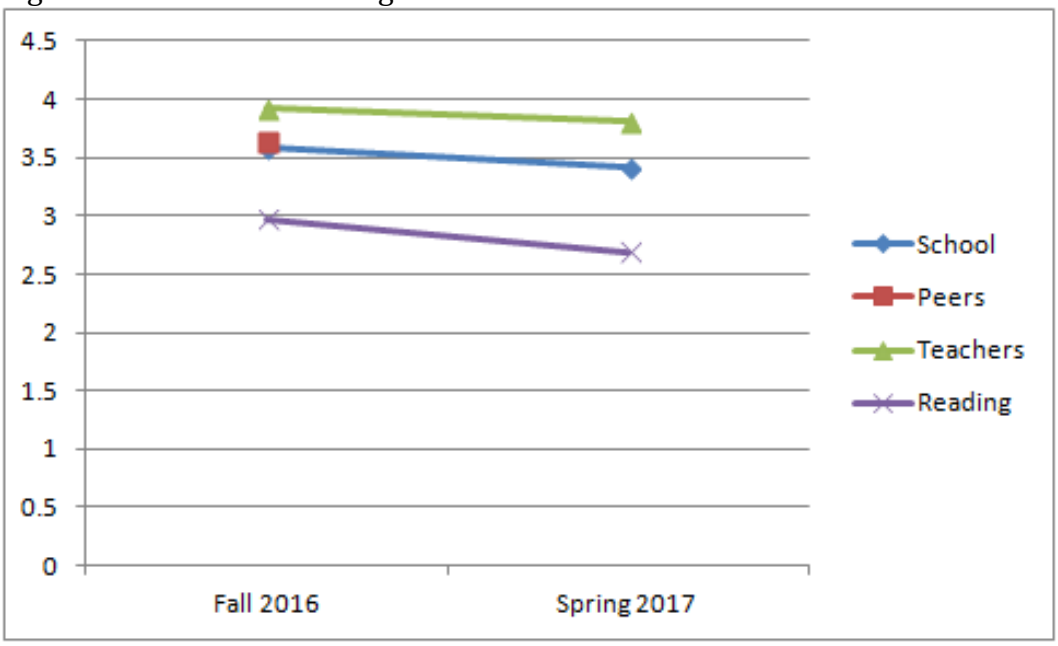
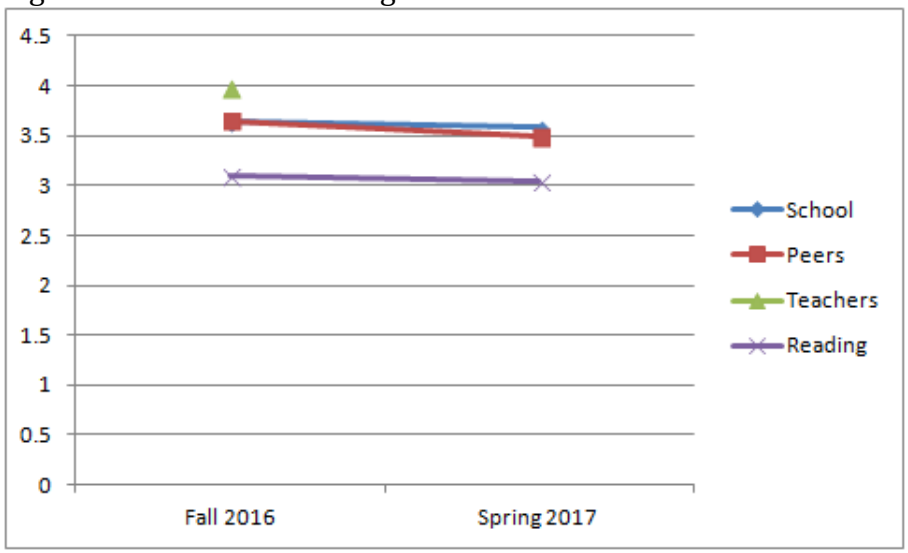


Figure 4.9 - Academic Ecological World for Proficients



The graphs demonstrate the trends seen in the averages for each group's scores. RUPs overall show an increase to flat connectedness scores whereas ENPs and Proficients demonstrate a decline in their connectedness scores. Observing the trends from the fall of 2016 to the spring of 2017, the RUPs have a clear advantage over the ENPs and Proficients. Where ENPs and Proficients decline in connectedness, the RUPs stay consistent or increase, with the exception of the reading scores which drop for all three groups.

This study does not have the survey data from the summer for ENPs or Proficients to show the same four points as the RUPs. The trend on both the ENPs and Proficients from the two data points shows a declining connectedness trend for all connectedness subscales within the academic domain with an acceptable value of Cronbach's alpha. While the ENPs and Proficients demonstrate a decline in connectedness, the RUPs show a flat or increasing connectedness trend for all scores with only a drop off in the spring reading score.

Research Question Number 3 - Correlation between Academic Ecological World and Science Learner Identity

Before disaggregating RUPs, ENPs, and Proficients, the data was analyzed as a large group to determine the relationship between the academic ecological world and science learner identity. Students self-reported their interest in majoring in a STEM field or entering a STEM career. Interest in STEM majors and STEM careers was used because they represent the fulfillment of the STEM pipeline (Hanson, 1996). Parallels between the Hanson's (1996) pipeline components of activity, achievement, attitude and access, were hypothesized to correlate with the academic ecological domains.

As discussed more in chapter two, science identity is the connection and view of the self within the scientific community. Those connections can be demonstrated through relationships with science teachers, ability to discuss science with peers, success in scientific endeavors, and scientific literacy. Similarly, the academic ecological domain of connectedness contains subscale scores for teachers, peers, school, and reading.

Using Pearson's correlation, Table 4.6 shows the correlations between positive interest in STEM majors and positive interest in STEM careers for each of the four times the surveys were administered. The first two times the surveys were administered, only RUPs participated in the survey but the final two times the surveys were given, the entire freshmen class took the survey.

Table 4.6 - Correlation and Frequencies between STEM Majors and STEM Careers

	Correlation between interest in STEM Major and interest in STEM Career	Frequency of interest in STEM Major		Frequency of interest in STEM Career	
		Reported Yes	Reported No	Reported Yes	Reported No
Early Summer 2016	0.589	14	28	18	28
Late Summer 2016	0.621	17	33	20	30
Fall 2016	0.777	73	132	79	131
Spring 2017	0.675	75	108	62	119

All correlations are significant at the 0.01 level.

A strong correlation is shown between students interested in STEM college majors and STEM careers although not as strong as anticipated. Students more frequently reported a STEM career over a STEM major. Being on track to become a STEM major or enter a STEM career both would place the student on the STEM "pipeline" (Berryman, 1983). Since there is some difference between STEM majors and careers, the next analysis will keep majors and careers separated.

Degree of Academic Connectedness and STEM Interest

Independent-samples t-tests, assuming equal variances, were conducted for the subscales of the academic ecological world. Students identifying themselves as being interested or not interested in STEM Majors and STEM careers were used as the independent grouping variable. These tests determine if students who identify as interested in STEM also score higher in academic connectedness fields regardless of their Rise Up status. Appendix L shows the results of these tests.

The results show a significant difference in the degree of academic

connectedness between students interested in STEM compared to those who are not interested. The STEM pipeline, as discussed in chapter two, indicates students who express an interest in entering STEM fields as a major or as a career based on access, activity, achievement and attitudes (Hanson, 1996). In particular, STEM pipeline students report higher degrees of connectedness on the subscales for school, teachers and reading with p values ranging from <0.0001 in the fall to 0.147 in the spring with the larger sample size of the entire freshmen class.

The fall connectedness to teachers for reported STEM majors is the least significant amongst teachers, school and reading. Even still, there is a strong confidence that teachers (p=0.147) are impacting student connectedness for STEM-interested students. The null hypothesis states that there is no difference between students interested in STEM majors and those not interested in regards to how connected they feel to their teachers. We have failed to reject the null hypothesis at the 95% confidence level but we can reject the null at the 70% confidence level for this two-tailed test. If we make the hypothesis that students interested in STEM majors are more connected to their teachers then we can reject the null with 85% confidence because it would be a one-tailed t-test instead.

The sample size for the fall and spring, which included the entire freshmen class, is much larger than the summer. Even still, not all of the students who took one survey necessarily took the second survey. This further reduced the sample size when looking at the results of the two surveys in conjunction with each other. Lower sample size decreases the significance of the findings. Students interested

and not interested in STEM were separated into two groups. The mean connectedness scores were compared for those two groups. The mean differences from the school year, reported above, showed some significance. However, the small sample size of the RUPs from the summer did not yield the same significance. The mean differences for the RUPs from the summer were approximately the same compared to the school year. This suggests that a larger RUP sample size in the summer could support a similar relationship. In other words, students interested in STEM could be shown to demonstrate higher connectedness scores.

The peers subscale score is the only academic ecological world connectedness subscale where non-STEM pipeline students showed slightly higher connectedness scores. However, the difference is not statistically significant with the lowest p value of 0.210 in the late summer for reported STEM majors. There is one exception to this statistical equivalence. Fall 2016 reported STEM majors were more likely to demonstrate a stronger connectedness value to peers than non-STEM majors ($p=0.068$). While the peers subscale alone may not provide conclusive evidence, taken in tandem with the rest of the t-tests, students in the STEM pipeline are more likely to demonstrate more academic connectedness.

Study Populations

Since previous studies (Aschbacher, Li, Roth, 2010; National Science Foundation, 2015) have addressed the racial discrepancies in STEM fields, this section will look at 9th grade interest in science disaggregated by race. First Figures

4.10 and 4.11 show the demographic breakdown of students in the study and the school in 2016 by race.

Figure 4.10 - Study Demographics by Race

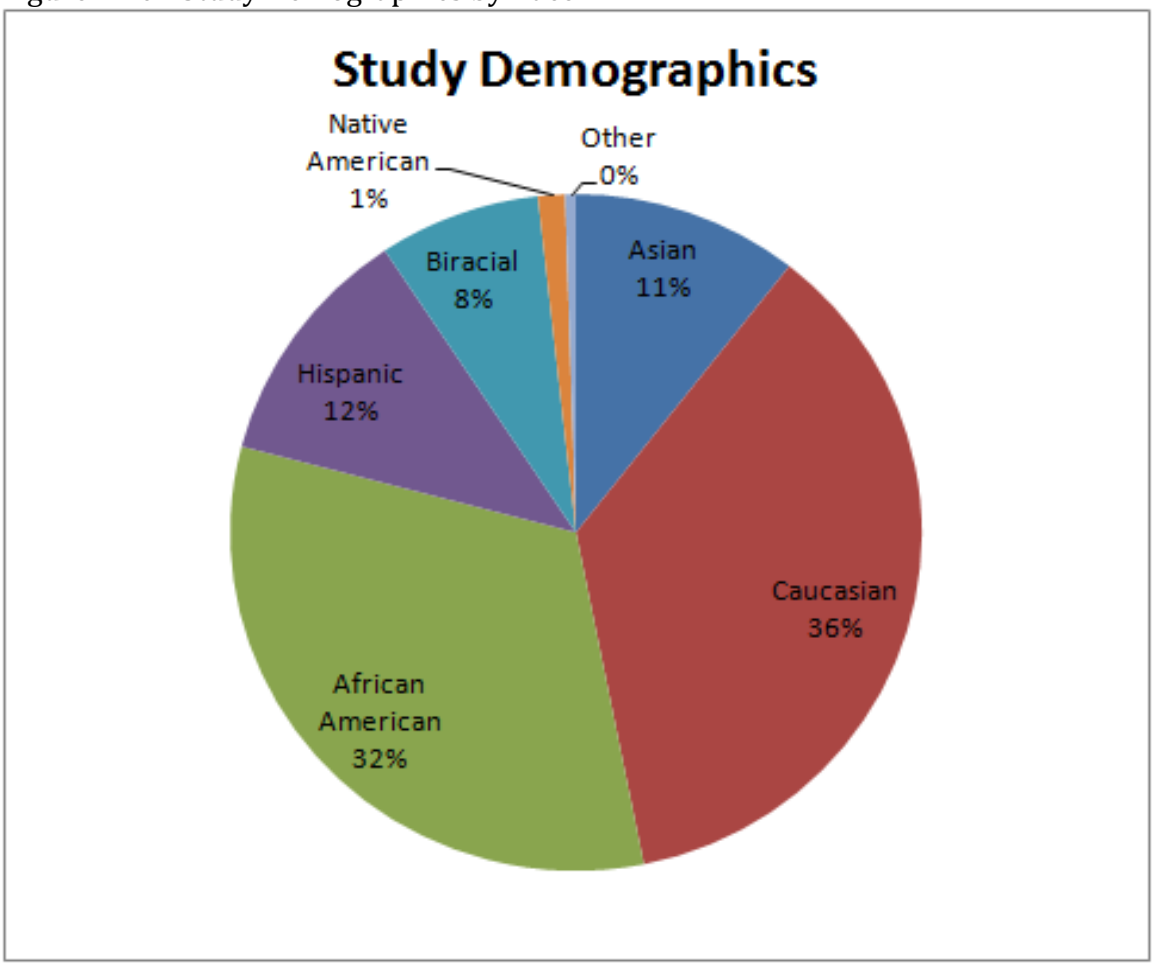
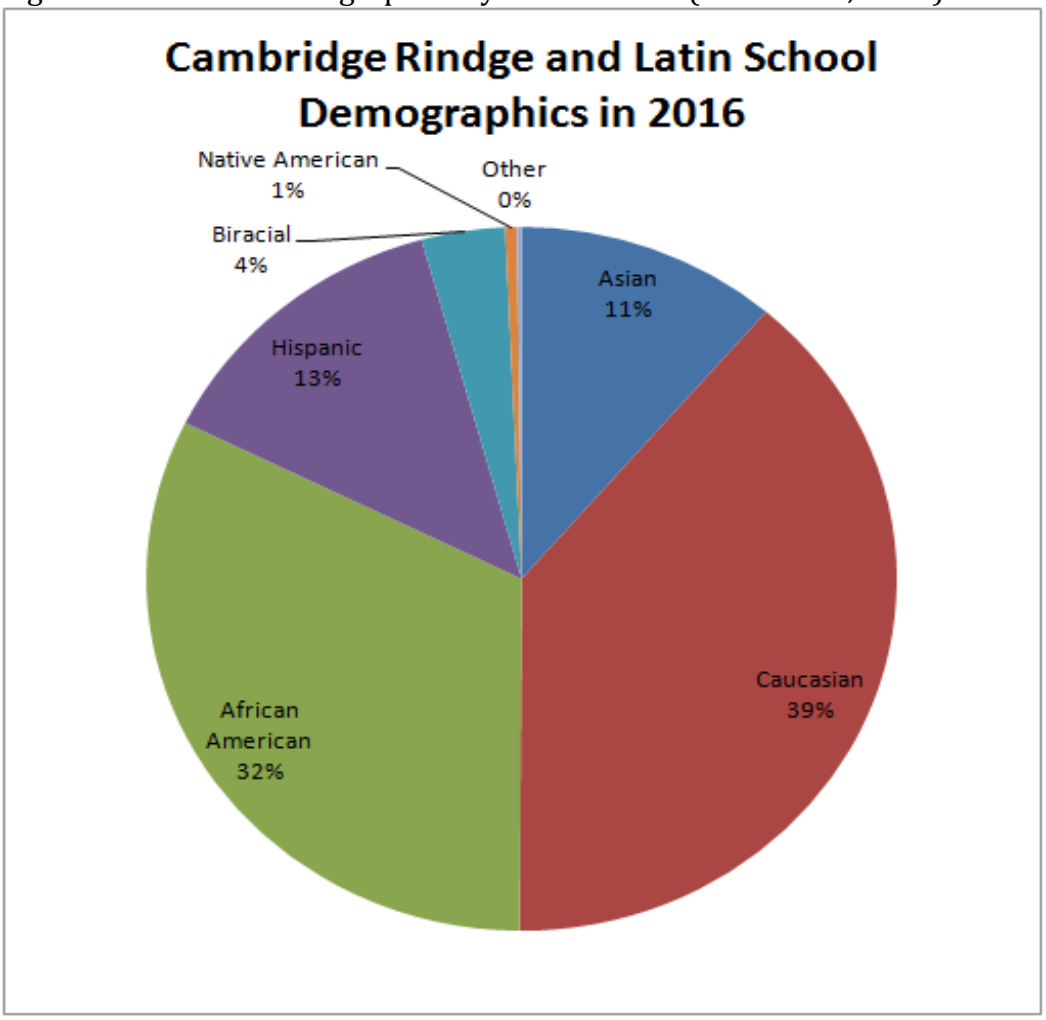


Figure 4.11 - CRLS Demographics by Race in 2016 (MA DOESE, 2017)



As seen in the figures above, both the study and school demographics are similar. However, it should be noted that the distribution of race between RUPs, ENPs and Proficients is far from even. Proficients were significantly more likely to be comprised of Asian and Caucasian students when compared to ENPs and RUPs (Chi square = 67.54, df=2, $p<0.0001$). 72.4% of Proficients were Asian or Caucasians whereas 29.5% of ENPs and RUPs were Asian or Caucasian. No statistical difference was found between RUPs and ENPs along these same racial lines. The racial

discrepancies will be discussed more in the next section and again in the final chapter (see Table 5.2).

Science Learner Identity and Race

A Chi Square test shows whether the study participants have an even distribution of interest in STEM fields based on race. Interestingly, the distribution of students in the STEM pipeline in the fall is relatively even. As seen in Table 4.7, the Chi square values for STEM majors and careers in the fall are 3.341 and 4.680 with a significance of 0.765 and 0.585. In other words, we fail to reject the null hypothesis and race does not seem to be a strong indicator of interest in STEM.

Table 4.7 - Chi Square Distribution Test for Interest in STEM by Race

	Chi Square	df	Sig.	N
STEM Majors	3.341	6	0.765	194
STEM Careers	4.680	6	0.585	199

Table 4.8 - Demographic Distribution Interest in STEM Major/Careers

		Asian	Cauca-sian	African-American	Hispanic	Biracial	Native Ameri-can	Other	Total
STEM Major Interest - Fall	Yes	15	45	34	16	12	1	1	124
	No	8	31	17	7	5	2	0	70
STEM Career Interest - Fall	Yes	11	44	35	17	12	2	1	122
	No	11	34	19	6	6	1	0	77

The spring survey is more consistent with previous research (Aschbacher, Li, Roth, 2010; National Science Foundation, 2015). Chi square values for STEM majors and careers in the spring are 15.083 and 12.072 with a significance of 0.020 and 0.060. Asian and Caucasian students are disproportionately more likely to report interest in STEM fields. Aschbacher, Li and Roth (2010) suggest that students do not persist in their STEM interests due to "poor instruction, lackluster curriculum with few hands-on activities or meaningful projects, and little encouragement to study or do science from teachers, counselors, and administrators alike" (Aschbacher, Li and Roth, 2010, 570). Some of these factors will be further explored throughout this and the next chapter.

By the spring, Asian and Caucasian freshmen are more likely to identify as part of the STEM pipeline compared to African American, Hispanic and other groups of students (as a side note, the term Hispanic here and in the charts above is being pulled from the district student information system. The term Hispanic is actually

referring to the Hispanic and Latino populations but the student information system does not distinguish even though those are two distinct groups). For the purpose of this study, two groups have been created. The first includes Caucasian and Asian students and the second includes all other groups.

On the *Is Science Me* survey, students responded to several prompts using a Likert scale that ranged from strongly disagree (1) to strongly agree (5). T-tests were used to compare the mean responses of groups one and two indicated above. Caucasians and Asians were significantly more likely to respond positively to the prompt, "I think I could be a good scientist one day," in both the fall and the spring ($t=1.727$ and $t=2.948$ with $p=0.086$ and $p=0.004$, respectively).

A similar result was found in response to the prompt, "I would like to enter a science competition or science fair in the future." Caucasians and Asians answered favorably with a t value of 1.759 and 2.496, $p=0.080$ and $p=0.013$ for the fall and spring surveys respectively.

Interestingly, responses to "Teachers or counselors have encouraged me to go into science, engineering, math, or medicine," showed no statistically significant difference. In fact, African Americans, Hispanics and other students were slightly more encouraged by teachers and counselors in the fall with a mean response of 2.96 vs. 2.92. Even though not statistically significant, this was one of the few times the advantage went against historic trends. Aschbacher, Li and Roth (2010) cited teacher and counselor lack of encouragement as one reason why students do not persist in STEM fields. Based on students responses to the surveys, lack of

encouragement does not appear to inhibit the population in Cambridge from STEM interest.

Looking only at the difference from the start of the summer to the end of the summer with the RUPs, some interesting science identity influences emerged. Since this sample size is much smaller, statistical significance is more difficult to demonstrate, but was found for a few statements. Students entered the summer with the belief that Caucasians and Asians were encouraged to enter STEM fields more often by both teachers and family members ($t=2.498$, $p=0.016$ and $t=2.075$, $p=0.044$, respectively for teachers then family comparing Caucasian/Asian versus all other groups). However by the end of the summer, RUPs reported statistically equal levels of STEM encouragement by family members ($t=0.712$, $p=0.480$). RUPs reported a slight reversal in the perceived levels of encouragement by teachers ($t=-0.195$, $p=0.847$). Although not statistically significant, African American, Hispanic and other students reported that they were at least as much encouraged to enter the STEM pipeline as Caucasian and Asian students.

Overall the trends show mixed results. In some regards historically underrepresented groups have increased their science identity by nearly pulling even with more prevalent groups. Notably, the underrepresented populations viewed their own access to STEM fields equal to Asian and Caucasian students. This is best demonstrated by the encouragement from teachers and family. However, persisting in the STEM pipeline was more likely for Asian and Caucasian students. Plans for future STEM majors and careers seems to diminish as underrepresented

groups report a lesser degree of certainty about remaining in STEM fields.

This seems to suggest that there is a difference between what happens at school versus what is occurring in society at large. All students feel like they can access STEM and engage in the STEM activities while in school. However, attitudes about STEM achievement in the long term seem to vary by demographic group. Programs such as Rise Up appear to be able to address two of the four components of the STEM pipeline (Hanson, 1996), access and activity. The other two components, attitude and achievement seem to have deeper entrenched roots that divide traditionally represented STEM groups compared to the underrepresented groups.

Science Learner Identity based on Rise Up Status

RUPs, ENPs, and Proficients were compared to determine the level of science learner identity. First a two-way contingency table analysis was conducted using a chi-square test. Two-way contingency analyses evaluate if there is a statistical relationship between the variables and can be used on a 3 x 2 table where the three groups of the study are compared to their two possible answers to STEM pipeline questions. The associated chi-square statistic determines the level of the relationship and the significance between interest in a STEM major and a STEM career.

