NOT DRIVEN BY HIGH-STAKES TESTS: EXPLORING SCIENCE ASSESSMENT AND COLLEGE READINESS OF STUDENTS FROM AN URBAN PORTFOLIO COMMUNITY HIGH SCHOOL

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ABSTRACT

Not driven by high-stakes tests: Exploring science assessment and college readiness of students from an urban portfolio community high school

Robin Earle Fleshman

This case study seeks to explore three research questions: (1) What science teaching and learning processes, perspectives, and cultures exist within the science classroom of an urban portfolio community high school? (2) In what ways does the portfolio-based approach prepare high school students of color for college level science coursework, laboratory work, and assessment? (3) Are portfolio community high school students of color college ready? Is there a relationship between students’ science and mathematics performance and college readiness? The overarching objectives of the study are to learn, understand, and describe an urban portfolio community high school as it relates to science assessment and college readiness; to understand how the administration, teachers, and alumni perceive the use of portfolios in science learning and assessment; and to understand how alumni view their preparation and readiness for college and college science coursework, laboratory work, and assessments.

The theoretical framework of this study encompasses four theories: critical theory, contextual assessment, self-regulated learning, and ethic of care. Because the urban high school studied partnered with a community-based organization (CBO), it identifies as a community school. Therefore, I provide context regarding the concept, culture, and services of community schools. Case study is the research design I used to explore in-depth this urban portfolio community high school, which involved mixed methods for data collection and analysis. In
total, six alumni/current college students, five school members (administrators and teachers), and three CBO members (administrators, including myself) participated in the study. In addition to school artefacts and student portfolios collected, classroom and portfolio panel presentation observations and 13 semi-structured interviews were conducted to understand the portfolio-based approach as it pertains to science learning and assessment and college science readiness. Data from the transcripts of two graduating classes were analyzed and the interview transcripts were coded and analyzed as well.

Analysis of qualitative data revealed key findings: (1) the school’s Habits of Mind, authentic scientific inquiry, self-regulated learning triggers and strategies, and teacher feedback practices driven by an ethic of care supported students’ science learning and portfolio assessment; and (2) the cyclical and extensive portfolio processes of writing, revision, and submission well prepared alumni for college science laboratory work and coursework, to a certain extent, but not for the traditional assessments administered in college science courses.

Analysis of quantitative data revealed that, if based solely on the City University of New York’s Regents score criteria for college readiness, the majority of students from these two graduating classes studied would not have been considered college ready even though all participants, including interviewed alumni, believed the school prepared them for college. The majority of these students, however, were transitioning to college readiness based on their Regents-level science and mathematics coursework. Findings of this study have implications for science assessment, professional development in science, education policy reform, and high school partnerships with CBOs and postsecondary institutions as they pertain to college and college science readiness for students of color in urban portfolio community high schools.
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Dedication

For it is but God’s grace, mercy, and love that made this accomplishment possible—and so, I dedicate this to Him. To God be all the glory!

To my Parents, Earl & Susie Fleshman

Everything I am and all that I have accomplished is because of all that you both instilled in me. You unrelentingly and graciously sacrificed so much to pour into all of your children. And so, I thank you a million times over. Across the universe, God could not have blessed me with better parents. Madre and Poppsy, you were amazing and extraordinary parents—both brilliant, wise, and gifted. Madre, God’s light and presence flowed through you. I miss you beyond measure.

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To Me

“She looked back and marveled how far she had come…She didn’t wonder how she made it.

She already knew the answer.

Only with God’s help had she powered through. For without His strength, she could do nothing.”

—Tracy Evans

“Not because she did not have failures or doubts.

But because she continued on despite them.”

—Beau Taplin
CHAPTER I
INTRODUCTION

My Philosophy of Teaching and Learning

My journey in education is deeply grounded and shaped by my convictions. My guiding force revolves around my teaching philosophy, which consists of my beliefs about schooling, teaching, learning, assessments, students, teachers, and my discipline. These beliefs are derived from my own experiences and reflections as a science teacher and learner. Teachers must be knowledgeable, not only about the content of their discipline, but also about the work in teaching and learning in general, as well as in their discipline. However, I believe that students are ultimately responsible for their own learning. This process of learning and teaching is socially constructed as “teachers” and “learners” communicate, develop, and negotiate objectives, knowledge, and skills cooperatively together. As such, students should be at the center of the learning environment.

Thus, I believe in student-centered and student-driven education. I also believe that we as educators must start with a clear and concise understanding of our learning objectives and when we make a choice about a teaching-learning-assessment issue or requirement, we should ask ourselves, “How will this impact student learning and development?” This should be our primary guiding force for making decisions and choices in all facets of education. Powerful learning is definitely affected by what takes place both inside of the classroom as well as outside of the classroom. I strongly believe in the incorporation of out-of-class learning experiences and a “seamless” learning environment, integrating curricular and extra-curricular components to enhance student learning and development, particularly in science. In addition, my philosophy
implies the importance of the following components: reflection; transformative and actionable assessment; equity and fairness; application/every-day-connection; data-driven instruction and leadership; engagement; rigor; and challenge. Additionally, we must do the best to help students experience genuine passion for science and to be engaged and motivated in their own learning development and academic outlook.

Drawing again from my own experiences, meaningful teaching and learning require both teachers and students to be reflective. As a continuous effort to incorporate the process of reflection in the learning experience, I used classroom formative and performance-based assessment techniques, making changes in response to student feedback and my own reflection as one can always make improvements in teaching and learning practices and outcomes. From that, we can develop the desire and the skills to engage in lifelong learning, which is a goal I have, not only for the students, but also for myself.

I can best sum up my philosophy of schooling, teaching, and learning in the science classroom environment by stating that I believe in giving the students the opportunity to seriously engage with the subject material and challenge them to do so, rather than simply memorizing facts that are easily forgotten. As a science teacher, I enacted my philosophy by offering a variety of activities and fostering discussions that brought the material of everyday life into the science classroom to be examined. I strongly believed in incorporating various learning and actionable assessment tools within the science-learning environment without compromising set standards and expectations for acceptable work. I held high expectations for my students and made the ways to achieve them very explicit. I saw then and still see skills such as critical thinking, critical discourse, critical reflection, and clear communication as imperative for becoming an active participant in the world, no matter what one’s major or career plans hold.
Essentially, towards the goal of college readiness, a keen emphasis on writing, speaking, analyzing and evaluating the sources of information is imperative.

Most of all, in my current capacity, I try to empower students to become the best of themselves, to be active students, to be teachers and leaders, to be what they want and need to be. Students need to be able to hope and dream, and to be able to act on behalf of those hopes and dreams in order to realize them. Besides being mine, it is their class, their community, their thoughts, their education, their society, and their future as our lives and impact on this earth are interconnected. And so, the extracting and cumulative effects of all my experiences have guided me towards a great interest in rethinking and re-examining equity of educational measurement and college readiness in science, in particular, for students of color in urban communities.

Overall, assessments at every level need to lead to equitable outcomes. However, this is not necessarily the case. According to Darling-Hammond (1994), the use of “educational testing in the United States has been criticized for its inequitable effects on different populations of students” (p. 5). She further posits that performance-based assessments are not innately equitable and advises educators to give conscientious attention to the ways in which they are utilized. Judging by our current climate of school reform entangled and engulfed in a frenzy of standardized assessments and turnaround strategies, Darling-Hammond’s account of “assessment reform as a lever for external control of schools” (p. 5) still rings true. Thus, the widespread concern around assessment reform contributes to my decision to focus on the portfolio-based approach in an urban community high school where 99% of the student population identify as Latino (including people of Latin American ancestry) and/or Black (including people of African American ancestry and the African diaspora).

Rationale
Statistics show that an alarming percentage of African American and Latino students are not prepared for science and mathematics at the college level (Kuh, 2007). Many high school seniors are not prepared academically for college-level work and do not have skills and the habits of mind for academic success (Kuh, 2007). Seventy-seven percent of African American and Latino students have not met the mathematics benchmark, and over 85% have not met the science benchmark (ACT, 2012). Nationally, 60% of white students in contrast to 40% of African American and 49% of Latino students who started college in 2004 earned bachelor’s degrees within six years (Nguyen, Bibo, & Engle, 2012). Even worse, of the African American and Latino students who graduate from high school and enter college, less than half earn a bachelor’s degree six years later (Nguyen, Bibo, & Engle, 2012).

Given the collective push towards better outcomes of education, we should certainly recognize the significance and necessity of fixing and bettering our schools, but placing emphasis on improving test scores solely is not enough, especially when students are grappling with so many educational barriers and challenges that need to be addressed (Carr, 2014). Such barriers to quality education in our urban communities can be addressed through the community schools strategy, which is sometimes referred to as “extended-service” or “full-service” schools (Dryfoos, 1995; Quinn, 2005). Since the high school for this study was established, first and foremost, as a portfolio school and then afterwards became a community school, it is important to provide relevant background information for context.

According to the Coalition for Community Schools and Institute for Educational Leadership (CCS & IEL, n.d.), the approach to community education first developed in the late 1800s with settlement houses in large urban centers and gained national visibility as a formal movement in the 1930s. Federal support was given to community schools in the 1970s when
Congress provided seed money for the Community Schools Act and the Community Schools and Comprehensive Community Education Act (Blank, Melaville, & Shah, 2003). Community efforts innovated approaches to address educational barriers that resulted from poverty, changing demographics, and other “social circumstances in inner cities [that] militate against the ability of urban schools and families to provide, unaided, enough support to stem student failure” (Eric, 1996, p. 238). Thus, with continued need, support, and funding, community school models such as Schools of the 21st Century, Beacon Schools, Caring Communities, Children’s Aid Society, Communities In Schools, Healthy Start, and the West Philadelphia Improvement Corps, among others, began to flourish (Blank, Melaville, & Shah, 2003).

In urban settings, barriers to equitable high quality general education and science education for African American and Latino youth often prevail—poverty, food insecurity, drugs, language, lack of community support services, teen pregnancy, unstable or violent homes and neighborhoods, lack of home/neighborhood support systems, lack of high quality schools and highly qualified teachers, overrepresentation of African American and Latino males in special education, and racial/ethnic discrimination with regards to academic opportunities (American Psychological Association, 2012; Eric, 1996; Schhneider, Martinez, & Ownes, 2006). According to the U.S. Department of Education Office for Civil Rights (USDOEOCR) (2014), the barriers are even greater for science learning, where science coursework for these students often does not extend past the foundational subjects of life science. More often than not, these students are not taught by science-credentialed teachers (Hudley, 2013) and do not take advanced subjects of chemistry and physics (USDOEOCR, 2014). Very few African American and Latino male high school graduates (9% African American and 11% Latino) meet the New York State Education Department criteria for being "college ready," defined as earning a New York State
Regents Diploma and receiving a score of 80 or higher on a mathematics Regents examination and a score of 75 or higher on an English Regents examination (Villavicencio, 2013).

This is particularly troubling because, without solid foundations and progressions in science across their high school years, these students will not be prepared for college science. This, in turn, translates into a dearth or complete absence of African American and Latino students, particularly from urban communities, in science-related degrees and careers (Nguyen, Bibo, & Engle, 2012). Therefore, as science and technology evolve and their related careers, so does the need to provide learning experiences and environments, pedagogies, and curricula that speak directly to urban students’ learning needs, interests, challenges, and academic and career aspirations and society’s responsibility of equitable education for all children.

This need is being tackled head on by portfolio schools. Rising over the last two decades and freed from the pressures of standardized assessment and the trap of “teaching to the test,” portfolio schools provide practitioner-designed, multi-layered, student-focused curricula and assessments that promote a culture focused on deeper learning skills—the very same skills promulgated through the Common Core Standards and Next Generation Science Standards (Davis & Le Mahieu, 2003; New York Performance Standards Consortium, 2012). Although there are few published statistics on the use of portfolios at the university level (Skrabal, Turner, Jones, Tilleman, & Coover, 2012), scant research, if any, exists on urban portfolio community high schools, especially regarding science teaching, learning, and assessment.

**Research Questions**

I formed the following research questions in response to the state of African American and Latino high school students in science education and career aspiration and a desire to explore
science education that may provide equitable science learning experiences for these students via portfolio schools that would prepare them for college level science work:

1. What science teaching and learning processes, perspectives, and cultures exist within the science classroom of an urban portfolio community high school?

2. In what ways does the portfolio-based approach prepare high school students of color for college level science coursework, laboratory work, and assessment?

3. Are portfolio community high school students of color college ready? Is there a relationship between students’ science and mathematics performance and college readiness?

**Structure of the Dissertation**

In Chapter I, I begin the dissertation by highlighting the performance of Black and Latino students in science at the high school and college level and their lack of college preparation and readiness as compared against national science and mathematics benchmarks. I further highlight the educational barriers that many of these students face, particularly those in distressed urban communities, and the rise of various community schools models to address and mitigate these barriers to improve high school graduation rates and college readiness and admissions.

In Chapter II, I offer details regarding the community schools strategy and the role of the partnering community-based organization responsible for specific work connected to the portfolio process. Next, I focus specifically on the following areas for the literature review: (1) standardized assessment, portfolio assessments, and related accountability policies (i.e. No Child Left Behind (NCLB), Common Core State Standards (CCSS), and Next Generation Science Standards (NGSS)); and (2) college readiness for science coursework and laboratory work.

Finally, I present the theoretical framework, expounding on the following theories—critical
theory, ethic of care, and self-regulated learning theory—and concepts—constructivist and contextual assessment, and habits of mind.

In Chapter III, I discuss the research design of this study and the mixed methods in which the data was collected and analyzed. With regards to the criteria for good scholarship, I address ethical considerations, rigor and reliability, and researcher bias. In Chapters IV and V, I present the findings of the qualitative data for the first two research questions, respectively. In Chapter VI, I present the findings of the quantitative data for the third research question. In Chapter VII, I discuss the major findings of Chapters IV through VI, and finally, in Chapter VIII, I present my conclusions and discuss study limitations along with implications for portfolio schools and teacher education as it pertains to science learning, assessment and college readiness. Lastly, I offer next steps for further research on urban portfolio high schools (community and non-community), specifically regarding science assessment, college readiness, self-regulated learning, and habits of mind within these particular high schools.
CHAPTER II
REVIEW OF THE LITERATURE

The literature review first introduces community schools (Agosto, 1999; Blank, Melaville, & Shah, 2003) to provide situational context to this study and then provide larger context as it relates to the following: (1) standardized assessment (Barnes & Slate, 2013; Linn, 2000), portfolio assessments (Davis & Le Mahieu, 2003; Paulson, Paulson, & Meyer, 1991), and related accountability policies (i.e. Next Generation Science Standards (NGSS), Common Core State Standards (CCSS) (Achieve, 2013; New York Performance Standards Consortium (PSC), 2012) and No Child Left Behind (NCLB)); and (2) college readiness (Conley, 2007) and college readiness for science (ACT, 2013). Finally, I review the theoretical framework on critical theory (Giroux, 2003; Hargreaves, Fernandes, & Dinanthompson, 2003; Kinchloe & McLaren, 2002), constructivist (Merriam & Kim, 2012; Mishra, 2014) and contextual assessment (Bellocchi, King & Ritchie, 2016; Klassen, 2006), ethic of care and Black ethic of care (Gilligan, 1982; Knight-Diop, 2010; Thompson, 1998), self-regulated learning theory (Moos & Ringdal, 2012; Nota, Soresia, & Zimmerman, 2004; Zimmerman, 2002, 2008), which includes a discussion on habits of mind and portfolio assessment (Duckor & Perlstein, 2014).

The Community School

The United States Department of Education (USDOE) defines community schools as providing “comprehensive academic, social, and health services for students, students’ family members, and community members that will result in improved educational outcomes for children” in which common elements are out-of-school time programming; health services
(mental and physical); counseling; and job, food, and housing assistance (Jenkins & Duff, 2016, p. 2). Because community schools take into consideration the culture of the students, their families and communities, great attention to cultural context is critical for effective school and community partnerships in urban communities. The focus is concentrated on “how that culture characterizes the ways in which students and families interact with schools, professionals, authorities, and each other” while utilizing “detailed knowledge of who the children are, what emotional and social make-up defines them, who they live with, and what defines the lives of the adults with whom they live” (Agosto, 1999, p.61).

As traditional schools are not structured to meet the multitude of students’ needs (i.e., social, health, emotional, mental, and academic enrichment) and hold a laser-like focus on the heavy academic responsibilities where their accountability rests, the community school provides for this structure. At community schools, the partners work together “toward common results; changing their funding patterns; transforming the practice of their staff; and working creatively and respectfully with youth, families and residents to create a different kind of institution” (CCS & IEL, n.d.). Therefore, the philosophy is that if learning barriers are removed by addressing students’ needs, then students are placed in a better position for learning.

Studies and explorations of community schools have examined methods by which they serve students’ holistic development and the effectiveness of those methods on student learning (reading and mathematics proficiency/performance, attendance and graduation rates), school effectiveness, family engagement, and community vitality (Blank, Melaville, & Shah, 2003; Eric, 1996; Quinn, 2005). For years across the nation community schools and community school models, such as Schools of the 21st Century, Beacon Schools, Communities In Schools, Children’s Aid Society, Providence Full Service Community Schools, and Cincinnati
Community Learning Centers have demonstrated more success than traditional schools (i.e., non-community schools): significantly higher mathematics test scores, narrower gap between student achievement scores, higher percentages of students performing at or above proficiency, increased attendance, decreased drop-out rates, and increased parent engagement (Coalition for Community Schools, 2009; Jenkins & Duffy, 2016).

**The Community-Based Organization**

A primary feature of the community school is its partnership with a non-profit or a community-based organization (CBO). Working directly alongside the school, the CBO serves as the lead partner to support vital areas of the school community through the provision of a wide array of services, structures and programs. Some CBOs provide direct assistance onsite to the school with an office located within the school and others provide assistance offsite. Aligned with the school’s mission and vision, CBOs provide some of, but not limited to, the following vital services: out-of-school-time programs focused on academic enrichment, the arts, unique sports, and socioemotional development; cultural excursion experiences; health (including dental, medical and mental health) services and referrals; parent-family engagement and services; college preparation, advising, and immersion programs; job training and paid internship programs; scholarship programs; and portfolio process mentorship.

**Assessments and Accountability**

“Only if we expand and reformulate our view of what counts as human intellect will we be able to devise more appropriate ways of assessing it and more effective ways of educating it.” --Howard Gardner

Over the decades, the nature and true purposes of assessment in education have been nearly obscured by the growing and divisive political and economic concerns of this country.
Assessment, according to The Standards of Educational and Psychological Assessment, is conducted to do the following: help determine students’ existing knowledge base, diagnose disabilities that may be impeding an individual’s learning, help award placements in programs of limited availability, and certify mastery of a particular level of learning (Kornhaber, 2004). According to the National Research Council’s (NRC) Knowing What Students Know: The Science and Design of Educational Assessment (2001), assessment is a process by which “educators use students’ responses to specially created or naturally occurring stimuli to draw inferences about the students’ knowledge and skills” (p. 20) (as cited in Songer & Ruiz-Primo, 2012). Just from these two definitions of educational assessment alone, two different types of assessment seem necessary. These two types—standardized and portfolio—have emerged and have been used at varying levels of competence and success over the decades in trying to assess what students know in general and in science (Barnes & Slate, 2013; Davis & Le Mahieu, 2003).

**Standardized Assessment: History and Development**

Although historically, standardized testing has been in existence since the 1800s (Longo, 2010), the U.S. has seen five waves of assessment since the 1950s. In the 1950s, standardized tests were used for tracking and selection, followed by program accountability in the 1960s (Linn, 2000). From 1958 to 1967, the National Defense Education Act (NDEA) of 1958, created in swift reaction to the Soviet Union’s launching of their Sputnik satellite, infused large sums of federal money into the American educational system to encourage students to study mathematics, science, computer technology, and foreign languages in efforts to put the U.S. back on the map as global leader (Barnes & Slate, 2013). To make sure the country was on track with its goals of global competitiveness as put on the shoulders of children, standardized tests were administered to elementary and secondary students, increasing from 10 million to 45 million
children, while standardized testing in high school increased from one-third of the student population to nearly 100% (Barnes & Slate, 2013).

Between World War II and the 1970s, standardized testing of elementary and secondary students in the form of multiple-choice tests dominated with few consequences for students or teachers (Koretz, 1998; Linn, 2000) although the passage of Title I of the Elementary and Secondary Education Act of 1965, which channeled federal money into underfunded schools, required school districts to prove that the funds were being used appropriately through justifiable results—standardized tests (Anderson, 2011; Longo, 2010). During the 1970s and 1980s, state-wide standardized testing ballooned from two states to 34 states to include system monitoring and accountability to the point that consequences were now serious (“high-stakes”) and attached to student test scores (Koretz, 1998; Linn, 2000). Minimum competency of students became a part of state and local district accountability such that students had to pass a low-level, multiple-choice test of basic skills to matriculate or graduate (Koretz, 1998; Linn, 2000). During the 1980s, teachers were targeted as responsible for their students’ scores of the standardized tests although concrete sanctions remained infrequent (Koretz, 1998). It is interesting to note that during the late 1980s, educational policy-makers and reformers became disillusioned with this model of testing as holding people accountable for scores on multiple-choice tests was unrealistic and appeared not to work well due to score inflation, “teaching to the test,” degraded instruction, excessive test preparation, and inappropriate forms of test and answer coaching (Koretz, 1998).

In the 1990s, standardized assessment regained flavor with politicians, non-education policy makers, businesses, and for-profit education interests (i.e., curriculum developers and test publishers) at the local, state, and federal level. They saw such standardization as the panacea to
the country’s declining economic competitiveness, low standards in school, low student achievement and motivation, poor curriculum and instruction, and educational inequality (Kornhaber, 2004; Linn, 2000). Ties between standardized assessments and school funding continued through Title 1 of the Improving America's Schools Act (IASA) of 1994, which required states to “develop high quality assessments aligned with state standards in reading and mathematics in one grade per grade span and to use these data to track student performance and identify low-performing schools” (Goertz & Duffy, 2003, p. 4). Since such assessment is relatively inexpensive, can be implemented rapidly even with changes, and the results are visible and reportable, state and federal mandates of testing proved to be a boon for test publishers as testing increased from once a year, if that, to multiple times a year (Lin, 2000).

No Child Left Behind

By the early 2000s assessment and accountability were put under a spotlight with the No Child Left Behind (NCLB) Act of 2001 as it required the “progress of all students to be measured annually in mathematics and reading in grades 3 through 8 and at least once during high school...[and] testing is to be conducted in science once during grades 3-5, 6-9, and 10-12” (Paul & Elder, 2007, p. 67). These assessments “must be aligned with state academic content and achievement standards and involve multiple measures, including measures of higher-order thinking and understanding” (Patz, 2006, p. 199). By the end of the 2013-2014 school year, NCLB required all students to score at or above the proficient level established by their state.

Further, under NCLB, scores were used to determine whether adequate yearly progress (AYP) has been met by a school and, if not, what consequences would be suffered. For example, schools that receive Title I funding (i.e., financial assistance to local educational agencies and schools with high percentages of children from low-income families) but fall short of AYP for
two consecutive years must provide students with other public school choices. Those that fall short for three consecutive years must provide students with supplemental educational services (Goertz & Duffy, 2003; Songer & Ruiz-Primo, 2012). Failing Title I schools can be restructured, converted into charter schools, or taken over by their district or state (Goertz & Duffy, 2003). Assessments that were meant solely to evaluate what students have learned have taken on multiple, confounding, and possibly unethical purposes: judge students’ learning and achievement, graduate/promote or retain students in grade, evaluate teacher effectiveness, make promotion or termination decisions about the teachers, judge the quality of schools, and judge the quality of education at the state level (Kornhaber, 2004; Songer & Ruiz-Primo, 2012).

This hyperfocus on assessment and accountability along with its consequences has produced an overwhelming and destructive focus on standardized testing, resulting in cheating scandals, teachers “teaching to the test,” and states making their standardized tests so easy to pass that passing them is meaningless (Associated Press/The Huffington Post, 2012; Paul & Elder, 2007; Ravitch, 2009). Researchers over the recent decade have found that “high-stakes testing and punitive accountability measures are detrimental to student learning, closing the achievement gap, lowering the dropout rate, increasing graduation rates, and preparing students for access to and success in academic endeavors beyond high school” (Barnes & Slate, 2013, p. 3). Further, high-stakes test preparation may undermine scientific inquiry called for by national science standards such as the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS) (Longo, 2010; Marx & Alejandro, 2006). Under NCLB, to accomplish science accountability measures, science teachers reported compromising their teaching practices as well as being discouraged by school leaders from teaching anything that did not help students to decode standardized test questions (Anderson, 2012). Principals and
teachers often direct time and resources away from science and other subjects like history and the arts (Anderson, 2012; Berg & Mensah, 2014; Judson, 2013; Marx & Alejandro, 2006; Mensah, 2010), often decreasing instructional time and professional development in science content or pedagogy (Anderson, 2012; Mensah, 2010).