Table 4.9 shows the distribution of students reporting their interest in pursuing a STEM major or a STEM career. The percentage of students reporting

each for administration of the survey is provided along with the expected distribution percentages. If the null hypothesis were correct, the expected percentage would match the actual percentage, in which case the chi-square value would be very low with a significance near 1. In fact, the fall STEM career data shows reported percentages almost exactly aligned with the expected values. Table 4.9 also includes the percentages of STEM-interested RUPs from the surveys administered over the summer. There is no expected column shown for the RUP summer data because there is only the RUP group. The summer data are included for comparison purposes only.

Table 4.9 - STEM Major/Career Distribution by Rise Up Status

			Reported		Expected			
		n	% No	% Yes	% No	% Yes	Chi-square	Sig.
Fall STEM Major	ENPs	71	71.8	28.2	64	36	3.048	0.218
	RUPs	30	60	40	64	36		
	Proficients	93	59.1	40.9	64	36		
Fall STEM Career	ENPs	74	63.5	36.5	61.3	38.7	0.271	0.873
	RUPs	31	61.3	38.7	61.3	38.7		
	Proficients	94	59.6	40.4	61.3	38.7		
Spring STEM Major	ENPs	53	73.6	26.4	59.6	40.4	8.888	0.012
	RUPs	23	69.6	30.4	59.6	40.4		
	Proficients	105	50.5	49.5	59.6	40.4		
Spring STEM Career	ENPs	54	74.1	25.9	66.7	33.3	2.768	0.251
	RUPs	21	71.4	28.6	66.7	33.3		
	Proficients	104	61.5	38.5	66.7	33.3		
Early Summer STEM Major	RUPs	41	65.9	34.1				
Early Summer STEM Career	RUPs	45	60	40				
Late Summer STEM Major	RUPs	48	66.7	33.3				
Late Summer STEM Career	RUPs	48	66.7	33.3				

The most significant finding from Table 4.9 is spring STEM majors (X^2=8.888, p=0.012). Approximately half of the Proficients reported interest in a STEM major when only 40.4% was expected. RUPs and ENPs were both on the other side of the expectation with RUPs reporting only slightly higher interest in STEM majors at 30.4% compared to the ENPs 26.4%.

While overall interest in STEM majors increased from the fall to the spring, both RUPs and ENPs reported a decreased interest (RUPs 40.0% to 30.4%; ENPs 28.2% to 26.4%) while Proficients substantially increased from 40.9% to 49.5% of students in the STEM pipeline. Interest in pursuing a STEM career dropped in all subgroups between the fall and the spring: ENPs went from 36.5% to 25.9%; RUPs 38.7% to 28.6%; Proficients 40.4% to 38.5%. While the decline in ENPs was the most dramatic, RUPs were a close second. Proficients' interest in STEM careers dropped but was still above the expected value of 33.3%. In other words, even with a dip, Proficients were still more interested in the STEM pipeline than RUPs and ENPs. The decreased interest for RUPs and ENPs took them from on par with expected percentages to well below expectations.

Longitudinally tracking the RUPs' interests in STEM majors and STEM careers, shows fluctuation but no significant change over time. A one-way ANOVA was conducted to determine the significance of the fluctuation. Table 4.10 shows the percent of RUPs expressing a positive interest in STEM majors or careers along with the associated F values and significance levels.

Table 4.10 - Percent of RUPs Reporting STEM interest

	Early summer	Late summer	Fall	Spring	F	sig.
RUPs Majors	34.1%	33.3%	40.0%	30.4%	0.195	0.899
RUPs Careers	40.0%	33.3%	38.7%	28.6%	0.302	0.824

Despite not being able to show any trends in the RUPs' reported interest in STEM majors and careers, there is a sizeable difference between RUPs and ENPs in the amount of interest in STEM majors entering the school year in the fall. RUPs reported 40.0% STEM major interest compared with ENPs 28.2%. The difference is significant with an F score of 3.913, p=0.051. Comparatively, RUPs' interest in a STEM major at the beginning of the summer (34.1%) was statistically the same as ENPs' in the fall (28.2%). The Rise Up program cannot claim responsibility for having the RUPs start high school with a higher interest in STEM majors, but the difference between RUPs and ENPs raises an interesting point. As previously seen in discussion on unexcused absences, tardies, sports participation and other fields, RUPs' science identities at the start of the school year appear to be more closely aligned with Proficients than ENPs or somewhere in between those two groups. Perhaps Rise Up provided a positive experience that students could recall as they entered the school year. During the weeks in between Rise Up and the school year, RUPs may have positively reflected on their own experiences in science and therefore held a higher science learner identity than the ENPs entering the school

year. This speculation is supported in the qualitative component of this study. Students in the RUP focus groups demonstrated more confidence in using their connections in the school to access more opportunities. This will be discussed in more detail during the fourth research question.

Comparing Three Sub-Groups with Academic Connectedness and STEM Interest

Multiple ANOVAs with post hoc analyses were run on the three sub groups to compare interest in STEM fields and academic connectedness scores. Students in each of the three sub groups, RUPs, ENPs, and Proficients were further separated by their expressed interest in STEM majors and STEM careers. After subdividing each subgroup, means for academic connectedness scores were run using ANOVAs. These same comparisons were run for the fall and the spring sets of surveys. As previously seen, students expressing interest in STEM fields showed higher academic connectedness scores for every statistically significant difference. This also held true when broken down by subgroups. The full results are shown in Appendices M and N.

Points to note in these tables include the school connectedness scores in both the fall and the spring. Proficients interested in either STEM majors or STEM careers showed the largest statistically significant difference in mean school connectedness scores compared to Proficients not interested in STEM majors/careers. In the fall, Proficients interested in STEM majors and careers had school connectedness scores of 3.885 and 3.821 compared to non-STEM interested

Proficients at 3.493 and 3.535 (t=2.855, p =0.006 and t=2.058, p=0.043). Similar results were noted in the spring for Proficients interested. Proficients interested in STEM majors and careers scored on school connectedness 3.731 and 3.844 compared to non-interest at 3.536 and 3.514 (t=1.353, p=0.180 and t=2.223, p=0.029).

By itself, the Proficients' results are not surprising since this is in line with the findings from the entire freshmen class. Adding a layer of comparison with the RUPs and ENPs, however, it appears that RUPs began the school year more closely aligned with the Proficients but ended the year similar or below the ENPs. In other words, any effects that Rise Up may have had on RUPs' school connectedness scores seem to have diminished by the end of the school year.

In the fall, RUPs interested in STEM majors and careers reported school connectedness scores of 3.857 (STEM majors) and 3.718 (STEM careers) with non-STEM interests at 3.434 and 3.470 (t=1.860, p=0.075 and t=1.001, p=0.326). The ENPs who began the year with STEM major and career interest had school connectedness scores of 3.728 and 3.722. Non-STEM interested ENPs had scores of 3.536 and 3.498 (comparing ENP connectedness means for ENPs interested and not interested in STEM majors and careers t=1.114, p=0.271 and t=1.489, p=0.143). Even with the smaller sample size of RUPs vs. ENPs, the RUPs show higher school connectedness scores for STEM-interested students. The ENPs demonstrate less statistical difference between the groups. This comparison is to highlight that in the fall, STEM interest and school connectedness scores for RUPs are more closely in

line with the Proficients than the the ENPs.

The spring results are strikingly different. STEM-interested RUPs show school connectedness scores of 3.619 and 3.700. Non-interested STEM RUPs showed means of 3.486 and 3.538 (t=0.529, p=0.604 and t=0.602, p=0.557). The statistical significance between STEM interest and non-STEM interest for RUPs has substantially declined from the fall.

Contrasting RUPs and ENPs, the statistical significance between STEM interest/non-interest, along with the school connectedness scores of ENPs substantially increased by the spring. ENPs interested in STEM majors and careers had school connectedness scores of 4.000 and 3.656 compared with non-STEM-interest at 3.370 and 3.414 (t=2.210, p=0.034 and t=0.871, p=0.390). The results show that during the school year, ENPs interested in STEM fields have become much more connected to the school. At the same time, ENPs not having or developing interest in STEM fields have the lowest overall school connectedness scores.

Similar patterns were found for the other subscales of the academic connectedness world: peers, teachers and reading. Notably, the teacher connectedness subscale in the spring for ENPs interested in STEM majors was the single highest score on the chart at 4.333. This surpassed both Proficients and RUPs (3.820 and 3.571). In fact, ENPs interested in STEM majors were the only group to see an increase in teacher connectedness scores from the fall to the spring. RUPs and Proficients saw declines in teacher connectedness scores for interested and uninterested STEM majors and careers.

For the spring, STEM-interested RUPs are reporting lower overall academic connectedness scores than either Proficients or ENPs. The lowest academic connectedness scores overall belong to the ENPs who are not interested in STEM fields. However, any gains that may have possibly been made by the summer intervention program of Rise Up do not seem to carry through to the spring. If Rise Up was providing a bump to academic connectedness scores for students reporting a higher science learner identity, the bubble seems to have burst by the spring. In contrast, the ENPs who were able to develop and report more interest in STEM fields experience a bump over the course of the school year. However, ENPs who did not report interest in STEM fields, dropped to show the lowest academic connectedness scores. In conclusion, students who show or develop a proclivity for STEM, and therefore have a stronger science learner identity, demonstrate a higher sense of connectedness to the academic ecological world. It's impossible to make a causation statement in either direction but there's clearly a correlation between increased science learner identity and the increased connectedness to the academic ecological world.

Science Learner Identity Measured Through Achievement

The four dimensions or pipelines for students to experience science and grow their science learner identity as identified by Hanson (1996) and further developed by Aschbacher, Li and Roth (2010) are access, activity, attitudes, and achievement. Both RUPs and ENPs had access to the summer intervention program

but only the RUPs took part in the activity. ENPs, eligible non-participants, by definition did not engage in this particular opportunity. There is a possibility ENPs could have taken part in other programs but that is beyond the scope of this study. Attitude has been explored by the Is Science Me surveys with students reporting their own feelings towards science along with their vision of themselves as scientists in the future. The only dimension of Science Learner Identity that has not yet been directly explored is achievement.

The simplest, most objective metric for scientific achievement for freshmen in high school is science grades. While this certainly does not cover all possibilities of achievement for students, grades are one universal metric for all freshmen. This section will explore the science grades for RUPs, ENPs and Proficients during freshmen year using ANOVAs with post hoc analyses. The average grades generated by the ANOVA are shown in Appendix O. The table shows the grades for RUPs, ENPs, and Proficients for each quarter in science, each quarter's overall GPA, semester science grades and cumulative GPA at the end of the year. Although grades were investigated in the beginning of this chapter, science grades are being presented this way to provide context with overall grades. Appendix O has a more complete representation of the data while Figures 4.12 and 4.13 show a visual representation of the three subgroups' grades overall and in science across each quarter.

Figure 4.12 – Quarter Grades by Subgroups, Proficients, ENPs, RUPs

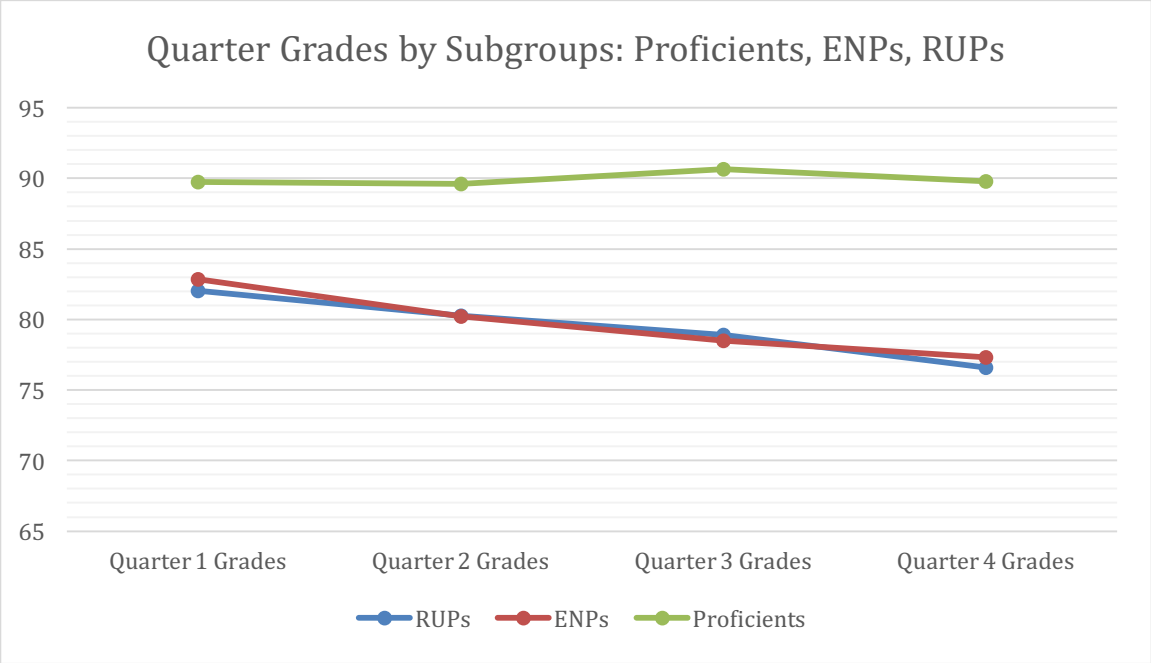
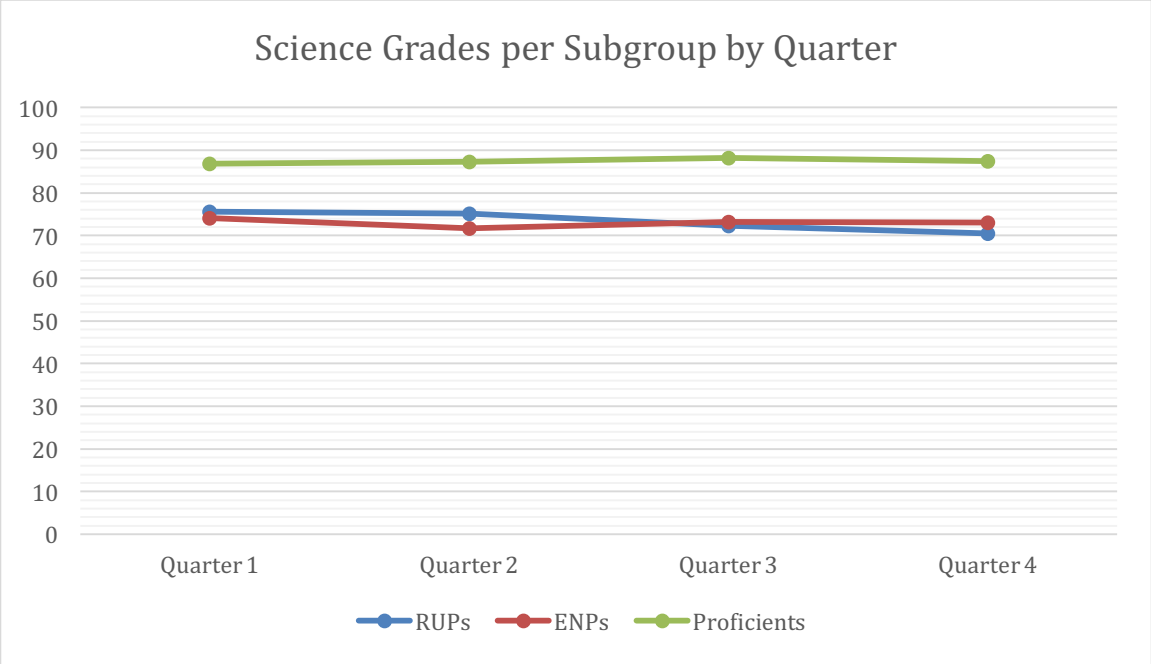


Figure 4.13 – Science Grades per Subgroup by Quarter



The F values for every category were high with a $p<0.0001$. Therefore post hoc analyses were run to investigate the differences. Appendix F contains the full results of the post hoc analyses for the ANOVA.

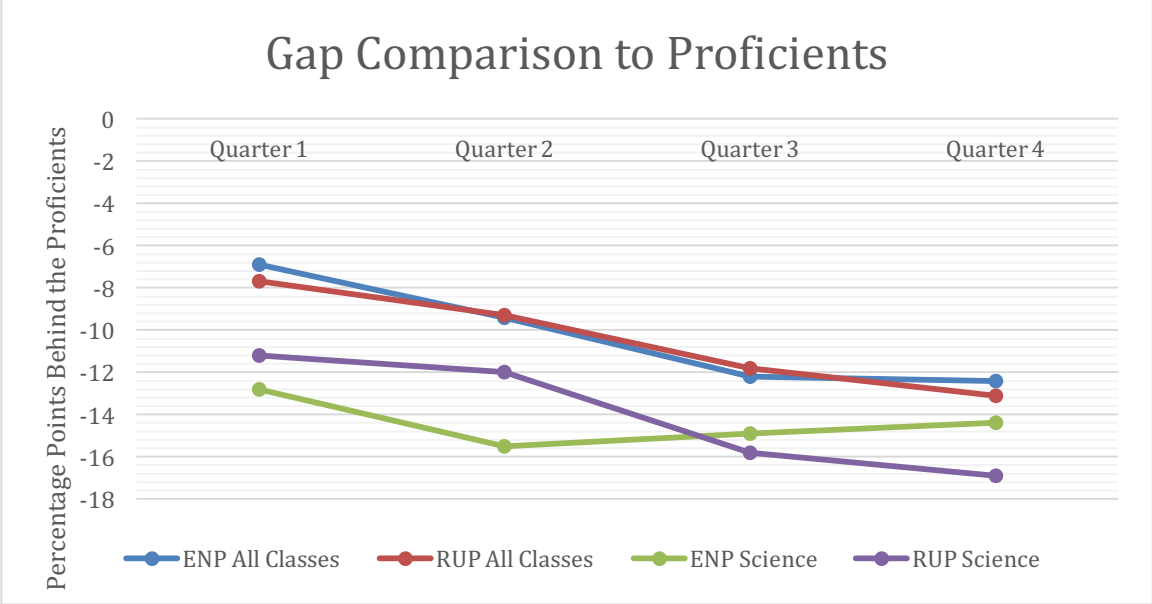
Important to note, Cambridge Rindge and Latin School is on a block schedule which means that students only take science classes for one semester, either in the fall or in the spring. A handful of highly motivated students register for a fall physics class and then move on to chemistry in the spring. All students fitting this description were in the proficients category.

As previously discussed and shown in Appendix O, the Proficients significantly outperformed both ENPs and RUPs in overall grades during freshmen year. Figure 4.12 shows the Proficients staying relatively constant while both RUPs and ENPs have grades that drastically decline. Appendix F shows the full comparison between the three groups in regards to grades.

Appendix P shows a summary of the differences between the RUPs' and ENPs' grades. Since the Proficients are relatively constant with their grades, Appendix P uses Proficients' grades as a reference point for RUP and ENP grades. The Proficients' grades are a bellwether for where RUPs and ENPs would like to be. Percentage points below the Proficients are shown in the table. For example, in the first quarter, the Proficients averaged a science grade of 86.8%. ENPs and RUPs respectively averaged 74.0% and 75.6%. Appendix P reports that ENPs and RUPs respectively were 12.8 and 11.2 percentage points below the Proficients. Therefore the lower the value, the closer the ENPs or RUPs were to the Proficient average.

Figure 4.14 shows a visual representation of the gap in grades of both the RUPs and ENPs compared to the Proficients. RUP and ENP grades are shown for all classes as well as specifically for science classes by quarter. In this figure, the zero line represents the Proficients' grades. Each data points shows the number of percentage points behind the Proficients.

Figure 4.14 – Gap Comparison to Proficients



All scores are significantly below the proficients at the 0.05 level

Sadly, as Figure 4.14 shows, the gap between the Proficients and the at-risk groups widens throughout freshmen year. The RUPs were never closer to the Proficients than they were in the first quarter in regards to both science grades and overall grades in all of their classes. The RUPs outperformed the ENPs throughout the first semester in science.

Interestingly, the ENPs outperformed the RUPs in the second semester in terms of science grades. While the ENPs did only slightly worse in science grades second semester compared to first semester, the RUPs did substantially worse. RUPs were only 11.7 percentage points away from the Proficients in science grades during the first semester. To put this in perspective, 11.7 percentage points is a little more than one letter grade difference. Whereas the Proficients were averaging a B+ for science in quarter 1, RUPs and ENPs were both in the C range. By the second semester, however, RUPs' science grades were 18.1 percentage points away from the Proficients. 18.1 percentage points is almost two full letter grades difference. Between 1st and 2nd semester, the Proficients' science grades remained in the B+ range. RUPs science grades dropped from the C range to the D+ range. ENPs average dipped from a low C to a C- average. Averaging science grades of a D+ for RUPs and a C- for ENPs in the second semester is an alarming low grade.

In terms of achievement, if Rise Up had contributed to any increase in science learner identity for the RUPs, those gains seem to have been diminished by second semester. The observed achievement metric is consistent with the attitude metric of interest in STEM majors and careers. Any positive effect on RUP grades seems to be gone by the spring.

Research Question Number 4 - If Rise Up is having an impact, what mechanisms may be contributing to that impact?

Mechanisms Explored through Focus Groups from the Fall

Focus group were conducted in the fall of 2016 and in the spring of 2017. Each focus group was composed of 4-5 freshmen. The list of ENPs and RUPs were assigned numbers and then the groups were selected by using a random number generator for each of the two lists. One focus group was made up entirely of ENPs and the other focus group contained all RUPs. The same students were invited back in the spring to meet up in their original groups. All students, except one ENP, participated in both the fall and the spring focus groups. All names of the focus group participants have been changed for confidentiality purposes. In the following descriptions, students are identified by first name pseudonyms. Teachers are identified with Mr. or Ms. and then a last name pseudonym.

To provide a degree of context for each of the focus group participants, each of the participant's demographics are provided including sex, race, IEP/504 status and socioeconomic status, as defined by means of paying for lunch. Just to clarify terms, an IEP is an Individualized Education Program that provides special education services as legally required by a special education law called the Individuals with Disabilities Education Act or IDEA. 504 comes from Section 504 of the civil rights law called the Rehabilitation Act of 1973 which does not allow for any individual to be excluded from education based on a disability. Both IEPs and

504s are legal documents that provide a blueprint to help a child be successful in the classroom. A more concise way of thinking about an IEP compared to a 504 is that an IEP modifies the curriculum to ensure students can be successful regardless of how their disability is adversely affecting their classroom performance. A 504 provides accommodations to meet the needs of the student within the general education classroom. For example, an IEP may include a special education teacher pulling the student from the classroom for one to one instruction. A 504 may include something along the lines of extended time on tests. The latter is an accommodation without modifying any of the curriculum. The specific modifications or accommodations change based on the needs of the student to maximize opportunities for success.

The four RUPs will be called Jakhai, Matty, Adam, and DJ. Their demographic information can be found in Table 4.11 below.

Table 4.11 – RUP Focus Group Participants

Name	**Gender**	**Race**	**IEP/504**	**Lunch**
Jakhai	M	African American	IEP	Free
Matty	M	Caucasian	IEP	Paid
Adam	M	Caucasian	None	Paid
DJ	M	Biracial	None	Free

The five ENPs in the focus group will be called Patrick, Abhijeet, Manuel, Sifaad, and Micaela. Their demographic information can be found in Table 4.12 below.

Table 4.12 – ENP Focus Group Participants

Name	Gender	Race	IEP/504	Lunch
Patrick	M	Caucasian	504	Paid
Abhijeet	M	Bengali	None	Free
Manuel	M	Hispanic	504	Reduced
Sifaad	F	Somali	None	Free
Micaela	F	Caucasian	None	Paid

To further explore how the ENPs and the RUPs were representative of their groups, Tables 4.13 and 4.14 show each focus group member on several indicators compared with the average scores from the their affiliated subgroup. Table 4.13 shows the RUPs in the focus group compared to the entirety of the RUP population. Table 4.14 shows the ENPs in the focus group juxtaposed with average ENP scores. All students took physics in the fall or the spring. Therefore, the code "NE" was used to indicated when a student was "not enrolled" and did not have a grade during that particular quarter. Further, no data was available for students who did not complete the surveys due to absence or other reasons. The code "ND" is shown in those cases. Finally low Cronbach alphas are indicated with an asterisk as previously discussed.

Table 4.13 – RUP Focus Group Members Compared to RUP Averages

	RUP Student Pseudonyms	Jakhai	Matty	Adam	DJ	Average RUP
Connectedness - Fall	School	3.75	ND	4.4	2.33	3.51
	Teacher	2.5	ND	5	2.83	3.6
	Peers	2.5	ND	4.33	2.83	3.51
	Reading	3	ND	3.25	3.25	2.81
SLI - Fall	STEM Major Interest	Yes	ND	ND	No	40.0% Yes
	STEM Career Interest	Yes	ND	ND	No	38.7% Yes
	Q1 Science Grade	77	67	NE	NE	75.57
	Quarter 1 GPA	82.49	85.28	95.57	75.04	82.05
Connectedness - Spring	School	3	2.75	2.83	3.67	3.61
	Teacher	1	3.8	4	3.67	3.53*
	Peers	1	2.5	3	3.17	3.51
	Reading	5	1	2	3.5	2.39
SLI - Spring	STEM Major Interest	ND	No	ND	No	30.4% Yes
	STEM Career Interest	ND	No	ND	No	28.6% Yes
	Q4 Science Grade	NE	NE	78.3	67.9	70.55
	Quarter 4 GPA	80.03	85.08	87.03	77.93	76.59
MCAS	8th Grade Science	P	NI	DNT	NI	NI
	7th Grade ELA	NI	P	DNT	P	NI
	7th Grade Math	W	NI	NI	NI	NI

Table 4.14 – ENP Focus Group Members Compared to ENP Averages

	ENP Student Pseudonyms	Patrick	Abhijeet	Manuel	Sifaad	Micaela	Avg. ENP
Connectedness - Fall	School	ND	3.4	3	ND	ND	3.58
	Teacher	ND	3.83	3	ND	ND	3.92
	Peers	ND	4.2	3	ND	ND	3.63
	Reading	ND	2.5	2	ND	ND	2.97
SLI - Fall	STEM Major Interest	ND	No	ND	ND	ND	28.2% Yes
	STEM Career Interest	ND	Yes	ND	ND	ND	36.5% Yes
	Q1 Science Grade	NE	NE	NE	NE	80	74.04
	Quarter 1 GPA	87.36	87.45	83.28	87.27	89.96	82.85
Connectedness - Spring	School	3	ND	2.67	ND	2.33	3.42
	Teacher	2.75	ND	3.67	ND	3.33	3.81
	Peers	3.67	ND	2	ND	3.67	3.52*
	Reading	1.75	ND	2.33	ND	2	2.69
SLI - Spring	STEM Major Interest	ND	ND	ND	ND	ND	26.4% Yes
	STEM Career Interest	ND	ND	ND	ND	ND	25.9% Yes
	Q4 Science Grade	82.5	93.19	84	67.83	NE	72.91
	Quarter 4 GPA	84.75	90.9	89.48	90.44	79.91	77.32
MCAS	8th Grade Science	NI	NI	NI	P	W	NI
	7th Grade ELA	NI	P	P	P	P	NI
	7th Grade Math	P	A	W	P	NI	NI

Dissecting the the RUP Table 4.13, DJ seems to be a pretty typical example of an RUP. Adam's scores demonstrate that he is on the high end of achievement and connectedness for RUPs. Adam presents most similarly to a Proficient whereas Jakhai aligns closely to the ENPs with his dramatic drop in connectedness to teachers and peers from the fall to the spring. Jack has a higher GPA than the average RUP but his science scores are noticeably lower. The RUP focus group has students both above the average and on the lower end of the curve.

The ENPs from Table 4.14 show that Abhijeet is in line with the average ENPs for connectedness where Manuel is slightly below. Patrick and Micaela are below the average ENP in terms of connectedness. All five of the ENPs from the focus group are above average when it comes to science grades and overall GPA. The only exception is Sifaad's 4th quarter science grade of 67.8% compared to the average 72.9. Overall, this is a reasonable sample of the ENP population and represents the slightly higher end of the ENP curve.

Themes that emerged from the focus groups included involvement and connections with teachers. Other types of connections, such as with peers and the school community, were observed but teacher connections were the dominant theme.

Involvement - Fall

Comparing the two focus groups, students in the fall Rise Up group reported being much better informed about clubs, activities and the building than their ENP

counterparts. While both ENPs and RUPs were involved in fall sports, the RUPs were more likely to cite learning about the teams with help from friends or over the summer. For example, RUP Matty signed up for the golf team and when asked how he heard about the team, he replied:

> Um... I think, actually, I don't remember. I think someone this summer said like... someone was going through a list of all the sports here and they said golf but I'm not entirely sure.

Rise Up specifically goes through the list of sports and scaffolds an activity for students to write to coaches for more information. Although not mentioned by name, it seems reasonable that Matty is talking about an experience from Rise Up.

Similarly, RUP Jakhai learned about the fencing club from friends. In his words:

> Oh, um, well I heard it from a couple of friends that actually went to this school and told me about that there was a fencing club at this school and that I should join it. So yeah.

The connections that Jakhai is talking about could come from a number of different avenues but fencing is also highlighted over the summer in Rise Up. Rise Up has older counselors that recently graduated from the high school come back and speak with the students. Fencing was not specifically a topic that was addressed in the

curriculum but it is something that may have organically come up.

The other RUPs in the focus group both talked about becoming involved in sports. It was clear that Adam's involvement was driven by his older brother being the captain of the Cambridge rugby team and so Adam intended on trying rugby as a new sport when the spring season started.

> I didn't know that CRLS had a rugby team until my brother signed up and then he became the team captain and then told me I should try out so. And I know a couple of people who are going to be playing so. It seems pretty cool.

DJ expressed interest in playing basketball during the winter season:

> Basketball's a big sport and I've been playing since I was little. And, uh, they won State last year so that made me want to play even more.

All the RUPs demonstrated confidence about becoming involved in sports or clubs and seemed to have a good plan on how to become involved. However, in the ENP focus group, this was not consistently the case. In fact, ENP Abhijeet said that he...

> ...didn't get to choose a sport because I guess I was just too late because I was in vacation for like the whole summer - so I just didn't have a chance to

> choose…. I'm not doing any clubs. I guess that I just forgot…. For the winter I'll probably do something…. I don't know what clubs are for winter so I'm not really sure.

Abhijeet is expressing interest in becoming involved but his lack of information seems to be the barrier preventing him. More decisively, Manuel stated,

> I didn't join a sport or club - for one, I'm awful at sports to be honest. And uh, I don't really have any interest in clubs.

The other ENPs explained that they had previous connections to extracurriculars. Sifaad explained that she is currently on the volleyball team and knew about it because she played volleyball in 8th grade. The volleyball coach recruited her to continue playing at the high school. Similarly, Patrick is planning on playing baseball in the spring and previously knew the Cambridge baseball coach. Patrick has begun a work out regimen with the coach and team during the fall. Micaela said she,

> ...didn't choose a sport yet but I think I'm going to do gymnastics [winter sport].... My sister told me [about gymnastics]

ENPs in the focus groups either did not know in time to sign up or had a previous connection to the sport or activity. Comparing RUPs and ENPs, the RUPs were better informed and demonstrated much more confidence in navigating the system to be involved beyond the school hours at the beginning of high school. Confidence here was demonstrated in the ease with which the RUPs described how they heard about their sport and started playing. This confidence was noticeable for students who had previously played a sport but also for the RUPs that were joining a team for the first time.

The same disparity of information and involvement was true for classes. When talking about the Rindge School of Technical Arts, RSTA, ENP Sifaad stated,

> I was going to do the RSTA one where you can do like the nursing thing but I didn't do that because I didn't know and I didn't sign up. I didn't know you needed to sign up this year. So I didn't do that. But I don't know what classes I can take for that...

This seems like an interesting contradiction because the ENPs demonstrated higher connectedness scores than the RUPs coming into high school in the fall. However, the RUPs started the summer with similar scores to where the ENPs started in the fall. Both Proficients' and ENPs' connectedness scores dropped off dramatically by the end of the year whereas the RUPs' connectedness scores generally maintained or increased. The results seem to suggest that the pattern is

for connectedness to decline but with the RUPs increased network and understanding of how the school functions, the RUPs were more likely to remain connected.

Connections with Teachers - Fall

To support the high degree of connectedness reported, the ENPs in the fall expressed overall positive feelings for their teachers. The overall positive feelings expressed by the ENPs will be supported by the comments throughout this section. ENPs reported a teacher connectedness score of 3.92 in the fall. That was statistically the same as the Proficients at 3.97. All the students could find some teacher that they really enjoyed. Micaela found:

> I like Ms. Kant because she's not like that boring, like she has energy. So she actually makes it fun.

The ENPs were asked what classes they enjoyed but not directly asked about teachers. The students made the direct association between classes and teachers and pedagogy rather than any content within the classes. Abhijeet stated:

> I really enjoy history because the teacher makes it really engaging because he makes open discussions with us…. It's just really engaging…. Like I really understand what's going on.

Making a connection with the teacher and finding some way to relate seemed to be the commonality as students talked about their classes. For example, Patrick enjoyed his English class unrelated to the content but instead because of connecting with his teacher beyond the classroom.

> I like Mr. Galt's class because I can like relate to him with sports and stuff.

The ENPs conveyed more of a sense of what their teachers were like rather than the classes. When asked the same questions, the RUPs had similar feelings about the importance of connecting with their teachers. For example, RUP Adam explained:

> That's just the class [language arts] I just feel most comfortable in cause I just know everyone. I know the teacher. The teacher is really nice. She's funny and yeah….I really like my teachers, so, I think that has a big part about how I think about my classes. I think, none of my teacher have a lot of attitude. Like they're not snappy or anything… so, and I know a bunch of the kids in my class. I just meet people so fast so it's fine.

In general, the RUPs talked more about expectations in classes instead of focusing on the teachers. RUPs discussed the classes being easy or hard and how to get a good grade. Over the summer in Rise Up, the RUPs had already met and

worked with several of their teachers so it is possible that they already had a sense of what the high school teachers would be like.

RUPs compared their experiences in the early days of the school year to the expectations of what 9th grade would be like coming out of 8th grade. Several RUPs commented on the perception of 9th grade that was created by the 8th grade teachers. The RUPs felt the 8th grade teachers had made 9th grade seem much more rigorous than what the RUPs had thus far encountered. For example, Matty said:

> It isn't too difficult to be a, you know, student who gets a decent grade. You, just, you know, do the work that's assigned to you and it isn't like too difficult…. Teachers in 8th grade made it sound like really difficult. But so far I like it, not too difficult.

Similarly, Jakahi described his perceptions entering high school by saying:

> In 8th grade they really made it seem like that it was, there was going to be other things that was going to be 10 times worse than it actually is. But no, it's just do your homework, pass it in, do some notes, answer some questions every now and easy Pete…. Something that I also didn't like that they told us in 8th grade was that the teachers weren't going to take some of our attitude and at the same time in the 8th grade that we're way too chatty loose. But

then again, now being here, some of the teachers are incredibly chill. Like they're calm, they're relaxed, most of the teachers are just laid back. Just do your work. Just do your thing. And if you're doing bad, and if you're doing bad, I'll have to intervene. But other than that, you do you.

When asked more specifically about teachers, the RUPs had mostly positive comments. Matty summarized the group's comments with,

I actually really enjoy all my teachers. Um, one of them I kind of, I guess you can say don't like as much. I don't like dislike her but for the most part I have some pretty cool teachers.

Similar sentiments were made by all the RUPs in the focus group in the fall. The RUPs had a more critical lens of the classes than shown by the ENPs. A few RUPs went so far as to explain why they preferred certain teachers over others. Adam explained,

I like teachers who like check in on you sometimes. Cause like sometimes like kids in the class don't want to say they don't know something. Some teachers like just don't check to make sure everyone is fine.

DJ commented on the structure of the class being the challenge and less so the teacher,

> This teacher is like, I like her, but like her class is kind of like confusing for me. I mean it's just different from like how all my other classes are. So it's kind of different and changed how I think.

The comments here are more specifically about the pedagogy of the teachers and go beyond simply liking or disliking the teacher as expressed by the ENPs.

Rise Up may have contributed to the differences in the way the RUPs and ENPs viewed the school and the teachers. RUPs referred to Rise Up unsolicited in the fall and described their initial trepidation about the program. Jakhai explained,

> At the start, I really did not like Rise Up but honestly I can say I didn't like the idea of Rise Up because I didn't like the feeling of giving up a month of my precious summer to go to essentially what counts as summer camp and I felt that it was really dumb. Like I really didn't see the point of preparing and since I wasn't in the mayor's program I was only getting credits for it which really didn't help that much because I'm only getting 10 out of like 200…. I ended up liking it a little towards the end because I met some great people like Matty and Adam [Matty and Adam are two other members of the RUP focus group in the room].

Matty echoed Jakhai's sentiment,

> When I first came to Rise Up I was like I do not want to do this because it was basically summer school but when I got there everyone, the teachers were nice, I met a bunch of cool people, you know who I still like hanging out with today and uh, it helped me actually a lot with my way around the building because most of my classes are in this general area and this is where the Rise Up was. So it was pretty helpful because I wasn't lost on the first day.

The notion of not being lost on the first day was mentioned by several RUPs in the focus group. As the discussion continued, the sense of not feeling lost seemed to take on a more complex meaning beyond being able to physically located rooms in the school. Adam expounded,

> I liked Rise Up because it helped me get ready for high school because I got to see the building and meet some of the staff members. So, it definitely gave me like a feel for high school…. I'd say it's [high school] only as big as you make it.

To summarize and contextualize the fall focus groups, the RUPs demonstrated a slightly less optimistic, but perhaps more realistic, sense of the high school than that ENPs. The RUPs seem to have a greater understanding of what

their high school experience will be like. In the three target groups, ENPs, RUPs and Proficients, connectedness scores overall declined from the first administration of the Hemingway to the second. However, the RUPs were the only group to maintain or increase by the spring. It is possible that the summer intervention of Rise Up adjusted expectations for high school for the RUPs, effectively getting the initial connectedness dip out of the way and affording the RUPs with inroads to connectedness that their ENP counterparts did not have.

In terms of inroads, the RUP focus group overwhelmingly reported in the fall focus group that they were able to navigate the school smoother and take advantage of different opportunities. While the ENPs reported on the Hemingway that they were more connected, the RUPs demonstrated a higher capacity to strengthen and build connections as seen in the fall focus groups. In a sense, the ENPs demonstrated a lost potential to maintain or build on their feeling of connectedness.

The lost potential notion is supported by the connectedness scores and focus groups from the spring. By the spring, the ENPs' scores for connectedness have declined whereas the RUPs' scores have persisted or increased. One reasonable explanation may be that the early school year involvement could have fostered feelings of connectedness that did not manifest on the surveys until the spring. The spring focus groups present a much more strikingly dichotomous view of the school. In the fall, both focus groups exhibited an overall enthusiasm for the upcoming school year. However, by the spring, the tenor of the ENP focus group compared with that of the RUP focus group was drastically different, as will be explored in the

next section. The ENP focus group demonstrated a significantly more pessimistic view of classes and teachers than the RUPs. While the RUPs seem to reflect a much more positive approach to the overall school community.

Mechanisms Explored through Focus Groups from the Spring

All members of the original two focus groups returned to participate in the spring focus group except for one ENP. The ENP who did not return, Manuel, stated that he did not want to come back because he felt he, "didn't have much to add to the group." This evened out the numbers so there were four in the ENP group and four in the RUP group. By the spring, the participants could report on their involvement freshmen year and give a sense of the mechanisms that impacted their involvement.

Involvement - Spring

Out of the ENPs, Sifaad played three sports, volleyball, basketball and softball. Micaela participated in the Modern Dance Company. Abhijeet joined science club and Patrick played baseball. For the RUPs, Adam played rugby and Matty played golf. Jakhai tried out for tennis instead of fencing. DJ did not join extracurriculars but intended to play lacrosse or baseball the following year. The discrepancy in levels of involvement and ability to navigate the high school described in the fall focus groups seems to be gone by the spring. As would be expected, the involvement translated to more connections inside and outside of school. ENP Patrick explained,

> I only had two kids from my team. But like we became really close but like, yeah, just really close now.

In a similar fashion, RUP Adam stated,

> Yeah I had a student in my math class that I didn't know and I found out he was on the rugby team and I got to know him. We sit on the opposite side so we don't really work together but we know each other and we're cool and that.

Even in the spring, the connections made before the school year still had a positive effect. In the fall, Matty said that he signed up for golf after someone in the summer read through a list of possible sports. Although not explicitly stated, that list was read at Rise Up, so it seems reasonable to presume that Rise Up may have directly impacted his involvement in golf. Matty's golf connections paid off throughout the entire school year as he explained,

> Yeah, last semester I had a kid from the golf team in my physics class and this semester I had a kid from the golf team in my history class. Um, yeah, it's cool. I knew both of them before the golf season started because the golf season started before the school year, like a week before. So, I didn't really know who was going to be doing it so it was cool to see people I knew that I

> was already friends with so, yeah, it's good to have friend and teammates in class…. Sometimes we do partner work in class together.

The connections made through outside activities benefited the overall connectedness for the students. When talking about making new friends, Adam explained,

> It really did [expand my friendship circle]. I got to know so many new people…. Well like, I didn't know them but once, they would be the be the kind of people that I'd want to hang out with whether they played rugby or not. I just met them through rugby.

Matty responded to Adam,

> I know what he means, you would be friends with them regardless of the sport, but you wouldn't have known them and if it wasn't for that sport you probably wouldn't have gotten to know them. So I guess it's kind of good that it's a way to bring people together.

Not surprisingly, the participation in sports created new friendships and new connections. Fortunately for these students, most of them took advantage of the opportunities to meet new people. There was no longer the divide between the RUPs and the ENPs in terms of navigating access to the opportunities that the school

offered. Adam maturely summed up the sports-school relationship in the spring when he said,

> I feel like playing a sport makes you feel more connected to the school community. Because you're playing for the school. You're representing the school.

Connections with Teachers - Spring

More surprising than sports increasing a feeling of connectedness was the RUP / ENP divide on their perceptions of the school by the spring. RUP school connectedness increased from 3.38 to 3.61 from early summer 2016 to the spring of 2017. ENP school connectedness scores went the opposite direction from 3.58 in the fall 2016 to 3.42 in the spring 2017 (the Cronbach's Alpha reliability scores were too low to count for teacher connectedness for RUPs in the spring and for peers connectedness in the spring of for ENPs).

These connectedness discrepancies were highlighted in the tenor of the spring focus group sessions. While the RUPs had a similar feel to the interviews in the fall, the ENPs expressed significantly more negative feelings towards the school community and teachers. The ENP group brought up feeling uncomfortable on several occasions based on racial tensions. Race was never asked about but the ENPs brought up the topic several times separately.

If there was any change in the RUP interview from fall to spring, the session became more positive overall. For example, Adam, who generally exhibited an

understated approach to his descriptions, changed his account of his classes from using the work "like" to,

> I love all my classes. I think they're all fine. I'm cool with everyone in all my classes. The teachers are pretty cool. Um yeah, they're fine….

Not all the RUPs were as effusive about their classes as Adam but the sentiment was definitely positive towards classes and more specifically towards teachers. During this focus group, the RUPs were more likely to ascribe their enjoyment of the class to the role the teacher played in the class. Adam commented,

> I feel like a lot of it has to do with you being able to like mess with your teachers, like joke with them, like I'm able to joke with a lot of my teachers and they'll understand it, you know. That plays a big role cause then like I can connect more.

Matty echoed Adam's sentiment when he said,

> They're [the teachers] just like really nice, kind of, I don't know, I can't really explain it, they're just like, not like relaxed but like they're not like super, like I don't know sometimes like if the kids are like messing around in class, the teacher will like yell at them and kick them out of the class and what not, but

like, you know a teacher who can kind of like laugh it off like with them and stuff but continue to learn and is like cool with the kids and is like easy to talk to like. You like understand what they're saying when they're teaching. I feel like that helps…. I have all really good teachers. There's no teacher that I don't like. I mean sometimes they'll get kind of annoying but overall they're really nice people. As far as the actual class, um, there's only one of them that I like really enjoy and that history. Other than that I don't like dread going to them but I just don't really enjoy myself in them. You know?