It is commonsensical and demonstrated in research studies that what gets tested and counted, gets taught (Judson, 2013). Thus, to ensure that test-based accountability policies support robust science teaching and learning for the 21st Century, Anderson (2012) makes the following recommendations:

1. Accountability testing in science should place more emphasis on skills and scientific reasoning found in instructional methods such as inquiry and active learning.
2. Accountability systems should use multiple measures of students’ ability, connecting to creativity, and student’s enjoyment of learning.
3. Policy makers should eliminate the high-stakes nature of mathematics and reading tests, and science where applicable, to enable more balanced curricular emphases.
4. Federal policy should encourage growth models tied to specific learning benchmarks, instead of arbitrary goals and scoring cut points.
5. Educators need assistance moving beyond seeing test-based accountability as a stressor and instead perceiving and using effective assessments as tools to improve practice and meet the needs of all students; an understanding that inquiry-based teaching can work in a high-stakes testing environment would also be helpful. (pp. 125-126)

Science Assessment

The National Assessment of Educational Progress (NAEP) measures the academic progress of students in Grades 4, 8, and 12 in a variety of content areas. The NAEP Science
assessment, whose framework is described in *Science Framework for the 1996 and 2000 National Assessment of Educational Progress*, was built around a matrix of three fields of science (earth, physical, life) and three ways of “knowing and doing” science (i.e., conceptual understanding, scientific investigation, practical reasoning) (Patz, 2006). The NAEP Science assessment was administered in 2011 and 2015. To meet AYP, only a few states factor in science or other subjects, albeit at a much smaller percentage than mathematics or reading (Anderson, 2012). Interestingly, the states that use science achievement in their accountability procedures yield significantly higher fourth-grade achievement results on NAEP Science assessment and maintain equivalent achievement in mathematics and reading versus those states that do not integrate science achievement results into their accountability procedures (Judson, 2013). Therefore, when science counts as much as reading and mathematics, students achieve relatively greater science results in fourth-grade classrooms as measured by NAEP (Judson, 2013). Even so, can standardized assessment evaluate science habits of mind and abilities promoted by the NGSS?

The NGSS were developed in two phases. The first phase was based heavily on the NRC’s *A Framework for K-12 Science Education: Practice, Crosscutting Concepts, and Cores Ideas* (2011), which identifies key scientific ideas and practices that all students should learn by the time they graduate from high school. Its vision is built on that of the *Framework*, stated in part as follows:

> The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. Throughout K-12 grades, students should have the opportunity to carry out scientific investigations and engineering design projects related to the disciplinary
core ideas…The framework principally concerns itself with the first task—what all
students should know in preparation for their individual lives and for their roles as
citizens in this technology-rich and scientifically complex world. (Pratt, 2012, p. 9)

From the Framework came the second phase—26 states and writing teams and partners across
the country developing the actual standards and architecture of the NGSS.

The organization of the NGSS is based on the core ideas in the major fields of natural
science (life, physical, earth, space) plus engineering. Currently, the states who have adopted the
NGSS are planning on three to four-year implementation timelines. A longer implementation
timeline will allow for capacity building of teachers and administrators for the new standards,
which include developing quality materials (Pruitt, 2014). Such capacity building focuses on
instruction first, which may “lead to an assessment that is indicative of science as opposed to
building a test that does not represent science or how it is conducted in classrooms” (p. 155).
The priority for developing assessments for the NGSS is to represent science education in the
21st Century with “open-response questions and tasks, requiring explanations and analysis”
(Community for Advancing Discovery Research in Education [CADRE], 2013, p. 5).

The integrated assessment of the three dimensions of the NGSS will challenge the long
held belief that science practice must be assessed separately from content and will hopefully
drive the integration of practice and content in the classroom. Groups such as The College
Board and others are working on this needed integration. The College Board in their Advanced
Placement Redesign has integrated dimensions and the development of the Programme for
International Student Assessment (PISA) 2015 will reflect a similar design (Pruitt, 2014). Yet
even as the focus of general education and science teaching, learning, and assessment are
changing, politicians, policy makers, businesses, and for-profit interests continue to call for more
standardized assessment even though such assessments “lose much of their dependability and credibility for that purpose when high stakes are attached to them” (Linn, 2000, p. 14).

Over the recent decade, researchers have stated more loudly that “standardization, as mandated by the NCLB Act, and homogenization of curriculum, as a result of the NCLB Act’s stringent accountability measures, has not decreased the dropout rate, lessened the achievement gap, increased graduation rates, or improved college-readiness rates” (Barnes & Slate, 2013, p. 7). Thus, many educators, education reformers, and education policy makers call for performance-based or portfolio assessments as more effective ways of assessing students. Davis and Le Mahieu (2003) suggest that meaningful assessment reform will occur when

- students are deeply involved in the assessment process;
- evidence of learning is defined broadly enough for all learners to show what they know;
- classroom assessment is understood to be different than other kinds of assessment;
- adequate investment in assessment for learning is made; and,
- a proper balance is achieved between types of assessment. (p. 18)

Portfolio assessment may provide an opportunity for such meaningful assessment.

**Portfolio Assessment: History and Development**

In the 1980s and 1990s, portfolio assessment (a type of performance-based assessment) became prominent in the national conversation on education and assessment reform. Although during this time there were various definitions of portfolio or portfolio assessment (Stecher, 1998), the consistent goal of internal portfolio assessment then was not only to broaden measures of student academic performance but also to improve instruction. With these goals in mind, internal portfolio assessments then were being conducted at the school level. However, external portfolio assessments slowly took root as a possibility for achieving internal goals while
providing enough student data on student capabilities and achievement to make comparisons across schools, districts, and states that would affect decision- and policy-making on a larger scale (Stecher, 1998). Such a time, energy, and resource-consum ing assessment practice had to expand to include aggregation of student data outside of the individual classroom or school and across time to be able to garner and sustain support (Jorgensen, 1996). Hence, external portfolios were then conducted on a state level first with Vermont and Kentucky and at the federal level with the National Assessment of Educational Progress (NAEP) (Koretz, 1998). Since then, portfolios have been promoted as a powerful instrument for internal assessment for student learning.

A particular definition of portfolio was developed in the early 1990s by Paulson, Paulson, and Meyer (1991) and has been used by practitioners and researchers over the years:

A portfolio is a purposeful collection of student work that exhibits the student’s efforts, progress, and achievements in one or more areas. The collection must include student participation in selection contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection. (p. 60)

In addition to the definition of portfolio, Paulson et al. also suggested eight guidelines to preserve the power of the portfolio:

(1) the end product must contain evidence of self-reflection; (2) the student must be involved in selecting the pieces; (3) any cumulative scores or data should only be included if they take on new meaning within the context of the other products in the portfolio; (4) the portfolio must convey the activity rationale, goals, contents, standards, and judgments; (5) the portfolio may serve different purposes for the student at different times of the year; (6) the portfolio may have multiple purposes which must not conflict;
(7) the portfolio should contain information that illustrates growth; and (8) students should be provided models of portfolios as well as models of self-reflections (pp. 62-63).

Thus, portfolio assessment is a “purposeful, multidimensional process of collecting evidence that illustrates a student’s accomplishments, efforts, and progress (utilizing a variety of authentic evidence) over time” (Gillespie, Ford, Gillespie, & Leavell, 1996, p. 487). Such a collection of multiple and various authentic pieces of student data reflect the social science practice of data triangulation which increases the validity of the findings regarding what the students have learned (Gillespie et al., 1996). Such evidence may include projects, lab work, writings, audio/visual media, assignments, constructions, videos, demonstrations, performances, and rubrics reflecting the level to which outcomes are achieved.

Davis and Le Mahieu (2003) summarized the works of various researchers positing the increased purposes of the portfolio:

- [Portfolios] show growth over time, provide assessment information that guides instructional decision-making, show progress towards curriculum standards, show the journey of learning including process and products over time as well as to gather quantitative information for the purposes of assessment outside the classroom. (pp. 3-4)

Although mostly serving internal purposes, portfolio assessment has expanded to serve external purposes of school, district, and state comparisons to varying degrees of success.

*Portfolio Benefits and Challenges*

Within a portfolio system, students are expressly invested in the construction of their portfolio as it represents them in their different stages of learning. Ideally, within this system, a portfolio invites “students to invent, organize, predict, represent, visualize, genuinely reflect on what they are learning, and build self-confidence” (Hamm & Adams, 1991, p. 20). Thus, a
portfolio for one student may not contain the same products as that of another student. Such student participation in the portfolio process and diversity of student data allow for fair and equitable ownership and representation of learning outcomes achieved (Davis & Le Mahieu, 2003). According to Davis and Le Mahieu, portfolios provide at least four potential “values-added” in assessing students’ learning that traditional, standardized data collection and assessment do not:

1) they are extensive over time and therefore reveal growth and development over time;
2) they allow for more sustained engagement and therefore permit the examination of sustained effort and deeper performance;
3) to the extent that choice is involved in the selection of content (both teacher and most especially student choice), portfolios reveal students’ understandings about and dispositions towards learning; and,
4) they offer the opportunity for students to interact with and reflect upon their own work.

(p. 5)

In this regard, traditional, standardized data collection and assessment fall very short to the strengths of portfolio assessment.

Early on, the question of validity (appropriateness of inferences of scores/results) and reliability (consistency of measurement) in portfolio assessment on small and large scales was an issue across decades of research (Koretz, 1998). The question of validity can be phrased as such: “to what degree does a given score on a [writing] portfolio justify the intended inference about the student’s proficiency?” (p. 311). However, in the recent decade, researchers have suggested that validity is addressed using triangulation of student evidence (Davis & Le Mahieu, 2003). Where triangulation signifies the use of at least three different data sources, students are able to
include several more and varied pieces of evidence in the portfolio that they and their teacher believe accurately portray their learning progress and achievement outcomes.

However, as validity of inferences depends on the reliability of the outcomes measures, it would prove difficult, if not, inappropriate to make any inferences about student performance from an unreliable measure (Koretz, 1998). Research on the reliability and general strengths and weaknesses of large scale portfolio assessment found several concerns: the difficulty of achieving acceptable inter-rater reliability between portfolio scorers even when teachers were trained on using the scoring rubrics; the wide variation of portfolio content, rubrics, and methods for applying the rubrics; the lack of experienced scorers; the various levels of skill and ability in the subject area of the scorers (Davis & Le Mahieu, 2003; Koretz, 1998); the question of whose work is being presented (i.e., how much help did the student receive on completing or choosing the presented work?) (Koretz, 1998; Reckase, 1995); and, the obstacles of time and motivation of the teachers to assemble and score the portfolios (Damiani, 2004; Shapley & Bush, 1999; Stecher, 1998; Whitworth & Bell, 2013). Instead of consistently measuring gains, portfolios may “measure items that reflect what states define as grade-level standards, but they do not measure student progress along a well-justified scale representing growing understanding of concepts or development of skills” (Darling-Hammond & Adamson, 2010, p.33).

The answer to these concerns evolved over the decades with continued research, specifically on improving the reliability of large-scale portfolio assessment. An increase in reliability could be achieved through the following, in part, or in whole: standardization of products and process; appropriate cut-off points being set for consistent decisions on mastery/non-mastery; the use of random sampling over the population and double-scoring a minimum percent of those portfolios; use of highly trained professional raters and tightly
controlled scoring conditions; using teachers in the inductive process as model scorers and thus training subsequent teachers using the model scorers to an acceptable criterion of performance (Davis & Le Mahieu, 2003).

Because portfolios allow for student reflection, choice, ownership, and responsibility of learning, students’ sense of self-efficacy, motivation, intrinsic interest, and consequently, their academic achievement in the subject matter are enhanced (Cole, Struyk, & Kinder, 1997; Davis & Le Mahieu, 2003). As not only the student and the teacher see portfolios, students’ motivation and ownership are enhanced when the audience of the portfolio is important to the student (Davies & Le Mahieu, 2003). Simply put, accountability increases when students know they will present their work to someone they care about. Yet these same reasons may not be enough for increasing student motivation for and performance on standardized assessments as students have no say in showcasing or not showcasing their standardized test outcome at particular moments in time. Accountability is further increased when students are made aware of the learning standards involved in each learning experience, the criteria for success for each assignment, and specific feedback throughout the process (Davis & Le Mahieu, 2003). The empowering effect of specific, positive, descriptive feedback over summarized, encoded, evaluative scores on the students’ work throughout the learning process and portfolio development cannot be overstated (Davis & Le Mahieu, 2003). Simply, a student is more likely to improve if the student is actually told and shown how to improve.

Portfolios promote different skills in both students and teachers such as critical thinking skills in the learning and teaching process for solid implementation (Paul & Elder, 2007). For students, in particular, cognitive, meta-cognitive, higher-order thinking, and communication skills are promoted and utilized as students learn to reflect on their work over time and prepare
self-assessments that explain the significance of each piece they have selected for inclusion in their portfolio (Cole, Struyk, & Kinder, 1997; Davis & Le Mahieu, 2003). As this process occurs over time, the students become more aware of and use assessment language for themselves and peers in class discussions and in constructing their portfolios (Davis & Le Mahieu, 2003). Considering the strengths and weaknesses of portfolio assessment, with “all things being equal, then, portfolio assessment is better than traditional assessment” (Paul & Elder, 2007, p.73). However, if not implemented well, portfolios can serve as a nebulous holding dock for shallow and extraneous student work.

**The New York State Performance Standards Consortium**

To understand and affect student outcomes on a more comprehensive scale beyond standardized testing, portfolio schools took root and used the performance-based assessment via the portfolio instead of standardized assessment. Portfolio schools continue to grow across cities and states in the U.S. The New York Performance Standards Consortium (PSC), with its current 39 member schools throughout New York State, developed a proven practitioner-developed, student-focused, performance-based assessment system, for which the validity of the assessment system was affirmed originally in 1995 and reaffirmed in 2008 when more schools were added (PSC, 2012). The Consortium includes a range of small public schools that are not selective regarding their student population. These schools range from transfer schools (or “second-chance” schools) to schools in the International Network to Title I schools and schools serving both the urban middle class and the urban poor. These schools have more students living at or below the poverty level and a higher percentage of Latinos, English Language Learners (ELLs), students with special needs, and students with lower English and mathematics skills than their peer schools within the state (PSC, 2012).
Supportive of standards and not standardization, Consortium schools are designed with intentionality toward intellectual inquiry and performance for the highest and lowest performing students, thus reflecting the values of the Common Core Standards in curriculum, instruction, and assessment: “open-ended questioning; intensive reading, writing, and discussion; student input; and assignments extended over longer periods of time than the more conventional standardized approach to assessment and instruction” (PSC, 2012, p. 1). The teacher-designed and revised curriculum, instruction, and performance-based assessment system bolsters the professional respect, responsibility, and accountability of the teachers to learn, know, and implement what works best for their students.

In direct opposition to standardized assessment, the Consortium takes a broader, more comprehensive scope towards outcomes of success than test scores. The Consortium includes the following in its definition of outcomes: graduation rates and college readiness, English Language Learners and special needs students, predictive validity and college persistence, minority male college data, suspension rates, and teacher turnover rates. The Consortium’s performance-based assessment work reflects the complexity of learning that readies students for college and instill in them 21st Century skills: “analyzing conflicting phenomena, supporting arguments with evidence, solving complex problems that have no obvious answer, and thinking deeply about what is being taught” (PSC, 2012, p. 4). These skills correspond with the CCSS and the NGSS.

The Consortium schools bested city and national rates for student graduation (students with and without Individualized Education Programs (IEPs)), college acceptance, and college persistence for working class and poor youth (PSC, 2012). They also performed better in the broader eight outcomes as compared to representative Department of Education (DOE)
partnership support organizations, charter high schools and 5-12 schools, and NYC high schools (PSC, 2012). As more schools choose standards over standardization in learning and assessment, portfolio assessment continues to grow and become a part of the instructional fabric of schools.

**Portfolios to Meet Students’ Needs**

Students with IEPs will benefit just as well or more so from the portfolio assessment process if targeted cognitive and metacognitive support for these students and their teachers is given to help the students develop their portfolios (Cole, Struyk, & Kinder, 1997). Active participation in the assessment/learning process increases the likelihood of successful inclusion in the classroom for these students (Cole, Struyk, & Kinder, 1997). Such supports may also include models of portfolio assessment that help the teacher support the students in identifying and reflecting their goals and content for their portfolios (Cole, Struyk, & Kinder, 1997). Further, as portfolios may include visual evidence of performance, students with IEPs may present photographic or video evidence of them learning and accomplishing their goals that otherwise could not be witnessed or assessed by traditional objective or standardized assessments (Damiani, 2004).

For teachers, cognitive, meta-cognitive, data collection, assessment, collaborative, and interpretive skills are promoted in five key ways:

1. Teachers learn about their students as individuals by looking at their learning represented in the portfolios;

2. Teachers learn about what evidence of learning can look like over time by looking at samples of student work;
3. Teachers form interpretive communities that most often have higher standards and more consistently applied standards for student work than was the case before entering into the development of portfolio systems;
4. Teachers challenge and enrich their practice by addressing the higher expectations of student learning with classroom activities that more effectively address that learning; and,
5. Teachers learn by keeping portfolios themselves to show evidence of their own learning over time. (Davis & Le Mahieu, 2003, p. 14)

Concerns about portfolio assessments are being addressed in more research and evaluation, demonstrating there are clear benefits to the system—benefits for student and teacher alike. However, without consistent and systematic support from administration to teachers and teachers to students, portfolio assessments, just as traditional standardized assessments, may fall short in meeting the needs of students, especially students with IEPs.

**Portfolio Assessment in Science Courses**

Taking root in the 1980s and 1990s, the use of portfolios in K-12 science classrooms has become increasingly common with the end goal of assessment of student performance and monitoring the training of preserve science teachers (Offerdahl & Impey, 2012). In 1992 in California, a portfolio was added to the Golden State Examination in biology, chemistry, and coordinated science tests, giving students the opportunity to demonstrate how they construct meaning in science and highlight their cumulative accomplishments (Martin, Miller, & Delgado, 1995). From 1993 to 1994, research was conducted on nearly 4,000 portfolios from this exam. Students were asked to submit the following three pieces of evidence along with a companion self-reflection sheet, with the understanding that the three pieces could be revised and improved
before submission: problem-solving investigation, creative expression of a scientific concept, and growth in understanding of a scientific concept through writing (Martin et al., 1995).

The results of the exam and the research were favorable, showing demographic differences across science subject and portfolio products. More and more teachers were drawn to the training sessions to learn how to successfully implement portfolios in their classrooms, reporting that portfolios were “providing them with a vehicle for implementing reform strategies, such as constructive teaching approaches, and have fostered a more conceptual or thematic classroom orientation” (Martin et al., 1995, p. 54). After analyzing the results, the researchers posited that “the portfolio may become the most fair, efficient, and effective tool for data collection and could replace, with equivalent reliability, other forms of assessment” (p. 54).

Studying portfolio assessment in elementary and middle grades mathematics and science, as implemented in the Authentic Assessment for Multiple Users Project funded by the National Science Foundation, Jorgensen (1996) came away with several lessons learned about the human, intellectual, and financial aspects of implementation. Jorgensen noted the costs in researching and refining such a large-scale portfolio assessment: human resource (i.e., one individual resigned), time (i.e., some could not find the time to meet or work as groups), and money (i.e., costs were exorbitant for the structured core of the portfolio). By the end of the project, participating teachers were in resounding agreement that the portfolio assessment process could be streamlined, participant retention could remain high, and the payoff of portfolio assessment in terms of teaching and learning was significantly greater than what could be gleaned through traditional assessment strategies (Jorgensen, 1996). The single most important result of the portfolio project was that “the teachers recognize[d] that the differences they had focused on at the local level were less important than the value they held in common for all students” (p. 219-
Further, the process of defining entry types was useful for judging student learning and facilitating change in teacher views and instruction (Jorgensen, 1996).

On a smaller scale, Whitworth and Bell (2013) researched Whitworth’s implementation of a physics portfolio project in two different high school physics courses over six years where on the first day of class each year, the teacher would provide students with a course syllabus, a description of the portfolio and its components, and the portfolio objectives. Although a great part of the portfolio’s power is the ability and opportunity for students to reflect and decide which pieces of evidence to submit, the structure and content of this particular physics class portfolio was prescribed from the beginning of the year so that students knew which content they would submit from the four quarters of the academic year. Throughout the year, the students worked on their assignments for a grade to be submitted in the portfolio, which itself would be “graded at the end of the year with the weight of one or two test grades” (p. 39). As such, students’ portfolios were essentially standardized in this instance as they all contained the following: “title page; table of contents; a letter and picture of introduction; essays, pictures, and study guides for each unit; self-evaluation and learning evidence from each quarter; project components; and a final reflective essay” (p. 39).

After each piece was submitted, students received feedback from the teacher, and students revised each piece and include the revised version in their portfolio. It was not clear whether instruction had changed based on the work students submitted and the feedback the teacher provided. It appeared that the portfolio for this physics class was used as assessment of learning and not for learning. Assessment of learning continued at the end of the semester at the Portfolio Gallery Hop where students and parents could give written and signed comments on
each student’s portfolio. In class, students presented and discussed select pieces of their portfolio with peers, allowing for questioning and answering, giving each other direct feedback.

**Portfolios in Undergraduate Science Education**

Although the use of portfolios is common in K-12 classrooms, its use is very limited in undergraduate science courses. The limited use seems contrary to science assessment objectives: “to demonstrate students’ mastery of science content or to reveal their problem-solving and critical-thinking skills” (Offerdahl & Impey, 2012, p. 19). Even though its use may be limited, portfolio assessment holds great potential for helping students learn science.

Researchers Offerdahl and Impey (2012) embarked on a study of a general education science course at the University of Arizona with the express goal of implementing portfolio assessment and utilizing iterative forms of writing to “help students learn about the scientific methods as applied to a dynamic research field” (p. 20). The researchers chose the Life in the Universe course because it included astrobiology and its interdisciplinary nature made it “the ideal context to demonstrate the breadth that is missing in most science classes and [it] give[s] students a chance to see how science works in more than one context” (p. 20). This class included two 75-minute lecture periods per week in a large lecture hall, where the first period was interactive lecture and the second period was small, collaborative learning groups of three to four students. To implement the use of portfolios for this one course, three graduate teaching assistants were added to organize and assess the collaborative learning groups in the class and to coordinate the portfolios in concert with the instructor. Portfolios were used in addition to the existing traditional assessment measures—standard quizzes and collaborative group write-ups.

The portfolio assessment was designed and implemented to support student progress toward given, specific learning objectives. Four instructional units were to be covered in class
and a minimum of eight pieces of student work were to be included in the portfolio reflecting the units. According to the researchers, a rigid schedule for the “collection, critiquing, and return of portfolio pieces was necessary to ensure continuous feedback to students” (p. 21) where submission of students’ final versions of their work would occur at the end of the semester. To support the purpose and power of the portfolio, the following aspects were insured:

Students were given instructions and rubrics for all aspects of the portfolio; the instructional team met weekly to discuss and compare scoring; two of the three graduate teaching assistants met three to five times a week to score student work together and identify themes in student progress which were then reported back to the instructor to be addressed in lecture. (p. 21-22)

Addressing the student response themes and issues as the course moved along reflected the purpose of portfolios of assessment for student learning during the semester as opposed to only assessment of student learning at the end of the semester.

The implementation of portfolio assessment in this educational setting and level was challenging. Even with the extra instructional assistants, time was still an issue with respect to adhering to the set schedule. Time was also a factor for students in preparing and revising the number of pieces required to meet the learning and assessment objectives of the course. For many students the high degree of engagement and coherent writing required of them for the learning outcomes was also very challenging. However, the researchers noted that using portfolios enabled them to explicitly meet the General Education requirements unlike previous semesters when portfolios were not used. Students communicated more scientifically, evaluated evidence more critically, engaged more with the material, self-directed their learning experience, interacted more meaningfully with the written feedback and instructor throughout, and
understood the scientific method better (Offerdahl & Impey, 2012). By the end, the majority of students believed that portfolios should be used the following semester with 53% of students believing portfolios were a better assessment than traditional exams (Offerdahl & Impey, 2012).

**Readiness for College and College Science**

College readiness has become prominent in the national discussion of K-12 education and in the text of federal education law. Built on the significant reforms already made in response to the American Recovery and Reinvestment Act of 2009, the Obama administration released in March 2010 its blueprint for revising the reauthorization of the Elementary and Secondary Education Act (ESEA) with a clear goal for college and career readiness: “Every student should graduate from high school ready for college and a career, regardless of their income, race, ethnic or language background, or disability status” (U.S. Department of Education, 2010, p. 3). Although the blueprint called on states to upgrade or develop and adopt “standards in English Language Arts and mathematics that build toward college- and career-readiness by the time students graduate from high school” (U.S. Department of Education, 2010, p. 3), it did not do the same for science. Essentially, science was not considered a factor in determining college and career readiness.