Matty is not as enthusiastic about all his classes like Adam but still enjoys his teachers. Several RUPs mentioned the ability to joke around with their teachers. The connections made between the RUPs and the teachers helped the RUPs see the teachers more as a whole person rather than only a teacher who helps a student work towards content mastery. Matty showed interest in learning more about his teacher and appreciated when teachers show their personalities in the classroom:

I don't like teachers that like don't like have a personality, if you know what I mean. Like they're just kind of like, you never really see them smile, and they're just always kind of like, like they're only focused on like the actual work and like nothing else.

Matty went on to explain that the workload of the class is independent from his

degree of connectedness:

> It's strange cause like my favorite class so far this year is um a class that actually has a pretty decent amount of work, um, she assigns a lot of homework, like pretty much every night. And there's like a lot of projects, like essays and what not, and it takes a lot to get those done but it's also the class that I enjoy the most, I think it's because of the teacher and who she is and the environment in the class.

Jakhai explained the narrow road that teachers can sometimes walk between friendly but still authoritative. At first, Jakhai described the importance of being able to joke with a teacher like a friend:

> I'm pretty sure like if you have a teacher that you like crack jokes with and that you can treat him as a friend and they won't mind, um, students connect with them more. Because you know they don't seem as like as a teacher, they seem like as a friend. Not like some symbol of authority which you know only reason actually helping you but as a friend, like someone you can actually go to when you need help or something.

Jakhai also recognized the importance of a teacher being able to maintain an orderly classroom as the authority figure:

> Yeah, like teachers that are more down to earth, like they understand. But when it comes to like something going down like the whole class is going haywire, they're not afraid to put their foot down or something. No, no, no, no, this stops now, which is nice.

Interestingly, Jakhai clearly appreciates the teacher being able to shift between roles of joking compatriot to disciplinarian as needed. Even though Jakhai initially described the relationship with the teacher as one of a friend, his follow up comment make it clear that Jakhai is looking for the teacher to establish a positive, productive community in the classroom.

DJ took the notion of classroom community and made it more individual. DJ discussed the idea of teachers getting to know their students and being able to read and adapt to the feelings of the students:

> Well I haven't really had any bad teachers. All the teachers that I've had have like wanted to help me. Haven't really pushed me away…. [I like] teachers that are more relatable to their students… Like teachers that can understand like why some kids get in trouble a lot or why they're having a problem, like teachers that can like talk to a student why they're having a bad day or how they're feeling is like most likely going to be a better teacher. Because you feel like they care about you and not just your education.

The teacher-student relationship became the main focus of the RUPs spring focus group session. The RUPs repeatedly looked for teachers that were interested in them as individuals and, in turn, the RUPs took an interest in their teachers as people. The RUPs' accounts of their teachers and classes were overwhelmingly positive.

ENP Connections

Unfortunately the ENPs did not report a similar set of positive connections. The ENP focus group painted a picture of more adversarial relationships between students and teachers, often blaming the teacher for not going far enough to establish an equitable classroom. The same students were interviewed from fall to the spring but the juxtaposition of the two interviews would make it seem like they were comprised of different students.

When asked about classes this year, Micaela responded,

> From the first semester I liked my diverse classes but like my physics class wasn't really diverse cause when I like walked in there was like a bunch of like white people and it was like ok. And I talked to the teacher about that too. So like she was like well we're going to fix it next years and stuff. And this semester, um, it depends on the teacher. So like my Spanish class, I have Ms. Maxwell, and she was like really crazy. I don't really like her class that much or my English class because it's boring, but yeah.

The interviewer followed up to inquire about Micaela's English class, asking why she thought it was boring and Micaela replied,

> Um, the teacher.

Later in the discussion, Micaela expounded on her early comments about her physics class by saying,

> Um, it was like the first day of school. I like, she [the physics teacher] gave us like a paper to write down like how you feel the class, and I was like comfortable I told her like I don't feel that good about um, the students being not diverse here. Because it's physics so like it's um, for freshmen, it's all, it's like CP like and honors option so like um, it should be more diverse. And then like um, she was like, ok we'll tell like, I'll talk to the dean and stuff.

Freshmen physics at CRLS is a non-tracked, heterogenous class that is college prep (CP) with an honors option. During the 2016-17 school year, physics was the only course that all students took that was completely untracked. While the class is designed to integrate students who might not otherwise have classes together and to expose all students to both CP and honors curricula, scheduling of other classes can impose a degree of de facto tracking in physics. CRLS has made moves to address this concern and starting in the fall of 2017 all freshmen English classes will

be untracked. In the fall of 2018, freshmen history classes are tentatively scheduled to make the same untracked move.

Micaela's comments about feeling uncomfortable were in response to an innocuous question about how classes were going. Race and diversity were not asked about. Micaela was not the only ENP to bring up the notion of race and negative feelings towards their classes. Sifaad separately brought up race when she described her experience during her freshmen year:

> In the first semester, I had RSTA was really fun, cause like, every week we have like different rotations and stuff and it was like really fun because sometimes you were with the same people, and you were doing different activities with the same people. So you get to know them and stuff. And I loved my English class cause it was like really diverse but then I was in CP but then I got moved up to honors in the second semester and then when I walked into my honors class it was really uncomfortable, like, Micaela said, it wasn't really diverse. It was a bunch of white kids. And it was like, I only have like, two friends in that class. And there's only like four people of color inside. And then everyone else is really white. I don't really like it, because like, I like the content and I like the teacher, but like the class is just like a bunch of know-it-alls

Rindge School of Technical Arts (RSTA) is a vocational program that operates within CRLS. Freshmen commonly will do a RSTA rotation where they are enrolled in one of the RSTA programs for a few weeks and then rotate to another. The rotation continues for the first semester when the students have experienced many of the RSTA offerings before they choose their schedule for the following year.

Sifaad's discomfort seems to be less about the teacher and more about the students. Micaela seems to have had a difficult time connecting with both her teachers and the majority of the students in her classes. Both students clearly felt a division between them and the "white people" or "white kids" in their class.

Sifaad did have some positive things to say about some of her classes but was very short with her praise.

> I like my algebra class. I like my history class. Like the class is good. The teacher is good. The content is good.

Later in the focus group, Sifaad explained that she actually felt disliked by a few of her teachers:

> With my like English and physics teachers, um, I could already tell they didn't like me. Like during like the first quarter, so then like I just started not to like them and then we just had like a hate relationship. With my arabic teacher, he's like really funny and he's like really easy to get along with, so like he's

like the best teacher so far. With history, she's okay when she's wants to be, but then like, in the first quarter she was like really nice and stuff and like a cool teacher and in the second quarter she started to get annoying. But yeah, it's getting towards the end of the school year. My other teachers are fine…. I still respect them and stuff but like they annoy me. Cause like, with my English teacher, I still respect her because she's my teacher, she's going to be the one that grades me and stuff, but then it's also like I don't like the way she treats me. And I tell her like whenever she's treating me different than the other kids.

Sifaad described her relationship as a "hate relationship" but still feels like she's able to respect the teachers. The feeling of being treated differently, whether that stems from a racial divide or not, sets up an odd contradiction of hate and respect.

Micaela also reported that she felt unliked by most of her teachers:

I don't really have a connection with my teachers. Maybe one because she actually tries to talk to us about our life and stuff. That's a chill class. It's film and production. And so like, we're like hanging and doing our projects and stuff, she tries to get us involved talking about our lives, one on one and stuff. And in my other classes, my teachers don't like me. I know they don't like me because like, I don't like, I do my work and I do everything like but I don't

know, I really try that much. I'm always late and stuff. I don't mean to be late but I am late. Like I said I respect them. I try to do well.

The other ENPs, Patrick and Abhijeet, reported mixed feelings towards their teachers. Patrick found teachers that he could relate to and connect with but had strong opinions against other teachers:

I like my English class all year because of the teacher. He's really chill. And like I don't know like, he's athletic. We just relate a lot of ways. And um, the class is like really chill. He's not strict at all but he has rules. That's probably like my favorite class this year. Um… my Spanish class is like easy. I have some of my friends in there. It's just like chill. I didn't really like math in the first semester. I don't know why I chose honors but like it was just way too fast paced and Ms. Dewey didn't explain stuff well. Um and this semester, physics is like okay. I just don't like my teacher. She knew that I was like a little behind, um, and then like I tried to go in for extra help and extra credit but she wouldn't give me it.

Patrick went further when describing his physics teacher:

The first quarter I did bad [in physics] because I just hated my teacher. Like I couldn't, you can't like talk to him. He's super strict about it and just I don't

know. Like the way he teaches, I just don't like, and now, I'm like understanding more. I understand more and I just like don't talk to him at all.

Patrick finished the first half of his physics class with a D- and the following quarter with a B-. Patrick is also involved in the CRLS AVID program which helps monitor and improve student grades so that they can be successful in college. He explained that he was successful connecting with two of his teachers:

> Um I already know that when I'm going to apply to colleges I'm going to talk to my ELA teacher. Like this whole year, I can literally tell him anything. Um, and speak my mind and he won't get upset. And then for like my AVID teacher, I'm going to go to her for college recommendation or whatever. And the other two teachers, I'm like respectful even though I don't like them…. In my AVID class, we all have positive, like our teacher like enforces positivity like at the beginning and now it's good like she doesn't have to say anything like you have to do this or that. I think we all kind of care for each other now, which is nice. If you look around and someone is down, almost always one of us is talking to them about it.

Patrick's involvement in the AVID program was one of the bright spots in the ENP focus group interview. Abhijeet expressed more favorable opinions about his

teachers and classes but even the positive depiction fell short of all the RUPs in their descriptions:

> For me, I think I can say that I've enjoyed, you know, most of my classes on a somewhat equal level. You know there are like one or two classes that I like favor more than others. Uh, for example, English is something that, because that my teacher allows you to be creative in your writing sometimes and I enjoy that. And all my teachers have been good in understanding. Yeah…. Uh, for me, uh, you know I respect all my teachers and I feel like I can go to them if I have any questions or if I need help. And my physics teacher, I feel like he explains stuff really well and does a really good job at teaching. Yeah.

Although Abhijeet showed more favorable opinions towards his teachers, he still expressed dislike for his classmates and found it more difficult to make friends outside of cliques. He explained:

> I feel like most students in this school don't want to approach other people and try to make new friends. They just kind of want to stick to their own group.

Abhijeet related to some of the comments by Micaela and Sifaad when he said:

> The teachers just don't really do anything about the know-it-alls. Like they're just allowed to speak out and have conversations, because happened, this was like an ongoing problem with math. Like Ms. Dewey used to yell at a group of boys or just like the group of girls like that weren't the know-it-alls. And then like a couple of us went to Ms. Dewey and told her, they're having conversations, they're speaking out like, you're not doing anything, and then you send us out of the class for something like that. Like it's not fair.

Feeling treated unfairly by teachers came up repeatedly in the ENP focus group. One final story from Sifaad about feeling treated unfairly has multiple components of connectedness.

> In my English class it's always me and these two other girls and us three always stick together in the class. Because like, we don't really talk to anyone else in the class and the rest of the class thinks that we're like, I don't know, they just think we're dumb, and it's kind of annoying. Because they think that just cause sometimes we talk that we're not even doing our work, or that we're just bad influences in the class. But then when we talk in like discussions, they're always surprised and like try to automatically skip us, especially in English because like when we do like whole group discussions, it's always the same people that talk and then like if one of us tries to raise our hand to talk, then everyone gets so surprised and they try to like cut us

> off…. And it's also like, because it's just like it's us three, we talk sometimes in class, we're always paying attention, we always do our work and stuff and like automatically when she [the teacher] thinks that someone is talking, she looks at us when it's like a whole other group talking on the other side of the room. She'll just like automatically point at us and then like everyone looks at us and they're like they weren't even talking really. Yeah, we weren't even talking. And it's just like she automatically assumes and it's like really annoying. And if you try to say something to her she says like she'll change but she never really does…. like at the end of the discussion thing, I got really upset about it because I was actually getting really annoyed cause I was raising my hand and she always gives me a low grade for participation in class and when I actually have a chance to raise my hand then she never really calls on me. And it's like really annoying and so I went up to her and was like can you please make sure that everyone in the room gets a chance to talk because you be putting my grade low as participation when I actually try to have something to say. And then she felt bad and now she actually calls on me every time I raise my hand.

Sifaad's story is typical of a few other stories told by the ENPs. Sifaad clearly felt connected to a small cohort of friends but otherwise felt isolated in the class full of a "bunch of white kids." She expressed contempt for the teacher at several points in the interview but was empowered enough to bring up her concerns with the

teacher. The final line of the story shows that there was some degree of resolution to the situation because the teacher began calling on her. Interestingly the reason the teacher began calling on Sifaad was because the teacher "felt bad" according to Sifaad's story. Sifaad does not say that the teacher began calling on her because there was any connection between the two of them.

While it is possible that the ENPs fed off each others' negative energy in the focus group, the ENPs were still able to provide numerous specific examples of feeling unconnected to their teachers and their peers. The ENPs did not bring up the same sense of being able to joke around with their teachers that the RUPs expressed. In fact the few positive comments about teachers were tempered by the barrage of concerning isolated feelings.

This same ENP focus group that began the year feeling optimistic and connected ended the year on a much more sour note. The RUPs began the year with what appeared to be more realistic expectations of high school and then ended the year with a much more favorable report on teachers and classes. Rise Up cannot take any direct credit for this discrepancy but, it is possible that the RUPs' expectations about high school were adjusted over the summer with a brief, sheltered, summer semester. That would account for the dip in connectedness scores seen in the RUPs that was later observed by the ENPs and Proficients. Appropriate expectations of high school would then be combined with connections with teachers and fellow students formed over the summer. Additionally the skills

to navigate the school landscape set up the RUPs for a much more positive freshmen year and much more likely chance of being successful.

CHAPTER FIVE

Discussion and Conclusion

This chapter addresses the hypothesis that summer intervention programs prior to freshmen year can impact high school success. Each particular research question is summarized in a table of results. Finally a discussion examines the implications of the findings from this study and makes suggestions for future actions.

Hypothesis

This study began with the hypothesis that participation in the Rise Up program in the summer before freshman year is related to academic success for at-risk students. The indicators of academic success as defined by this study are academic outcomes, connectedness, and science learner identity. As seen in the literature review, these indicators predict academic success during freshmen year which is the "primary indicator" (Allensworth & Easton, 2007) of successfully completing high school on time.

Upon conclusion of the study, RUPs (Rise Up Participants) graduated 8th grade academically lower than their at-risk peers. Rise Up was found to show a strong correlation with academic gains during freshmen year, especially in the first semester bringing the RUPs up to speed with the ENPs (Eligible Non-Participants). Secondary academic outcomes, such as behavior, attendance and sports

involvement, also showed higher successes for students who participated in Rise Up compared to non-participating at-risk students. Connectedness for Rise Up students remained consistent throughout freshmen year whereas connectedness declined for other freshmen. Science Learner Identity increased for Rise Up students in the short term but was seen to diminish over the course of freshmen year. Overall, the students involved with Rise Up demonstrated more reasonable expectations of high school and maintained a better approach to the school community.

Table 5.1 – Grid Overview – Summarizing the Results Explained in the Following Sections

Research Questions:	Summary of Findings:
1. What effect does Rise Up (RU) have on at-risk students' grades, sport participation, attendance and behavior?	• RUPs enter the summer on average academically below ENPs. After one quarter of high school, RUPs and ENPs have statistically equivalent GPAs. • Behavior records show statistical equivalence between RUPs vs. ENPs and between RUPs vs. Proficients. Proficients and ENPs were different, leaving RUPs in the middle between two groups. • Attendance for RUPs is slightly better than ENPs but both groups are similar to Proficients when it comes to absenteeism. However RUPs and ENPs are more frequently late for school. • Fall sports participation has been significantly higher for RUPs over ENPs for several years but data from fall 2016 did not show that difference.
2. How does a summer intervention program prior to freshmen year impact connectedness in high school for at risk students?	• RUPs' connectedness subscale scores show that they enter high school less connected than either ENPs or the highly-connected Proficients. However, the RUPs connectedness values steadily increase or remain constant from the early summer to the following spring. In contrast, the ENPs' and Proficients' subscale scores decline from the fall to the spring. • In the academic ecological world of connectedness (subscales: school, teachers, peers, reading), the

	RUPs show notable gains to nearly match the Proficients by the spring of 2017.
3. Does the degree of connectedness in the academic ecological world correlate to science learner identity?	• Across all all three subgroups, RUPs, ENPs and Proficients, academic connectedness scores show a strong relationship with science learner identity. • While Proficients report the highest degree of science learner identity, RUPs seem to have started the summer on par with where the ENPs entered the fall. By the fall, RUPs science learner identity is in between ENPs and Proficients. However, as gauged by attitudes and achievement, any gains made by the RUPs seem to have disappeared by the spring. • In science achievement, the RUPs started the fall higher but ended freshmen year lower than their ENP counterparts. • Where connectedness dipped for ENPs and Proficients from fall to spring, RUPs stayed consistent. • However, RUP Science Learner Identity increased from summer to fall but then declined by the spring. • Science learner identity usually shows a strong relationship with academic connectedness but cannot be directly correlated as seen with the relative decline in RUP science achievement despite relatively higher connectedness scores.
4. If Rise Up is having an impact, what mechanisms may be contributing to that impact?	• RUPs entering the school year report more realistic expectations for their high school careers concerning classes and teachers compared to ENPs, but ENPs enter high school more optimistic. • RUPs seem better prepared to navigate the high school landscape in terms of involvement and making connections with teachers and classmates. RUPs report being familiar and comfortable in the building, learning about ways to be involved and meeting teachers and classmates are mechanisms from Rise Up that contribute to their success. • RUPs had increased networking and information in place to start the school year. By the spring, the RUPs demonstrate a more positive view of the high school and the ENPs report a much more cynical view.

Positive Outcomes for RUPs - Distinguishing Three Groups: RUPs, ENPs, and Proficients

The conclusion of the previous section suggests that one mechanism that may be contributing to a disparity between ENPs and RUPs during freshmen year is a realignment of expectations of the high school experience over the summer. Having an experience at the high school, building connections, and then having a small window away from the school may be what helps the RUPs in the fall.

For example, RUPs' science learner identity from the survey dipped from the early summer to the late summer and a similar dip was shown for ENPs from the fall to the spring. However, the RUPs' science learner identity by the fall rebounded from the late summer. Keeping in mind the notion of science learner identity having to do with achievement, activity, attitude and access (Hanson, 1996), the RUPs have had increased access and activity in science over the summer compared to the ENPs. Low achievement over the summer may cause the observed dip, especially considering these students came into the program underachieving. Even if the RUPs did not experience achievement over the summer, the act of participating may make them believe they are more capable in being successful in science. Such a belief may explain why they reported more interest in STEM fields after being away from Rise Up for most of the month of August 2016.

Similar support for the realignment of expectations of high school can be found in the results of the Hemingway surveys. The RUPs' academic connectedness scores seem to dip in the same manner as science learner identity from early summer to late summer. Also parallel, the RUPs' scores rebound and remain

consistent or increase throughout the rest of the school year. The RUPs' academic connectedness scores were below the Proficients but the trend to remain consistent or improve outperformed both the ENPs and the Proficients.

The science learner identity and the connectedness scores may exemplify part of a larger picture. The RUPs entered high school with a lower academic record than their peers. According to MCAS data, the RUPs were significantly behind the ENPs. By definition, the Proficients scored higher than either the RUPs or the ENPs. Even though the RUPs were behind the ENPs leaving 8th grade, the RUPs were able to outperform the ENPs in terms of freshmen-year grades. The RUPs' first quarter, immediately following the summer intervention, showed the highest grades for the RUPs both in general and specifically in science. In other words, students who were behind by one academic measure, the MCAS, caught up and passed the ENPs according to a second academic measure, grades. Statistically speaking, there was not a significant difference between the RUP and ENP grades during freshmen year. Even still, just catching up is an improvement from being statistically behind during middle school. Certainly no definitive conclusion can be drawn from this comparison because the MCAS and grades are not the same metric and there are a myriad of unmeasured factors that could have played a role.

This study did find that the Proficients earned an average cumulative GPA during freshmen year of 89.88%. Therefore, Proficients' average cumulative GPA was an A-. Average cumulative GPAs for RUPs and ENPs were on the border between a C+ and a B-, staggeringly over 10 percentage points below Proficients.

While this information by itself is insufficient to reach any conclusions, it highlights the embedded obstacles facing the RUPs and ENPs. Even though Rise Up is having a positive impact, the gap between Proficients and the at-risk groups seems insurmountable.

Behavior and attendance saw similar upticks for the RUPs compared to the ENPs. Statistically there was no difference between RUPs and ENPs during middle school in terms of behavior. However there was an interesting finding during high school. While the RUPs were statistically the same with both the ENPs and the Proficients in terms of disciplinary referrals and unexcused absences, the ENPs and the Proficients were statistically different. The Proficients had the fewest unexcused absences and disciplinary referrals and the ENPs had the most. The findings suggest that there is a gradient from Proficient to RUP to ENP in terms of favorable to unfavorable behaviors and attendance. An adjusted view of the high school experience along with increased connectedness to the academic world would support this gradient.

One theory that the PI posited was that parental involvement may play a role in unexcused absences compared to excused absences since the difference between the two can be as small as a phone call from a parent excusing the absence. However the parent connectedness score between all three groups did not show any significant difference. Of course, connectedness is not the same as a degree of parental involvement. There are numerous reasons why some parents do not call the high school as frequently as others and possible reasons may range from

language barriers to conflicts with work hours. This study does not have a direct metric for parental involvement to explain the gradient in unexcused absences.

Diminishing Rise Up Effect

Whether the difference between the RUPs and the ENPs is caused by Rise Up or something else remains unclear. However, the difference between those two groups seems to diminish over the course of freshmen year. This is seen most clearly in RUP grades. Both RUPs' and ENPs' grades remained significantly behind the Proficients throughout the course of this study. However, at the start of the year, the RUPs were outperforming their ENP counterparts. The RUPs were as close to the Proficients as they ever would be during the fall of freshmen year. By the end of the year, the ENPs were receiving higher grades than the RUPs but both were further away from the Proficients in the spring (see Tables 4.24, 4.25, and 4.26).

This is particularly true for science grades. ENP science grades for the first semester were in the C/C- range almost 3 percentage points behind the RUPs mid-C grades. By the second semester, the ENPs had pulled ahead, or more accurately, not fallen off as rapidly. The ENPs finished their second semester science class with a C- while the RUPs had dropped to a D+ average. Any boost that the RUPs had received from the summer intervention seems to have gone away in terms of science achievement.