**Definition and Benchmarks**

Interestingly, even with heightened national and state conversations, policies, and initiatives, there does not seem to be one consistent definition of college readiness in general or in science. David Conley, college and career readiness researcher, defined college readiness as “the level of preparation required for students to enroll and succeed without remediation in credit-bearing, entry-level, or general education course work at a postsecondary institution that
offers a baccalaureate degree or transfer to a baccalaureate program” (Conley, 2007, p. 5). The benchmarks for ACT’s College Readiness are the minimum ACT test scores “required for students to have a high probability of success in credit-bearing college courses—English composition, social sciences courses, college algebra, or biology” (ACT, 2013, p.1). Students who meet a benchmark criterion on “the ACT or ACT Compass have approximately a 50 percent chance of earning a B or better and approximately a 75 percent chance of earning a C or better in the corresponding college course or courses” (ACT, 2013, p.2). Barnes and Slate (2013) note that with “the only measure of college readiness primarily being standardized tests, college readiness may be more aptly defined as academic preparedness” (p. 5). Rightly differentiated by the authors, there is a distinct difference between academic preparedness (where the focus is on course navigation) and college readiness (where the focus is on college life navigation). In his noted college and career readiness framework, David Conley (2008) offers four areas that students must demonstrate to be adequately ready for college and career: (1) key cognitive strategies, which include interpretation, problem solving, and the ability to construct an argument; (2) key content knowledge, which includes the necessary concepts and skills foundational to the subject; (3) contextual skills and awareness, which involve awareness and knowledge of the campus system and the norms necessary for successful academic and social navigation; and (4) academic behaviors, including study skills and habits, the ability of students to be organized and keep a schedule, and to work within groups (as cited in Castro, 2013, p. 3).

The CCSS has the following definition of college readiness: “College ready indicates preparation for credit-bearing coursework in two- or four-year colleges, without the need for remediation and with a strong chance for earning credit toward a designated program or degree”
Where the CCSS’s is a general definition, it does not apply to science as few colleges offer remediation in science; therefore, there are rarely alternatives to taking credit bearing science courses. In addition, while most postsecondary students start mathematics with college level algebra, there is no clear starting point for science, or even a placement test. Instead, students determine their science enrollment by interest or mathematics skills. (CADRE, 2013, p. 3)

Although the NGSS does not provide a specific definition of college readiness, it references CCSS, ACT, the College Board, and David Conley’s definitions of college readiness and points to the importance of practice, modeling, and application over mere knowledge and the ability to conduct meaningful research (NGSS, 2013):

1. Applying a blend of science and engineering practices, crosscutting concepts, and disciplinary core ideas (DCIs) to make sense of the world and approach new problems, new situations, new phenomena, and new information;
2. Self-directed planning, monitoring, and evaluation;
3. Applying knowledge more flexibly across various disciplines through the continual exploration of science and engineering practices, crosscutting concepts and DCIs;
4. Employing valid and reliable research strategies; and,
5. Exhibiting evidence of the effective transfer of mathematics and disciplinary literacy skills to science. (Achieve, 2013b, p. 1; CADRE, 2013, p. 3; NGSS, 2013)

Moreover, states and school districts define “college ready” with their own quantitative benchmarks, which vary sometimes to the point of confusion. For example, The City University of New York (CUNY) requires the following to be considered “college ready”:
Graduate with a Regents diploma by August [of the entrance year];

Score 75+ on the English Regents, 480+ on the Critical Reading SAT, 20+ on the ACT, or 70+ on the CAT Reading and 56+ on the CAT Writing tests; and,

Earn 80+ on one mathematics Regents and complete coursework in Algebra II/Trigonometry (or higher level mathematics), or score 480+ on the Mathematics SAT, 20+ on the ACT, or 35+ on the CAT Mathematics 1 and 40+ on the CAT Mathematics 2 tests. (CUNY, 2017; Harper, 2014, p. 26)

Although a score of 65 on the Regents exams is passing and sufficient to be eligible for a Regents diploma, it is still not enough for a student to be considered “college ready.” However, students who do not achieve the required scores on SAT, ACT, or Regents Exams can satisfy the college readiness requirements by passing the CUNY Assessment Tests in Reading, Writing and Mathematics with the following scores:

- Reading Test score of 55 or higher
- Writing Test score of 56 or higher
- Elementary Algebra (Mathematics 5) score of 57 or higher. (CUNY, 2017)

Preparation for college and pathways to college entrance is supported through high school course sequences and high school-college coursework partnerships. The New York City Department of Education (NYCDOE) lists the following courses as supporting “students in successfully transitioning to college or the workplace”:

Subject-Specific Course Sequences

- Mathematics: Eight (8) Regents-level credits, including a sequence that consists of at least Algebra I, Geometry, and Algebra II
Science: Eight (8) Regents-level credits, including a sequence that consists of at least three of the following: Living Environment, Chemistry, Physics, or an Advanced Placement science course

Advanced Courses

- Advanced Placement (AP) courses
- International Baccalaureate (IB) courses
- Courses for college credit such as College Now or CUNY Early College. (NYCDOE, 2007, p. 1)

Reality and Concerns

The reality of college readiness for the 21st Century appears bleak or at best not promising. College readiness researchers over the years and especially today with the federal and state drive using a college readiness agenda, purport that the agenda is a “one-size-fits-all” agenda and that students are “earning diplomas, but they are graduating without the knowledge, skills, and metacognitive strategies needed to be successful at postsecondary institutions” (Barnes & Slate, 2013, p. 1). Further, Conley (2008) suggests that by his multidimensional model, far fewer students are truly ready for college than when judged by the conventional standard of number and type of courses taken, grades received in high school, and standardized test scores. The goal of his model is “not to deny students entrance to college but to highlight the gaps that exist between those who are college eligible and those who are college ready” (p. 11).

Castro (2013), through critical race theory, points out that the two largest challenges that the college readiness agenda faces is growing educational inequity and establishing contextualized college readiness benchmarks. For Castro, the battle is not simply what students of color know or do not know with regards to academic subject matter when they enter college,
but it is the equitable measurement of their academic content knowledge and their knowledge, or lack thereof, of overt and covert racial matters and how to manage them when they experience them on the college campus. For Castro, the “prevalence of structural discrimination and racial bias trumps even well-intended educational efforts, including intervention policies and programming for college and career readiness, that do not explicitly consider how the forces of racism and poverty operate” (p. 4).

For students of color who step onto college campuses, readiness goes beyond the numbers and scores that follow them. ACT (2013) purports that their benchmarks “offer users a concise, reliable method of articulating postsecondary expectations to middle schools and high schools so that timely interventions can be made” (p. 3). Yet, interestingly, even by ACT’s benchmarks, not many students on a national level seem college ready: only 24% of the graduates of the class of 2010 and 25% of the graduates of the class of 2011 who took the ACT exam met or surpassed all four of the ACT College Readiness Benchmarks (Harvey, Slate, Moore, Barnes, & Martinez-Garcia, 2013). Worse yet, 28% of the 2011 graduates who took the ACT did not meet any of the readiness benchmarks, which remained the same from 2010 (Harvey et. al, 2013).

New York State, however, fared significantly better with 43% of the graduates of the class of 2014 meeting all four of the ACT College Readiness Benchmarks versus 26% nationally (ACT, 2014). From 2010 to 2014, the percentage for New York State has increased from 40% to 43% while nationally, the percentage has increased only slightly from 24% to 26% (ACT, 2014). However, whether by number of core courses taken in high school, by subject area, or composite score, Black and Latino students consistently scored lower than their White and Asian counterparts for New York State and nationally (ACT, 2014).
Understanding the challenges that Black and Latino students in urban communities face, the ACT’s quantitative benchmarks do not reflect the qualitative, contextual benchmarks, such as the emotional and psychological fortitude and empowerment that students of color need to succeed especially on campuses where they number the fewest. Poor and minority students are disproportionately represented in both the community college sector and in remedial education courses as college readiness differs across race and class (Castro, 2013). Approximately half (44%) of community college freshmen require remediation in core courses and that students of color do not have graduation rates comparable to their White and Asian peers (Hervey & Hinton, 2013). Black and Latino students have failed drastically in meeting performance standards in English Language Arts and mathematics in the course of their secondary school education, and as a result, enter our nation’s colleges requiring remediation in those same core subjects. With regards to the national discussion of college readiness and program interventions, emphasis should be placed on structural and institutional reasons for low readiness (i.e., larger sociopolitical dynamics of structural racism, poverty, and educational neglect) and away from the deficit ideology which blames students of color for their positions and situations in life (Castro, 2013).

Arnold, Lu, and Armstrong (2012a, b), in taking an ecological systems theory approach to studying college readiness, looked not only at the individual student and the structural and institutional influences but called for an integrative model for research, policy, and practice of college readiness—one that integrates the complexities of student interactions with her or his environments at each system level (individual, micro, meso, exo, macro, and chrono). The individual level includes, for example, the student’s ethnicity, motivations, and college knowledge; the micro level includes school, readiness programs, social media sites; the meso
level includes forces that comprise social and cultural capital; the exo level includes politics, curricular design, financial aid structures; the macro level includes racism, capitalism, and meritocracy; and the chrono level includes time. Arnold et al. (2012b) recognized the interplay between students and all of the system levels that directly and indirectly affect the students and their motivation, ability, and opportunities to be college ready: “The ecology of the individual student determines whether that student acquires the constellation of aspirations, dispositions, and academic and practical knowledge that constitute college readiness” (p. 94).

**College Science Assessment Practices**

Across the U.S., universities and colleges utilize different assessment practices for their science courses. In a study of higher education faculty in the U.S., significant differences were found among the assessment practices of biology, chemistry and physics faculty at colleges and universities (Goubeaud, 2010). In a self-report questionnaire, faculty were asked whether they used none, some, or all the following practices: multiple-choice exams, essay exams, short-answer exams, term/research papers, formative assessment practices (i.e., student evaluation of each other’s work, and using multiple drafts of written work), and grading practices (i.e., grading on a curve and competency-based grading) (Goubeaud, 2010). For this study, a sample of 2,750 science faculty were drawn from the 28,576 higher education faculty who participated in the National Study of Postsecondary Faculty (NSOPF), a National Center for Education Statistics (NCES) dataset sponsored by the U.S. Department of Education.

From this sample, a greater proportion of biology faculty used a wider repertoire of assessment types than physics or chemistry faculty: “biology faculty were more likely to use multiple-choice exams as well as assessments that are more open-ended and provide student feedback, such as multiple drafts of written work and peer evaluation” (Goubeaud, 2010, p. 242).
Further, less than half of physics and chemistry faculty used assessments that require students to express their ideas in writing through extended-response such as essay answers or term papers (Goubeaud, 2010). Although reasons were not stated, this may simply be because faculty might believe that the answers to the problems or questions are most valuable to ascertain and not the thinking processes involved.

It is important to know the types of assessments that science faculty administer at the college level because if new students are not familiar with these types of assessments or adept at taking them, then successful completion may be a challenge, especially for students from high schools that utilize performance-based or portfolio assessment. Miyasaka (2000) identified five types of preparation practices for high-stakes tests: (a) teaching the content domain, (b) using a variety of assessment approaches and formats, (c) teaching time management skill, (d) fostering student motivation, and (e) reducing test anxiety (as cited in Gulek, 2003, pp. 42-43). The second strategy depends on the type of assessments the school promotes: if portfolio schools never use traditional, standardized assessments, their students may suffer in colleges where traditional, standardized assessments may be the norm, especially during their freshman year where introductory level courses in large schools may contain class sizes in the hundreds; if traditional schools never use performance-based measures, their students may suffer in colleges, especially small colleges, where performance-based measures may be the norm. For portfolio students, reducing test anxiety may be a challenge as they would not be familiar with traditional test-taking scenarios.

**Steps to Readiness for Students of Color**

With the undeniable educational, economic, and prejudiced plight of African American and Latinos especially in urban areas, ways to achieve college readiness must be made
prominent, readily accessible, and readily available to all students and their families. It is a must. For African American and Latino males, the plight is even worse almost to the point of incomprehension, and as such, the steps and trajectory to college readiness must be that much more engaged, targeted, and most importantly, understood from the perspective of African American and Latino young men succeeding and working to get there.

In a recent study of Black and Latino male high school achievement in New York City, Harper and associates (2014) used an anti-deficit ideology to explore and emerge understandings of “how these young men succeeded in and out of school, developed college aspirations, became college-ready, and navigated their ways to postsecondary education” (p. 1). The study entailed 415 students (current high school and college students) from 40 NYC public high schools. Ninety were enrolled across 44 colleges and universities (27 within NY and 17 outside of NY), and the rest were college-bound high school juniors and seniors. These high schools were part of NYCDOE Expanded Success Initiative (ESI) in 2012, a component of the Office of the Mayor’s Young Men’s Initiative. These schools won competitive grants to create and implement practices to achieve coherence within academic rigor (as reflected in Common Core), youth development (emphasizing student resilience, life beyond high school, and restorative approaches), and school culture (including strategies for promoting college and career focus).

Harper (2014), the project director and author, chose to study students “who figured out how to foster productive relationships, resist pressures to join gangs and drop out of high school, and succeed in environments cyclically disadvantaged by structural inequities” (p. 1) to shift the focus and conversation to the successes of African American and Latino males—a refreshing and necessary departure from the overwhelming negative focus and standpoints found in social
science and educational research. Face-to-face interviews with the college students yielded instructive findings:

- College choice was heavily influenced by proximity and exposure. For students who stayed within NY, proximity to home and work, and guidance counselor feedback were the deciding factors. For students outside of NY, campus tours drew them away.

- College readiness quantitative measures did not reflect the qualitative reality of college expectations and reality. Many participants said they were not sufficiently prepared for the academic expectations of college (effective study habits, multitasking, time management, in-class exam performance) reflecting again that academic preparedness is not synonymous with college readiness.

- College/campus life realities and expectations surprised many students. Newfound sense of freedom, flexible scheduling, exorbitant costs, demanding study skills, and demanding assignment timelines. Further community colleges were outside of student expectations as community colleges are rarely part of college tours.

- College/campus clubs, organizations, and activities remain largely unknown to working students or beyond their time commitments.

- Relationships and interactions with professors and knowledge of support systems were largely non-existent for students not previously a part of one of NY or NYC college readiness and college support programs. Students did not seek the support or advice of their professors or support services when they were struggling.

- Students persisted amidst academic and financial hardship. Their determination and commitment to complete their college goal was fueled by the very same determination and commitment in high school.
From the findings, Harper makes salient, ecological recommendations that expand from the individual outward to parents and families, high school teachers, high school guidance counselors, high school principals and leaders, postsecondary faculty, professionals, and leaders, and finally, mayors, governors, and policymakers to bolster the college readiness and persistence of African American and Latino young men. Although from the college journeys of African American and Latino young men matriculating through and graduated from New York public high schools, these recommendations would seem to serve well for all students of color regardless of gender, learning abilities, and backgrounds.

**Theoretical Framework**

This section focuses on the theoretical lenses that guide this study. Establishing my theoretical framework required extensive grappling and wrestling over several interpretive frameworks and perspectives. Initially, and emerging as the lead, transformative learning theory guided my work. As the research unfolded, I began to consider critical theory, constructivism and constructivist assessment, self-regulated learning theory, habits of mind, and ethic of care.

Thus, what follows is a foundational review of these theories and concepts that will thread my exploration and discussion of the perceptions, culture, context, and science experiences within the school community as it pertains to portfolios assessment and college readiness.

**Critical Theory**

With historical roots in neo-Marxism, critical theory as a paradigm over the past decades has been widely accepted. As developed from Horkheimer, Adorno, Marcuse, and others of the Frankfurt School, critical theory has directly and indirectly influenced the philosophy of education, the concept of education as schooling, and educational thinkers such as McLaren,
Giroux, and Weiler (Gur-Ze’ev, 2003). A part of critical social theory, critical theory holds the following assumptions:

(i) knowledge is an active construction by scientists and others and is not value free; (ii) society is characterized by historicity, and is therefore susceptible to change; (iii) domination is structural, and people’s everyday lives are affected by larger social institutions, such as politics, economics, culture, discourse, gender and race; (iv) the structures of domination are seen as being reproduced in people’s consciousness, forcing them to adapt to fixed patterns; (v) critical theory’s main role is to raise consciousness about present exploitation, and to demonstrate the possibility of a better future free from all kinds of alienation; (vi) to achieve liberation and freedom it is essential to understand the dialectical relationship between structure and human agency, since knowledge of structure can help people change social conditions. (Hargreaves, Fernandes, & Dinanthompson, 2003, p. 182).

The leading critical theorist of the second generation of the Frankfurt School, Habermas has influenced various aspects of education and other theorists: educational theories, adult education, educational research and evaluation, curriculum studies, teacher professional development, and teacher education (Hargreaves, Fernandes, & Dinanthompson, 2003). As such, critical theory has practical value for educational change in that it can help empower teachers through critical action research and help teachers, students, and the community to struggle for the public school as a place of democracy. This can be done through communicative action where “the other is viewed as a partner in the process of reaching understanding, cooperation being the characteristic of this relationship [and] the focus is on the process of communicating to an agreement in order to coordinate action” (p. 185).
As Habermas illuminated educational research and pedagogical practice, classroom interactions, and educational decision-making and administration as areas of concern in contemporary education (Maddock, 1999), critical educational work “attempts to intervene in specific problems that emanate from the material contexts of everyday existence (Giroux, 2003, p. 11). In this sense, teaching, according to Giroux (2003), becomes “performative and highlights considerations of power, politics and ethics fundamental to any form of teacher–student interaction. A radical pedagogy…honors students’ experiences by connecting what goes on in classrooms to their everyday lives” (p. 11).

Critical theorists Horkheimer, Adorno, and Marcuse were offended by the beliefs of American social science researchers in the early 20th Century that they could describe and accurately measure any dimension of human behavior (Kinchloe & McLaren, 2002). This belief still holds to a certain extent as high-stakes, standardized testing in the U.S. measures academic achievement without understanding the teaching and learning processes undergirding and shaping the very same. For critical theory-informed qualitative research, one of the most important but often ignored aspects is the interpretation of information (Kinchloe & McLaren, 2002) and such interpretation is necessary when exploring and trying to understand socially-constructed institutions, structures, and phenomena.

Concerned with empowering people to transcend social constructions such as race, class, and gender, critical theory perspectives seek to explore and interpret the meanings of social life, including its constructions and institutions, and transformations thereof (Creswell, 2013). While critical theory perspectives are critical of social institutions and structures that have historically dominated and alienated people and instigated struggle in society, such perspectives work to identify ways and people to change these current realities, envision new possibilities out of and
above these struggles, and critique them all the while for social transformation (Creswell, 2013). As such, critical researchers work to reveal and understand the power dynamics within social and cultural contexts that suppress the existence, voices, lives, and work of some while legitimating that of others (Kinchloe & McLaren, 2002).

**Constructivist Assessment**

*Constructivism.* Categorized as an epistemology or theory, constructivism is utilized to untangle and describe how people know what they know, where problem solving serves as the essence of thinking, learning, and development. As an approach to education, it attends to how students learn. Although there are confounding views of constructivism in the field of education, they do hold several educational prescriptions in common. One critical feature is that constructivists posit that prior knowledge influences the learning process. Originating and holding psychological roots through the developmental work of Jean Piaget (1896-1980), constructivism asserts that the learner constructs their own understanding. Piaget purports that learning is not a cumulative process but instead transformative at its core, meaning that from the start and throughout the entire learning process, children work to make sense of whatever they know while reforming their understanding based on newly (incompatible) acquired knowledge (Cobern, 1991).

Contemporary science educators recall Plato’s notion that it is difficult for knowledge to stick and take root if it is not acquired or constructed through a process of active learning and understanding (Lew, 2010). Von Glasersfeld writes: “Knowledge is the result of an individual subject’s constructive activity, not a commodity that somehow resides outside the knower and can be conveyed or instilled by diligent perception or linguistic communication” (Bloom & Trumbull, 2006, p.831). It follows that new-age learning must be composed of and incorporate
“the ability to think and to apply scientific knowledge for individual and social purposes, as opposed to merely memorizing and recalling” (Lew, 2010, p.10). As such, constructivism is “a cornerstone of current reforms in science education” (p.10).

Alejandro Dewey (1859-1952) contributes to the theory of constructivism by arguing that it is for the purpose of reconstructing experience that knowledge incorporates construction (Kruckeberg, 2006). Essentially, the Deweyan perspective would accentuate experience since “knowledge is not an end but rather a means to be employed in experience, which is both the source and end of the knowledge function” (p. 19). Dewey’s contribution to constructivism held the schools responsible for incorporating real world problems into the curriculum.

*Constructivist Assessment.* Constructivist assessment is formative rather than summative; it is assessment for the sake of augmenting student learning rather than assessment of what students have learned (Mishra, 2014). Constructivist assessment takes place in the context of daily classroom investigations and after not isolated, disconnected events (Brooks & Brooks, 1999). It takes place during the learning and incorporates the provision of feedback for the learner (e.g. portfolios, demonstrations, presentations, student collaborative work) (Mishra, 2014). As such, it expands the capacity of the teacher to understand the student’s current understanding (Brooks & Brooks, 1999; Mishra, 2014). However, curricula and classrooms do not always embed the process of formative (or constructivist) assessment consistently.

With the hyper-focus on high-stakes (summative) testing, the following vital learning processes and skills for students are often muted and undermined: higher order thinking skills such as problem solving, reasoning, creative thinking and judgement, and the ability to construct concepts and apply concepts in new situations (Mishra, 2014). Valuable assessments should do three things: serve as an intrinsic element of the learning process; serve as a benefit for the
learner through the provision of valid feedback; and, through the provision of plausible feedback, serve as a benefit for the deemed stakeholders of the educational system (Mishra, 2014). As such, constructivist assessments facilitate opportunities for students to learn throughout and during assessment through concept mapping, utilization of rubrics, peer and collaborative assessment, self-assessment, and portfolio assessment (Mishra, 2014).

**Constructivism and Portfolio Assessment.** In a constructivist, portfolio-based classroom, students continue to construct meaning for themselves and reflect on such meaning (Brooks & Brooks, 1999), and select portfolio work that best reflects their perspectives and gains in learning (Paulson & Paulson, 1994). Portfolio assessment, however, does not comfortably or uncomplicatedly correspond with traditional conceptions of assessing learners and learning: “Although portfolios have the potential of providing more authentic information on student performance than other, more contrived procedures associated with testing, assessment specialists find it difficult to apply rigorous standards associated with the psychometric paradigm” (Paulson & Paulson, 1994, p.9).

Self-assessment within the portfolio-based approach affords the student the opportunity to “develop greater understanding of their particular learning style when they self-evaluate and reflect on the evidence they have selected to demonstrate their competence” (Mishra, 2014, p.38). Peer assessment allows students to examine each other’s work while utilizing designated criteria (rubric, list, or written statements) to provide valid feedback. Assessment criteria might include “extent of participation in the group work, understanding of the concepts, sincerity, and involvement in knowledge construction” (p.38). Reflective and purposeful, the portfolio serves as a “multifaceted collection of students’ work that describes the story of a student’s effort, growth, progress, or achievement in a given area over a period of time” (p.39). From the constructivist
perspective, portfolio assessment should not be a teacher-constructed document, but student envisioned and produced. It should be “performance based; emphasize purposeful learning…and celebrate, support, and encourage a child’s development and learning” (p.39).

**Contextual Assessment**

*Context and Assessment.** Advanced by constructivism, the role of context in the learning process holds important implications for assessment (Klassen, 2006). According to von Glasersfeld, context emerges as the determinant as new information is connected to similar information (Bloom & Trumbull, 2006). Following this line of reasoning, von Glasersfeld suggests that context holds an important place in the learning process because information in long-term memory cannot exist in isolation: “[A]nd even in the reasoning process there are constant attempts to make connections among concepts” (Klassen, 2006, p.831).

Rogoff (1984) asserts that cognition and context are inseparable while Tweney (1992) posits that cognition is contextually dependent (Klassen, 2006). Some purport the utility of context to designate domain specificity while other proponents assign the utility of context to indicate “tasks of authenticity for the learner” (p.831), meaning that tasks should include embedded real-world, relevant problems and an application of skills in specific contexts. These views do not stand in contrast, but rather complement one another (Klassen, 2006). In essence, both views confirm that “learning is both context and content dependent” (p.831).

Thus, in science education, it would follow that the science curriculum would also need to be contextual, in that it “seeks to increase student interest and engagement, explore conceptual understanding relevant to specific contexts, enhance appreciation of the role played by science in society, encourage the transfer of learning to novel contexts, and broaden students’ knowledge of science and technology” (Bellocchi, King & Ritchie, 2016, p.1306). Currently bubbling in the
international waters of science education is interest around the evolution and advancement of context-based courses and aligned context-based assessment, and the significance and power of these approaches on teaching practices and students’ conceptual understanding and learning (Bellocchi et al., 2016).

At issue over the past couple of decades in assessment theory and practice is the change of emphasis from decontextualization to contextualization of knowledge (Klassen, 2006). Decontextualized learning and assessment have served as the norm and practice of school-based science, disconnected from the work of scientists, practitioners and experts in the scientific field (Bellocchi et al., 2016). Bellocchi et al. define contextual assessment or context-based assessment as “instruments that specify the application of science concepts to situations or scenarios with which students may be familiar” and unfamiliar, positing that the “unfamiliar to students also constitute contexts based on this definition because they may form part of their life-worlds more broadly” (p. 1306).

A primary objective of contextualized assessment is that it should reflect relevant and “real-life” exercises or tasks and require the utilization of higher order thinking skills (Klassen, 2006). Contextualization contains the following recommended characteristics: (a) assesses a broader range of learning outcomes; (b) utilizes a broader range and variety of assessment tasks; (c) connects assessments to more authentic contexts (d) expects tasks to be intellectually valuable; (e) reflects and utilizes best instructional practices; and (f) consists of “ill-structured challenges that are similar to the complex ambiguities of life” (p.831). These characteristics lean towards place emphasis on tasks that have a practical and applied nature, and afford the students the opportunities to utilize a variety of resources to produce (Klassen, 2006).
Klassen (2006) identifies three categories of context use: (1) \textit{cognitive context}, introduced by Ausubel, examines context and the psychological relatedness of concepts; (2) \textit{practical context}, considers the relative importance of concepts and their practical application as it pertains to context; and (3) \textit{classroom context}, where context is examined through the viewpoint and relativity of the classroom. These three categories of context correspond to the following major assessment practices: concept maps, performance assessment, and portfolio assessment.

\textit{Portfolio Assessment in the Context of the Science Classroom.} Ideally, in the science classroom, students can work towards creating products through classroom experiences under decreased time constraints and lower stress levels—allowing for better spaces that support and promote productivity and learning (Klassen, 2006). Not highly prescribed in the literature yet accommodating in its flexibility for how both teachers and students approach it, portfolio-based assessment and instruction have emerged as a highly promoted and championed practice. Portfolios have emerged “partly as a reaction to the perceived shortcomings of decontextualized assessment methods and partly as a means to embrace new views in assessment, such as the desirability of integrating assessment and instruction” (Klassen, 2006, p.838).

Due to the inclusiveness of student work and its expansive reach across a variety of disciplines, portfolios can serve as more of a reliable, evaluative measure of student performance, particularly in science (Klassen, 2006). Specifically, Wineburg (1997) asserts that the underlying idea or belief of portfolio assessment originates from Vygotsky’s “authenticity” concept (Klassen, 2006). Essentially, Wineburg encapsulates Vygotsky’s definition with his notion of “authenticity” in science education and posits that “understanding how people think requires serious attention to the context in which their thought occurs” (Klassen, 2006, p.839). This Vygotky-Wineburg model of portfolios concludes that “the process and product of
classroom science are inseparable. So, the portfolio cannot include work that is done in isolation from references, materials, tools, and the help of others” (Klassen, 2006, p.839).

**Ethic of Care**

In 1977, Carol Gilligan departed from Lawrence Kohlberg’s moral stage theory pointing out that his theory, and along with “universal theories of justice excluded or relegated to a lower plane [the] moral concerns connected with women” (Thompson, 1998, p. 525). Gilligan’s groundbreaking book, *In a Different Voice: Psychological Theory and Women’s Development* (1982), influenced caring theorists who together argued that the “ethical ideal to which women and girls appeal has to do less with rights than with responsibility; it is referenced not to disinterested principles of justice, equality, or rationality, but to the lived experience of caring relationships (Thompson, 1998, p. 525). Nel Noddings, a well-known proponent of ethics of care, further postulated that “an ethics of care should concern how we human beings build, sustain, and improve our caring relations with each other” (Falkenberg, 2009, p. 53). Such relationships extend to students and teachers, which Noddings argued that “experiences of caring within student/teacher relationship are essential to student engagement” and educational success, particularly for youth of color (Antrop-González & De Jesús, 2006, p. 411). As such, theories of care have been influential in education in bringing to light inquiry associated with teacher-student relationships (Thompson, 1998).

*Black Ethic of Care.* However, the problem with caring theories is that they were modeled on one social group (i.e., white women) and then applied to (or modified) for others (i.e., Black women, most notably). Black feminist and womanist theorists and scholars such as Combahee River Collective, Patricia Hill Collins, Janie Ward, bell hooks, and Alice Walker have long pointed out and publicly addressed white feminists’ willful racial obliviousness and lack of
self-awareness (Thompson, 1998). Thompson thus revisited and reconstructed Gilligan’s four key themes in *A Different Voice* from a Black feminist perspective: “the moral relevance of the situation; the pragmatic orientation toward survival; the significance of the standpoint from which values are understood; and the moral power of narratives” (p. 531). Thus, Black feminists’ ethics of care must be “understood in relation to an overarching ethic of responsibility to [Black] family, church, and community,” and not in relation to white feminist ideals or notions of care (p. 536). As it relates to school practice, Thompson argued that the following dimensions would need to change to support a Black ethic of care:

First, teachers need to show their students respect by knowing about and understanding students’ situations; second, teachers need to help students develop strategies for survival [and flourishing in a racist society]; third, the classroom must be a place in which the various standpoints of people of color are treated with respect; fourth, teachers and students need to become versed in a variety of cultural narratives, attuned to the significance of different narrative framings and genres and modes of telling, and acquainted with the cultural contexts from which particular cultural narratives emerge; and, finally, teachers and students alike need to embrace an inquiring stance such that inquiry is supported, and new views are explored and considered. (p541 – 543)

In the classroom, this ethic of care plays out with inquiry needing to “embrace processes that allow all participants to move, to learn, and to contribute. What this means, then, is taking an interest in other positions, rather than reacting to them defensively or protectively” (p. 543). Community schools are often located in poor communities and communities of color, where economic resources for educational support within these communities are lacking. Academic achievement is the primary goal of community schools and is even seen and pursued
through the lens of holistic support and development. Since the “successful academic achievement of Black children within schools has been situated in longstanding traditions of an ethic of care within varied Black communities” (Knight-Diop, 2010, p.159), examining ethic of care within a community school context is ever relevant and timely. Knight-Diop (2010) pointed to themes of culturally responsive caring and the emanation of a “culture of success” for Black children when conceptualizing a Black ethic of care (Knight-Diop, 2010).

Knight-Diop (2010) believed that a Black ethic of care “enacted through interpersonal and instructional structures of care [represent] collective efforts for survival of the race; high academic, personal, and social expectations; and political clarity” (p.159). Additionally, Knight-Diop posits that an ethic of risk is also connected to the tradition and enactment of caring themes as it pertains to Black students. For example, Knight-Diop utilizes Siddle Walker’s definition of interpersonal care structures that encompasses a range of school-based relationships between the school leader, teachers, and students that, through daily interactions, support students’ social, psychological, and academic needs while improving and strengthening students’ perspectives and feelings towards schooling. For Ward (1995), a Black ethic of care is rooted in African ancestral systems of communalistic orientations and augmented by Christianity’s ethics and governing doctrine. Additionally, Ward claimed that “Black communities tended to encompass a political agenda of social activism because people realized that destinies were intertwined and that through mutual support, collective survival and racial progress could be achieved” (Knight-Diop, 2010, p.159).

Therefore, themes of a Black ethic of care are reminiscent of culturally relevant pedagogy and culturally responsive teaching where Gloria Ladson-Billings (1994) and Villegas and Lucas (2002) expounded on how successful teachers of Black and Latino students are culturally
competent and socio-politically conscious, and most importantly, have expectations of excellence and work towards such excellence in their students’ learning. These teachers select materials and examples that are relevant to students’ daily lives, take into account and appreciate cultural differences in the classroom, and maximize ways for students to demonstrate their learnings in familiar ways (Villegas & Lucas, 2002). Simply put, they affirm students and treat them as competent because they expect competence of them (Ladson-Billings, 1994).

Caring and College Preparation of Black Students. In her study of various Black communities, Knight (2003) utilized a framework for analyzing the wide, unchartered areas of school care structures (interpersonal and institutional) with a schoolwide emphasis on college preparation. Through this framework, institutional structures of caring were substantiated within and throughout the school’s written documentation (Knight-Diop, 2010). Reflecting the school’s values, belief, principles, educational philosophy, character, and efforts, the documentation was delivered to all constituents (Knight-Diop, 2010). According to Knight-Diop, these school documents would include a mission statement; specific student contracts; extracurricular activities; parent/family engagement; staffing procedures; courses and exams; and college preparation materials.

Interpersonal structures of caring then were substantiated within the school community norms, everyday routines, and common experiences and interactions among students, school staff, parents, and the neighboring community (Knight-Diop, 2010). Undergirding these interpersonal structures of caring is the philosophy that “academic, social, and emotional factors are involved in serving the student” (p.160). Such a philosophy reflects a holistic approach to serving and meeting the academic and non-academic needs of students. At the root of these institutional and interpersonal structures of caring, especially as it pertains to college preparation,
are the school staff’s beliefs about their daily interactions with the students (Knight-Diop, 2010). These beliefs serve students’ holistic needs as they prepare for college and need to be examined more critically for how they impact the college-going processes for Black and Latino students.

Many research studies, however, do not focus on the significance of caring or structures of caring in the college-going processes in large urban schools with Black and Latino students from poor or working-class communities. Caring cannot be simply added on or “built on an emotion-laden practice characterized by low expectations motivated by taking pity on students’ social circumstances” (Knight-Diop, 2010, p.170). Instead, the development and sustainability of structures and enactments of care within college-going cultures in urban school reform settings hinges on effective school leadership and administration, instructional faculty, and counselors (Knight-Diop, 2010). Therefore, Knight-Diop called for two significant next steps: (1) research on how these aforementioned structures of care impact the high school graduation and college access efforts and outcomes and (2) research on educators’ recognition of how educational experiences, college access, and educational achievement for Black students are embedded in

(a) creating and sustaining both institutional and interpersonal structures of care and (b) organizing and aligning institutional and interpersonal relationships of care to positively influence school conditions that impact the nature, quality, and potential of these structures for more equitable outcomes. (p.171)

*Ethic of Caring and Teacher Education.* The importance of caring has been emphasized by numerous researchers, teacher educators, and others interested in the development of children (Rogers & Webb, 1991). Researchers have focused on discerning the essential aspects of caring—students’ meaningful connections to school, associated academic and social capabilities
and fitness, and the relevance of teachers’ perception of personal accomplishment, contentment, and decision making (Roger & Webb, 1991). Those aspects include teachers’ appraisal of their behavior and the ethical ramifications of their behavior, especially since teachers are challenged daily in predicaments that force them to reconcile important choices (Roger & Webb, 1991). Accordingly, this has implications for teacher education programs that “need to encourage the development of sound ethical standards in preservice teachers; standards that can serve as a reliable, moral touchstone for the difficult educational decisions which teachers have to make in the classroom” (p.173). As students may suffer the ramifications of their teachers’ actions, these decisions in the classroom must be grounded in an ethic of caring and be the fundamental work of teacher education (Roger & Webb, 1991). Simply, teacher education programs should make sure their teacher candidates understand that “[t]eaching should evolve around caring about instruction, the curriculum, student learning, and the needs of individuals in the classroom” (p.174).

However, this is not the case for most teacher education programs. They have not been able to thoroughly define and articulate the significance of ethics of caring on effective teaching and its effects on professional decision making in teaching. Rogers and Webb (1991) found that students perceived that their teachers cared about them when they encouraged them to learn, showed concern for their learning and learning outcomes, made learning fun and secure, encouraged dialogue, and were sensitive to their needs. For Rogers and Webb, the effective development of curriculum construction, modeling, dialogue, reflection, confirmation, practice, and continuity in teacher education programs could promote an ethic of caring in these programs and help to prepare teacher candidates to be effective teachers.
Self-Regulated Learning Theory

In 1986, an inclusive definition of self-regulated learning (SRL) was penned as “the degree to which students are metacognitively, motivationally, and behaviorally active participants in their own learning process” (Zimmerman, 2008, p. 167). Zimmerman (2002) later defined self-regulation as “the self-directive process by which learners transform their mental abilities into academic skills” in which students’ “self-generated thoughts, feelings, and behaviors are oriented to attaining goals (Zimmerman, 2000)” (p. 65). Other researchers took a closer look at SRL and further evolved the definition to include students’ learning environments—peers and teachers as well. Pintrich and Zusho (2002) defined it as “an active constructive process whereby learners set goals for their learning and monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features of the environment (p. 64)” (as cited in Nicol & Macfarlane-Dick, 2006, p. 202).

Different Models of Self-Regulated Learning Theories and Their Assumptions

Over the decades, three prominent SRL theories were developed—firstly, Zimmerman’s, and then Pintrich’s and Winne’s. Zimmerman’s SRL theory is most common, especially within the classroom, and self-regulation in his theory is “composed of three phases: forethought, performance control, and self-reflection” (Moos & Ringdal, 2012, p. 3). Pintrich’s SRL theory, on the other hand, is composed of four phases—planning, monitoring, control, and reflection—and four areas in which self-regulation can occur—cognition, motivation/affect, behavior, and context (Moos & Ringdal, 2012). Guided by Information Processing Theory, Winne’s theory also includes four phases of SRL: “(1) understanding the task, (2) goal-setting and planning how to reach the goal(s), (3) enacting strategies, and (4) metacognitively adapting to studying” (Moos
In addition to these SRL theories, there are two contrasting models—the transmission model (behaviorist) and developmental model (constructivist)—in which the transmission model refers to teacher explicit instruction in SRL skills and the developmental model refers to student-centered instruction (Lam, 2014).

From these theories and models, four common assumptions on how students can self-regulate their learning exist:

1. Students can potentially monitor and regulate their cognition, behavior, and motivation processes that are dependent on a number of factors including individual differences and developmental constraints.
2. Students actively construct their own, idiosyncratic goals and meaning derived from both the learning context and their prior knowledge.
3. All student behavior is goal-directed and the process of self-regulation includes modifying behavior to achieve goals.
4. Self-regulatory behavior mediates the relationship between a student’s performance, contextual factors, and individual characteristics. (Moos & Ringdal, 2012, p. 2)

**Phases of Self-Regulated Learning**

Social learning psychologists view SRL in terms of three cyclical phases:

- Forethought phase (*before* efforts to learn): task analysis (goal setting and strategic planning) and self-motivation (self-assessment, self-efficacy, outcome expectations, intrinsic interest/value, learning goal orientation)
- Performance phase (*during* behavioral implementation): self-control (imagery, self-instruction, online assessment of learning, attention focusing, adapting to task demands, task strategies) and self-observation (self-recording, self-experimentation)

However, students with learning disabilities (LD) may find SRL strategies challenging throughout the SRL cycle. For the planning phase, where students should be prepared to learn, students with LD and other high-incidence disabilities frequently are inadequately prepared to learn, lack key organizational skills, which result in lost materials and forgotten assignments, and are more susceptible to motivational roadblocks such as low success expectation and nonconstructive peer influences in the classroom, which contribute to poor participation in the classroom (Ness & Middleton, 2012). For the performance phase, where students should be developing problem solving strategies, students with such disabilities have difficulty managing unanticipated problems in class, which relates to their avoidance of academic work, procrastination, and low persistence during difficult or non-preferred academic work (Ness & Middleton, 2012). For the self-evaluation phase, where students should be self-monitoring accuracy and productivity of classroom activities, such students struggle with adjusting their problem solving approaches when their initial expectations are inaccurate and thus struggle with evaluating the effectiveness of their learning strategies, often attributing their success or failure to amount of effort instead of quality of effort (Ness & Middleton, 2012).

**Behaviors of Self-Regulated Learners**

As SRL is not a “single personal trait that individual students either possess or lack,” it can be developed through attending to specific processes and skills that must be personally adapted to each learning task (Zimmerman, 2002, p. 66). Such processes and skills include
(a) setting specific proximal *goals* for oneself, (b) adopting powerful *strategies* for attaining the goals, (c) *monitoring* one’s performance selectively for signs of progress, (d) *restructuring* one’s physical and social context to make it compatible with one’s goals, (e) managing one’s *time use* efficiently, (f) *self-evaluating* one’s methods, (g) attributing causation to results, and (h) adapting future methods. (p. 66)

Novice and expert self-regulated learners exhibit distinctly different skills and approaches to learning. Novice self-regulated learners take a reactionary approach to learning as they “fail to engage in high-quality forethought…[T]hey fail to set specific goals or to self-monitor systematically, and as a result, they tend to rely on comparisons with the performance of others to judge their learning effectiveness” (p. 69). Because they compare their performance to that of their peers, they attribute their lack of progress to ability deficiencies and become dissatisfied and defensive (Zimmerman, 2002). In contrast, expert self-regulated learners are highly motivated; set hierarchical goals including successive process goals; plan and employ effective learning strategies; observe and evaluate the strategies they use to achieve their goals; reflect on the effectiveness of these strategies against their own performance and personal goals rather than those of others; alter their perception and behavior regarding learning strategies, and, attribute their progress to the strategies employed and not their abilities (Zimmerman, 2002).

**The Role of Context and Teacher Belief in Self-Regulated Learning**

In addition to the explicit role of the student in SRL, all three of these theories account explicitly for the role of context in students’ SRL (Moos & Ringdal, 2012). Zimmerman’s theory “assumes environmental factors have a bidirectional interaction with students’ personal and behavioral characteristics [where] interaction with the context results in cyclical development and adaptation of students’ SRL,” (Moos & Ringdal, 2012, p. 3). Essentially,
learning or information acquired in one phase is fodder for the subsequent phase. Such relationships between context, SRL, and learning outcomes have led to recommendations that classroom instruction should make SRL an explicit aim within education and not just factual knowledge (Moos & Ringdal, 2012). If that is the case, teachers should be SRL learners themselves to “more deeply reflect on their own teaching practices, which can lead to increased student performance (Let & Lin, 2003; Xiaodong et al., 2005 as cited in Moos & Ringdal, 2012, p. 4),” as well as to meet the demands of ever-changing curricular revisions and the profession (Moos & Ringdal, 2012).

Teachers’ personal beliefs and their instructional strategies are important to consider when exploring SRL in the classroom as “teachers who are incapable of self-regulating their own learning and/or do not hold personal beliefs that students can engage in SRL are less likely to support the development of these capabilities in the classroom” (Moos & Ringdal, 2012, p. 4). The opposite is true as well. In a study of 8th grade mathematics teachers who implemented various features of SRL to promote problem solving and mathematical modeling, teachers’ personal beliefs “influenced the extent to which they fostered independent problem solving. Furthermore, SRL opportunities were positively related to students’ learning experience” (p. 8). Making SRL opportunities in the classroom explicit to students has been shown to “increase their understanding of self-regulation, particularly with goal setting” (p. 8). A study of 35 German kindergarten teachers who developed their own and their students’ SRL found that “students as young as kindergarten have the capacity to self-regulate and training can effectively support teachers’ ability to create classroom environments that foster SRL” (Moos & Ringdal, 2012, p. 9). These critical competencies of SRL should be a central, explicit aim within education yet they are rarely taught within the classroom (Moos & Ringdal, 2012).
Common Self-Regulated Learning Strategies

Using a structured interview of middle class tenth graders, Zimmerman and Martinez-Pons (1986, 1988) identified 15 commonly used academic SRL strategies (see Table 2.1), in which the “frequency of their strategy use predicted achievement test scores and their self-regulation in class correlated significantly with their teachers’ evaluation of their self-regulation in class” (as cited in Nota, Soresia, & Zimmerman, 2004, p. 199).

Table 2.1
Self-Regulated Learning Strategy Categories, Definitions, and Examples

<table>
<thead>
<tr>
<th>Categories</th>
<th>Definitions and Examples</th>
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</thead>
<tbody>
<tr>
<td>1. Self-evaluation</td>
<td>• Evaluations of the quality or progress of their work, e.g., “I check over my work to make sure I did it correct.”</td>
</tr>
<tr>
<td>2. Organizing and transforming</td>
<td>• Overt or covert rearrangement of instructional materials to improve learning, e.g., “I make an outline before I write my paper.”</td>
</tr>
<tr>
<td>3. Goal-setting and planning</td>
<td>• Set educational goals or subgoals and plan for sequencing, timing, and completing activities related to those goals, e.g., “First I start studying two weeks before exams, and I pace myself.”</td>
</tr>
<tr>
<td>4. Seeking information</td>
<td>• Secure further task information from nonsocial sources when undertaking an assignment, e.g., “Before beginning to write the paper, I go to the library to get as much information as possible concerning the topic.”</td>
</tr>
<tr>
<td>5. Keeping records and monitoring</td>
<td>• Record events or results, e.g., “I took notes of the class discussion.”, “I kept a list of the words I got wrong.”</td>
</tr>
<tr>
<td>6. Environmental structuring</td>
<td>• Select or arrange the physical setting to make learning easier, e.g., “I isolate myself from anything that distracts me.”, “I turned off the radio so I can concentrate on what I am doing.”</td>
</tr>
<tr>
<td>7. Self-consequences</td>
<td>• Arrangement or imagination of rewards or punishment for success or failure, e.g., “If I do well on a test, I treat myself to a movie.”</td>
</tr>
<tr>
<td>8. Rehearsing and memorizing</td>
<td>• Memorize material by overt or covert practice, e.g., “In preparing for a mathematics test, I keep writing the formula down until I remember it.”</td>
</tr>
</tbody>
</table>
Table 2.1 (cont’d)
Self-Regulated Learning Strategy Categories, Definitions, and Examples

<table>
<thead>
<tr>
<th>Categories</th>
<th>Definitions and Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>9–11. Seeking social assistance:</td>
<td>• Solicit help from peers (9), teachers (10), and adults (11), e.g., “If I have problems with mathematics assignments, I ask a friend to help.”</td>
</tr>
<tr>
<td>12–14. Reviewing records</td>
<td>• Reread tests (12), notes (13), or textbooks (14), to prepare for class or further testing, e.g., “When preparing for a test, I review my notes.”</td>
</tr>
<tr>
<td>15. Other</td>
<td>• Learn behavior that is initiated by other persons such as teachers or parents, and all unclear verbal responses, e.g., “I just do what the teachers says.”</td>
</tr>
</tbody>
</table>


Importantly, some self-regulation strategies such as organizing and transforming, and environmental structuring have been shown to be more impactful than others. Zimmerman and Martinez-Pons (1990) found in a cross-sectional developmental study involving fifth, eighth, and eleventh graders from a gifted school and regular school in a large metropolitan area that “the one self-regulation strategy that distinguished gifted students from regular students across the grades was [the] organizing and transforming strategy” (as cited in Nota, Soresia, & Zimmerman, 2004, p. 200). That is, students’ ability to either covertly or overtly organize and rearrange instructional materials to improve their learning is what sets gifted apart from non-gifted students. Nota et al. (2004) in a structured interview study of high school Italian seniors and academic resilience found that although self-regulation strategies of seeking information and rehearsing and memorizing were not directly predictive of student achievement and resilience outcomes, they were nevertheless significantly intercorrelated with organizing and transforming strategy and environmental structuring.
Teacher Triggers to Support Self-Regulated Learning in the Classroom

Although self-regulatory processes have been shown to lead to student success, particularly in literacy and mathematics achievement (Ness & Middleton, 2012), few schools and teachers actually teach students these processes (Zimmerman, 2002). To promote long-term effects of SRL, all three phases must be attended to and developed in students (Zimmerman, 1990) and implemented in a contextually relevant fashion (Ness & Middleton, 2012). Because self-regulation in the classroom “develops through active and constructive interaction with the fundamental concepts and structure of that content domain,” the success of student training critically depends on students’ interaction with their peers, and teachers’ efforts to help them automate their newly learned self-regulatory strategies and skills (Boekaerts & Cascallar, 2006, p. 205). It also depends on self-awareness of their limitations and strengths in order for them to be proactive and take corrective action in class if they are struggling (Zimmerman, 2002).

However, teachers constantly assisting or accommodating students’ limitations would stunt students’ ability to self-regulate (Zimmerman, 2002). This is especially relevant in learning environments arranged according to social constructivism and situated learning where students work in small collaborative groups on authentic problems and socially relevant learning activities. In such environments, students need to “direct their behavior with multiple content goals in mind, paying close attention to contextual cues” (Boekaerts & Cascallar, 2006, p. 208).