While science grades fell for both ENPs and especially for RUPs, the Proficients saw a slight increase. RUP and ENP grades in the first quarter were only

about 7 percentage points behind Proficients. By the fourth quarter, ENPs and RUPs were about 13 percentage points behind the Proficients. The gap between the Proficients and the two groups eligible for Rise Up widened over the course of the year.

Looking into possible causes for the widening achievement gap, teacher language and encouragement seems to be ruled out. The science learner identity surveys did not note any differences in how students reported they felt about how their teachers acted towards them. This is supported by qualitative research from Aschbacher, et al. Science teachers were seen as the ones who most inspired interest in science (2010).

Even with equal encouragement from teachers, underrepresented groups still demonstrated a lower science learner identity. In other questions on the survey, Caucasians and Asians showed they held higher views of themselves as scientists in terms of activity and attitude. In both the fall and the spring surveys, Caucasians and Asians showed significantly more interest in participating in STEM activities such as science fairs and could see themselves as good scientists in the future. Whereas the underrepresented groups showed less interest in the same activities or views of themselves in the future (see discussion in Chapter 4, *Science Learner Identity and Race*).

As previously discussed, RUPs' interest in STEM majors and careers declined from early to late summer but peaked in the fall. However over the course of freshmen year, STEM major and career interest fell off dramatically. Starting in the

summer, 34.1% and 40% of RUPs were interested in STEM majors and careers, respectively. By the end of the summer, interest waned to 33.3% and 33.3% for both majors and careers. The fall scores, with the hypothesized readjusted expectations of high school, showed a high with 40% and 38.7% interested in STEM majors and careers. The percentage of RUPs interested in STEM majors was significantly different to the ENPs' STEM major interest ($F=3.91$, $p=0.05$ and $F=0.168$, $p=0.683$, fall major and career respectively).

RUPs enter the summer with a similar vision of themselves as science learners compared to where the ENPs entered the school year. During the summer, the RUPs' science learner identity declined. However, by the time the RUPs entered the fall, their science learner identity had peaked. Over the course of the school year, RUP science learner identity once again declined. This ebb and flow of identity shows an interesting pattern. When students are actually participating in science, their identity decreases. In between participation, their science learner identity increases.

There are a few possible reasons for this fluctuation. These students have generally been below average in terms of being successful at school. When they are actually involved in science classes, they likely may be encountering some of the same barriers to success that they came across in the past. Academic barriers would likely make the students perceive themselves as being less successful. This could explain why when actually participating in science classes, their science learner identity decreases.

On the opposite end, science learner identity may increase for a combination of reasons, confidence and nostalgic memories being two possibilities. First, the RUP focus groups spoke with increased confidence about being successful in classes and understanding expectations. In this case, Rise Up may have helped adjust RUPs' expectations of high school to a reasonable and realistic level. RUPs show confidence in what they perceive to be needed to succeed as they enter high school in the fall.

Second, students' self perception may not exactly match the actual struggles they face in the classroom. As already noted, when participating in science class, students' science learner identity tends to decrease. However, there is a five week window in between the end of Rise Up and the start of the school year. During that time, students may reflect on their experiences in Rise Up in a positive light. RUP focus groups reported that by the end of Rise Up, the students held warm feelings about their experiences overall. Possibly those same warm feelings about Rise Up translated into a fond memory of their science experiences. In turn, positive science experiences could manifest as increased interest in STEM. Having a time to reflect on their experiences might allow students to forget their struggles and focus on the positive aspects. The combination of reflecting on their positive experiences after being given some distance, as well as actually feeling more confident about ways to be successful, seem like a reasonable explanation for the fluctuation in science learner identity.

Unfortunately by the spring, RUPs' STEM major and career interest fell

significantly to 30.4% and 28.6%. A similar decline was observed for the ENPs, dropping from 28.2% and 36.5% in the fall to 26.4% and 25.9% by the spring (See Table 4.21 - STEM Major/Career Distribution by Rise Up Status). While the RUPs finished the year showing more STEM interest than the ENPs, there was no statistical difference ($F=0.47$, $p=0.495$ and $F=0.20$, $p=0.646$, spring major and career respectively). More alarming was the precipitous drop observed within the RUP population from the fall to the spring which realigned RUPs' STEM interest levels with that of the ENPs. In other words, any positive gains in science learner identity that were made by the RUPs, possibly because of Rise Up, seem to have diminished by the end of freshmen year.

The Proficients' interest level in STEM majors increased from 40.9% in the fall to 49.5% by the spring. Thus the divide between the Proficients and the ENPs/ RUPs grew similar to what was observed with grades in the same time span.

Since this is such a pivotal time for students entering STEM fields, race was further analyzed after the qualitative component of this study. As a frame of reference from chapter 2, the NSF chart showed that 88% of scientists and engineers working in science and engineering are Caucasian or Asian (National Science Foundation, 2015). Since those two populations make up the vast majority of individuals in science and engineering, the remaining populations are considered underrepresented.

Looking at the science learner identity divide through the lens provided by the NSF, 72.4% of the Proficients were Asians or Caucasians with 27.6% comprised

of underrepresented groups. ENPs and RUPs together were comprised of 29.5% Asians and Caucasian and 70.5% underrepresented populations. Table 5.2 shows the breakdown of the three subgroups by population.

Table 5.2 - Demographics % Asian/Caucasian vs. STEM Underrepresented Populations

Subgroup	% Asian/Caucasian	% Underrepresented Populations in STEM	Chi-Square	df	Asymptotic Significance (2-sided)
RUP	30.4	69.6	67.54	2	p<0.0001
ENP	29.2	70.8			
Proficient	72.4	27.6			

Statistically ENPs and RUPs are the same while the Proficients have nearly the exact opposite composition. This is particularly alarming considering the findings from chapter 4 (see section *Science Learner Identity and Race*) where the null hypothesis was rejected and race does not appear to play a role in STEM interest during the fall. Somehow this changes by the spring and students who have been historically underrepresented in the STEM fields are on the trajectory to continue underrepresentation. Rise Up appears to be one possible mitigating factor for the fall but those gains have diminished by the end of freshmen year. Students of color, in particular the RUPs, seem to lose interest in STEM fields throughout the course of freshmen year.

Using the qualitative component from this study, RUPs do not provide any insight into the dip in science learner identity. However, within the ENP focus

groups, race was brought up several times without being directly asked in the research questions. When asked about her classes, ENP Micaela replied,

> From the first semester I liked my diverse classes but like my physics class wasn't really diverse cause when I like walked in there was like a bunch of like white people and it was like ok. And I talked to the teacher about that too. So like she was like well we're going to fix it next years and stuff.

Similarly, ENP Sifaad described feeling uncomfortable when she was moved from college prep (CP) English to honors English:

> I loved my English class cause it was like really diverse but then I was in CP but then I got moved up to honors in the second semester and then when I walked into my honors class it was really uncomfortable, like, Micaela said, it wasn't really diverse. It was a bunch of white kids. And it was like, I only have like, two friends in that class. And there's only like four people of color inside. And then everyone else is really white.

Both of these stories illustrate that race is on the mind of these freshmen, especially when the racial makeup of a classroom does not match the school's general demographics. Sifaad highlighted that honors classes are even more skewed away from the racial breakdown of the entire school compared to her CP

class.

Students clearly make observations about race in class. Freshmen physics is heterogeneous, CP with an honors option. The non-tracked approach should relieve some inadvertent racial tracking, although Micaela's comments above show that the system is far from perfect.

The science learner identity survey failed to reject the null regarding teachers disproportionately encouraging any racial group to pursue STEM fields over another. Teacher encouragement to enter STEM fields was quantitatively the same regardless of race according to the survey. A few explanations for the survey results are plausible. First, the freshmen physics teachers found a way to overcome what students felt as racial tension in the classroom and delivered the same level of encouragement throughout. Second, the non-tracked approach contributed to the findings by more evenly distributing students throughout classes and providing more consistent messaging of high expectations and encouragement.

There is no way to definitively know if either of these options, or some other factor, played a role in the survey results. Hopefully all teachers are encouraging their students evenly regardless of race. However, the focus groups do show that students still feel treated unfairly by teachers sometimes along perceived racial lines. For example, Sifaad described feeling treated unfairly by her English teacher from the aforementioned class full of "a bunch of white kids" and implied a racial component when describing how her English teacher...

> ... looks at us when it's like a whole other group talking on the other side of the room. She'll just like automatically point at us and then like everyone looks at us and they're like they weren't even talking really. Yeah, we weren't even talking. And it's just like she automatically assumes and it's like really annoying. And if you try to say something to her she says like she'll change but she never really does…. like at the end of the discussion thing, I got really upset about it because I was actually getting really annoyed cause I was raising my hand and she always gives me a low grade for participation in class and when I actually have a chance to raise my hand then she never really calls on me.

Sifaad felt that both her English teacher and her physics teacher did not like her and so she in turn did not like them. She described her relationship with them as a "hate relationship" (see chapter 4: *ENP Connections*). Overall, the physics teachers received mixed reviews from the ENPs. For example ENP Patrick said,

> The first quarter I did bad [in physics] because I just hated my teacher. Like I couldn't, you can't like talk to him. He's super strict about it and just I don't know. Like the way he teaches, I just don't like, and now, I'm like understanding more. I understand more and I just like don't talk to him at all.

But on the contrary ENP Abhijeet explained,

> ...my physics teacher, I feel like he explains stuff really well and does a really good job at teaching.

In trying to explain the science learner identity teacher encouragement component, the heterogeneous classes may play a larger role instead of the physics teachers consistent encouragement.

Unpacking Sifaad's account of English class and her feeling of being unsupported by her teacher, there seems to be more at play in that scenario. Sifaad identified social pressures from her classmates as they began looking at her and her friends. Shortly after Sifaad described her English class as, "a bunch of white kids," she further explained by saying,

> In my English class it's always me and these two other girls and us three always stick together in the class. Because like, we don't really talk to anyone else in the class and the rest of the class thinks that we're like, I don't know, they just think we're dumb, and it's kind of annoying. Because they think that just cause sometimes we talk that we're not even doing our work, or that we're just bad influences in the class.

Sifaad and other ENPs seemed particularly in tune with the racial dynamics of their classes and in particular the perceptions of their peers. The peer connectedness scores for ENPs in the fall was 3.63. This was statistically the same as the fall scores for RUPs, 3.51, and Proficients, 3.65. Unfortunately the subscale score for ENP peer connectedness in the spring showed a Cronbach's alpha that was too low to consider reliable. Therefore peer connectedness cannot be used to explain how Sifaad intuited uneasiness with her classmates. RUPs saw peer connectedness scores in the spring remain unchanged whereas Proficients saw a drop in the spring to 3.49.

Decreased science learner identity for underrepresented populations in the STEM fields is certainly a disappointing finding. The cause remains unclear but unfortunately race seems to play some sort of role in separating future career pathways. Rise Up appears to help in the short term but any positive effects on science learner identity appear minimal by the end of freshmen year.

The findings from this study's analysis during the fall support Gilmartin, et al.'s 2006 study. Gilmartin et al. found that SES status had no relationship to science interest for 10th graders. The current study finds that race does not affect 9th grade interest in science in the fall. While clearly race and SES are not equivalent, this study can be seen as a compliment to Gilmartin, et al. during the fall. However by the spring, in Cambridge, race does seem to play a role in STEM interest.

Work by Aschbacher, Li, and Roth (2010) found two interesting pieces that directly connect to the work in this research study. First, Aschbacher, Li, and Roth

found that “no students developed a strong interest in science after 10th grade” (2010). Second, the same study found that SES determined 12th grade college/career plans. With that in mind, 12th grade is too late to alter college/career trajectory.

The current study in combination with Aschbacher, et al. and Gilmartin et al., shows that 9th grade is the pivotal point in an adolescent's path toward STEM fields. Synthesizing the aforementioned studies leads to the conclusion of the importance of freshmen year. Strong interest does not develop after 10th grade (Aschbacher, et al., 2010). SES does not influence STEM interest in 10th grade (Gilmartin, et al., 2006). Race does not influence STEM interest at the start of high school (from the previous discussion). 9th grade must be one of the last opportunities to solidify and foster students’ science learner identities.

Considering the downward trajectory in science achievement by both the RUPs and ENPs found in this study, it seems reasonable to surmise that science learner identity is waning for these at-risk populations. Rise Up appears to mitigate some of the decline in science learner identity. However, one intervention is not nearly enough to stem the tide.

Rise Up Participants, Other and Repeaters

An interesting anomaly was discovered during this research study that was technically out of the purview of this study but is worth a brief discussion. The main

focus of this study was to compare RUPs vs. ENPs and to use the Proficients group as a baseline comparison. When establishing the criteria for these three groups, two other populations were teased out. The first group was the Repeaters. Repeaters were students who did not accumulate enough credits during their freshmen year and therefore became freshmen for a second time. The Repeaters in this study were technically eligible for Rise Up but were intentionally not recruited into the program. Their omission from Rise Up was to ensure that the incoming 9th graders, who just finished 8th grade, would have positive experiences with a success-oriented mindset as their first interaction with the high school.

The Repeaters data was included in the student information system and was therefore analyzed with all the other student demographic data. Overall the Repeaters group did not fare well during their second attempt at freshmen year. In fact, attendance was so low, the Repeaters did not have enough surveys to analyze as a group for any statistical significance.

The repeater phenomenon is nothing new and directly contributes to students not graduating on time as was discussed in chapter two. Allensworth and Easton called this the "Bottleneck Effect" (2007) and Black warns about "the Bulge" in *The Pivotal Year* (2004).

The second population was a group that fell in between RUPs and ENPs. Some students attended part of Rise Up but were not present for a long enough period of time to have been considered an RUP. At the same time, since this group received some of the Rise Up intervention, they could not technically be considered

ENPs either. This population was named the Others. As previously explain in chapter 4, a threshold was set at 60% attendance at Rise Up to be considered an RUP.

Since the Others fell in between RUPs and ENPs in terms of how much of the intervention they received, the Others were expected to yield data also in between the two groups. Surprisingly, instead of falling in between the RUPs and ENPs, the Others were most closely aligned with the Repeaters. The same attendance issues and small sample size made the Others' surveys statistically insignificant.

It is unclear why the Others and the Repeaters are statistically the same in multiple comparisons. GPA, behavior records and attendance records all group Others and Repeaters statistically the same as each other and different from the three main focus groups, RUPs, ENPs, and Proficients. The sample sizes are too small to draw any definitive conclusions linking Others and Repeaters but there are a few similarities. For a full explanation of the similarities between the Others and the Repeaters, see chapter 4 beginning at *Academic Comparisons during Freshmen Year*.

One possible reason for the similarities is that five out of the nine Repeaters attended Rise Up after their 8th grade year and before their first time entering 9th grade. Three of the Repeaters attended Rise Up in 2014 and two attended in 2015. Going back to the attendance records of those five students, the percentage attendance is shown in Table 5.3.

Table 5.3 - Repeaters Who Attended Rise up

Study ID Number	Year Attending Rise Up	Percentage of Rise Up Attendance	Mayor's Program Employee
238	2015	71.9%	Yes
245	2014	90.0%	Yes
248	2015	86.5%	No
253	2014	98.3%	Yes
256	2014	67.5%	Yes

None of the five repeaters would have been categorized into the Others group based on their attendance. However, it is worth noting that four of the five also received payment through the Mayor's Summer Youth Employment Program (MSYEP) which, anecdotally, is a strong motivator for students to attend Rise Up. Upon calling home, students from the Others category would frequently report that they had stopped coming regularly because they were not being paid and their peers were.

The largest statistical difference between Repeaters and Others is in attendance during the school year. The mean difference in total absences shows a difference of nearly 56 absences which is statistically significant at $p<0.0005$ (see Appendix E). Even with the small sample sizes, the difference is significant. Repeaters come to school substantially less than all other groups in the study and would suggest they are more likely to drop out.

Cambridge does not currently have a truancy officer, one whose sole job is to help bring students to school. Therefore students who do not come to school do not necessarily have an officer coming to check on them. The City of Somerville, which abuts Cambridge and has roughly 25% fewer students than Cambridge (MA DOESE, 2017), employs two truancy officers. In Somerville, the truancy officers' role is to visit homes and appear in court as needed. The high rate of absences in Cambridge may be, at least in part, due to a personnel oversight.

Discussion and Recommendations – Grade Disparities and Unforeseen Related Groups

Upon completion of this study, there are a few interesting findings that would warrant a follow up study. First, as mentioned in the previous section, a more thorough exploration of the impact a truancy officer has on attendance could be beneficial to the students in Cambridge. This could be done in at least two ways. First Cambridge attendance records could be more thoroughly compared to surrounding towns with similar demographics both with and without truancy officers. Second, if Cambridge was willing to hire a truancy officer, a longitudinal study within the Cambridge community would be the most effective at measuring the impact of a truancy officer on Cantabrigians.

Next given the large disparity in freshmen cumulative GPAs for Proficients vs. everyone else, an investigation of grades seems warranted. Proficients finished freshmen year with an A- GPA on average. ENPs and RUPs finished on the cusp of a

B- and a C+. This is not factoring in the effect from Others' and Repeaters' GPAs, which would no doubt drag down the ENP/RUP average substantially.

Since most classes at CRLS are tracked, or at least are CP with an honors option, the increased rigor of the honors courses should balance GPAs so as not to leave a chasm between Proficients and everyone else. A follow up study could quantitatively look at grade distribution in CP versus honors classes and explore the findings with a qualitative component by speaking with all of the stakeholders. The follow up study would be particularly interesting considering the reports from the spring ENP focus group. Clearly the students in that focus group felt disenfranchised in several of their classes. Exploring the origins for the sense of disconnect could reveal some of the underlying causes for the grade distribution disparities.

Related to grades, the anomalous correlations found between the Others and the Repeaters should be explored. Coming out of this study, the Others appear to be the future Repeaters with one major current difference. The Others are coming to school much more regularly than the Repeaters. If the Others are bound to be next year's repeaters, that means flagging them early as high risk may help intervene before their attendance dips like the rest of their statistics. Rise Up is specifically designed to integrate at-risk students into the high school community. If the Others cannot be successful in that environment, the school at large will be much more challenging. If a student drops out of Rise Up, that student should be immediately considered for extra help by the school. Working with an effective High School

Extension Program (HSEP), CRLS's non-traditional, alternative education program, the Others should be considered for HSEP enrollment with a lower threshold than most students. A longitudinal study moving forward or a look back at old Rise Up attendance records could reveal if the Others are truly the most likely to become Repeaters. The is especially true keeping mind the importance of being successful during freshmen year and not becoming a Repeater.

Discussion and Recommendations – Rise Up Boosters: Homeroom and Imagine-the-Future Rise Up Extension

Rise Up is overall highly successful at integrating students into the high school for the fall. Since many of the positive effects of Rise Up diminish throughout the course of freshmen year, designing a Rise Up cohort booster seems like a logical next step to maintain the successes of RUPs. Meeting periodically throughout the year, or arranging a meaningful homeroom experience for the RUPs with the Rise Up teachers, should help sustain the bonds created over the summer. Homeroom is currently being called Community Meeting but according to the focus groups, community is not actually being built during this time. Several RUPs and ENPs outright complained during focus groups about the lack of structure in homeroom as a waste of time. Nothing positive was said about the current homeroom structure.

In fact, given the overwhelmingly negative language about homeroom, a

complete overhaul of the current system should be undertaken by the school leadership. In lieu of the needed sweeping reform, revamping homeroom to meet the needs of the RUPs is a small actionable step that would have a direct positive impact on a small population. RUPs begin the year with increased science learner identity and a stronger sense of connectedness than the ENPs. Creating 3-4 homerooms that house only RUPs and are lead by two Rise Up teachers in each should help maintain some of the gains made over the summer. To maximize the effect, the principal should commission the teachers to develop Imagine-the-Future-type curriculum to meet the needs of the RUPs in homeroom. This study and other research on programs such as AVID, show that targeted support helps students be successful. Mindful Imagine-the-Future curriculum would serve to build on summer gains. A follow up study to determine the effectiveness of changes to the homeroom structure would be an interesting complement to this study. Finding ways to maintain and boost the gains made in the summer is essential to combatting the precarious drop in science learner identity seen by at-risk students.

In the same vein as Rise Up homerooms, a separate Imagine the Future class should be undertaken during the school year. This class should be modeled after the Imagine the Future class during the Rise Up program and conducted similar to the AVID program. Imagine the Future would identify the most at-risk students from Rise Up and place them into a separate class that meets for one block, 80-minutes, every other day. Rise Up can serve as an early detection program for students who will struggle in high school. The Rise Up administrators and teachers

have had years of successfully identifying the students who will have a difficult time with the transition to high school. Alerting administration of these individuals has not been enough since no plan is put in place to help these students transition to high school.

By enrolling Rise Up students who are identified as potential concerns in Imagine the Future during the school year, there will be many benefits. One is having a small cohort working with a Rise Up teacher who would continue the connections from the summer and provide a mentor during the school year for the most at risk RUPs. Helping these students pass freshmen year would eliminate the "bottleneck" (Allensworth & Easton, 2007) which prevents students from graduating on time. Imagine the Future during the school year would act as an extension of the Rise Up program to ensure success during freshmen year.

Not only does this proposal directly help students, it also makes financial sense for the district. Although relieving a teacher's schedule for one period a day is a burden to the district budget, preventing multiple students from repeating freshmen year is a substantial financial benefit. Further, students from this high-risk cohort are more likely to be outplaced, sent to an alternative school outside of Cambridge. Depending on the outplacement, one student can cost the district up to an entire teacher salary with benefits. Imagine the Future has the potential to help students be successful in their home community.

After one year of the Imagine the Future course, students in the cohort would have a few choices. Students who have been successful could have the extra support

removed from their schedule and return to support during RUP homerooms only. Other students could enter the AVID program which targets getting students into college. A third option would be to allow students to enroll in Imagine the Future again as sophomores as needed. These slightly more mature sophomores could then help with the next year's freshmen in Imagine the Future as role models.

In fact, Imagine the Future as a class was tried during the 2015-16 school year. One of the Rise Up administrators successfully petitioned his department to undertake the class. Student gains were astounding. As part of the proposal to run the class, similar students were identified from the 2014-15 school year who would have been placed in Imagine the Future class if it existed for the sake of comparison. Retroactively looking at the would-be 2014-15 cohort, these high-risk students failed 57% of core classes. With the Imagine the Future class, the 2015-16 cohort was passing every single class at the end of one semester. While certainly the comparison was not officially-conducted research, the results are still remarkable.

Unfortunately despite knowing about the findings from Imagine the Future, the program and teacher in charge lost support from the principal and school committee. In the end, internal politics removed supports for the most at-risk students in Cambridge.