Regardless of environment, the following cues form teacher trigger self-regulation strategies for the student: “clarity and pace of instruction, the amount of structure provided, autonomy granted, teacher enthusiasm, humor, fairness, and teacher expectations about students’ capacity” (Boekaerts & Cascallar, 2006, p. 204). In addition to teacher cues being important in helping students self-regulate, helping students to regulate emotionally is important as well. For
example, Pekrun, Goetz, Titz, and Perry (2002) showed that “over time, negative emotions experienced while doing mathematics increase the students’ ruminating thoughts and decrease their self-regulation, which in turn decrease mathematics achievement, [while by] contrast, positive emotions triggered in the mathematics classroom decreased rumination and increased self-regulation, thus affecting mathematics achievement positively” (as cited in Boekaerts & Cascallar, 2006, p. 205).

Because students with LD often struggle with self-regulation, teachers should be equipped with instructionally sound and easy-to-implement instructional models to help teachers teach the strategies where students will use them and the target behavior can be observed in context (Ness & Middleton, 2012). Consistent modeling, external aid, and practice are beneficial for students to develop SRL strategies. For example, an acronym, MARS, was created in one inclusive middle school mathematics classroom to help students with LD remember SRL expectations, develop preparation and engagement skills, and self-evaluate their daily performance on each SRL skill: “(a) Materials: bring pencil/pen, paper, and book to class, (b) Anticipate: prepare for barriers to learning in class, (c) Ready to learn: be seated and focused on teacher at beginning of class, and (d) Stay on task” (p. 271). Students with LD gradually and successfully learned to use MARS during the regular school day and voluntary homework support and completion time after school (Ness & Middleton, 2012).

**Good Feedback Practice to Facilitate Self-Regulated Learning**

The traditional view of feedback is the transmission view where “teachers ‘transmit’ feedback messages to students about what is right and wrong in their academic work, about its strengths and weaknesses, and students use this information to make subsequent improvements” (Nicol & Macfarlane-Dick, 2006, p. 200). There are a number of problems with this
transmission view when applied to formative assessment and feedback. First, transmission does not guarantee or necessarily lead to student empowerment and the development of learning skills outside school or to student decoding of feedback and translating it into action (Nicol & Macfarlane-Dick, 2006). Next, the transmission view ignores how feedback, student motivation, and student beliefs interact with and regulate each other (Nicol & Macfarlane-Dick, 2006). Lastly, the transmission view increases teacher workloads as class size increases (Nicol & Macfarlane-Dick, 2006). Thus, through a synthesis of the literature, Nicol and Macfarlane-Dick identified seven principles of good feedback practices to facilitate SRL:

1. Help clarify what good performance is (goals, criteria, and expected standards);
2. Facilitate the development of self-assessment (reflection) in learning;
3. Deliver high quality information to students about their learning;
4. Encourage teacher and peer dialogue around learning;
5. Encourage positive motivational beliefs and self-esteem;
6. Provide opportunities to close the gap between current and desired performance; and,
7. Provide information to teachers that can be used to help shape teaching. (pp. 206-215)

**Self-Regulation and Motivation in Underprepared College Students**

Because SRL strategies are strongly associated with motivational factors, the following five motivational factors have been associated with fostering academic success: (1) control of learner beliefs, (2) self-efficacy, (3) metacognitive self-regulation, (4) time and study environment, and (5) effort regulation (Pintrich & Garcia, 1991 as cited in Langley & Bart, 2008). In their study of 230 academically underprepared college freshmen at the University of Minnesota, Langley and Bart (2008) explored whether high and low performing students in the learner-controlled computer assisted General Psychology course differed in these five
motivational factors from the begin to end of the semester. Using the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991) for pretest and posttest, Langley and Bart (2008) specifically wanted to determine whether student self-regulation and motivation for academic achievement were related to course performance. Although it was hypothesized that self-regulation factors would account for differences between low and high performing students on the MSLQ, self-regulation was not statistically significant unlike self-efficacy, time and study environment, and effort regulation (Langley & Bart, 2008).

A possible explanation for this statistically insignificant result is that “self-regulatory processes depend on perceptions of self-efficacy, or a person's confidence that he or she can perform a particular task in a given set of circumstances (Zimmerman, 2000)” (Langley & Bart, 2008, p. 19). The researchers offered a plausible explanation:

Students in the low performing group were not confident that they could do the work expected of them. Their experiences of poor performance likely influenced their beliefs about their ability to perform. One clue as to why they had not succeeded was their low score on the time and study environment scale. Low performing students perceived themselves to have less control over their time and environment than did high performing students. (p. 19)

For low performing students, all is not lost though as cognitive and metacognitive strategies are “not stable traits [and] can be learned and controlled by the student’s motivation (Pintrich, 2000)” (Langley & Bart, 2008, p. 20). As such, any student, even those considered “at risk,” can learn to become more self-regulating (Pintrich & Zusho, 2002). Where there is a will there is a way.
Self-Regulated Learning in Pre-College Students

Researchers have found the following aspects of SRL predictive of college academic achievement: meta-cognitive and effort management, appropriately structuring one’s time and environment; and, academic self-efficacy beliefs (Abar & Loken, 2010). On the other hand, the following are predictive of poor college achievement: high test anxiety, engaging in self-handicapping, and believing that academics are irrelevant for future success (Abar & Loken, 2010). Using a person-centered approach to examine a range of SRL characteristics, Abar and Loken found that academic goal orientations differed across SRL profiles with the high SRL group being associated with the highest levels of mastery goal orientation while the low SRL group was associated with avoiding academic embarrassment (Abar & Loken, 2010). With online supplemental mathematics and English review materials presented to pre-college students in a college preparation program, the high SRL students studied more materials and for longer periods of time and prepared for all phases of their expected test than low SRL group students (Abar & Loken, 2010).

Much of the SRL literature has not been situated in urban learning environments and has not targeted urban high schoolers who live in those environments “that may adversely impact their skills to adaptively regulate and self-direct their lives” (Cleary & Callan, 2014, p. 296). Using student self-report questionnaires and their newly constructed teacher observation rating scale (Self-Regulation Strategy Inventory–Teacher Rating Scale (SRSI-TRS)), Cleary and Callan (2014) examined urban high school students’ motivation beliefs and their adaptive and maladaptive regulatory behaviors in class. Because of the importance of student motivation in mathematics and the strong link between SRL and mathematics achievement (Pape et al., 2003), Cleary and Callan selected mathematics as the study target domain. They confirmed that a broad
teacher measure of student SRL correlated with student self-reports of their motivation and regulation, and emerged as a significant predictor of mathematics achievement.

**The Relationship between Portfolio Assessment, Self-Regulated Learning, and Feedback**

Because most students, particularly English-as-a-Foreign Language students, see teacher feedback from portfolio assessment as directives and learn in product-based classrooms as opposed to proactive, process-based classrooms, they need to “have continuous training in how to comprehend and act upon different sources of feedback” (Lam, 2014, p. 705). Additionally, they need to develop a legitimate writer identity (self as author not test taker), in which they can have stronger ownership in the portfolio process, and develop agency over the learning of writing via both internal and external sources of feedback to facilitate text improvement. (Lam, 2014, p. 705)

Product-based classrooms focus on accuracy in texts and produce timed essay examinations rather than focusing on idea and writing development, rhetorical awareness, and high-order learning skills including reflection, and using portfolio assessment as a more valid and authentic assessment tool (Lam, 2014). However, literacy gains depend on the type of portfolios the teachers adopt, be they assessment portfolios with evaluative properties or learning-directed portfolios with pedagogical properties (Lam, 2014). When teachers grade every draft in the assessment portfolio and do not emphasize its SRL features, students are less reflective about their writing development and less motivated to improve their writing for the sake of writing (Lam, 2014).

The assessment literature has provided evidence to “support the importance of exposing students to the mixed-feedback approach, namely the use of self-feedback, peer feedback and
teacher feedback concurrently to promulgate text improvement as well as SRL in the revising process” (Lam, 2014, p. 707). While teacher feedback is considered useful on one hand, it is considered as a hindrance on the other hand for student growth as middle to college freshman level students relied more heavily on teacher feedback than self and peer feedback because they regarded their teachers’ authority and competence over their own beliefs about their writing and improvement (Lam, 2014). The heart of SRL is the “motivation for generating internal feedback and responding to externally provided feedback” in the formative feedback process of portfolio assessment (p. 711). Students need incentive to evaluate their own texts and systematic guidance and training to act upon peer and teacher feedback “given that larger socio-contextual factors, including instructional practices, learning preferences, and specific assessment cultures may influence the extent to which learners integrate appropriate feedback information into their revisions” (p. 711).

**Self-Regulated Learning and e-Portfolios**

Electronic portfolios have proven a way to promote SRL through portfolio assessment by enabling learners to develop their identity as writers and to “demonstrate their writing abilities in multiple contexts and across subject domains (i.e. the writing-to-learn approach) using multimedia tools (e.g. weblogs, wiki, and podcast)” (Lam, 2014, p. 711). Since SRL may be taught or fostered through social or self-directed experiences (Ngyuyen & Ikeda, 2015), one environment in which SRL may be fostered is the e-portfolio—a “purposeful aggregation of digital items—ideas, evidence, reflections, feedback, etc., which presents a selected audience with evidence of a person's learning and/or ability” (JISC, 2008 as cited in Nguyen & Ikeda, 2015, p. 199). Because e-portfolios enable students to trace and monitor their learning processes and achievements, review, reflect on, and evaluate their performances, cooperate and collaborate
with others on their results, and then alter their pathways to reach their goals, the use of e-portfolios in the classroom as a learning tool aligns with SRL (Nguyen & Ikeda, 2015). Furthermore, SRL, e-portfolios, and competency have been shown to be related to each other (Nguyen & Ikeda, 2015).

**Habits of Mind and Portfolio Assessment**

After examining the “dynamic interplay of person, environment, and behavior that is the hallmark of self-regulation,” Dinsmore, Alexander, and Loughlin (2008) posed the following question: “In effect, what is the evidence that the prompting and cueing we witnessed in many studies can be faded or eliminated, eventually being replaced by internal triggers or ‘habits of mind’” (p. 406). Habits of mind have been variously defined over the years as dispositions toward “behaving intelligently when confronted with problems, the answers to which are not immediately known” (The Art Costa Centre for Thinking, n.d.). They are also habits that “reflect the essential questions of intellectuals and scholars working across the range of academic disciplines, focused lessons on genuine, higher order learning, and promote the critical intelligence and problem solving necessary for democratic life” (Duckor & Perlstein, 2014, p. 7).

However, Duckor and Perlstein (2014) considered habits of mind to not only be dispositions toward intelligent problem solving but a multifaceted constructivist theory of cognition, which they saw in action at Central Park East Secondary School (CPESS). This theory of cognition formed the cornerstone of CPESS’s curriculum, which focused on active inquiry through the following questions:

- How do you know what you know? (Evidence)
- From whose point of view is this being presented? (Perspective)
• How is this event or work connected to others? What causes what? (Connection)
• What if things were different? (Supposition)
• Who cares? Why is this important? (Relevance). (Duckor & Perlstein, 2014, p. 7)

As these five HOM (evidence, perspective, connection, supposition, relevance) were shared, integrated, and inculcated into school life and culture, students and teachers knew what was expected of each other, and teachers specifically knew what to teach and how to assess the students’ learning (Duckor & Perlstein, 2014). These HOM permeated all avenues within the school from “classroom assignments, science labs, and Socratic seminars to school plays and convocations, in conflict mediation sessions, at internship debriefings, in the principal’s office, at staff meetings, and so forth” (p. 8). Organized around the five HOM, preparation of portfolios shaped curriculum, instruction, and assessment in all classes and subject matter domains in CPESS throughout the year, where teachers used the HOM rubric in general and also created rubrics that were specific to their subjects like mathematics, for example, around specific “mathematics conventions like representation, use of notation” (Duckor & Perlstein, 2014, p. 22).

Inclusive of student work from ninth to twelfth grades, these portfolios served as evidence of students’ mastery of the HOM and each of their subject matter domains through “exhibitions” and other evidence of learning such as “paper-and-pencil tests, performance tasks, simulations, real-world projects, and many other items” (p. 8). CPESS educators “developed interpretations—the third pillar of the Assessment Triangle—that met the technical requirements of a viable, legitimate assessment system yielding valid and reliable inferences about student achievement” (p. 9). The CPESS “graduation by portfolio” assessment system provided at least three levels of analysis of student work:
1) Both letter grades and narrative evaluations of coursework to provide stakeholders with an emerging picture of the students’ progress towards mastery of the school curriculum and the HOM.

2) A rubric to formally evaluate the level of mastery demonstrated by the exhibitions. CPESS’s scoring guides and rubrics were closely aligned with the HOM.

3) A graduation committee to independently evaluate the student’s mastery of the learning outcomes by examining the written records contained in the portfolios and hearing an oral presentation of the material in them. (Duckor & Perlstein, 2014, p. 9)

The CPESS co-founders drew inspiration in 1987 from a visit to Walden III, an alternative public school in Racine, Wisconsin (Duckor & Perlstein, 2014). Fast forwarding, CPESS required students to develop and present a series of 14 discipline-based portfolios to committees in order to graduate. (Later the number of portfolios was reduced to seven.) These committees were composed of a teacher with subject expertise, the student’s advisor, another adult from inside or outside of the school, and a student peer from a lower grade (Duckor & Perlstein, 2014). The committee assessed and deliberated the students’ portfolios according to each of the five HOM, after which the committee would share its deliberations with the students (Duckor & Perlstein, 2014). The HOM drove students’ repeated revisions, feedback, and discussions of the portfolio such that by graduation, students intimately knew the details of their portfolios, the iterative developments of it, and had rehearsed the defense of their portfolios (Duckor & Perlstein, 2014).

CPESS used the five HOM to build a culture of learning, assessment, and respect. These habits also played a significant role in the assessment of teaching because they had a keen sense of what they were assessing in terms of:
1) how to maintain focus on the HOM; 2) how to assess in different modalities such as projects and multi-media; 3) how to interpret student work with rubrics and scoring guides aligned with the HOM; and 4) how to address and work through the challenges and opportunities posed by competing interpretations of the student data, related to issues of score generalizability and rater reliability. (Duckor & Perlstein, 2014, p. 23)

Teachers and students were able to face and consider opposing social, cultural, and academic perspectives and tensions from students and teachers alike via a climate of trust and communication grounded in the five HOM—a prerequisite to assessment for learning and not merely of learning (Duckor & Perlstein, 2014).
CHAPTER III
RESEARCH DESIGN AND METHODOLOGY

Considering the current state of urban high school youth in science achievement and advancement and the literature review pertaining to learning, assessments, and college readiness, I explored the following research questions in this study:

1. What science teaching and learning processes, perspectives, and cultures exist within the science classroom of an urban portfolio community high school?
2. In what ways does the portfolio-based approach prepare high school students of color for college level science coursework, laboratory work, and assessment?
3. Are portfolio community high school students of color college ready? Is there a relationship between students’ science and mathematics performance and college readiness?

The overarching objectives of the study are the following: to learn, understand, and describe what transpires in a science classroom of an urban portfolio community high school; to understand how teachers and students perceive and experience science and science assessment; to understand how this urban portfolio community high school prepares its students for college and college science coursework, laboratory work, and assessment; and, to understand how alumni, teachers, and, administrators view students’ readiness for college and college science.

Case Study

Howe and Eisenhart (1990), in offering general standards of educational research, stated that “research questions should drive data collection techniques and analysis rather than vice versa” (p. 6). Thus, as my research questions evolved so did the design of my study, which
evolved as a case study. According to Yin (2008), a case study is “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident” (p. 18, as cited in Merriam, 2009, p. 40). Bounded by time and activity, case studies explore “in depth a program, an event, an activity, a process, or one or more individuals” (Creswell, 2003). Stake (2005) sees case study “less as a methodological choice but a choice of what is to be studied” (p. 443) where the researcher seeks to “uncover the interaction of significant factors characteristic of the phenomenon [and focus] on holistic description and explanation” (Merriam, 2009, p. 43).

For this study, the case is Spirit High School (pseudonym)—an urban portfolio community high school. It is one of 39 small portfolio high schools throughout New York State in the New York Performance Standards Consortium. I have an intrinsic interest in Spirit as I am seeking to understand Spirit within its community school context as much as possible as it relates to portfolio assessment and college readiness of Black and Latino students and will seek to describe it in detail. Therefore, it is an intrinsically interesting case (Creswell, 2013). Spirit is a bounded system since a single school, individual, or program are bounded systems as “the boundaries have a common sense obviousness” to them (Adelman, Jenkins, & Kemmis, 1983, p. 3 as cited in Merriam, 2009, p. 42). Anchored in real-life context, a case study is an intensive, holistic description and analysis of a single entity which offers “insights and illuminates meanings that expand its readers’ experiences” (Merriam, 2009, p. 51).

Although the power of case study is particularization and not generalization (Stake, 2006), researchers have an obligation to demonstrate how and in what ways their findings may be transferable to other contexts or used by others (Simons, 2009). This transferability can be demonstrated through generalizations that are naturalistic or situated (i.e., similarities and
differences to cases or situations are familiar to readers), concept (i.e., concept generalizes even when the specific instance does not), or process (i.e., the process generalizes even when the content and context may not) (Simons, 2009). In the discussion of findings, I will demonstrate how and in what ways the findings of this study may transfer to other similar contexts.

Setting and Selection of Participants

Setting

Spirit High School is in one of the poorest communities in the state of New York. Its residents are predominantly Black (32%) and Latino (65%), half of whom live below the federal poverty line and in low-income public housing projects. In 2015, the federal poverty line in NY for a family of two was $15,930 and a family of five was $28,410 (U.S. Department of Health and Human Services, 2015). Less than 10% of the residents surrounding the school own their homes. The surrounding communities are still recovering from unrelenting urban decay of decades prior. Its high rates of violence and incarcerated residents persist as people try to survive, live, and raise their families on a median income of approximately $23,000—income that is less than 40% of the median income for NY State. Although the effects of the decay are still visible and palpable, residents can enjoy local parks and natural scenery.

With its limited, unscreened admissions, Spirit’s students are traditionally low-performing students of color from traditional public schools who come from highly disenfranchised and marginalized communities and homes. Of its approximate 500 students, 30% are Black and 70% are Latino; 11% are ELLs; 28% have IEPs; and 9% are over age. The 4-year graduation rate for this school is 66% (lower than statewide but slightly higher than peer school percentages), and its college and career readiness rate is 27% (lower than statewide and
peer school percentages). Spirit qualifies for universal free lunch and a schoolwide Title I program. In 2011, upwards of 80% of these college-bound students were classified as first generation and approximately 97% of those students who applied to college were accepted.

To support school efforts, the school is partnered with the Northeast Family Support Services (NFSS), a major community-based organization with an office based inside the school, which provides important health services, leadership development support, mentoring services for students with the portfolio process and including afterschool academic, socioemotional, and leadership programming for students; pregnancy prevention; family center health services; and, a College Center. Spirit’s mission is to teach students to use their minds well in pursuit of college and career readiness and prepare them to live productive, socially useful, and personally satisfying lives. A community of caring and concerned student and faculty citizenry and community-based full-service partnership commits to meaningful work in order to prepare students for life during and beyond Spirit.

As a portfolio school, Spirit is part of the New York Performance Standards Consortium, which reflects a very small percentage of public high schools in New York State (3.3% or 39 out of 1,176). Based on a waiver issued by the New York State Department of Education, Consortium students are exempt from taking all Regents course exams except for the English Language Arts (ELA) Regents exam. (Regents course exams are high stakes, statewide standardized examinations in core high school courses administered by the New York Board of Regents for a student to earn the Regents Diploma.) For the Consortium schools, portfolios are endorsed as appropriate assessments in place of Regents exams, except for ELA. Before the Mathematics Regents stopped being required in 2011, only 26% of students passed it (PSC, 2012). The passing rate for ELA was 23% (PSC, 2012). Even so, its average scores on
academic expectations, communication, engagement, and safety/respect increased over the last year and were higher than citywide schools.

*The Portfolio Process at Spirit High School*

At Spirit, the portfolio-assessment process couples portfolio completion with oral presentations. During Division I (9th and 10th) grades, students are introduced to Spirit’s language portfolio system, which familiarizes the students with portfolios, what they are, and what is required to successfully construct them with a focus on critical writing and language development. Students, with the guidance of their teachers, create a language portfolio for each semester of Division I, which includes an exhibition from each subject such as mathematics, science, social studies, Spanish, and humanities, for example. These language portfolios are categorized also as benchmark portfolios. Thus, by the end of each semester in 9th and 10th grade, students submit a benchmark portfolio, which has an exhibition from each subject. At the end of the 10th grade, students present and discuss the final 10th grade benchmark portfolio before a panel. By now, having created four portfolios and presented on the final portfolio in Division I, they are quite familiar with the expectations, requirements, and demands of portfolio-based assessment.

As students matriculate to the upper grade levels of Division II (11th and 12th grades), they now enter a mastery portfolio system where they create seven mastery portfolios where each mastery portfolio is a distinct subject-specific portfolio, for instance, a science mastery portfolio, a mathematics mastery portfolio, and a social studies mastery portfolio, where these upper-level students demonstrate advanced content and skill comprehension. The mastery portfolios are not intended for students to demonstrate the breadth of material covered or studied in the course, but should be designed to reflect an in-depth comprehension of a specific issue of interest in context.
of the overall discipline and incorporation of Spirit’s HOM. As student choice is important at Spirit and in the portfolio process, they also have the choice of substituting one of the non-core mastery portfolios with an autobiography that reflects their life, who they are, what has shaped them, and what has made them become who they are.

They then will choose three of these mastery portfolios from the core subjects to present and discuss before a three-member panel at the end of the 12th grade as a graduation requirement. The panel consists of two teachers and an invited outside guest. The science mastery portfolio, for example, contains an exhibition from whichever science course students believe reflected their best work, whether that work is from upper level coursework like chemistry or physics or lower level coursework like biology or living environment. Choosing lower level coursework rarely happens since the subject-specific mastery portfolios have to satisfy graduation requirements and replace Regents exams, except for the ELA Regents. Although it is also rare to see students including two science masteries (i.e., both Chemistry and Physics) or two mathematics masteries, it happens if students feel so strongly about their work and the high caliber of work is evident. Consistent support is given to students throughout this cyclical process during their years at Spirit.

**Participants**

Onwuegbuzie and Leech (2005) make the point that the goal of appropriate sampling, or selection of research participants, in qualitative research is to reach data saturation in order to yield rich data. Onwuegbuzie and Leech give guidelines regarding sample sizes for various qualitative methodologies, for example, 3-5 participants for case study research, 6-10 for phenomenological studies, 6-12 for focus groups, 15-20 for grounded theory, and 30-50 for ethnographic research. They further restate a point made by Sandelowski in the 1990s that, in
general, “sample sizes in qualitative research should not be too small that it is difficult to achieve data saturation, theoretical saturation, or information redundancy [while] at the same time, the sample should not be too large that it is difficult to undertake a deep, case-oriented analysis” (p. 282). Great effort was made to meet these guidelines.

Case study research requires two levels of sampling—the case itself and the sites (e.g., participants, events, activities) within the case (Merriam, 2009). As Spirit was selected as the case, the participants were selected using purposeful sampling with direct experience with Spirit’s portfolio assessment process and college readiness as the selection criteria. The participants of the study included two teachers, six alumni, three school administrators, and three NFSS administrators. Although for case study research, there should be between three to five participants (Creswell, 2013; Onwuegbuzie & Leech, 2005), I felt that the perspectives from each different group of participants—Spirit alumni, Spirit administrators and faculty, and NFSS administrators—would serve to richly illustrate the portfolio assessment process and college readiness at this urban portfolio community high school, thus supporting it as an intrinsic case (Creswell, 2013; Stake, 2005). From each perspective, there are at least three participants. For the NFSS perspective, I included myself as an NFSS administrator. Although in my capacity in NFSS I was not directly involved in the day-to-day operations of the school, I participated on four panels for the science mastery portfolio panel presentations and, prior to that, I conducted observations in one of the science classrooms. Thus, my direct experience with the portfolio process was during its culmination with the mastery portfolio presentations.

Using snowball sampling (and assistance from the College Center Director in reaching alumni), I obtained an alumni sample size of six to participate and with whom to conduct semi-structured interviews. After reviewing the alumni interview transcripts, I believed that data
saturation or information redundancy was achieved as it related to the research questions (Onwuegbuzie & Leech, 2005). Therefore, I did not seek any more alumni to participate. The three school administrators included the founding principal, current principal, and one of multiple assistant principals. Of Spirit’s multiple assistant principals, only one fit the selection criteria. All eight science teachers were invited to participate in the study; however, two science teachers responded to my invitation. Since both teachers had taught at Spirit at least one complete academic year and thus had experienced the portfolio assessment process from beginning to end, I included both in my study. Each science class at Spirit had approximately 25 students enrolled where, on average, 20 to 24 students attend class each day.