Discussion and Recommendations – Race and Science Learner Identity

The investigation into race and science learner identity was an unexpectedly rich finding. Considering the precipitous decline in science learner identity during freshmen year, an intervention seems warranted. The intervention would need to find a way to target students who are historically underrepresented in STEM fields and provide access and encouragement to actively participate. Ensuring achievement to whatever degree possible and therefore a more positive attitude towards STEM would be keys to a successful intervention. This would need to take place during freshmen year when students are most in need of an augmented science learner identity. This STEM intervention could be done separately or in tandem with the Rise Up booster suggestion. A follow up research study with intermittent science learner identity surveys would be a relatively easy way to track this progress and could be done within the science department. Small changes like this could have the most profound positive impact on the trajectory of students' lives.

Cambridge has made strides in recent years to provide more access to thinking and talking about science. The science department chair has arranged visiting lecturers, several of whom are Nobel Prize winners in science, to come and speak with interested science classes during the day. Increasing access and activity in science should help augment science learner identity. The teachers select if they would like to bring their class to the lecture. Also, teachers are left to prepare and debrief their classes before and after the lecture. Class selection, preparation and

post-discussion creates a wide range of experiences for the students. Inadvertently, these excellent lecture opportunities may contribute to increased disparity in science learner identity. More advanced science classes take advantage of the lectures which means that fewer CP classes with at-risk students participate. This perpetuates that STEM divide between historically represented and underrepresented groups in STEM fields since honors and CP classes are already divided by similar demographics. The lecture series is one example of advanced students having increased access and activity in STEM whereas at-risk students are not afforded the same opportunities. Lectures are only one examples but others may include field trips, science extracurricular activities, and enrollment in electives. All of these could be further explored in future studies.

Other communities in the area face similar problems and have devised similar solutions. For example, Sharon High School offers more frequent lectures outside of school hours. Once per month, locals who work in STEM fields give a talk about their work to anyone interested. While these individuals are not Nobel winners, tapping into the expertise of the community fosters important relationships between the school and the larger community. Research that Rise Up is based upon found that connections to the community were helpful to the success of summer programs (McCombs, et al., 2011). Connecting back to the high school, several of the science teachers in Sharon offer extra credit to students for attending the lectures. If Sharon facilitated a post discussion after the lectures, the burden of debriefing with students could be taken away from the science teacher and students

would have incentive and opportunity to enhance their own science learner identity. Most importantly in this model, the opportunity to enhance science learner identity is evenly distributed for all students. Therefore at-risk students interested in STEM majors/careers early in high school could attend these lectures prior to any decline in science learner identity.

Discussion and Recommendations – Connectedness and SLI Discrepancies

Early in the study, similarities were noted between the academic ecological world of connectedness and science learner identity. Parallels were hypothesized between the connectedness subscales of reading, teachers, peers and school compared with scientific literacy, relationships with science teachers, peer discussions of science, undertaking scientific endeavors. Early data from the fall seemed to suggest that there was a correlation between connectedness and science learner identity. However, by the spring, science learner identity and connectedness scores showed a widening divide. This was particularly true for the at-risk RUP group and the not-at-risk Proficient group.

The RUPs showed connectedness scores on the four academic subscales that stayed consistent or increased throughout the school year. The RUPs were the only group to show this relationship. Both the ENPs and the Proficients decreased connectedness scores throughout the year. However, the RUPs' science learner identity peaked in the fall and plummeted by the spring. RUPs showed their

strongest interest in pursuing a STEM major or career in the fall and they also earned their highest grades in science classes during the first quarter of the school year. By the spring, RUPs reported their lowest interest in STEM majors and careers and also earned their lowest science grades of the year during the fourth quarter. The correlation between the connectedness scores and science learner identity does not seem to hold throughout the entire year.

The reverse was true for the Proficients. This group saw decreasing connectedness scores while their science learner identities substantially increased. At first pass, connectedness to the academic ecological domain showed a strong relationship with science learner identity. In the fall, students who scored high in academic connectedness also demonstrated high degrees of science learner identity. However, looking at the trends with RUPs and Proficients, the actual relationship between academic connectedness and science learner identity appears more complex.

The dip in science learner identity for the RUPs appears to be a part of a bigger issue. In other words, academic connectedness and science learner identity likely do have some relationship but the RUP decline as well as the Proficients increase may be more convoluted. The same SLI decline was observed with both the RUPs and the ENPs. In other words, both of the groups, RUPs and ENPs, that had previously been identified as at risk, saw precipitous drops in pursuing science, despite connectedness scores. RUPs and ENPs both reported from the Is Science Me survey that teachers were encouraging STEM as a major/career for all students. If

teachers are not directly contributing to the divide, other factors must be contributing.

As previously discussed, RUPs and ENPs are comprised of approximately 70% students from underrepresented STEM demographics. Whereas the Proficients are just the opposite with only about 30% from underrepresented STEM demographics. The question of why this pattern continues to emerge looms large. Cambridge is a vibrant, diverse, open and progressive city. As race has been increasingly discussed on a national stage, Cambridge has recently unearthed new racial divides within the high school. Even during the time when this study was being written, new racially-charged stories emerged from CRLS.

In the fall of 2017, a student-made documentary entitled, "Cambridge Minority Reports: Volume 1" was uploaded to YouTube. The video features current CRLS students chronicling incidents of racial and cultural insensitivity within the school. The majority of the incidents involve teachers doing or saying something reprehensible to students of color. Reactions varied about the appropriateness of the video. The administration responded by saying the video was not approved and a special long homeroom block was scheduled so teachers and students could discuss the topic. The administration prepared a video to be shown in homeroom about addressing micro-aggressions. Students who spoke in the video were individually checked on by their dean or guidance counselor. Even still, the culture at CRLS is viewed as a high concern by some teachers and students.

The high school, built on respect for diversity, seems to be failing to provide

equitable opportunities for all students to grow as learners, let alone as science learners. The most alarming aspect of this study is how students from at risk populations decrease interest in science during freshmen year. If students from all subgroups report even STEM interest coming in to high school and the students also report consistent support from their science teachers, the reasons for the divide must be much more elusive and possibly part of a much larger problem. Just as in the video, "Cambridge's Minority Reports," the focus groups from this study point to no action being taken when treatment is viewed as unequitable. Community meeting is seen as a anything but community building and instead a waste of time. Teachers taking on initiatives to build courses to protect the most at-risk students, are unsupported by the administration and school committee.

Overall, the school culture needs to be addressed. Individual targeted efforts such as lectures by Nobel winners or Imagine-the-Future classes are excellent patches to help address school culture problems, but on their own, they cannot go far enough to address systemic problems and lack of support. If any community can come together to fix these issues, the people's republic of Cambridge can be an example to the country on how to tackle these problems.

Glossary

Eligible Non-Participants (ENPs) – Students who are eligible for Rise Up based on receiving a warning or needs improvement score on their 7th grade math or ELA MCAS but who have elected to not participate in Rise Up; this includes students who participated in 10% or less of Rise Up

Gap Summer – The summer between 8th and 9th grade

Others - Students who participated in Rise Up but missed at least 7 days of the program and are therefore neither RUPs or ENPs.

Proficients – Students who are not eligible for Rise Up because they received a proficient or advanced score on both their math and ELA 7th grade MCAS

Repeaters - Students who did not earn enough credits to advance to sophomore year and are repeating their freshmen year

Rise Up Participants (RUPs) – Students who participate in at least 75%, 15 out of 20 days, of Rise Up during the gap summer between 8th and 9th grade

Socioeconomic Status (SES) – For the purposes of this study, SES is broken in to three categories based on students free or reduced lunch standing; Free lunch will be considered lowest SES; reduced lunch will be considered lower SES; paying full price for lunch will be considered elevated SES – Students receiving free or reduced lunch may be grouped into a low SES status category

Appendices

Appendix A – Hemingway Measure of Adolescent Connectedness – Short Version (Karcher, 2011)

Below are listed the 57 items from the short version of the Hemingway.

Responses should be given in a Likert-type fashion 1-5 from not at all to very true

(1) I like hanging out around where I live (like my neighborhood).

(2) Spending time with friends is not so important to me.

(3) I can name 5 things that others like about me.

(4) My family has fun together.

(5) I have a lot of fun with my brother(s) or sister(s). (leave blank if you have none.)

(6) I work hard at school.

(7) My classmates often bother me.

(8) I care what my teachers think of me.

(9) I will have a good future.

(10) I enjoy spending time by myself reading.

(11) I spend a lot of time with kids around where I live.

(12) I have friends I'm really close to and trust completely.

(13) There is not much that is unique or special about me.

(14) It is important that my parents trust me.

(15) I feel close to my brother(s) or sister(s). (leave blank if you have none.)

(16) I enjoy being at school.

(17) I like pretty much all of the other kids in my grade.

(18) I do not get along with some of my teachers.

(19) Doing well in school will help me in the future.

(20) I like to read.

(21) I get along with the kids in my neighborhood.

(22) Spending time with my friends is a big part of my life.

(23) I can name 3 things that other kids like about me.

(24) I enjoy spending time with my parents.

(25) I enjoy spending time with my brothers/sisters. (leave blank if you have none.)

(26) I get bored in school a lot.

(27) I like working with my classmates.

(28) I want to be respected by my teachers.

(29) I do things outside of school to prepare for my future.

(30) I never read books in my free time.

(31) I often spend time playing or doing things in my neighborhood.

(32) My friends and I talk openly with each other about personal things.

(33) I really like who I am.

(34) My parents and I disagree about many things.

(35) I try to spend time with my brothers/sisters when I can.

(36) I do well in school.

(37) I get along well with the other students in my classes.

(38) I try to get along with my teachers.

(39) I do lots of things to prepare for my future.

(40) I often read when I have free time.

(41) I hang out a lot with kids in my neighborhood.

(42) I spend as much time as I can with my friends.

(43) I have special hobbies, skills, or talents.

(44) My parents and I get along well.

(45) I try to avoid being around my brother/sister(s).(leave blank if you have none)

(46) I feel good about myself when I am at school.

(47) I am liked by my classmates.

(48) I always try hard to earn my teachers' trust.

(49) I think about my future often.

(50) I usually like my teachers.

(51) My neighborhood is boring.

(52) My friends and I spend a lot of time talking about things.

(53) I have unique interests or skills that make me interesting.

(54) I care about my parents very much.

(55) What I do now will not affect my future.

(56) Doing well in school is important to me.

(57) I rarely fight or argue with the other kids at school.

Appendix B - Is Science Me? Survey

First Name: _____ Last Name:_____

How much do you agree/disagree with the following statements? Circle your choice.

	Disagree strongly	Disagree somewhat	Mixed-Neutral	Agree somewhat	Agree Strongly
a. Science can be fascinating	1	2	3	4	5
b. I like to read about, learn or do science or engineering in my free time	1	2	3	4	5
c. I think I could be a good scientist one day	1	2	3	4	5
d. Scientists can really make a difference in the world	1	2	3	4	5
e. I would like to enter a science competition or science fair in the future	1	2	3	4	5
f. I would like to major in science or engineering in college	1	2	3	4	5
g. I know what doing scientific research is like	1	2	3	4	5
h. I know what doing engineering is like	1	2	3	4	5
i. The life of a scientist or engineer is not “me”	1	2	3	4	5
j. I know what it takes to become a scientist	1	2	3	4	5
k. I know what it takes to become an engineer	1	2	3	4	5

l. Teachers or counselors have encouraged me to go into science, engineering, math, or medicine	1	2	3	4	5
m. People in my family encourage me to go into science, engineering, math or medicine	1	2	3	4	5
n. I'm good at math	1	2	3	4	5
o. I'm good at standing up for my ideas	1	2	3	4	5

What college major(s) are you considering?

_____

What job(s) or career(s) would you like to have eventually?

_____

Keep going on the other side…

How interested are you in a job or career where you would do these things? Circle your choice.

	Not!	A little bit	Somewhat	Moderately	Very much
Design, invent, develop new products or tools	1	2	3	4	5
Make scientific discoveries	1	2	3	4	5
Solve difficult problems	1	2	3	4	5
Work in teams or groups	1	2	3	4	5
Work outdoors part of the time	1	2	3	4	5
Work in a laboratory	1	2	3	4	5
Use technology (e.g. computers, lab equipment, etc.)	1	2	3	4	5
Do experiments	1	2	3	4	5
Analyze data	1	2	3	4	5
Explain your work to others in writing	1	2	3	4	5
Give talks about your work	1	2	3	4	5

Defining science is difficult because it is complex and does many things, but MOSTLY science is: (there is no "right answer" -- circle the one that best matches how you feel)

1. A study of field such as biology, chemistry and physics
2. A body of knowledge such as principles, laws and theories, which explain the world around us (matter, energy, life, etc)
3. Exploring the unknown and discovering new things about our world and universe and how they work
4. Carrying out experiments to solve problems of interest about the world around us
5. Inventing or designing things (e.g. artificial hearts, medicines, computers, spacecraft, etc)
6. Finding and using knowledge to make the world a better place to live in (e.g. curing diseases, solving pollution, and improving agriculture)

7. An organization of people (called scientists) who have ideas and techniques for discovering new knowledge
8. I don't understand
9. I don't know enough about this subject to make a choice
10. None of these choices fits my basic viewpoint

How are science and technology related? (there is no "right answer" -- circle the one that best matches how you feel)

1. Science is the basis of all technological advances; but it's hard to see how technology could aid science
2. Scientific research leads to practical applications in technology, and technological developments increase the ability to do scientific research
3. Although they are different, they are linked so closely that it's hard to tell them apart
4. Technology is the basis of all scientific advances; though it's hard to see how science could aid technology
5. Science and technology are more or less the same thing
6. I don't understand
7. I don't know enough about this subject to make a choice
8. None of these choices fits my basic viewpoint

Adapted from Is Science MeCalTech Summer Research Connection Student Survey
Aschbacher, P.R., Li, E., Roth, E.J. (2010). Is science me? High school students' identities, participation and aspirations in science, engineering, and medicine. *Journal of Research in Science Teaching, 47*(5), 564-582.

Appendix C - GPA ANOVA Post Hoc

Dependent Variable				Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
GPA Quarter 1	Scheffe	ENP	RUP	0.803183	1.473439	0.990	-3.75868	5.36504
			Proficient	-6.900664*	1.085885	0.000	-10.26263	-3.53870
			Other	14.069008*	2.594928	0.000	6.03495	22.10307
			Repeater	16.933694*	3.360994	0.000	6.52785	27.33954
		RUP	ENP	-0.803183	1.473439	0.990	-5.36504	3.75868
			Proficient	-7.703847*	1.431739	0.000	-12.13660	-3.27109
			Other	13.265825*	2.757604	0.000	4.72811	21.80354
			Repeater	16.130511*	3.488124	0.000	5.33106	26.92996
		Proficient	ENP	6.900664*	1.085885	0.000	3.53870	10.26263
			RUP	7.703847*	1.431739	0.000	3.27109	12.13660
			Other	20.969672*	2.571479	0.000	13.00821	28.93113
			Repeater	23.834358*	3.342923	0.000	13.48446	34.18426
		Other	ENP	-14.069008*	2.594928	0.000	-22.10307	-6.03495
			RUP	-13.265825*	2.757604	0.000	-21.80354	-4.72811
			Proficient	-20.969672*	2.571479	0.000	-28.93113	-13.00821
			Repeater	2.864686	4.090188	0.974	-9.79879	15.52817
		Repeater	ENP	-16.933694*	3.360994	0.000	-27.33954	-6.52785
			RUP	-16.130511*	3.488124	0.000	-26.92996	-5.33106

			Proficient	-23.834358*	3.342923	0.000	-34.18426	-13.48446
			Other	-2.864686	4.090188	0.974	-15.52817	9.79879
	Bonferroni	ENP	RUP	0.803183	1.473439	1.000	-3.35811	4.96447
			Proficient	-6.900664*	1.085885	0.000	-9.96742	-3.83390
			Other	14.069008*	2.594928	0.000	6.74041	21.39761
			Repeater	16.933694*	3.360994	0.000	7.44157	26.42582
		RUP	ENP	-0.803183	1.473439	1.000	-4.96447	3.35811
			Proficient	-7.703847*	1.431739	0.000	-11.74737	-3.66033
			Other	13.265825*	2.757604	0.000	5.47779	21.05386
			Repeater	16.130511*	3.488124	0.000	6.27934	25.98168
		Proficient	ENP	6.900664*	1.085885	0.000	3.83390	9.96742
			RUP	7.703847*	1.431739	0.000	3.66033	11.74737
			Other	20.969672*	2.571479	0.000	13.70729	28.23205
			Repeater	23.834358*	3.342923	0.000	14.39327	33.27545
		Other	ENP	-14.069008*	2.594928	0.000	-21.39761	-6.74041
			RUP	-13.265825*	2.757604	0.000	-21.05386	-5.47779
			Proficient	-20.969672*	2.571479	0.000	-28.23205	-13.70729
			Repeater	2.864686	4.090188	1.000	-8.68683	14.41621
		Repeater	ENP	-16.933694*	3.360994	0.000	-26.42582	-7.44157
			RUP	-16.130511*	3.488124	0.000	-25.98168	-6.27934
			Proficient	-23.834358*	3.342923	0.000	-33.27545	-14.39327

			Other	-2.864686	4.090188	1.000	-14.41621	8.68683
GPA Quarter 2	Scheffe	ENP	RUP	-0.066874	1.591446	1.000	-4.99402	4.86028
			Proficient	-9.412574*	1.172853	0.000	-13.04375	-5.78140
			Other	16.123095*	2.717040	0.000	7.71109	24.53510
			Repeater	18.796103*	3.630176	0.000	7.55701	30.03520
		RUP	ENP	0.066874	1.591446	1.000	-4.86028	4.99402
			Proficient	-9.345701*	1.546407	0.000	-14.13341	-4.55800
			Other	16.189968*	2.897947	0.000	7.21787	25.16207
			Repeater	18.862977*	3.767488	0.000	7.19876	30.52719
		Proficient	ENP	9.412574*	1.172853	0.000	5.78140	13.04375
			RUP	9.345701*	1.546407	0.000	4.55800	14.13341
			Other	25.535669*	2.690907	0.000	17.20457	33.86677
			Repeater	28.208677*	3.610657	0.000	17.03001	39.38734
		Other	ENP	-16.123095*	2.717040	0.000	-24.53510	-7.71109
			RUP	-16.189968*	2.897947	0.000	-25.16207	-7.21787
			Proficient	-25.535669*	2.690907	0.000	-33.86677	-17.20457
			Repeater	2.673008	4.363894	0.984	-10.83769	16.18371
		Repeater	ENP	-18.796103*	3.630176	0.000	-30.03520	-7.55701
			RUP	-18.862977*	3.767488	0.000	-30.52719	-7.19876
			Proficient	-28.208677*	3.610657	0.000	-39.38734	-17.03001
			Other	-2.673008	4.363894	0.984	-16.18371	10.83769

	Bonferroni	ENP	RUP	-0.066874	1.591446	1.000	-4.56137	4.42762
			Proficient	-9.412574*	1.172853	0.000	-12.72489	-6.10025
			Other	16.123095*	2.717040	0.000	8.44975	23.79644
			Repeater	18.796103*	3.630176	0.000	8.54392	29.04828
		RUP	ENP	0.066874	1.591446	1.000	-4.42762	4.56137
			Proficient	-9.345701*	1.546407	0.000	-13.71299	-4.97841
			Other	16.189968*	2.897947	0.000	8.00572	24.37422
			Repeater	18.862977*	3.767488	0.000	8.22301	29.50295
		Proficient	ENP	9.412574*	1.172853	0.000	6.10025	12.72489
			RUP	9.345701*	1.546407	0.000	4.97841	13.71299
			Other	25.535669*	2.690907	0.000	17.93613	33.13521
			Repeater	28.208677*	3.610657	0.000	18.01162	38.40573
		Other	ENP	-16.123095*	2.717040	0.000	-23.79644	-8.44975
			RUP	-16.189968*	2.897947	0.000	-24.37422	-8.00572
			Proficient	-25.535669*	2.690907	0.000	-33.13521	-17.93613
			Repeater	2.673008	4.363894	1.000	-9.65131	14.99732
		Repeater	ENP	-18.796103*	3.630176	0.000	-29.04828	-8.54392
			RUP	-18.862977*	3.767488	0.000	-29.50295	-8.22301
			Proficient	-28.208677*	3.610657	0.000	-38.40573	-18.01162
			Other	-2.673008	4.363894	1.000	-14.99732	9.65131
GPA Quarter 3	Scheffe	ENP	RUP	-0.426610	1.575362	0.999	-5.30410	4.45088

			Proficient	-12.181033*	1.162626	0.000	-15.78065	-8.58142
			Other	12.602138*	2.774429	0.000	4.01221	21.19207
			Repeater	19.177597*	3.593487	0.000	8.05178	30.30342
		RUP	ENP	0.426610	1.575362	0.999	-4.45088	5.30410
			Proficient	-11.754423*	1.532012	0.000	-16.49770	-7.01115
			Other	13.028748*	2.948359	0.001	3.90032	22.15718
			Repeater	19.604207*	3.729411	0.000	8.05755	31.15086
		Proficient	ENP	12.181033*	1.162626	0.000	8.58142	15.78065
			RUP	11.754423*	1.532012	0.000	7.01115	16.49770
			Other	24.783171*	2.750046	0.000	16.26874	33.29761
			Repeater	31.358630*	3.574695	0.000	20.29099	42.42627
		Other	ENP	-12.602138*	2.774429	0.000	-21.19207	-4.01221
			RUP	-13.028748*	2.948359	0.001	-22.15718	-3.90032
			Proficient	-24.783171*	2.750046	0.000	-33.29761	-16.26874
			Repeater	6.575459	4.373123	0.688	-6.96419	20.11511
		Repeater	ENP	-19.177597*	3.593487	0.000	-30.30342	-8.05178
			RUP	-19.604207*	3.729411	0.000	-31.15086	-8.05755
			Proficient	-31.358630*	3.574695	0.000	-42.42627	-20.29099
			Other	-6.575459	4.373123	0.688	-20.11511	6.96419
	Bonferroni	ENP	RUP	-0.426610	1.575362	1.000	-4.87583	4.02261
			Proficient	-12.181033*	1.162626	0.000	-15.46458	-8.89749