Data Collection Methods

Qualitative

According to Merriam (2009), case study “does not claim any particular methods for data collection” (p. 42), so mixed methods can be used, although certain qualitative methods are used more than others. Because this was a case study, data collection was in-depth, involving multiple sources of information: qualitative (e.g., direct observations, participant observation, interviews, documents, archival records, physical artefacts) (Creswell, 2013; Merriam, 2009) and quantitative (Yin, 2009 as cited in Creswell, 2013). To explore the first two research questions, which were qualitative, I used school and Consortium website artefacts, classroom observations, student portfolios, panel judge observation/participation, and face-to-face semi-structured interviews as detailed below.
Artefacts. To gain historical and philosophical perspective of Spirit and the Consortium, I retrieved pertinent information from their websites (i.e., school and Consortium history, research on portfolio-based assessment, research on the failure of standardized assessments).

Classroom Observations. I observed one science teacher from Division I (9th and 10th) five times across two months for one period (50 minutes) each. I conducted a semi-structured interview with her as well (Science Teacher Interview Questions, Appendix 3) to gain her perspectives on teaching and learning science and students’ readiness for college science.

Student Portfolios. I collected six student science portfolios as artefacts of the science portfolio-assessment process and their science learning at Spirit.

Participant Observer. I served as a panel judge for students’ science portfolio presentations, observing and scoring 6-8 hours of four 12th grade student science mastery portfolio presentations. Each panel had five students. I was a participant observer (Creswell, 2003) and I used my own panel notes and observations as data on portfolio process and the teaching and learning of science as well at Spirit.

Semi-structured interviews. I conducted 13 semi-structured interviews—six alumni, two teachers (one of whom I observed), three school administrators, and two NFSS administrators. For the teachers and administrators, I conducted the interviews at the school, in either the teachers’ classrooms or the administrators’ offices. I conducted them over the course of a year.

Teachers. I interviewed the science teachers in their classrooms (Science Teacher Interview Questions, Appendix 3). The teacher interviews lasted, on average, 31 minutes.

Administrators. I interviewed three school administrators—the Founding Principal (Founding Principal Interview Questions, Appendix 4), the current Principal and one of three Assistant Principals (Current Principal and Assistant Principal Interview Questions, Appendix
5)—and two NFSS administrators—the Community School Director and the College Center Director (College Center Director/Community School Director Interview Questions, Appendix 6)—at the school individually in their offices. The administrator interviews lasted, on average, 97 minutes.

Alumni. I interviewed six alumni (Alumni Interview Questions, Appendix 7). Each had graduated from Spirit within the previous three years. There were two females, both of whom were Latina and four males—two Latino, one African American, and one Black Caribbean. By the time of the interview, two alumni had just completed their freshman year, while two others had completed their sophomore year. The fifth alum was a junior in college and the sixth alum was not currently enrolled. I conducted five of the interviews individually at the school in an available conference room, classroom, or the library, and the remaining interview I conducted off site in an office location. The student interviews lasted, on average, 68 minutes, with the shortest at 53 minutes and the longest at 97 minutes.

Quantitative

Transcript Data. For the third research question, which was quantitative, the data emerged from the academic transcripts of Spirit alumni who graduated in 2015 and 2014. These transcripts were the transcripts colleges received for admissions consideration, and as such, did not have the spring semester of the students’ senior year. For example, a 2015 transcript had up to fall 2014 data, and a 2014 transcript had up to fall 2013 data. However, this illuminated the question of college readiness even more because colleges look at students’ academic performance up to their junior year and fall semester of their senior year to evaluate admission eligibility and college readiness (i.e., Are Spirit students ready for college by the end of their junior year?).
For 2015 graduating seniors, each student’s transcript contained actual credits, credits earned, credits averaged, and overall average for each subject area (i.e., English, Social Studies, Science, Mathematics, Foreign Language, Health/Physical Education); cumulative actual credits, cumulative credits earned, cumulative credits averaged, overall cumulative average; and, Regents exam scores (which may or may not include both ELA and Algebra Regents). For example, from fall 2011 to fall 2014, student XYZ from the class of 2015 enrolled in a science course each semester—Living Environment (9th grade fall and spring), Biology 1 and Biology Lab 1 (10th grade fall), Biology 2 and Biology Lab 2 (10th grade spring), Physics 1 (11th grade fall), Physics 2 (11th grade spring), and Chemistry (12th grade fall) with course marks ranging from 80% to 90% for each course. Therefore, as indicated on the transcript, student XYZ earned a science subject area average of 86.7%. Actual credits, credits earned, and credits averaged all equaled 7.0. This student scored a 58 on the ELA Regents taken in 2013 and a 62 on the Algebra Regents taken in 2012.

Scores and grades on transcripts for 2014 graduating class, on the other hand, were indicated and organized differently, where marks were averaged over terms (semesters) as opposed to subject area. Instead of subject area average, it was a term (semester) average. Therefore, 2014 transcripts did not include actual credits, credits earned, credits averaged, and overall average for each subject area. Thus, no science or mathematics averages were computed for these students. The cumulative data were calculated the same as the transcripts for the 2015 graduating class and Regents exam scores were also on the 2014 transcripts. For example, from fall 2009 to fall 2013, student ABC enrolled in a science course each semester of each year except for 10th grade spring: Earth Science and Earth Science Lab (9th grade fall) and Living Environment 1 (9th grade spring); Living Environment 2 (10th grade fall); Chemistry 1 and
Chemistry 1 Lab (11th grade fall) and Chemistry 2 and Chemistry 2 Lab (11th grade spring); and Living Environment (12th grade fall) and a science Performance-Based Assessment Task (PBAT) (12th grade spring) with course marks ranging from 55% to 81%. Student ABC scored a 63 on the ELA Regents taken in 2013. See Table 3.1 below for a summary of the data collected for each research question.

Table 3.1
Research Summary Table

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What science teaching and learning processes, perspectives, and cultures exist within the science classroom of an urban portfolio community high school?</td>
<td>• Classroom observations</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of alumni</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of science teachers</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of school and NFSS administrators</td>
</tr>
<tr>
<td></td>
<td>• School archival information (i.e., Web site information)</td>
</tr>
<tr>
<td>2. In what ways does the portfolio-based approach prepare high school students of color for college level science coursework, laboratory work, and assessment?</td>
<td>• Science portfolio presentation panel participation and observation field notes (Recorded student responses during open forum/Q&amp;A session)</td>
</tr>
<tr>
<td></td>
<td>• Student science portfolios</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of alumni</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of science teachers</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interviews of principals, assistant principal, and NFSS College Center coordinator</td>
</tr>
<tr>
<td></td>
<td>• Semi-structured interview of NFSS director</td>
</tr>
<tr>
<td></td>
<td>• School archival information (i.e., Web site information)</td>
</tr>
</tbody>
</table>
Data Analysis

Qualitative Analysis

As the case study is “an intensive, holistic description and analysis of a single, bounded unit,” (a school, in this study), conveying an understanding of the case is paramount (Merriam, 2009, p. 203). Thus, case study analysis consists of “making a detailed description of the case and its setting” (Creswell, 2013, p. 199). It also consists of categorizing and collapsing the data into themes and possible sub-themes; looking for single instances to draw more meaning from the case; establishing patterns and looking for correspondence between two or more categories; and finally, developing generalizations that people can learn from the case and apply to other cases (Creswell, 2013). As all the data were qualitative for the first two research questions—whether spoken or in print—I conducted a thematic analysis on the data (Creswell, 2003, 2007; Miles & Huberman, 1994), developing codes and noting emergent themes and sub-themes in relation to and separately from the theoretical framework and the research questions. I conducted a thematic analysis on the participants’ semi-structured interview transcripts to understand their perspectives within and across, and the general patterns that may exist within them (Creswell, 2003, 2007; Miles & Huberman, 1994).

Data Analysis for Research Questions 1 and 2. To begin the thematic analyses, I coded the interview transcripts using NVivo (a common qualitative data analysis software program) and generated 69 codes, using structural, descriptive, in vivo, and process codes (Saldaña, 2009). Structural coding is a question-based code that is particularly appropriate for studies with multiple participants, standardized or semi-structured interviews, or exploratory investigations to gather topics, lists, or major categories or themes (Saldaña, 2009). So, for example, responses directly from the interview question, “If you only had five words to describe yourself, what
would they be?” were coded using StudentFiveWords. Descriptive codes summarize in a word or short phrase—most often as a noun—the basic topic of the qualitative data (Saldaña, 2009). For example, PortfolioProcessPositives and PortfolioProcessNegatives were descriptive codes used for alumni’s responses about the portfolio process and CollegeAdjustmentIssues was used for whatever issues alumni expressed about adjusting their first year of college. Both structural and descriptive codes lend themselves to various types of analyses, for example, thematic analysis, content analysis, frequency counts, illustrative visuals, within-case displays, and cross-case displays (Saldaña, 2009). In vivo codes arose organically such as HabitsOfMind, for example, which was used when an alum specifically said “habits of mind” during the interview (Creswell, 2013; Saldaña, 2009). Process codes use gerunds to reflect observable action or conceptual action (e.g., struggling, adapting) (Saldaña, 2009). The process code ScienceTeachingAndLearning was used when alumni were asked about their learning experiences in science. Across the interview transcripts, 69 codes were generated. Code lists of that size are not uncommon as “most qualitative research studies in education will generate 80-100 codes that will be organized into 15-20 categories which eventually synthesize into five to seven major concepts” (Saldaña, 2009, p. 20). Reliability of the coding was good with intercoder agreement of at least 80% (Creswell, 2013; Miles & Huberman, 1994).

**Quantitative Analysis**

**Data Analysis for Research Question 3.** The quantitative analysis for the third research question focused primarily on college readiness vis-à-vis students’ ELA and Algebra Regents scores only, and not ACT, SAT, or CAT scores since the transcripts only had Regents data. (Therefore, city, state, and university college readiness data for Spirit will differ since those data take into consideration Regents, ACT, SAT, CAT, or other university assessment test scores.)
Since the quantitative data include grades and other numerical data for science and mathematics coursework, such coursework data were included in the analysis and compared to the NYDOE’s criteria for transitioning to college and career readiness vis-à-vis Regents-level science and mathematics coursework taken in high school. Thus, the Regents exam scores indicate readiness for college while the science and mathematics coursework indicate transitioning (on the path) to readiness for college and career.

Since CUNY has no readiness criteria for college science, the question of readiness for college science is addressed in the qualitative analyses of the semi-structured interview transcripts of the Spirit alumni where alumni talked freely about their freshman college science experiences. It is also addressed in the qualitative analyses of the semi-structured interview transcripts of Spirit and NFSS administrators and staff as well, where they talked about their perceptions of and efforts to make students college ready in general and in science. Nonetheless, it is important to know what science students studied in high school in their transition to college and career readiness. Therefore, descriptive statistics of the science coursework are included at the end of this section to help inform the discussion of students’ readiness for college science.

For both 2014 and 2015 transcripts, descriptive statistics (i.e. averages, standard deviations, frequencies, percentages, ranges) were computed to summarize the data overall and gain a picture of students’ performance across graduating class. Comparative statistics were computed for graduating class and gender to examine how the class of 2015 compared to the class of 2014, and how female students compared to male students across each numerical variable. See Table 3.2 below for the numerical variables and their definitions. Thus, a two-sided independent samples t-test was conducted at significance level α = .05 using SPSS (a statistical software program) to see if there were statistically significant differences between the
average Regents scores between the graduating class of 2015 and the graduating class of 2014, and female and male students as well. A 95% confidence interval (CI) was calculated on the difference of the average scores as well.

To determine the magnitude of these differences (or how noticeable the differences were), Cohen’s $d$ was calculated. Although Cohen’s $d$ is a standardized effect size, SPSS does not calculate it for $t$-tests. Therefore, Cohen’s $d$ was calculated using Excel with the following formula for two groups with unequal sample sizes: $d = \frac{(M_a - M_b)}{SD_{pooled}}$, where $M_a$ is the mean of group A, $M_b$ is the mean of group B, and $SD_{pooled}$ is the average of the standard deviations (SDs) for the two groups with unequal sample sizes ($n$s) (Keppel & Wickens, 2004; Leech, Barrett, & Morgan, 2008). The values for Cohen’s $d$ are interpreted as ranges, for example, if $d \approx |0.20|$, then the effect size or magnitude of the difference between the groups is considered small or smaller than typical in the field. The difference would be noticeable to a small degree, so to speak. If $d \approx |0.50|$, then the effect is medium or typical; if $d \approx |0.80|$, then large or larger than typical; and, if $d \approx |1.00|$, then much larger than typical (Keppel & Wickens, 2004; Leech, Barrett, & Morgan, 2008). Racial/ethnic comparisons were not made since race/ethnicity was not indicated on the transcript.

All ELA and Algebra Regents scores were compared against CUNY’s college readiness Regents score criteria and determinations were made on the college readiness for these 242 students. To understand students’ transition to college readiness as indicated by NYDOE mathematics and science coursework recommendations, I included in the analysis students’ last two mathematics courses taken and the last two science courses taken, indicating their highest mathematics and science courses taken at Spirit. Because upper level coursework is often determined by mutual discussions, goals, and faculty advisement of the student with the advisor,
science and mathematics coursework did not necessarily follow expected trajectories. Some seniors may not have taken a science or mathematics course their senior year if their course requirements had been fulfilled or if consultation supported a different course path.

In addition to descriptive and comparative statistics, correlation statistics were calculated and used “to assess the association or relationships between two variables” (Leech, Barrett, & Morgan 2008, p. 245). Specifically, I wanted to see if there was a relationship between students’ science and mathematics performance at Spirit and their college readiness vis-à-vis their Regents scores (i.e., If students’ science grades were high, would their Regents scores be high as well? Is there a tendency for students who have high science grades to have high Regents scores as well?). See Table 3.2 below for the variables used from the transcripts and their definitions.

Table 3.2
Variables and Definitions Created from Transcript Data

<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Definition</th>
<th>Variable Name</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LastMathClass1</td>
<td>Last mathematics class taken</td>
<td>LastSciClass1</td>
<td>Last science class taken</td>
</tr>
<tr>
<td>LastMathClassGrade1</td>
<td>Last mathematics class grade</td>
<td>LastSciClassGrade1</td>
<td>Last science class grade</td>
</tr>
<tr>
<td>LastMathClass2</td>
<td>2\textsuperscript{nd} to last mathematics class taken</td>
<td>LastSciClass2</td>
<td>2\textsuperscript{nd} to last science class taken</td>
</tr>
<tr>
<td>LastMathClassGrade2</td>
<td>2\textsuperscript{nd} to last mathematics class grade</td>
<td>LastSciClassGrade2</td>
<td>2\textsuperscript{nd} to last science class grade</td>
</tr>
<tr>
<td>OverallMathAve</td>
<td>Overall mathematics average</td>
<td>OverallSciAve</td>
<td>Overall science average</td>
</tr>
<tr>
<td>MathActCred</td>
<td>Actual mathematics credits</td>
<td>SciActCred</td>
<td>Actual science credits</td>
</tr>
<tr>
<td>MathCredEarned</td>
<td>Mathematics credits earned</td>
<td>SciCredEarned</td>
<td>Science credits earned</td>
</tr>
<tr>
<td>MathCredAve</td>
<td>Mathematics credits averaged</td>
<td>SciCredAve</td>
<td>Science credits averaged</td>
</tr>
<tr>
<td>CumAve</td>
<td>Cumulative average (all courses)</td>
<td>CumActCred</td>
<td>Actual cumulative credits</td>
</tr>
<tr>
<td>CumCredEarned</td>
<td>Cumulative credits earned</td>
<td>CumCredAve</td>
<td>Cumulative credits averaged</td>
</tr>
<tr>
<td>AlgebraRegScore</td>
<td>Algebra Regents score</td>
<td>ELARegScore</td>
<td>ELA Regents score</td>
</tr>
</tbody>
</table>

93
Pearson product-moment correlation coefficient $r$ is commonly used in examining the linear relationship or association between two variables. Before using Pearson’s $r$, I first tested the assumptions of normality, homoscedasticity, linearity, and absence of outliers by examining histograms for numerical variables and bivariate scatterplots for the same numerical variables against both Regents exam scores. The bivariate scatterplots showed that the assumptions of linearity, homoscedasticity, and absence of outliers were not violated. However, the following variables by themselves did not approximate a normal distribution: LastMathClassGrade1, LastMathClassGrade2, LastSciClassGrade1, LastSciClassGrade2, SciActCred, and SciCredAve. Therefore, Spearman’s rank correlation coefficient rho $\rho$, or $r_s$, was used to assess a monotonic relationship (i.e., as one variable increases, the other either increases or stays the same; or vice versa) between these six variables and both Regents exam scores (Leech, Barrett, & Morgan, 2008). (Monotonic relationships can also be linear.) Spearman’s rho, $r_s$, is a nonparametric statistic that may be used when normality and other assumptions are markedly violated as it does not require the variable data to be normally distributed (Leech, Barrett, & Morgan, 2008).

Both correlation coefficients were tested at significance level $\alpha = .05$. Effect sizes for both correlation coefficients are interpreted as ranges as well: if $r \approx |0.10|$, then the effect is small or smaller than typical; if $r \approx |0.30|$, then medium or typical; and, if $r \approx |0.50|$, then much larger than typical (Leech, Barrett, & Morgan, 2008). Unlike $d$ which varies from 0 to $-\infty$ or $+\infty$, $r$ varies from 0 to -1.0 or +1.0 (Leech, Barrett, & Morgan, 2008). Since 2014 transcripts did not include actual credits, credits earned, credits averaged, and overall average for each subject area, correlations for OverallMathAve, MathActCred, MathCredEarned, MathCredAve, OverallSciAve, SciActCred, SciCredEarned, and SciCredAve could only be calculated for 2015 transcript data.
Criteria for Good Scholarship

Ethical Concerns

I followed ethical research procedures from initial research introduction to all participants throughout the research period (Creswell, 2003). Participants were not coerced into participating in the research, and signed consent forms for active participation were obtained (Appendix 2). Participants were informed that they had the option at any time during the research to opt out of participating in the data collection (i.e., interviews, portfolio presentations) without any negative effect on collegiate or work status (e.g. for alumni employed by NFSS). No participant was marginalized or put at risk for participating or choosing not to participate in this study, in part or in whole.

The identities of participants, the school, and the CBO have been protected using aliases throughout the dissertation and any future research documents stemming from the research. Although Davis’ (1998) emphasis was regarding working with children in research, her instruction for researchers to be “reflexive, question their own assumptions about [participants] and adapt to each individual, rather than assume there are universal answers to the ethical and methodological issues of researching with [participant]” is completely relevant (as cited in Hill, 2005, p. 65).

Rigor and Reliability

Since data triangulation adds rigor and depth to any inquiry (Denzin & Lincoln, 2008), I triangulated my findings with multiple data sources (i.e., observation fieldnotes, interview transcripts, student portfolios, reflections, and academic transcripts) to help me understand Spirit and its portfolio assessment and college readiness. It involves “corroborating evidence from different sources to shed light on a theme or perspective” (Creswell, 20130, p. 251); considering
alternative interpretations of the data; neutralizing biases of any single method; and minimizing the potential threat for the consideration of forced, nonsensical or nonexistent relationships (Creswell, 2003, 2007). Peer reviews and external audit were conducted to provide “an external check of the research process” (Creswell, 2013, p. 251).

Reliability in qualitative research “often refers to the stability of responses to multiple coders of data sets” (Creswell, 2013, p. 253). To assess the reliability or stability of these codes, I asked two professionals from different walks of life to assist me—one was the dean of a middle school and the other was a registered nurse. I explained to them what coding was, what I needed them to do, and how long the process could take. Coding, as practiced in qualitative research, was unfamiliar to the nurse. They both agreed to help me with this process. I gave them both the full list of 69 codes and asked them to read the list to familiarize themselves with the codes. Even though the longest transcript used all 69 codes, I decided not to train them on the longest transcript for fear of fatigue. For the alumni, the number of transcript pages ranged from 23 to 51 with an average of 33.2, and for the teachers and administrators, the number of transcript pages ranged from 16 to 57 with an average of 32. I used the shortest transcript of the alumni for training with 23 pages.

The dean asked how much text could one code represent, and I explained that a unit of text to code would be anything that represented a single message, a different idea, or change of subject (Kurasaki, 2000). I told them it could be a few words, a complete sentence, or longer, and that any responses, be they from the student or interviewer, such as “yeah” or “okay” were not to be coded. I instructed them to write the code they thought appropriate to the side of each unit of text. I stayed in the room with them as they coded, just in case they needed to ask me any questions. They sat separately and coded separately without any help from each other or me.
(Lombard, Snyder-Duch, & Bracken, 2002), and took breaks when they needed. The training sample used 39 of the 69 codes and lasted approximately an hour and a half.

No new codes emerged from the training; however, we discussed units of text that they coded differently and came to agreement on the codes. For example, on a unit of text that the dean coded SelfChangesInCollege, the nurse coded it as CollegeInfluenceGoals. After discussing where they believed the actual unit of text began and ended, there was agreement on both codes with the related unit of text. Intercoder agreement means that when the coders assign a code to a passage or unit of text, they each assign the same code and not that they necessarily bracket the exact same lines for each code (Creswell, 2013; Kurasaki, 2000). For the training transcript, intercoder agreement for the 39 codes was 82.1%, a little higher than the recommended minimum of 80% (Creswell, 2013; Miles & Huberman, 1994).

With two breaks in between to eat snacks and dinner, they coded two more transcripts. I randomly selected these two transcripts, one ended up being from one alum and the other from a NFSS administrator, producing from both 35 page of transcripts that took both of the coders over two hours. Intercoder agreement for the alumni transcript was 92.7%, and 91.9% for the NFSS administrator transcript. These three transcripts represented over 10% of the full set of alumni and non-alumni interview transcripts coded (Lombard, Snyder-Duch, & Bracken, 2002). I was satisfied with the list of codes and applied them to the remaining interview transcripts later, of which, 45 of the 69 codes were more commonly used than the others.

**Researcher Role and Bias**

It was imperative for me to comprehend my role(s) in this study as a researcher of science teaching and learning, portfolio assessment, and college readiness as it pertained to Black and
Latino students. As an African American woman, educator, scientist, and CBO administrator, it was critical for me to gain a solid understanding of my role(s) as my upbringing, skills, capabilities, and philosophies and principles around education, science, and college experiences emerged in my thought processes throughout the various phases of this study.

As a CBO administrator, I worked directly with Spirit and the school administration in the past for several years. The focus of my work was about the provision of integrated academic and non-academic services and initiatives such as the college summer immersion experience and the annual vision screening. Although I was no longer the CBO administrator responsible for the partnership with Spirit at the time of the study, it was essential for me to reflect on my previous position with the school to address and clarify any potential biases (i.e. not fixating on how I believe students should deliver during the panel presentation) since being a participant observer may support the acquisition of privileged and independent or subjective data (Creswell, 2013).

Freeman and Mathison (2009) admonished researchers to know themselves before embarking on research, especially research in schools, by asking themselves questions about how they were perceived by teachers when they were students or were they troublesome and frequently sent to the principal’s office? The past experiences of researchers within the context of schooling are very much relevant to the school research they are conducting and will “well up” within that context especially if it “is one the researcher has lived through” (p. 57). Although the context for Freeman and Mathison was with children, the admonition of researchers to know their own biases still speaks to me as a researcher and teacher.

This unmaskes and illustrates the problem of researcher bias that was addressed as I collected and interpreted the data while also interfacing with the participants under study. My philosophy of teaching and learning (Chapter I) shaped by my cherished childhood family
experiences, my years of experience as a science teacher and science staff developer, my professional work with community schools and enrichment programs (in-school and out-of-school time), and connections to a variety of STEM initiatives would invariably cast influence on the data collection and analysis processes. Documenting my thoughts through ongoing reflections during the data collection and analysis processes provided support and clarity as I confronted and struggled with any potential biases due in part to my personal and professional background.

**Organization of the Findings, Discussion, and Conclusions**

What follows are the remainder of the dissertation—Chapters IV through VIII. Chapters IV through VI present the findings for each of the research questions, respectively, while Chapter VII discusses the findings in-depth. The dissertation ends with Chapter VIII, where I discuss my conclusions of this research study and provide implications and next steps for further research.
CHAPTER IV

FINDINGS

Science Teaching and Learning Processes, Habits, and Cultures in an Urban Portfolio

Community High School

This chapter focuses on the findings of research question one—the science teaching and learning processes, perspectives, and culture within Spirit’s science classroom. The following major themes emerged from the qualitative data: Spirit’s Habits of Mind (HOM), scientific inquiry, specific troublesome SRL strategies, SRL triggers and teacher feedback practices, and persistent care. Within each of the major themes are subthemes that are explored in-depth.

**Spirit’s Habits of Mind**

Founded on CPESS’s HOM, Spirit uses these same five HOM to drive its culture and program goals of intellectual development and political and social involvement in our society. Spirit makes its HOM known to its school population and online audiences: viewpoint (understanding perspectives), evidence (supporting viewpoints with evidence), connections (connecting ideas with individuals and society), conjecture (thinking of alternatives) and relevance (understanding importance of an issue). These five HOM are at the foundation of how Spirit works to develop and advance its students as these habits are at the heart of all of Spirit’s work, care, and concern for others. Spirit’s curriculum plays a large part in affirming and developing its HOM within the student body as it affirms students learning how to learn, reason, and investigate complex issues that require collaboration, personal responsibility, and a tolerance for uncertainty.