			Other	12.602138*	2.774429	0.000	4.76646	20.43782
			Repeater	19.177597*	3.593487	0.000	9.02869	29.32650
		RUP	ENP	0.426610	1.575362	1.000	-4.02261	4.87583
			Proficient	-11.754423*	1.532012	0.000	-16.08121	-7.42764
			Other	13.028748*	2.948359	0.000	4.70185	21.35565
			Repeater	19.604207*	3.729411	0.000	9.07142	30.13700
		Proficient	ENP	12.181033*	1.162626	0.000	8.89749	15.46458
			RUP	11.754423*	1.532012	0.000	7.42764	16.08121
			Other	24.783171*	2.750046	0.000	17.01635	32.54999
			Repeater	31.358630*	3.574695	0.000	21.26280	41.45446
		Other	ENP	-12.602138*	2.774429	0.000	-20.43782	-4.76646
			RUP	-13.028748*	2.948359	0.000	-21.35565	-4.70185
			Proficient	-24.783171*	2.750046	0.000	-32.54999	-17.01635
			Repeater	6.575459	4.373123	1.000	-5.77533	18.92625
		Repeater	ENP	-19.177597*	3.593487	0.000	-29.32650	-9.02869
			RUP	-19.604207*	3.729411	0.000	-30.13700	-9.07142
			Proficient	-31.358630*	3.574695	0.000	-41.45446	-21.26280
			Other	-6.575459	4.373123	1.000	-18.92625	5.77533
GPA Quarter 4	Scheffe	ENP	RUP	0.727432	1.852864	0.997	-5.00931	6.46418
			Proficient	-12.457631*	1.368737	0.000	-16.69545	-8.21981
			Other	13.703698*	3.260606	0.002	3.60837	23.79903

			Repeater	30.698889*	4.222559	0.000	17.62521	43.77257
		RUP	ENP	-0.727432	1.852864	0.997	-6.46418	5.00931
			Proficient	-13.185063*	1.799806	0.000	-18.75753	-7.61259
			Other	12.976266*	3.463728	0.008	2.25204	23.70049
			Repeater	29.971457*	4.381308	0.000	16.40627	43.53665
		Proficient	ENP	12.457631*	1.368737	0.000	8.21981	16.69545
			RUP	13.185063*	1.799806	0.000	7.61259	18.75753
			Other	26.161330*	3.230751	0.000	16.15844	36.16422
			Repeater	43.156521*	4.199547	0.000	30.15409	56.15895
		Other	ENP	-13.703698*	3.260606	0.002	-23.79903	-3.60837
			RUP	-12.976266*	3.463728	0.008	-23.70049	-2.25204
			Proficient	-26.161330*	3.230751	0.000	-36.16422	-16.15844
			Repeater	16.995191*	5.137539	0.029	1.08860	32.90178
		Repeater	ENP	-30.698889*	4.222559	0.000	-43.77257	-17.62521
			RUP	-29.971457*	4.381308	0.000	-43.53665	-16.40627
			Proficient	-43.156521*	4.199547	0.000	-56.15895	-30.15409
			Other	-16.995191*	5.137539	0.029	-32.90178	-1.08860
	Bonferroni	ENP	RUP	0.727432	1.852864	1.000	-4.50561	5.96047
			Proficient	-12.457631*	1.368737	0.000	-16.32335	-8.59191
			Other	13.703698*	3.260606	0.000	4.49478	22.91262
			Repeater	30.698889*	4.222559	0.000	18.77313	42.62465

		RUP	ENP	-0.727432	1.852864	1.000	-5.96047	4.50561
			Proficient	-13.185063*	1.799806	0.000	-18.26825	-8.10188
			Other	12.976266*	3.463728	0.002	3.19367	22.75887
			Repeater	29.971457*	4.381308	0.000	17.59734	42.34558
		Proficient	ENP	12.457631*	1.368737	0.000	8.59191	16.32335
			RUP	13.185063*	1.799806	0.000	8.10188	18.26825
			Other	26.161330*	3.230751	0.000	17.03673	35.28593
			Repeater	43.156521*	4.199547	0.000	31.29575	55.01729
		Other	ENP	-13.703698*	3.260606	0.000	-22.91262	-4.49478
			RUP	-12.976266*	3.463728	0.002	-22.75887	-3.19367
			Proficient	-26.161330*	3.230751	0.000	-35.28593	-17.03673
			Repeater	16.995191*	5.137539	0.010	2.48525	31.50513
		Repeater	ENP	-30.698889*	4.222559	0.000	-42.62465	-18.77313
			RUP	-29.971457*	4.381308	0.000	-42.34558	-17.59734
			Proficient	-43.156521*	4.199547	0.000	-55.01729	-31.29575
			Other	-16.995191*	5.137539	0.010	-31.50513	-2.48525
GPA Cumulative	Scheffe	ENP	RUP	0.260646	1.461243	1.000	-4.26333	4.78462
			Proficient	-10.162297*	1.075867	0.000	-13.49315	-6.83144
			Other	14.937163*	2.496610	0.000	7.20772	22.66661
			Repeater	20.662182*	3.336235	0.000	10.33328	30.99109
		RUP	ENP	-0.260646	1.461243	1.000	-4.78462	4.26333

			Proficient	-10.422943*	1.421502	0.000	-14.82388	-6.02201
			Other	14.676517*	2.663877	0.000	6.42922	22.92381
			Repeater	20.401536*	3.463184	0.000	9.67960	31.12347
		Proficient	ENP	10.162297*	1.075867	0.000	6.83144	13.49315
			RUP	10.422943*	1.421502	0.000	6.02201	14.82388
			Other	25.099460*	2.473559	0.000	17.44138	32.75754
			Repeater	30.824479*	3.319021	0.000	20.54887	41.10009
		Other	ENP	-14.937163*	2.496610	0.000	-22.66661	-7.20772
			RUP	-14.676517*	2.663877	0.000	-22.92381	-6.42922
			Proficient	-25.099460*	2.473559	0.000	-32.75754	-17.44138
			Repeater	5.725019	4.011417	0.729	-6.69423	18.14427
		Repeater	ENP	-20.662182*	3.336235	0.000	-30.99109	-10.33328
			RUP	-20.401536*	3.463184	0.000	-31.12347	-9.67960
			Proficient	-30.824479*	3.319021	0.000	-41.10009	-20.54887
			Other	-5.725019	4.011417	0.729	-18.14427	6.69423
	Bonferroni	ENP	RUP	0.260646	1.461243	1.000	-3.86606	4.38736
			Proficient	-10.162297*	1.075867	0.000	-13.20066	-7.12393
			Other	14.937163*	2.496610	0.000	7.88647	21.98786
			Repeater	20.662182*	3.336235	0.000	11.24029	30.08407
		RUP	ENP	-0.260646	1.461243	1.000	-4.38736	3.86606
			Proficient	-10.422943*	1.421502	0.000	-14.43742	-6.40847

			Other	14.676517*	2.663877	0.000	7.15344	22.19959
			Repeater	20.401536*	3.463184	0.000	10.62113	30.18194
		Proficient	ENP	10.162297*	1.075867	0.000	7.12393	13.20066
			RUP	10.422943*	1.421502	0.000	6.40847	14.43742
			Other	25.099460*	2.473559	0.000	18.11386	32.08506
			Repeater	30.824479*	3.319021	0.000	21.45120	40.19775
		Other	ENP	-14.937163*	2.496610	0.000	-21.98786	-7.88647
			RUP	-14.676517*	2.663877	0.000	-22.19959	-7.15344
			Proficient	-25.099460*	2.473559	0.000	-32.08506	-18.11386
			Repeater	5.725019	4.011417	1.000	-5.60366	17.05370
		Repeater	ENP	-20.662182*	3.336235	0.000	-30.08407	-11.24029
			RUP	-20.401536*	3.463184	0.000	-30.18194	-10.62113
			Proficient	-30.824479*	3.319021	0.000	-40.19775	-21.45120
			Other	-5.725019	4.011417	1.000	-17.05370	5.60366

*. The mean difference is significant at the 0.05 level.

Appendix D - Behavior Post Hoc Analysis

Dependent Variable				Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
conduct HS	Scheffe	ENP	RUP	0.266	0.351	0.966	-0.82	1.35
			Proficient	0.762	0.253	0.061	-0.02	1.54
			Other	-2.444*	0.558	0.001	-4.17	-0.72
			Repeater	-3.722*	0.767	0.000	-6.09	-1.35
		RUP	ENP	-0.266	0.351	0.966	-1.35	0.82
			Proficient	0.496	0.344	0.720	-0.57	1.56
			Other	-2.710*	0.605	0.001	-4.58	-0.84
			Repeater	-3.988*	0.801	0.000	-6.47	-1.51
		Proficient	ENP	-0.762	0.253	0.061	-1.54	0.02
			RUP	-0.496	0.344	0.720	-1.56	0.57
			Other	-3.207*	0.553	0.000	-4.92	-1.49
			Repeater	-4.484*	0.763	0.000	-6.85	-2.12
		Other	ENP	2.444*	0.558	0.001	0.72	4.17
			RUP	2.710*	0.605	0.001	0.84	4.58
			Proficient	3.207*	0.553	0.000	1.49	4.92
			Repeater	-1.278	0.911	0.742	-4.10	1.54
		Repeater	ENP	3.722*	0.767	0.000	1.35	6.09
			RUP	3.988*	0.801	0.000	1.51	6.47

			Proficient	4.484*	0.763	0.000	2.12	6.85
			Other	1.278	0.911	0.742	-1.54	4.10
	Bonferroni	ENP	RUP	0.266	0.351	1.000	-0.73	1.26
			Proficient	.762*	0.253	0.027	0.05	1.48
			Other	-2.444*	0.558	0.000	-4.02	-0.87
			Repeater	-3.722*	0.767	0.000	-5.89	-1.56
		RUP	ENP	-0.266	0.351	1.000	-1.26	0.73
			Proficient	0.496	0.344	1.000	-0.47	1.47
			Other	-2.710*	0.605	0.000	-4.42	-1.00
			Repeater	-3.988*	0.801	0.000	-6.25	-1.73
		Proficient	ENP	-.762*	0.253	0.027	-1.48	-0.05
			RUP	-0.496	0.344	1.000	-1.47	0.47
			Other	-3.207*	0.553	0.000	-4.77	-1.65
			Repeater	-4.484*	0.763	0.000	-6.64	-2.33
		Other	ENP	2.444*	0.558	0.000	0.87	4.02
			RUP	2.710*	0.605	0.000	1.00	4.42
			Proficient	3.207*	0.553	0.000	1.65	4.77
			Repeater	-1.278	0.911	1.000	-3.85	1.29
		Repeater	ENP	3.722*	0.767	0.000	1.56	5.89
			RUP	3.988*	0.801	0.000	1.73	6.25
			Proficient	4.484*	0.763	0.000	2.33	6.64

			Other	1.278	0.911	1.000	-1.29	3.85
conduct MS	Scheffe	ENP	RUP	-0.040	0.037	0.883	-0.16	0.08
			Proficient	0.031	0.027	0.852	-0.05	0.11
			Other	-0.062	0.059	0.894	-0.25	0.12
			Repeater	0.049	0.081	0.985	-0.20	0.30
		RUP	ENP	0.040	0.037	0.883	-0.08	0.16
			Proficient	0.072	0.036	0.427	-0.04	0.18
			Other	-0.022	0.064	0.998	-0.22	0.18
			Repeater	0.089	0.085	0.894	-0.17	0.35
		Proficient	ENP	-0.031	0.027	0.852	-0.11	0.05
			RUP	-0.072	0.036	0.427	-0.18	0.04
			Other	-0.093	0.059	0.639	-0.28	0.09
			Repeater	0.018	0.081	1.000	-0.23	0.27
		Other	ENP	0.062	0.059	0.894	-0.12	0.25
			RUP	0.022	0.064	0.998	-0.18	0.22
			Proficient	0.093	0.059	0.639	-0.09	0.28
			Repeater	0.111	0.097	0.858	-0.19	0.41
		Repeater	ENP	-0.049	0.081	0.985	-0.30	0.20
			RUP	-0.089	0.085	0.894	-0.35	0.17
			Proficient	-0.018	0.081	1.000	-0.27	0.23
			Other	-0.111	0.097	0.858	-0.41	0.19

	Bonferroni	ENP	RUP	-0.040	0.037	1.000	-0.15	0.07
			Proficient	0.031	0.027	1.000	-0.04	0.11
			Other	-0.062	0.059	1.000	-0.23	0.11
			Repeater	0.049	0.081	1.000	-0.18	0.28
		RUP	ENP	0.040	0.037	1.000	-0.07	0.15
			Proficient	0.072	0.036	0.504	-0.03	0.17
			Other	-0.022	0.064	1.000	-0.20	0.16
			Repeater	0.089	0.085	1.000	-0.15	0.33
		Proficient	ENP	-0.031	0.027	1.000	-0.11	0.04
			RUP	-0.072	0.036	0.504	-0.17	0.03
			Other	-0.093	0.059	1.000	-0.26	0.07
			Repeater	0.018	0.081	1.000	-0.21	0.25
		Other	ENP	0.062	0.059	1.000	-0.11	0.23
			RUP	0.022	0.064	1.000	-0.16	0.20
			Proficient	0.093	0.059	1.000	-0.07	0.26
			Repeater	0.111	0.097	1.000	-0.16	0.38
		Repeater	ENP	-0.049	0.081	1.000	-0.28	0.18
			RUP	-0.089	0.085	1.000	-0.33	0.15
			Proficient	-0.018	0.081	1.000	-0.25	0.21
			Other	-0.111	0.097	1.000	-0.38	0.16

*. The mean difference is significant at the 0.05 level.

Appendix E - Attendance Post Hoc Analysis

Dependent Variable				Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Total Absent	Scheffe	ENP	RUP	0.940	2.334	0.997	-6.28	8.16
			Proficient	4.290	1.709	0.180	-1.00	9.58
			Other	-13.140*	3.781	0.018	-24.84	-1.43
			Repeater	-69.068*	5.059	0.000	-84.73	-53.41
		RUP	ENP	-0.940	2.334	0.997	-8.16	6.28
			Proficient	3.350	2.279	0.706	-3.70	10.40
			Other	-14.080*	4.070	0.019	-26.68	-1.48
			Repeater	-70.008*	5.279	0.000	-86.35	-53.67
		Proficient	ENP	-4.290	1.709	0.180	-9.58	1.00
			RUP	-3.350	2.279	0.706	-10.40	3.70
			Other	-17.430*	3.747	0.000	-29.03	-5.83
			Repeater	-73.358*	5.034	0.000	-88.94	-57.78
		Other	ENP	13.140*	3.781	0.018	1.43	24.84
			RUP	14.080*	4.070	0.019	1.48	26.68
			Proficient	17.430*	3.747	0.000	5.83	29.03
			Repeater	-55.928*	6.059	0.000	-74.69	-37.17
		Repeater	ENP	69.068*	5.059	0.000	53.41	84.73
			RUP	70.008*	5.279	0.000	53.67	86.35

			Proficient	73.358*	5.034	0.000	57.78	88.94
			Other	55.928*	6.059	0.000	37.17	74.69
	Bonferroni	ENP	RUP	0.940	2.334	1.000	-5.65	7.53
			Proficient	4.290	1.709	0.125	-0.54	9.12
			Other	-13.140*	3.781	0.006	-23.82	-2.46
			Repeater	-69.068*	5.059	0.000	-83.35	-54.78
		RUP	ENP	-0.940	2.334	1.000	-7.53	5.65
			Proficient	3.350	2.279	1.000	-3.08	9.78
			Other	-14.080*	4.070	0.006	-25.57	-2.59
			Repeater	-70.008*	5.279	0.000	-84.91	-55.10
		Proficient	ENP	-4.290	1.709	0.125	-9.12	0.54
			RUP	-3.350	2.279	1.000	-9.78	3.08
			Other	-17.430*	3.747	0.000	-28.01	-6.85
			Repeater	-73.358*	5.034	0.000	-87.57	-59.14
		Other	ENP	13.140*	3.781	0.006	2.46	23.82
			RUP	14.080*	4.070	0.006	2.59	25.57
			Proficient	17.430*	3.747	0.000	6.85	28.01
			Repeater	-55.928*	6.059	0.000	-73.04	-38.82
		Repeater	ENP	69.068*	5.059	0.000	54.78	83.35
			RUP	70.008*	5.279	0.000	55.10	84.91
			Proficient	73.358*	5.034	0.000	59.14	87.57

			Other	55.928*	6.059	0.000	38.82	73.04
Unexcused Absences	Scheffe	ENP	RUP	0.851	1.959	0.996	-5.21	6.92
			Proficient	4.245	1.435	0.070	-0.20	8.69
			Other	-11.647*	3.174	0.010	-21.47	-1.82
			Repeater	-55.248*	4.247	0.000	-68.39	-42.10
		RUP	ENP	-0.851	1.959	0.996	-6.92	5.21
			Proficient	3.395	1.913	0.534	-2.53	9.32
			Other	-12.498*	3.416	0.010	-23.07	-1.92
			Repeater	-56.099*	4.431	0.000	-69.82	-42.38
		Proficient	ENP	-4.245	1.435	0.070	-8.69	0.20
			RUP	-3.395	1.913	0.534	-9.32	2.53
			Other	-15.893*	3.145	0.000	-25.63	-6.16
			Repeater	-59.494*	4.225	0.000	-72.57	-46.41
		Other	ENP	11.647*	3.174	0.010	1.82	21.47
			RUP	12.498*	3.416	0.010	1.92	23.07
			Proficient	15.893*	3.145	0.000	6.16	25.63
			Repeater	-43.601*	5.086	0.000	-59.35	-27.86
		Repeater	ENP	55.248*	4.247	0.000	42.10	68.39
			RUP	56.099*	4.431	0.000	42.38	69.82
			Proficient	59.494*	4.225	0.000	46.41	72.57
			Other	43.601*	5.086	0.000	27.86	59.35

	Bonferroni	ENP	RUP	0.851	1.959	1.000	-4.68	6.38
			Proficient	4.245*	1.435	0.033	0.19	8.30
			Other	-11.647*	3.174	0.003	-20.61	-2.68
			Repeater	-55.248*	4.247	0.000	-67.24	-43.26
		RUP	ENP	-0.851	1.959	1.000	-6.38	4.68
			Proficient	3.395	1.913	0.767	-2.01	8.80
			Other	-12.498*	3.416	0.003	-22.15	-2.85
			Repeater	-56.099*	4.431	0.000	-68.61	-43.59
		Proficient	ENP	-4.245*	1.435	0.033	-8.30	-0.19
			RUP	-3.395	1.913	0.767	-8.80	2.01
			Other	-15.893*	3.145	0.000	-24.77	-7.01
			Repeater	-59.494*	4.225	0.000	-71.42	-47.56
		Other	ENP	11.647*	3.174	0.003	2.68	20.61
			RUP	12.498*	3.416	0.003	2.85	22.15
			Proficient	15.893*	3.145	0.000	7.01	24.77
			Repeater	-43.601*	5.086	0.000	-57.96	-29.24
		Repeater	ENP	55.248*	4.247	0.000	43.26	67.24
			RUP	56.099*	4.431	0.000	43.59	68.61
			Proficient	59.494*	4.225	0.000	47.56	71.42
			Other	43.601*	5.086	0.000	29.24	57.96
Excused	Scheffe	ENP	RUP	0.089	0.937	1.000	-2.81	2.99

Absences			Proficient	0.045	0.686	1.000	-2.08	2.17
			Other	-1.493	1.518	0.915	-6.19	3.21
			Repeater	-13.819*	2.031	0.000	-20.11	-7.53
		RUP	ENP	-0.089	0.937	1.000	-2.99	2.81
			Proficient	-0.045	0.915	1.000	-2.88	2.79
			Other	-1.582	1.634	0.919	-6.64	3.48
			Repeater	-13.909*	2.119	0.000	-20.47	-7.35
		Proficient	ENP	-0.045	0.686	1.000	-2.17	2.08
			RUP	0.045	0.915	1.000	-2.79	2.88
			Other	-1.537	1.504	0.903	-6.19	3.12
			Repeater	-13.864*	2.020	0.000	-20.12	-7.61
		Other	ENP	1.493	1.518	0.915	-3.21	6.19
			RUP	1.582	1.634	0.919	-3.48	6.64
			Proficient	1.537	1.504	0.903	-3.12	6.19
			Repeater	-12.327*	2.432	0.000	-19.86	-4.80
		Repeater	ENP	13.819*	2.031	0.000	7.53	20.11
			RUP	13.909*	2.119	0.000	7.35	20.47
			Proficient	13.864*	2.020	0.000	7.61	20.12
			Other	12.327*	2.432	0.000	4.80	19.86
	Bonferroni	ENP	RUP	0.089	0.937	1.000	-2.56	2.73
			Proficient	0.045	0.686	1.000	-1.89	1.98

			Other	-1.493	1.518	1.000	-5.78	2.79
			Repeater	-13.819*	2.031	0.000	-19.55	-8.09
		RUP	ENP	-0.089	0.937	1.000	-2.73	2.56
			Proficient	-0.045	0.915	1.000	-2.63	2.54
			Other	-1.582	1.634	1.000	-6.19	3.03
			Repeater	-13.909*	2.119	0.000	-19.89	-7.93
		Proficient	ENP	-0.045	0.686	1.000	-1.98	1.89
			RUP	0.045	0.915	1.000	-2.54	2.63
			Other	-1.537	1.504	1.000	-5.78	2.71
			Repeater	-13.864*	2.020	0.000	-19.57	-8.16
		Other	ENP	1.493	1.518	1.000	-2.79	5.78
			RUP	1.582	1.634	1.000	-3.03	6.19
			Proficient	1.537	1.504	1.000	-2.71	5.78
			Repeater	-12.327*	2.432	0.000	-19.19	-5.46
		Repeater	ENP	13.819*	2.031	0.000	8.09	19.55
			RUP	13.909*	2.119	0.000	7.93	19.89
			Proficient	13.864*	2.020	0.000	8.16	19.57
			Other	12.327*	2.432	0.000	5.46	19.19
Tardy Total	Scheffe	ENP	RUP	-1.764	2.791	0.982	-10.40	6.88
			Proficient	8.087*	2.044	0.004	1.76	14.42
			Other	-21.404*	4.522	0.000	-35.40	-7.41

			Repeater	-29.006*	6.050	0.000	-47.73	-10.28
		RUP	ENP	1.764	2.791	0.982	-6.88	10.40
			Proficient	9.851*	2.725	0.012	1.42	18.29
			Other	-19.641*	4.867	0.003	-34.71	-4.57
			Repeater	-27.242*	6.312	0.001	-46.78	-7.70
		Proficient	ENP	-8.087*	2.044	0.004	-14.42	-1.76
			RUP	-9.851*	2.725	0.012	-18.29	-1.42
			Other	-29.491*	4.481	0.000	-43.36	-15.62
			Repeater	-37.093*	6.020	0.000	-55.73	-18.46
		Other	ENP	21.404*	4.522	0.000	7.41	35.40
			RUP	19.641*	4.867	0.003	4.57	34.71
			Proficient	29.491*	4.481	0.000	15.62	43.36
			Repeater	-7.601	7.246	0.894	-30.03	14.83
		Repeater	ENP	29.006*	6.050	0.000	10.28	47.73
			RUP	27.242*	6.312	0.001	7.70	46.78
			Proficient	37.093*	6.020	0.000	18.46	55.73
			Other	7.601	7.246	0.894	-14.83	30.03
	Bonferroni	ENP	RUP	-1.764	2.791	1.000	-9.64	6.12
			Proficient	8.087*	2.044	0.001	2.31	13.86
			Other	-21.404*	4.522	0.000	-34.17	-8.64
			Repeater	-29.006*	6.050	0.000	-46.09	-11.92

		RUP	ENP	1.764	2.791	1.000	-6.12	9.64
			Proficient	9.851*	2.725	0.003	2.16	17.54
			Other	-19.641*	4.867	0.001	-33.38	-5.90
			Repeater	-27.242*	6.312	0.000	-45.07	-9.42
		Proficient	ENP	-8.087*	2.044	0.001	-13.86	-2.31
			RUP	-9.851*	2.725	0.003	-17.54	-2.16
			Other	-29.491*	4.481	0.000	-42.15	-16.84
			Repeater	-37.093*	6.020	0.000	-54.09	-20.09
		Other	ENP	21.404*	4.522	0.000	8.64	34.17
			RUP	19.641*	4.867	0.001	5.90	33.38
			Proficient	29.491*	4.481	0.000	16.84	42.15
			Repeater	-7.601	7.246	1.000	-28.06	12.86
		Repeater	ENP	29.006*	6.050	0.000	11.92	46.09
			RUP	27.242*	6.312	0.000	9.42	45.07
			Proficient	37.093*	6.020	0.000	20.09	54.09
			Other	7.601	7.246	1.000	-12.86	28.06

*. The mean difference is significant at the 0.05 level.

Appendix F - Science and Overall Grades by RUPs, ENPs, Proficients

Dependent Variable				Mean Difference (I-J)	Std. Error	Sig.
Q1 Sci Grade	Scheffe	ENPs	RUPs	-1.530450	2.984441	0.877
			Proficients	-12.808180*	2.240332	0.000
		RUPs	ENPs	1.530450	2.984441	0.877
			Proficients	-11.277730*	2.659797	0.000
		Proficients	ENPs	12.808180*	2.240332	0.000
			RUPs	11.277730*	2.659797	0.000
	Bonferroni	ENPs	RUPs	-1.530450	2.984441	1.000
			Proficients	-12.808180*	2.240332	0.000
		RUPs	ENPs	1.530450	2.984441	1.000
			Proficients	-11.277730*	2.659797	0.000
		Proficients	ENPs	12.808180*	2.240332	0.000
			RUPs	11.277730*	2.659797	0.000
GPATrm1	Scheffe	ENPs	RUPs	0.803183	1.461191	0.860
			Proficients	-6.900664*	1.076858	0.000
		RUPs	ENPs	-0.803183	1.461191	0.860

			Proficients	-7.703847*	1.419838	0.000
		Proficients	ENPs	6.900664*	1.076858	0.000
			RUPs	7.703847*	1.419838	0.000
	Bonferroni	ENPs	RUPs	0.803183	1.461191	1.000
			Proficients	-6.900664*	1.076858	0.000
		RUPs	ENPs	-0.803183	1.461191	1.000
			Proficients	-7.703847*	1.419838	0.000
		Proficients	ENPs	6.900664*	1.076858	0.000
			RUPs	7.703847*	1.419838	0.000
Q2 Sci Grade	Scheffe	ENPs	RUPs	-3.457800	3.183765	0.556
			Proficients	-15.497651*	2.389958	0.000
		RUPs	ENPs	3.457800	3.183765	0.556
			Proficients	-12.039851*	2.837439	0.000
		Proficients	ENPs	15.497651*	2.389958	0.000
			RUPs	12.039851*	2.837439	0.000
	Bonferroni	ENPs	RUPs	-3.457800	3.183765	0.838
			Proficients	-15.497651*	2.389958	0.000

		RUPs	ENPs	3.457800	3.183765	0.838
			Proficients	-12.039851*	2.837439	0.000
		Proficients	ENPs	15.497651*	2.389958	0.000
			RUPs	12.039851*	2.837439	0.000
GPATrm2	Scheffe	ENPs	RUPs	-0.066874	1.570474	0.999
			Proficients	-9.412574*	1.157397	0.000
		RUPs	ENPs	0.066874	1.570474	0.999
			Proficients	-9.345701*	1.526028	0.000
		Proficients	ENPs	9.412574*	1.157397	0.000
			RUPs	9.345701*	1.526028	0.000
	Bonferroni	ENPs	RUPs	-0.066874	1.570474	1.000
			Proficients	-9.412574*	1.157397	0.000
		RUPs	ENPs	0.066874	1.570474	1.000
			Proficients	-9.345701*	1.526028	0.000
		Proficients	ENPs	9.412574*	1.157397	0.000
			RUPs	9.345701*	1.526028	0.000
S1 Sci Grade	Scheffe	ENPs	RUPs	-2.494125000000000	2.972760764764560	0.704

			Proficients	-14.152915700000000*	2.231563931659180	0.000
		RUPs	ENPs	2.494125000000000	2.972760764764560	0.704
			Proficients	-11.658790700000000*	2.649387857420870	0.000
		Proficients	ENPs	14.152915700000000*	2.231563931659180	0.000
			RUPs	11.658790700000000*	2.649387857420870	0.000
	Bonferroni	ENPs	RUPs	-2.494125000000000	2.972760764764560	1.000
			Proficients	-14.152915700000000*	2.231563931659180	0.000
		RUPs	ENPs	2.494125000000000	2.972760764764560	1.000
			Proficients	-11.658790700000000*	2.649387857420870	0.000
		Proficients	ENPs	14.152915700000000*	2.231563931659180	0.000
			RUPs	11.658790700000000*	2.649387857420870	0.000
Q3 Sci Grade	Scheffe	ENPs	RUPs	0.892323	2.614883	0.943
			Proficients	-14.907121*	1.916874	0.000
		RUPs	ENPs	-0.892323	2.614883	0.943
			Proficients	-15.799445*	2.642523	0.000
		Proficients	ENPs	14.907121*	1.916874	0.000

			RUPs	15.799445*	2.642523	0.000
	Bonferroni	ENPs	RUPs	0.892323	2.614883	1.000
			Proficients	-14.907121*	1.916874	0.000
		RUPs	ENPs	-0.892323	2.614883	1.000
			Proficients	-15.799445*	2.642523	0.000
		Proficients	ENPs	14.907121*	1.916874	0.000
			RUPs	15.799445*	2.642523	0.000
GPATrm3	Scheffe	ENPs	RUPs	-0.426610	1.549336	0.963
			Proficients	-12.181033*	1.143419	0.000
		RUPs	ENPs	0.426610	1.549336	0.963
			Proficients	-11.754423*	1.506702	0.000
		Proficients	ENPs	12.181033*	1.143419	0.000
			RUPs	11.754423*	1.506702	0.000
	Bonferroni	ENPs	RUPs	-0.426610	1.549336	1.000
			Proficients	-12.181033*	1.143419	0.000
		RUPs	ENPs	0.426610	1.549336	1.000
			Proficients	-11.754423*	1.506702	0.000

		Proficients	ENPs	12.181033*	1.143419	0.000
			RUPs	11.754423*	1.506702	0.000
Q4 Sci Grade	Scheffe	ENPs	RUPs	2.545222	2.688259	0.639
			Proficients	-14.410499*	1.922862	0.000
		RUPs	ENPs	-2.545222	2.688259	0.639
			Proficients	-16.955721*	2.703843	0.000
		Proficients	ENPs	14.410499*	1.922862	0.000
			RUPs	16.955721*	2.703843	0.000
	Bonferroni	ENPs	RUPs	2.545222	2.688259	1.000
			Proficients	-14.410499*	1.922862	0.000
		RUPs	ENPs	-2.545222	2.688259	1.000
			Proficients	-16.955721*	2.703843	0.000
		Proficients	ENPs	14.410499*	1.922862	0.000
			RUPs	16.955721*	2.703843	0.000
GPATrm4	Scheffe	ENPs	RUPs	0.727432	1.818566	0.923
			Proficients	-12.457631*	1.343401	0.000
		RUPs	ENPs	-0.727432	1.818566	0.923

			Proficients	-13.185063*	1.766490	0.000
		Proficients	ENPs	12.457631*	1.343401	0.000
			RUPs	13.185063*	1.766490	0.000
	Bonferroni	ENPs	RUPs	0.727432	1.818566	1.000
			Proficients	-12.457631*	1.343401	0.000
		RUPs	ENPs	-0.727432	1.818566	1.000
			Proficients	-13.185063*	1.766490	0.000
		Proficients	ENPs	12.457631*	1.343401	0.000
			RUPs	13.185063*	1.766490	0.000
S2 Sci Grade	Scheffe	ENPs	RUPs	1.382998670212760	2.984890710147410	0.898
			Proficients	-16.686819640000000*	2.176231929149130	0.000
		RUPs	ENPs	-1.382998670212760	2.984890710147410	0.898
			Proficients	-18.069818310000000*	3.019943839203670	0.000
		Proficients	ENPs	16.686819640000000*	2.176231929149130	0.000
			RUPs	18.069818310000000*	3.019943839203670	0.000
	Bonferroni	ENPs	RUPs	1.382998670212760	2.984890710147410	1.000
			Proficients	-16.686819640000000	2.176231929149130	0.000

				0*		
		RUPs	ENPs	-1.382998670212760	2.984890710147410	1.000
			Proficients	-18.069818310000000*	3.019943839203670	0.000
		Proficients	ENPs	16.686819640000000*	2.176231929149130	0.000
			RUPs	18.069818310000000*	3.019943839203670	0.000
GPA Cumulative	Scheffe	ENPs	RUPs	0.260646	1.460409	0.984
			Proficients	-10.162297*	1.075253	0.000
		RUPs	ENPs	-0.260646	1.460409	0.984
			Proficients	-10.422943*	1.420691	0.000
		Proficients	ENPs	10.162297*	1.075253	0.000
			RUPs	10.422943*	1.420691	0.000
	Bonferroni	ENPs	RUPs	0.260646	1.460409	1.000
			Proficients	-10.162297*	1.075253	0.000
		RUPs	ENPs	-0.260646	1.460409	1.000
			Proficients	-10.422943*	1.420691	0.000
		Proficients	ENPs	10.162297*	1.075253	0.000
			RUPs	10.422943*	1.420691	0.000

*. The mean difference is significant at the 0.05 level.

Appendix G – MCAS Comparison – 3 Groups

		RUPs	ENPs	Proficients	Percentage of total
English MCAS 7th grade	Advanced	0	0	31	8.4%
	Proficient	20	71	118	56.5%
	Needs Improvement	19	57	0	20.5%
	Warning	6	9	0	4.1%
	Did not take	11	7	21	10.5%
	Total	56	144	170	n = 370
Math MCAS 7th grade	Advanced	4	3	75	22.2%
	Proficient	7	18	72	26.2%
	Needs Improvement	10	65	0	20.3%
	Warning	25	55	0	21.6%
	Did not take	10	3	23	9.7%
	Total	56	144	170	n = 370
Science MCAS 8th grade	Advanced	0	2	18	5.4%
	Proficient	7	13	92	30.3%
	Needs Improvement	18	79	42	37.6%
	Warning	25	46	5	20.5%
	Did not take	6	4	13	6.2%
	Total	56	144	170	n = 370

Appendix H – MCAS Comparison Chi Square Results - 3 groups

		Value	df	Asymptotic Significance (2-sided)
English MCAS 7th grade	Pearson Chi-Square	190.455	30	.000
	Likelihood Ratio	238.177	30	.000
	N of Valid Cases	397		
Math MCAS 7th grade	Pearson Chi-Square	312.368	27	.000
	Likelihood Ratio	382.948	27	.000
	N of Valid Cases	397		
Science MCAS 8th grade	Pearson Chi-Square	208.587	33	.000
	Likelihood Ratio	217.540	33	.000
	N of Valid Cases	397		

Appendix I – GPA comparisons - ANOVA

		Sum of squares	df	Mean Square	F	Sig.
GPA Quarter 1	Between Groups	11313.446	4	2828.361	33.209	.000
	Within Groups	31086.714	365	85.169		
	Total	42400.160	369			
GPA Quarter 2	Between Groups	17566.707	4	4391.677	44.201	.000
	Within Groups	36364.935	366	99.358		
	Total	53931.641	370			
GPA Quarter 3	Between Groups	21600.616	4	5400.154	55.466	.000
	Within Groups	35438.882	364	97.360		
	Total	57039.498	368			
GPA Quarter 4	Between Groups	28791.529	4	7197.882	53.567	.000
	Within Groups	48776.684	363	134.371		
	Total	77568.213	367			
GPA Cumulative	Between Groups	19311.474	4	4827.868	57.505	.000
	Within Groups	30811.667	367	83.955		
	Total	50123.141	371			

Appendix J – Cronbach's Alpha by Subscale and Survey Administration, RUPs

Subscales	Early Summer	Late Summer	Fall	Spring
Neighborhood	0.802	0.749	0.795	0.855
Friends	0.812	0.663	0.713	0.637
Self-in-Present	0.631	0.645	0.748	0.822
Parents	0.641	0.782	0.485	0.873
Siblings	0.808	0.646	0.802	0.831
School	0.608	0.483	0.726	0.648
Peers	0.643	0.451	0.703	0.767
Teachers	0.651	0.69	0.799	0.482
Self-in-Future	0.647	0.534	0.527	0.489
Reading	0.83	0.832	0.844	0.886
Average Cronbach Alpha	0.7073	0.6475	0.7142	0.729
Standard Deviation	0.091980735	0.126069866	0.1189125	0.1547011

Appendix K – Cronbach's Alpha by Subscale and Survey Administration, ENPs and Proficients

Subscales	ENP - Fall	ENP - Spring	Proficient - Fall	Proficient - Spring
Neighborhood	0.646	0.81	0.795	0.855
Friends	0.812	0.81	0.685	0.637
Self-in-Present	0.578	0.855	0.793	0.822
Parents	0.525	0.868	0.778	0.873
Siblings	0.454	0.838	0.767	0.831
School	0.652	0.781	0.708	0.648
Peers	0.68	0.582	0.686	0.767
Teachers	0.726	0.728	0.624	0.482
Self-in-Future	0.573	0.798	0.69	0.489
Reading	0.602	0.816	0.8	0.886
Average Cronbach Alpha	0.6248	0.7886	0.7326	0.729
Standard Deviation	0.102223937	0.082544533	0.061445911	0.154701146

Appendix L – Interest in STEM Majors/Careers compared to Academic Connectedness

		STEM Majors - Interested or Not Interested				STEM Careers - Interested or Not Interested			
		t	df	sig. (2-tailed)	Mean diff.	t	df	sig. (2-tailed)	Mean diff.
Early summer 2016 (RUPs only)	School	0.771	35	0.446	0.14	1.164	39	0.252	0.19
	Peers	-1.028	35	0.311	-0.2	-0.295	39	0.769	-0.05
	Teachers	0.129	35	0.898	0.03	0.065	39	0.949	0.01
	Reading	1.62	35	0.114	0.047	1.386	39	0.174	0.36
Late summer 2016 (RUPs only)	School	0.966	42	0.340	0.16	1.37	42	0.178	0.21
	Peers	-1.272	42	0.210	-0.26	-0.552	42	0.584	-0.11
	Teachers	0.628	42	0.533	0.13	0.742	42	0.462	0.15
	Reading	0.542	42	0.591	0.18	0.724	42	0.473	0.23
Fall 2016 (entire freshmen class)	School	3.789	166	0.000	0.36	2.641	170	0.009	0.25
	Peers	1.837	166	0.068	0.18	0.989	170	0.324	0.09
	Teachers	0.1459	166	0.147	0.15	1.679	170	0.095	0.16
	Reading	2.544	165	0.012	0.38	2.468	169	0.015	0.36
Spring 2017 (entire freshmen class)	School	2.383	130	0.019	0.26	2.507	128	0.013	0.29
	Peers	-0.337	130	0.737	-0.04	-0.347	128	0.729	-0.04
	Teachers	1.655	128	0.100	0.18	0.745	126	0.458	0.09
	Reading	1.802	129	0.074	0.36	0.906	127	0.366	0.20

Appendix M – STEM Major Interest vs. Non Interest compared to Academic Connectedness by RUPs, ENPs and Proficients

			STEM Majors - Interested vs. Not Interested					
			t	df	sig. (2-tailed)	Interested Mean	Not Interested Mean	Mean diff.
Fall 2016	RUPs	School	1.86	25	0.075	3.857	3.434	0.423
		Peers	0.715	25	0.078	3.664	3.524	0.481
		Teachers	0.741	25	0.466	3.733	3.522	0.211
		Reading	0.223	25	0.826	2.896	2.806	0.09
	ENPs	School	1.114	50	0.271	3.728	3.536	0.192
		Peers	1.269	50	0.21	3.851	3.624	0.228
		Teachers	1.513	50	0.136	4.174	3.911	0.264
		Reading	1.83	50	0.073	3.306	2.803	0.502
	Proficients	School	2.855	77	0.006	3.885	3.493	0.391
		Peers	1.308	77	0.195	3.752	3.548	0.204
		Teachers	0.774	77	0.441	4.012	3.911	0.102
		Reading	2.202	77	0.031	3.434	2.959	0.475
Spring 2017	RUPs	School	0.529	16	0.604	3.619	3.486	0.137
		Peers	-0.739	16	0.471	3.429	3.697	-0.268
		Teachers	0.52	16	0.61	3.571	3.391	0.181
		Reading	-0.074	16	0.942	2.143	2.182	-0.039
	ENPs	School	2.21	32	0.034	4	3.37	0.629
		Peers	0.529	32	0.601	3.639	3.505	0.134
		Teachers	2.453	32	0.02	4.333	3.709	0.624
		Reading	1.542	32	0.133	3.042	2.399	0.642
	Proficients	School	1.353	77	0.18	3.731	3.536	0.193
		Peers	0.065	77	0.948	3.456	3.447	0.009
		Teachers	0.624	75	0.535	3.82	3.737	0.083
		Reading	0.872	76	0.386	3.228	3	0.228

Appendix N – STEM Career Interest vs. Non Interest compared to Academic Connectedness by RUPs, ENPs and Proficients

		STEM Careers - Interested vs. Not Interested					
		t	df	sig. (2-tailed)	Interested Mean	Not Interested Mean	Mean diff.
Fall 2016	RUPs	1.001	26	0.326	3.718	3.47	0.248
		0.087	26	0.931	3.569	3.552	0.017
		0.586	26	0.563	3.678	3.51	0.167
		1.483	26	0.15	3.146	2.583	0.563
	ENPs	1.489	52	0.143	3.722	3.498	0.224
		1.236	52	0.222	3.788	3.592	0.197
		1.512	52	0.137	4.109	3.878	0.231
		1.509	51	0.137	3.167	2.804	0.363
	Proficients	2.058	78	0.043	3.821	3.535	0.286
		0.461	78	0.646	3.7	3.629	0.071
		0.939	78	0.351	4.026	3.903	0.123
		1.069	78	0.288	3.272	3.034	0.238
Spring 2017	RUPs	0.602	14	0.557	3.7	3.538	0.162
		-0.058	14	0.955	3.567	3.591	-0.024
		0.234	14	0.819	3.5	3.406	0.093
		-0.261	14	0.798	2.05	2.205	-0.154
	ENPs	0.871	33	0.39	3.656	3.414	0.241
		2.055	33	0.048	3.956	3.459	0.496
		0.819	33	0.419	4	3.782	0.217
		1.43	33	0.162	3.083	2.48	0.603
	Proficients	2.223	76	0.029	3.844	3.514	0.331
		-1.056	76	0.294	3.336	3.493	-0.157
		0.309	74	0.758	3.795	3.751	0.044
		0.342	75	0.733	3.18	3.083	0.096

Appendix O – Science and Overall Grades by RUPs, ENPs, and Proficients

		N	Average Grade
Q1 Science	RUPs	25	75.57
	ENPs	40	74.04
	Proficients	86	86.85
GPA Term 1	RUPs	56	82.05
	ENPs	131	82.86
	Proficients	161	89.76
Q2 Science	RUPs	25	75.22
	ENPs	40	71.77
	Proficients	86	87.26
GPA Term 2	RUPs	56	80.28
	ENPs	131	80.21
	Proficients	161	89.62
Semester 1 Science	RUPs	25	75.4
	ENPs	40	72.9
	Proficients	86	87.06
Q3 Science	RUPs	32	72.36
	ENPs	92	73.25
	Proficients	85	88.16
GPA Term 3	RUPs	56	78.91
	ENPs	131	78.48
	Proficients	160	90.67
Q4 Science	RUPs	30	70.55
	ENPs	90	73.1
	Proficients	86	87.51
GPA Term 4	RUPs	56	76.59
	ENPs	130	77.32
	Proficients	160	89.78
Semester 2 Science	RUPs	32	69.25
	ENPs	94	70.63
	Proficients	86	87.32
GPA Cumulative	RUPs	56	79.46
	ENPs	132	79.72
	Proficients	161	89.88

Appendix P – Percentage Points of Grade Below Proficients

Science Grades	Group	Percentage Points Below	Grades for all class	Group	Percentage Points Below
Quarter 1	ENP	12.8	Quarter 1	ENP	6.9
	RUP	11.2		RUP	7.7
Quarter 2	ENP	15.5	Quarter 2	ENP	9.4
	RUP	12.0		RUP	9.3
Semester 1	ENP	14.2			
	RUP	11.7			
Quarter 3	ENP	14.9	Quarter 3	ENP	12.2
	RUP	15.8		RUP	11.8
Quarter 4	ENP	14.4	Quarter 4	ENP	12.4
	RUP	16.9		RUP	13.1
Semester 2	ENP	16.7	Cumulative GPA end of freshmen year	ENP	10.2
	RUP	18.1		RUP	10.4

All scores are significantly below the proficients at the 0.05 level

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