The HOM are not just words. Belief and practice of the HOM were evident, explicitly
and implicitly, among the study participants. Spirit Principal Elvin Rossi readily expounded on the five HOM, how they form the bedrock of Spirit’s culture, and drive its curriculum. Encouraged and driven by the five HOM, Principal Rossi said that the faculty often says that “student resistance is met with teacher persistence.” Because the HOM underlie everything at Spirit, even their relationships with their community and technology partnerships, Spirit was recognized for its use of technology and making a difference in closing the achievement gap for its students of color. Before coming to Spirit as one of two assistant principals several years ago, Principal Rossi had worked previously in a portfolio-based school as teacher, co-director, and assistant principal.

Displayed online and throughout the school, the five HOM form the basis of Spirit’s efforts to move students toward completion of their college-going and college-persistence goals. These HOM stay with students subconsciously (enacting the habits without naming them) or consciously (enacting the habits and naming them) during their high school tenure and their first year in college. Noted in the findings, I put in italics specific mention of the HOM and bracketed italics of implicit mention. I also put in italics specific mention of SRL strategies, triggers, or feedback practices, and bracketed italics of implicit mention.

*Presence and direct influence of HOM.* Spirit’s HOM were not only readily available for online audiences to see, but they were also inside the school, often in classrooms, for all within Spirit’s walls to see. Eric, an energetic African American 22-year old now in his junior of college, shared how he learned the HOM and how they were displayed in the classrooms:

And one of the big things we focused on, I think it’s called *habits of mind*…[looking around the classroom] they should be around here somewhere in this classroom. I think it’s five of them. It’s like *connection*, evaluation. It’s like five components that you
should always having in your writing…Like reasoning. I can’t find them. [Still looking around the room] I can’t remember them but they always have these five components. Umm, but, yeah, though, even though it was hard for me, I always try to keep one of those habits in mind: connection. You know, to use all of my whatever I learned, no matter what, I always connect it. Everything, whether it’s far-fetched from your life, it connects to your life somehow. I did good in the astronomy class. It was really because I made the questions connect to my life [connection]. That’s pretty much it, like it’s not going to be important to me until I make that connection.

Although Eric could not locate them in the classroom during the interview, he distinctly remembered that there were five, with connection being foremost on his mind.

**Scientific Inquiry**

*Teacher-created curriculum.* Scientific inquiry at Spirit is driven by its teacher-created curriculum. As indicated on its website, the curriculum is inquiry-based, emphasizing projects, which students design and carry out themselves with teachers as guides and coaches. In addition, Spirit developed and fine-tuned its science curriculum over the years. Although there are science textbooks in the school, they are not used as curriculum but as supplemental resources. As such, science teachers can use the curriculum and prioritize topics, cover them more deeply, connect them to relevant current events, and connect them to their students much more so than non-portfolio schools may allow. Katelynn, a white female Chemistry teacher in her late 20s, really enjoyed joining with the other science teachers and constructing a curriculum on their own. She saw her and the other science teachers’ expertise, topical connections, and enthusiasm for science benefitting themselves and the students:
I really love the curriculum and the topics. Because we are a Consortium school, there is more freedom and less restriction in deciding upon sequence and topics…We have chosen what I believe are the most interesting topics for students and discovery learning.

*Flexibility in teacher-created curriculum.* Additionally, the authentic teacher-made curriculum allowed Spirit’s teachers the flexibility to explore topics or concepts they saw as relevant and necessary for the students to learn, especially if they affected students’ lives. For instance, in 2011, a devastating, earthquake-causing tsunami struck Japan, leaving 18,000 Japanese dead and 300,000 people needing to be evacuated as three reactors of the Fukushima Daiichi nuclear power plant began to meltdown. Eric’s teacher Jillian changed her lesson midstream to engage the class in a discussion as it related to chemistry and their lives even when they might not have appreciated it or wanted to learn it. Eric excitedly recalled that day:

I remember the day after [the power plant meltdown]. She was like we’re going to do a lesson on this. She said we’re not worrying about what we were going to do. This is more important. This is what happened and this is why it happened *[relevance]*. And that whole day I was like, I do not want to do this….I was like, I’m trying to graduate and you holding me back… Let me just type up this paper. And she was like, no, we’re gonna do this today….But I learned a lot. She was like, this is what happened, and this is why it happened, and this is why it connects to chemistry *[connections]*.

*Typical classroom lesson.* Situated by the gymnasium, Katelynn’s classroom was not a typical science classroom with lab stations. It was small, without lab stations and tables; it only had student desks. Although her classroom was not a typical science classroom, there were three science classrooms with lab stations in the school, one on each of its three floors being used by other science teachers. Katelynn’s desk was at the front of the classroom towards the right side.
near the chalkboard and Smartboard. Around the room hung students’ lab investigations and pictures of students doing their lab investigations. Katelynn also hung a chart of the classroom point system, showing points of academic behavior and achievement. A sign with “The Scientific Method” was also hung but only as steps for students to write up their lab investigations. Science concepts related to the current science topics were also hung around the room as well as Spirit’s HOM.

Katelynn, using the teacher-created curriculum, would start class with a question or an activity for the students to explore, individually or with their desk groups, usually two to four students per group. After deliberating about the question or activity at hand, students would share their thoughts and ideas, and how they processed the question or activity itself in their minds. As Spirit follows an inquiry-based science philosophy, Katelynn usually did not answer the questions for the students “but instead [we] go into a mini-lesson” which could consist of a PowerPoint presentation, notes, or diagrams. After discussing the mini-lesson, they would do another activity or practice, after which they would talk about the initial question where, by the end of the class, she said, as is the nature of scientific inquiry, “sometimes we arrive at an answer, sometimes we don’t.”

Scientific inquiry process. In exploring and investigating ideas learned in class, the science teachers taught students scientific inquiry processes, which students called “the scientific method.” Although many scientists and science educators over the years have critiqued and debunked the notion of “the scientific method” as an actual method of scientific inquiry, it remains a part of public school education (Brown & Kumar, 2013; Crawford, 1998). Some scientists and science educators see it as, at worst, scientific mythology and at best, a fixed, artificial, idealized set of steps, which has limited usefulness in teaching the physical sciences
(Brown & Kumar, 2013; Crawford, 1998). For some, teaching science in such a mythologized way “reinforces a misconception of the nature of scientific work and sets up contradiction between school science and science in the real world” (Crawford, 1998, p. 52) and may cause “young students … to miss the enjoyment, excitement and creativity characterized by real science in the real world,” (Brown & Kumar, 2013, p. 2).

That was not the case, however, for Spirit’s students, or at least, not for the alumni who quite enjoyed learning science and conducting investigations at Spirit through the scientific inquiry processes taught by the teachers. “Scientific method” did not emerge in the interviewed teachers’ transcripts, although alumni mentioned the term “scientific method” in their interviews as part of their learning in science. For the purposes of this study, I will use “scientific inquiry process.” To be clear, what alumni were recalling the “scientific method” was the laboratory investigation written report format they used. The science teachers may use it as well simply to describe the science inquiry process, although such practice is not aligned with the current practice of science.

Eric recalled learning “the scientific method” (scientific inquiry process) during his freshman and sophomore years at Spirit with Kathy and during his junior year with Jillian, and how it helped him through his freshman astronomy course at a local community college. At first, he thought that nothing he learned in his freshman and sophomore years at Spirit connected to astronomy. However, he soon realized and applied his lessons learned of the “scientific method” and interconnectivity at Spirit to his astronomy course: “…it all connects in one way or another like the elements are in space, you know, like hydrogen balls, things like that, helium, carbon, things like that. Really the research method that we learned, like you know, the scientific method, things like that, I remember using that.”
Administration’s support of scientific inquiry. Scientific inquiry was such a major part of the science teaching and learning experience at Spirit that administration was clear on how students engaged with science at all grade levels at Spirit. Assistant Principal Megan, who started at Spirit in the mid to late 1990s as a teacher in its 4th year of founding and became assistant principal ten years later, excitedly talked about teacher and student engagement in science at Spirit. She saw the science teachers more as coaches than teachers because of their role in supporting the inquiry-based curriculum and guiding students’ hands-on science research and experimentation:

So most students do some type of experimentation that they’ve…been coached by the teachers somewhat, but they’ve come up with their own hypothesis … they’d done their own research around it, they’ve carried out their own experiment \[evidence\]. They’re figuring out what the teacher…a coach, kind of helping them figure it out. Or they are doing or looking at a scientific issue. But there has to be a question there. It can’t just be, let me tell you all about the bone system or whatever it’s called. (Chuckling) You know, it can’t kind of be like a book report. It has to be like an actual experiment or a question that you are taking a viewpoint on.

Scientific inquiry in the community. Licensed to teach science with a bachelor’s degree in biology, Tom is a white male in his late 20s who believed that community issues affected how students think about and respond to the science they learn in class. In his first full-time teaching job at Spirit, Tom believed those issues enriched their science learning and thus later their exhibition and portfolio development:

I think, especially in the community that we’re in, we’re by the river here, so we do a lot of work around the river curriculum, and they’re just sort of able to relate to it so well
They’re constantly pulling things in from the environment, umm like, for example, we do water testing down at the river, and we look at water clarity, water temperature, pH, and all that stuff [evidence]. The kids came, one kid came the next day and we were talking about, umm, I think it was nitrates, and he was like, wow, there’s so much dog feces on the floor, like I can’t believe, like I wonder if that affects the nitrate levels in the water [connections]. And I was like, it does. And then we had a whole class discussion about like how the [neighborhood] right here is all on a hill, and when it rains everything gets washed down into the river [connections]. Things like that really just make the lessons a lot better.

Meaningful classroom discussion. Tom used their classroom and community experiences to engage the students in meaningful discussion, whether in science class or during advisory, to explore students’ perceptions and feelings about those experiences. He admitted that many of his students first questioned the importance of these scientific issues in their communities and even the need to discuss them but then soon saw the relevance and connections of these issues to their environment and community:

…a lot of the students are like, ‘Who cares? We’re in [this neighborhood], what do we have to worry about?’ But after learning about all the things we can do in our environment, I think they start [to care], [relevance] because for so long they’re told ‘do good in school and get out.’ But like now it’s starting to become ‘do good, and change the community for the better.’ [connections]. So I think that’s really, really important. I think the students by the time they’re in 10th grade really understand that.

Such meaningful discussion also served Alejandro well, a self-described cynical but humorous 24-year old Latino. Alejandro had Gary, a white male in his late 20s as well, as his
science teacher during his junior and senior years at Spirit, learning basic Earth Science, astronomy, physics, and even political science. Alejandro thoroughly enjoyed astronomy because of Gary’s enthusiasm, meaningful class discussions, and how Gary’s delivery took him “mentally away from his problems here on Earth.” Gary’s class was a safe place for Alejandro. He excitedly recalled his time with Gary:

   And umm with science I liked it because it was very far away from anything involving
like now, involving like my life, where everything else is…Astronomy is as far as I could
 go. So like since I was into neutron stars and stuff like that, just getting interested in that
kept me away from Earth [and my problems]… a neutron star’s like the size of, it could
be about the size of a basketball and yet it’s 100 or 1000 times stronger than the sun. So,
yeah…if you were to take the diameter of it and put it in the palm of your hand, it would
weigh the equivalent of 100 battleships. So your hand would just obliterate. … So I liked
things that looked like it should be this way but it’s completely different…And that’s the
reason why I got hooked into Gary’s class was because the subjects kept me always away
from [thinking about my problems at] home, so I never had to deal with it.

   Amazing hands-on learning experiences. Each alumnus expressed excitement and
fondness, particularly over the labs that connected to them, the process of learning during the
labs, what they learned, and how their teachers engaged with them during the work. Students
used such words and phrases as “pretty awesome,” “really cool,” “disgusting,” “fun learning
experience,” “interesting,” “connected to me,” “amazing,” and “loved it” when I asked them
about their lab experiences. Maria, a 21-year-old Latina female, spoke excitedly about her lab
experiences:
The labs were like pretty, the labs were pretty awesome… So sometimes in the lab, we would have to measure weight and mass. I know at one point we had to go to Six Flags and see how tall the rides were and then we had to come back and draw the rides [evidence]. It was like a fun learning experience.

She appreciated how her teacher, Nick, a young White male in his late 20s, combined lab experiments or hands-on activities and teaching with class materials. She found it an amazing way to learn science:

So like, you know how like sometimes you go to like the class and you know the teacher would just teach you off the book. But with Nick, it was like I want to teach you from the book but also we’re going to do hands-on activities, which I feel like that’s really amazing to do when it comes to like learning anything.

Maria smiled and laughed when she said, “That’s really amazing.” It was clear that she really enjoyed that particular lab.

Like Maria, Vicente enjoyed the experiments and how they connected to his life. The connections and relevance of those experiments were more important than formulas and equations to fully engage him in science. Not able to retain formulas, Vicente, a 22-year old reflective, quiet Latino, recalled in his senior year taking physics under Gary as well. He fondly remembered Gary’s class as being a lot about inertia and mass, and that “it made sense and I was able to grasp a lot of it because he gave us a lot of real-world examples. He was like inertia, inertia is when the train stops and your body goes this way and you come back.” He found Gary’s class a combination of a traditional science class but with relevant, applicable investigations to complement the lesson. Vicente, as well as other students appreciated the
hands-on, trial-and-error aspect of science, as demonstrated through the egg drop project and Gary’s engaging way of delivering the topic to students:

But it was also like the traditional science class where you’re experimenting with things to figure out why these equations make sense. How can these equations help you figure out how to drop the egg from 30 feet high and not let it crack? So that’s what he was teaching as far as physics. And, it was the project. One day he just took everybody’s projects and threw them out the window. And I know he loved it! (Laughing) Like, I know you worked so hard on this! I know he loved it but I think we also loved it because it was kind of like that hit or miss kind of experience. But it was forgiving because it was very structured. Next day you knew that he was going to throw your egg out the window.

Vicente and his friend created their protective casing out of a box, taped together and filled with cheddar cheese popcorn. They were thrilled when they “threw it down the stairs and the egg didn’t crack! It did not crack!” He laughed at how their egg cushioned by cheddar cheese popcorn did not break while other students’ eggs cracked with “complicated designs.” The best part to him was being able to “partner up with his best friend…go home with like these ridiculous sketches of how to throw it down the stairs,” and have fun learning science.

**Struggle with Particular SRL Strategies**

*Struggle with note-taking and discovery.* Although Katelynn’s students preferred the free-flow of scientific ideas through inquiry, intense discussions, and connecting those ideas to their lives, she still struggled with getting them to take notes, write their science assessments, and, most importantly, move past the notion that there must be a “right answer” to guide their discovery:
Overall, my students really enjoy science. They seem to really like learning new things, although they push back on taking notes or writing essays. They don’t like doing assessments like lab reports, essays, or presentations but they enjoy learning new materials, asking questions, and having discussions about things they’ve read, heard, seen. I would say my students think science is something to be learned, rather than discovered, and usually want to know the “right answer” when I ask them to pursue something they don’t yet know…they get nervous about working independently and ask a lot of questions about directions and right vs. wrong.

Her students’ struggle to take class notes indicated that they did not employ the SRL strategy of “keeping records and monitoring.”

This was the case as well for Tom as he struggled with students not taking notes in his class. Although he knew they needed to take notes, he often did not remind them. He admitted “he wasn’t so big on them keeping a notebook” and that he needed to do better on requiring them to keep one. He believed they struggled in class because of that very same reason—they were not taking notes. He realized that if they had notes, the time it takes to select and revise exhibitions for the science portfolio would require less direct guidance from him and more autonomy from them:

And I realized this year that I really need to start making sure they have these notes saved somewhere because that would make the exhibition time way more their work rather than them asking me, what is this again? And me getting annoyed and then realizing it’s my fault because I didn’t make them take notes.
SRL Triggers and Teacher Feedback Practices

*Self-regulated learning triggers.* Particular SRL triggers drove students’ science learning, development, and portfolio construction: level of autonomy, pace of instruction, teacher enthusiasm, humor, amount of structure given by the teacher, and the expectations of students’ capacity. In his junior year in Chemistry, Eric wanted to test if hydrogen peroxide could dye hair. Although his science teacher Jillian knew that it could not dye hair, he was adamant and she was sure about his capacity to conduct and complete the experiment:

And when I kind of got the idea, she would say, are you sure you want to do this experiment? And I’m like, yeah, I don’t know, and she would be like, are you sure? And, I’d be like yeah, I want to do it! And she was like, alright, if you really want to do this, I’m gonna let you do it *[Autonomy, Teacher expectation of student capacity]*. And, after a while I was like, I don’t understand why it’s not doing it, and she was like… it was really about why. And in my paper, I was like, I didn’t know why my experiment failed. People always want to know, umm, like your experiment did well or perfect. That’s what they want to see. But, it’s not like that in the real world, you know? *[Connection]* It wasn’t like that. I went through a lot of things. I had to find real hair *[SRL forethought phase]*. I couldn’t use wig hair. I went all over the place, wig shops, weave shops. They wouldn’t give me like one strand of hair so it was a lot that I had to do *[SRL performance phase]*. And this is what I had to go through, and my experiment failed, you know. But this is what I learned from doing that that day *[SRL reflection phase]*.

Although Jillian knew the outcome of the experiment, she stepped back and granted Eric the autonomy he needed to conduct and complete it for himself. In the process, he had to strategize his steps in setting up the experiment (SRL forethought phase), stay encouraged and in control to
continue with the experiment amidst challenges in acquiring the necessary materials (SRL performance phase), and judge his steps and reflect on why his experiment failed (SRL self-reflection phase). He made connections and understood his viewpoint about experimentation and the real world. He came to understand that what the world expects is not necessarily reality and that he still needed to persevere to complete his goal.

For Vicente and his egg drop project, Gary’s humor, enthusiasm, and delivery of instruction served him well in not only this project but also the other project in physics class. The amount of structure and autonomy provided and the level of expectation of project completion connected Vicente to a subject that often times is burdensome for students because of the formulaic mathematics involved. The feedback that Gary gave to Vicente and the rest of the class regarding the effectiveness of their egg protection inventions was meaningful and motivated them to improve on their idea. Such SRL triggers from the teacher brought learning physics to life for Vicente.

**Risk-taking, Safety, and SRL triggers.** In his first years at Spirit, Tom tried to create a culture “where students don’t feel afraid to take risks.” He wanted students to “take risks without fear of being wrong, fear of being made fun of.” In his words, he “just wanted to help push their education in a positive direction.” Developing a supportive and risk-rewarding classroom culture of learning and participation aligns itself with SRL triggers of autonomy and expectations of his students’ capacity. Autonomy and expectations of students’ capacity were also enacted in the “very student-led and student-centered” teaching and learning processes in his classroom where he tried “to be more like a coach rather than a teacher in front of the classroom.” For him, that entailed “really just figuring out what the students need, their strengths and their struggles, and using the strengths to help the struggles get better.” Because
Spirit and its classrooms are student-centered, students choose what they consider to be their best exhibitions to include in their portfolios. Not only are the students invested in their decisions, so are the teachers.

*Feedback practices.* However, it was challenging for Tom and other teachers, he admitted, to allow students that autonomy and structure, that space to decide what really reflects what they have learned and their best work simply because they were so invested in their students’ doing and portraying their best work in their portfolios. Tom said that all too often, teachers treated students’ work as a reflection of their own work and would not allow an exhibition in the portfolio if it were not perfect, thus greatly lowering the percentage of submitted and completed portfolios in Division I during the 9th and 10th grades. Tom reflected on the feedback and revision process after the students would choose their exhibitions:

They revise it, revise it, revise it, revise it to make it perfect. But we try to make it so it’s not the teacher’s work. We want it strictly to be the student’s, so there comes a point where the teacher has to decide to let them just go, like this is your best work at this moment, put it into your portfolio.

According to Tom, students’ 9th and 10th grade portfolios are graded and given feedback based on Spirit’s five HOM rubric by two different teachers for each portfolio. Because the school uses Google Docs, teachers “are constantly giving them feedback [on] Google Docs [and] can give kids feedback as they’re typing, as they’re looking at the document [Feedback practices].” The teachers tell the students that the teachers are “just there to say like this is what you need to get done, and here’s the timeline you’re gonna do it in, and let me know if you need help [Feedback practices].” These feedback practices of the course teacher and two non-course teachers facilitate SRL via clear understanding of good performance; development of self-
assessments in learning; delivery of high quality information about their learning to the student; teacher-student dialogue about their learning and progress; and, consistent opportunities to close the gap between current and desired performance (Macfarlane-Dick, 2000).

Because Spirit uses the digital platform of Google Docs for the construction and development of students’ portfolios, feedback from teachers is instantaneous, constant, tracked, reviewable, and discussable by the students and their teachers. As such, students’ development and progress are validated and observable in real time throughout their high school career along with the type and amount of support the teacher has rendered plus the students’ response to that support. The process is transparent. Communication is two-way and open between the students and the teachers about what they are learning and how they are manifesting it in their exhibitions. Feedback is cyclical through the repeated portfolio process and is embedded in students’ science learning and reporting processes.

**Persistent Care**

For Maria, her teacher’s care and persistence along with her fellow students care and persistence helped her break out of her shell. Although not immediately, Maria finally gained footing in science over the years and grew. She shared that in her freshman year with science teacher Jillian, “she sat in the corner, remained quiet, and tried to figure it all out by herself” even though Jillian always encouraged her to speak and to participate. Maria did not know anyone in the class and she was scared. Even though Jillian persisted throughout the year, Maria said she did not raise her hand because she was afraid to talk.

However, by the time she reached 11th grade (10th grade was a blur to her), she had met new people and friends who helped her out of her shell. They told her to go ask for help: “people were like, no, go ask ‘cause sometimes I would stay like stuck there. And they would
like push me to go do it *[seek social assistance, learn behavior of others]*. And I think that’s what really helped me as well.” One of those people was her science teacher, Nick, who she thought was very caring, positive, and enthusiastic:

Umm one thing about Nick was that he was very caring. And he always had a positive outlook on all the students. So for him to like always push us to do better, especially for myself when, you know, I was, like I said when I was confused with something, and I will like go to him and ask him, and he would come back to me and say, are you sure you got it? And then I would say like yes, I did have it. That’s something really good about teachers like that who like sit there and are trying to help you, who really care for you.

In sum, the teachers enlivened science for these alumni in the following ways: their humor and enthusiasm for science in class; how they structured the class but gave students enough autonomy to explore and conduct authentic investigations; how they engaged students in meaningful class discussions; how they gave consistent feedback on student investigations and portfolios; how they taught and engaged students in HOM aligned, scientific inquiry processes inside and outside of class through the teacher-created curriculum; and, how they persisted in caring even when students resisted and struggled to take notes and take risks in learning and investigation.
CHAPTER V

FINDINGS

Portfolio-Based Assessment in Science: Perspectives and Practice Towards Readiness for College and College Science Coursework, Laboratory Work, and Assessment

This chapter focuses on the findings of research question two—the ways the portfolio-based approach prepares Spirit’s students for college science coursework, laboratory work, and assessment. This chapter is sectioned into three parts: how Spirit prepared the alumni, how Spirit did not prepare the alumni, and the portfolio panel via my observations. Within each of the first two sections, the perspectives of the alumni, Spirit teacher and administrators, and NFSS administrators are given with major themes and subthemes as well.

How Spirit Prepared the Alumni

Alumni’s Perspectives

Major themes of this section are alumni’s lasting laboratory and course experiences, self-regulated learning strategies, exposure to traditional assessments (for one alum), and the College Center’s constant support. The following subthemes emerged: college-ready, college-going, and college-persistence mindset; rigorous science coursework; science courses reflected college courses; self-evaluation and friendly competition at Spirit; self-evaluation and self-competition in college science; self-advocacy; and, seeking social assistance.

Lasting Laboratory and Coursework Experiences

College-ready, college-going, and college-persistence mindset. From an alumnus perspective, Rafaela believed Spirit prepared her for college freshman biology at a local
community college because she remembered much of what she learned in freshman and sophomore years at Spirit taking biology. She recoiled as she remembered dissecting a sheep’s brain in biology at Spirit, calling it “so disgusting.” However, because of her experiencing brain dissection at Spirit, she felt some level of confidence in freshman biology lab in college when it came time to dissect a baby pig’s brain. Here is a dialogue we shared:

Rafaela: I think it did prepare me for biology because umm I was starting to memorize, even though when I first came to Spirit…umm those were one of the first subjects we learned so we used the, the, I forgot what you call it…. When you go to the science room, they give you like these little plates, and you have to use like a microscope?

Interviewer: The petri dishes?

Rafaela: Yeah, and you could look under the microscope, yeah, there you go. Umm I used that also in biology class [in college], and I was like, oh, this brings back memories. Okay, I think I know what I’m doing. And I remember my teacher, Joan, here, she taught me how to use it. So I was like, okay, but I was still having trouble looking for it, so you have to like turn it, play with it a little?

Interviewer: What, the microscope?

Rafaela: Yeah, and then you turn it a wee little bit more, and you just like, oh I can see the little animal in it. I did that. I dissected a sheep’s brain here in high school. I think it was a sheep’s brain. It was so disgusting. And then when I was in biology for college, I dissected a baby pig. (Laughing)
Just as disgusted as she was in high school dissecting the sheep’s brain, she was disgusted in college dissecting the baby pig. However, regardless of her turning stomach she knew she had to dissect the baby pig well since she was “getting graded for this and [her] professor was walking around.” Rafaeila was able to complete her task by drawing on the science skills and confidence she had gained at Spirit and well applied it to her freshman biology class.

*Rigorous science coursework.* Part of Rafaeila’s ability to do and complete her college biology lab work was because of her increasingly difficult science program at Spirit. When students enter Spirit in the 9th grade, they take Biology/Living Environment and continue Biology/Living Environment for a second year in 10th grade. In 11th grade, students take Chemistry and 12th grade students may take Physics although it is not required. Transitioning from 10th to 11th grade science, Rafaeila was not ready for the level of difficulty in Chemistry but still had the support of the Chemistry teacher as she had in the previous years of science:

Yeah. They were still very supportive but it just got harder. I was like, wait, but I just came from being a sophomore and now I’m taking this type of science. What’s this? So I was already lost. I was like, wait, and it was only the first day. And I was like, whoa!

Even though moving from the fun of Biology the previous year to the expectedly difficult Chemistry, Rafaeila said that she still felt supported in Chemistry.

*Science courses reflected college courses.* For Eric, his level of college readiness was “wonderful” as some aspects of the class administration and teaching at Spirit mirrored college. For example, in some of his classes at Spirit, he remembered receiving syllabi with his teachers telling the class that “this is what’s going to happen to you when you go to college. You’re going to get syllabi, you have to do this work on time at a completed time and if not, it’s done, you know. You don’t have any more time to do it.” Even if a student did not want to go to
college, it “was still in your head, like this is what to expect, whether you go right off from high school or five years from now, this is what is gonna happen, no matter what.” Eric well remembered his teachers instilling this college-ready, college-going, and college-persistence mindset in the class, expectations of college academic life, and his responsibilities to owning his progress. This attitude helped prepare him for his freshman year in college:

So, when I had that in my mind, when I saw the syllabus [in college], I was like, all right, I remember this. This is how I have to do. I have to be responsible for my work. So, it just teaches you discipline at Spirit. The teachers are like professors. They don’t go home after work, like I’m done, bye. Teachers stay here till like six o’clock, seven o’clock at night working with the students. Whether they wanted to or not, it shows that they were like, okay, this is what you’re going to be doing when you go to college.

**Self-Regulated Learning Strategies**

*Self-evaluation and friendly competition at Spirit.* For Vicente, self-evaluation and competition helped him prepare for and cope his first year of college. Specifically, self-evaluation and competition in completing one’s project to receive a red tag was how he believed Spirit prepared him for college and college level science. Although not direct advice from teachers or staff, these strategies were coping mechanisms for successful completion of his academic goals at Spirit that worked for him. Their teachers gave students red tags on their projects if the projects were of high enough quality to indicate students’ readiness to matriculate to the next grade level.

Vicente and his friends constantly competed against one another to see “who’s going to walk out of here and not have to stay for lockdown”—when the building is locked down for students who have not completed their project assignments. As it is school policy, security
guards and gym teaching assistants would support classroom teachers in this regard and make sure students did not leave the building until their work was complete. Although this may seem a severe measure to people outside of Spirit, it reveals Spirit’s ethic of care and teacher persistence in motivating students to complete their work. Although some students stayed up to two hours after school completing work, Vicente proudly stated that the most he ever stayed after school was only for 20 minutes because his teacher “was just not giving [him] that red tag.” So Vicente typed it again and submitted it again, and “would keep going like that” until his teacher accepted it.

_Self-evaluation and self-competition in college science._ That constant self-evaluation, that competitive drive, that “I’m going to win” attitude, helped him succeed in his Climate Change class as a freshman at City Tech. Seeing the 50 to 60 students in this class, he asked himself, “How am I going to succeed in here?” It was not in Vicente’s nature to stand out—he did not stand out in Spirit and did not care to do so at City Tech. He thought opposite of what he believed most freshmen thought in classes that size, which seemed big for him. He believed that most students in classes that size wanted to know how could “they get the teacher to know [their] name? How could they build that relationship?” Vicente’s only question was, “How do I connect my name to my test scores when my teacher sees it?” And, to that question Vicente answered with "competition":

So I just thought about it as competition. I would hear what grades they had, and I would focus on how do I get a higher grade than that one? In my head, that’s how I thought about it. Whenever my teacher sees my name, I want to make sure that she saw a high score next to my name. So that’s kind of how it helped me succeed in science.
Within that friendly competition were SRL strategies of goal-setting and planning, self-evaluation, self-consequences, seeking information, seeking social assistance, and learning other-initiated behaviors that Vicente engaged to receive a red tag on his portfolio in that moment and later succeed his first year in science.

**Self-advocacy.** In addition to these SRL strategies engaged at Spirit, Vicente’s teachers taught him how to advocate for himself. Self-advocacy includes the same SRL strategies as competition. He believed that his Spirit-learned self-advocacy also helped him prepare for and be successful in his freshman Climate Change class:

To prepare you for science, one lesson I learned is if you’re struggling, don’t stay quiet. Advocate for yourself. Nobody is gonna do it for you. I would say advocate for yourself, for your education because it’s only so much your teacher can do, it’s only so much your mom can do, your friend can do without you saying look, this matters to me and I want to find the best resources to help me accomplish this. Ultimately, you are in control of your education.

**Seeking social assistance and learning other-initiated behavior.** The SRL strategies Maria developed during her junior year at Spirit (seeking social assistance and learning other-initiated behavior) carried with her during her freshman college science class. She admitted not remembering much of what she learned after graduating from Spirit. Summer learning loss is a reality and it affected her at the beginning of the semester as she struggled in her science class. She admitted that “she did not get it at all.” However, thinking about Spirit and how friends helped her gain ground in her science classes and studies, Maria applied the same strategies when she saw she was struggling her freshman year and advocated for herself by seeking help from her professor and others:
So me going into college and having to do the course, like I really didn’t remember what I learned in science. So it was like kind of like a struggle but I noticed like when I got the middle of the semester within that class, everything started to get better. Why? Because I started to speak to my professor! I was like, you know what, nooo, Maria, it’s time to go speak to my professor to see what she can help me with…And umm I went to my professor and she like helped me with anything I needed help with. And then I noticed that my grades going up and up. And umm, it was just an interesting thing because we also have to work with a group [in Spirit science classes]. We had to like work in groups and you know in college it’s like just all about groups.

**Limited Exposure to Traditional Assessments**

Although Spirit is a portfolio school and prepared the students with extensive writing skills for developing their portfolios, some of Maria’s science teachers also administered quizzes. This was especially helpful when she arrived in freshman chemistry class with 149 other students.

Some quizzes were given but it wasn’t something that was like actually given to us every week…. just to see where we were at….So you know, in terms of the quizzes, it was beneficial, I feel. Because, you know, even though it was portfolio based, some of the teachers were like, you know, let’s just do it to see. And that’s something I like because at Alejandro Jay, they give quizzes and in the majority of the courses sometimes consists of exams. So the fact that I got a little bit of both in Spirit, like the writing and the quizzes and then like some exams.
And that “little bit of both” was what Maria preferred in terms of assessment as did the other alumni. Of note, none of the other alumni mentioned receiving quizzes from their science teachers.

**College Center’s Constant Support**

Nigel was grateful to Spirit for the constant encouragement and support they gave him in word and in deed. He expressed great appreciation to Mariana and Sam, College Center Director and staff member, respectively, as well for the programs they brought to Spirit and constantly provided. Located in the rear of the library for easy student access, the College Center was established by NFSS in partnership with the NYDOE. Administered by NFSS, the Center housed numerous college preparation and college going resources for students. Mariana and Sam put Nigel in several college-based and college-focused programs to expose him to opportunities, which he believed not every student accepted or valued:

> Well, actually, I’m grateful to Spirit. Actually Spirit did a lot for me. Spirit pushed me into college. If it wasn’t for Spirit, I don’t know if I’d even be in college, you know, ‘cause they pushed me in so many programs. There was so much to do and Sam and Mariana, they’re like these big role models and big help in getting me to where I am now, and taking that first step. I’m grateful to them. That’s one thing that Spirit does for you. They’re there and everybody doesn’t take advantage of them, and that’s sad.

In sum, the alumni shared many ways in which they felt Spirit prepared them for college, such as lasting laboratory and course experiences, SRL strategies, exposure to quizzes (for one alum), and the College Center’s constant support. A closer look revealed the particular school mindset, class processes, and SRL strategies that supported students.
A Teacher’s Perspective

In this section, I give Tom’s perspective on how Spirit prepared students for college. He saw their science college readiness in the following components of their Spirit matriculation: science learning comparable to traditional high schools; the extensiveness of their required, written portfolio exhibitions; skills-based, hands-on assessment; the college level scientific inquiries and lab work that he and the other science teachers directed; and student advisory to discuss college readiness.

*Science learning comparable to traditional high school.* Thinking back to his youth as a student in a traditional high school and what students learn today in traditional high schools, Tom did not believe that Spirit students learned any less science at Spirit than at traditional schools:

I definitely feel as a science person, I could get a lot more science content, if it were just a science curriculum classroom. If that content is needed at this level, I don’t know. It’s like I have a bachelor’s in straight biology and I want to give out all this information but then I think back to when I was in high school, I really didn’t learn all that then. So I really don’t think they lose any content. I think they definitely could get more but I don’t think it’s anything other than what students at traditional schools are getting.

*Extensiveness of their required, written portfolio exhibitions.* In fact, Tom believed that Spirit’s portfolio-based assessment philosophy and structure prepared students for college, and that the science curriculum prepared students for college science. He believed that even though students were not taking the Regents, except for the ELA Regents, they were “getting so much more…such a valuable education here [because] they’re getting the science education here but they’re also getting like, they’re learning.”
Because Spirit is a portfolio school, students write “over 20 research papers by the time they graduate from high school,” according to Tom. Having graduated from a traditional high school, Tom admitted going to “college not knowing how to write a research paper” and feeling like his professors laughed at him. Therefore, he believed that his students, because of the intense focus on research and writing in each of the subjects at Spirit, were better prepared for college than he was.

*Skills-based, hands-on assessments.* In addition to writing multiple, extensive research papers each semester of each academic year, students were given “on-demands” or hands-on assessments in science after each unit for students to demonstrate what they had learned in the lab. Tom believed these practicum assessments were indicative of students’ readiness for college science over students from traditional schools that may not allow students these lab and lab assessment opportunities:

We also do these on-demands. So after every unit, because we do a lab for every unit, we try and do like a practical type thing where students come on and they show us, by themselves, they’ll show us the techniques they learned. So whether it’s how to use a triple beam balance, use a microscope, or like use a pipette, we also assess on that. And, I think that’s really cool because when they go to college, no matter what their major is, they’re going to take a science class, and these are all skills that will put them ahead of traditional students that didn’t have time for that.

*College level scientific inquiries and lab work.* Tom felt very sure that, because of the science curriculum and extensive lab work, students would be prepared for college science lab work. Students in his class conducted scientific investigations at the high school level and beyond into what first- and second-year college students would do in science lab work.
We’re actually doing these labs at our school that you’d be doing like your second-year of college. We are extracting DNA from insects. We’re running PCR [polymerase chain reaction] analysis and gel iontophoresis. So I think what we do here really, really prepares them for [college] science.

He believed students’ connections between high school science and college science “probably really starts to happen more in 11th and 12th grade” since this is when “they make these statements like, ‘Why are we doing this?’” These connections were also probably made as the science coursework and lab work became more challenging, for example, with the Wolbachia lab. (Wolbachia is a genus of intracellular bacteria that infect arthropod species and are used to fight malaria.) Tom explained the Wolbachia lab he enjoyed conducting with his students in the context of the neighboring river and community. In conducting the lab, he made sure to tell them at what level of college science they were already operating in high school:

They are looking to see if there’s this parasite Wolbachia living in any insects around the neighborhood, because Wolbachia can be used to help prevent malaria. So like we take, we extract the DNA from the insects, we run the PCR, we run the gel iontophoresis. We can actually see if the insects we collected have the Wolbachia in it. And kids kind of like don’t understand why we’re doing it but then I explained to them that this is something that you will do in college. I didn’t do this until my third year of college but you guys are doing it in 9th grade. Like they started to think that’s really cool, that they’re doing college-level stuff they take it more seriously and they get more involved.

Student advisory to discuss college readiness. Tom kept his own high school and college science learning experiences in mind as he, like the other teachers, also served as advisors to their students. During his advisory, he focused on college readiness even though students often
wanted to focus on their portfolio exhibitions for extra feedback or support from him. However, he made sure to steer the advisory back to college since students had time outside of class, in study hall for example, to work on their exhibitions. He wanted to help his students realize what they were already doing yet still needed to do to be prepared for college and college science, especially since he believed some people would view their not taking a science Regents as negatively affecting their chances of being accepted into college. Although Tom did not hold that same belief himself, he also did not “know if colleges look at that so much anymore.”

In sum, Tom felt the science courses, portfolio assessment, and student advisory prepared students for college science although he did not know for certain what colleges look for when determining college acceptance, particularly, in terms of standardized exams like the Regents.

**Spirit Administrators’ Perspectives**

In this section, I give Elvin and Megan’s perspectives on how Spirit prepared students for college. They saw students’ science college readiness in the following components of students’ matriculation: persistence and high quality work; college as an option for all; and preparing students to be independent and confident.

*Persistence and high quality work.* Megan immediately saw students’ repeated learning and extensive use of “the scientific method” as helping students to be prepared for college science coursework and lab work. Because students in each science course at each grade level engage with and employ scientific inquiry processes, she believed this reflected what is required of students in college science. The quality of students’ portfolios is evaluated by a rubric as well as their panel presentations, which she believed were demonstrated evidence of students’ college readiness. For Megan, students successfully navigating the portfolio process while matriculating through and graduating from Spirit helped to prepare them for college science.
That successful navigation was due in part to the administrators and teachers’ persistence, or what they jokingly called, “teaching by harassment.” An SRL trigger and principle of good feedback practice, the teachers persisted in letting the students know their clear expectations of the work itself and students’ successful completion of that work. Because Spirit welcomes students with many challenges (i.e. chronic absenteeism, high poverty, high special needs, lack of engagement), teachers and administrators know the consistent and often intense level of encouragement and motivation their students need against their own resistance. Students feel that persistent presence, care, and high expectation immediately when they enter Spirit and spend a lot of their 9th and 10th grade years getting accustomed, so that on their own, they begin to say, “Yep, I’m doing work” and “I have to do this work now.”

Megan was emphatic that they, the administrators, the teachers, and NFSS, always make sure the students know that “we’re not going to write you off. We’re not going to let you fall through the cracks. We’re still expecting this of you and we’re going to harass you until you do it, and we want to find a way for you to do it.” She believed such teacher and Spirit persistence showed in students’ class performance, especially in science with the high quality of coursework and lab work, where students strive to meet HOM and subject rubric standards. Megan believed that there was research showing that the portfolios—state-approved alternatives to the Regents—exceed the expectations and standards of the Regents “in terms of the quality and level of work that [Spirit] asks students to do.” To Megan, this persistence and high quality work helped to prepare students for college and college science.

*College as an option for all.* Elvin also believed that Spirit’s culture of persistence and high quality work helped to prepare students for college—even students who may not believe college is for them. He proudly stated, “We have the saying here: ‘Student resistance is met with
NFSS supports this persistence and Elvin was emphatic about how NFSS has helped many students who before coming to Spirit did not see college in their future. The majority of Spirit students now see going to college as something that will improve their life. Elvin partly accredited that change to NFSS as they have “done a tremendous job helping us with that.” However, he recognized that Spirit has “kids, who because of years of not being successful in school and years of neglectful homes or neglectful schools, don’t see school as an option. But they don’t say that. Very few of them say that. They just don’t act on it.”

Spirit and NFSS administrators and staff, though, are persistent in helping students who say they want to go to college, almost like a mantra or automatic response, but do not act on it and list multiple reasons why they believe they cannot go to college. Frankly, Elvin, like Megan, did not believe that every student wants to go to college or should go to college because that “may not be what their life’s work is.” However, they did believe that it is their responsibility as a school “to prepare [his emphasis] everyone for college. Like, I don’t think we should say those kids aren’t college material. Every kid should be prepared to go to college and our job is to work on every kid and prepare them.”

Even alumni who graduated from Spirit and pursued other life goals over the years often return to Spirit and seek assistance because they have decided to go to college. Megan said Spirit has “college counselors for life” because several alumni come back for assistance. She shared how an alumna who graduated in 2005 came back just this year to say she wanted to go to CUNY, and they immediately started helping her with her application. Megan said, “I feel like once you’re here, you’re ours forever. You know, you can always come back.”

Prepared for students to be independent and confident. Elvin wanted to make sure Spirit is persistent in helping students answer the question, “What do you want to do?” to give context to
and impetus for college and career readiness. He wanted students to be independent and confident in their pursuit of that question, wherever that question would lead them. Spirit’s culture of persistence and nurturing drives students to answer that question and try to pursue their life goals, inclusive of college. Elvin was proud of Spirit’s culture and the academic and personal skills and characteristics it instilled in the students. Validation of the culture was often felt when alumni would return and share the ways in which it prepared them for college. He shared what alumni often said to him upon their return:

Spirit really prepared me to be independent. Spirit prepared me to be a college student, present my work, verbalize my opinions on things, get up with a group and do presentations. It really helped me prepare for that. It really helped me prepare for writing papers in college. I feel like, wherever I go, I’m very confident. I can write a 10-page paper with no problem and my classmates freak out.

Thus, Spirit administrators saw students’ science college readiness in the following components of their Spirit matriculation: culture of persistence, high quality work, nurturing and college as an option for all, and students being independent and confident in the pursuit of their goals.

NFSS Administrators’ Perspectives

In this section, I give Mariana and Adamo’s perspectives on how Spirit prepared students for college. They saw students’ college readiness in the following components of their Spirit matriculation: closely supporting students and families through college entry process; applying to city and state college academic and financial programs; grooming students for independence and success; portfolio process and tutoring resources; portfolio process for advocacy; portfolio panel presentations; real-world, collegiate and professional experiences; and test preparation.
Closely supporting students and families through college entry process. Mariana, the NFSS 12th grade college coach and College Center Director, helps every upper level student through every part of the college entry process: college introduction, search, visit, application (including the personal statement and financial aid), admissions (which may include an interview), acceptance/denial, and their first year as a college freshman. As such, she has an intimate and unique perspective on students’ college readiness, particularly because she is very knowledgeable about CUNY, SUNY (State University of New York), private, and out-of-state schools that she feels may or may not be the best fit for each student she counsels. Although some of the students resist and refute her college recommendations, she assures them that they will go to college and they will go to the college that is right for them:

So I tell them forget about the names of the colleges. Forget about the accolades or what you hear about them. I will get you into your college… we try to encourage them to understand that they need to go to the college that’s for them. Don’t follow trends. Don’t go there because 10 of your friends are going. Go there because you know that it is the college that has your name visibly written on the wall because sometimes you need to embody that school.

To be able to make such assurances and to help prepare students for college, Mariana gets to know each student and their family very closely since, when considering college, all types of challenges often arise from cultural to personal to financial. For instance, many students fear traveling and being away from home because even as teenagers “they get scared to get on the train to go to [downtown].” She also shared that some Latino parents she has met have a very traditional and narrow viewpoint of how their daughters should develop into women,
specifically, that their daughters “should be more set up to do housework than to actually go out and get a career, get a college education, or be CEO over others.”

Applying to city and state college academic and financial programs. Also, Mariana said frankly, that the students know that “they can’t take us with them to that environment in college.” As such, she also closely supports them in applying to college educational programs that support mid-level performing students’ college-going and college-persistence efforts through academic and financial support such as HEO (Higher Education Opportunity Program), MAP (Mathematics Advancement Program), and College Discovery programs and SUNY’s EOP (Educational Opportunity Program). In addition to these college-based programs, Spirit helps to prepare students for college through the College Center and its close partnership with the NFSS with the College Center working directly with the 9th, 10th, and 12th grade and a NFSS staff person working directly with the 11th grade. Since 2013 the Center and NFSS’s close support of and push for students’ college readiness have proven successful in helping students enter not only local community colleges but now enter in-state and out-of-state colleges and universities such as Manhattanville College, Daemen College, Spelman College, Sarah Lawrence College, and Syracuse University.

Mariana was proud to say that Spirit has become a school “where we can name drop now, where before we would say, okay, it’s great, we graduated 80% of the senior class but they’re all going to local community colleges. But now we’re able to say we graduated the 80% and out of those 80% like 30% of those are going to either a SUNY or [a 4-year college] or now even the private colleges.” The college culture that is evident in the College Center is what Mariana said draws alumni back to Spirit to talk with her and Spirit students about their college experiences usually in January for Alumni Day, during college breaks, or the summer.
Grooming students for independence and success. Spirit instilled in its students the belief in themselves that they could be accepted into college, go, and succeed. She said they have “a lot of students who started in [local community] colleges and they’ve transferred into like other [4-year college] campuses which is great, you know, and that’s what I mean by helping them get that personality or build that character, saying, “I can do this. I can do this on my own. I know I’ve developed the skills.” Mariana said Spirit also made students understand that they were not alone—that there were always people rooting for them, supporting them, believing in them. Like Megan, Mariana and the Center reminded them that they could always come home to Spirit to recharge and hear what they had always heard from Spirit—that they can do this:

They say, ‘I know I can always count on them. I can call them. I can see them.’ They come here and visit us. They know that they have people who will tell them, yes, you can do this. And you know, that’s really what they look for once they leave here.

Someone that still is able to encourage them and tell them that they can.

Portfolio process and tutoring resources. Adamo, the NFSS Community School Director for Spirit, saw Spirit’s portfolio process and NFSS’s tutoring initiative as preparing students for the rigor and high expectations of college work. NFSS’s tutoring initiative has placed a tutor in each classroom—three in Division I, which houses 9th and 10th graders in mixed instruction classrooms and two in Division II, which houses 11th and 12th graders in grade-level classrooms. Depending on funding, there may be three in Division I and only one in Division II, specifically 12th grade since with “12th grade being a very challenging year in terms of making sure you’re finishing your portfolios and everything with college access and, you know, the masteries and the panels that go on here as well. So, there’s really a lot.” However, Adamo emphasized that
more support continues to be given to 9th and 10th graders because they noticed something very important regarding student performance:

We noticed that after the first year of this model, there was a 4% increase in cumulative GPA for each of the houses [9th and 10th grade] and we saw a 25% increase of those 9th and 10th graders that were accumulating 10 or more credits in that academic year.

Something stood out to me that Elvin said, and this is actually a nationwide statistic, but they said that 90% of kids that don’t accumulate 10 to 12 credits in their freshman year [of high school], don’t graduate within four years. And we really wanted to make a dent in that…we really wanted to say, you know what, let’s really target our efforts on the lowest performing students and really try to help them along so they don’t fall behind.

In-class tutoring, according to Adamo, was more about portfolio management than content tutoring for the lower 25% of each class, thus supporting these students in their research, writing, and editing process so that “hopefully by the time that they put it in front of the teachers, they will get what’s called a blue tag [needs work here] or red tag, which signifies that the work really satisfies the criteria that the teachers are looking for.” To help students towards successful portfolio completion, the tutors collaborate with the teachers and join them in planning meetings to understand the expectations for each particular section or exhibition of the portfolio and the needs of each student they assist, which is often four or five students at a time.

Portfolio process for advocacy. Adamo proudly recalled such a case where a student used her portfolio work, specifically her mathematics exhibitions and reflection papers, to show that she was prepared for college and to make her case for why she should be admitted into her university of choice:
A student who was trying to negotiate with the school saying that I’m very, very interested in going to your college and the question was, well… how can you compete with a student that has taken let’s say, a mathematics Regents exam, you know? And that’s something that we’ve often had to deal with, you know? But the student was able to say, listen I’ve never taken a Regents exam, but I am required to have a math portfolio that I can obviously forward to you and you can see the type of mathematics that I’m doing, as well as all of the reflections that I’ve written…So, having something that’s tangible, that you can actually give to a college admissions office, officer kinda put her over the top, and I believe now that she’s at Syracuse.

It is that self-advocacy that Spirit teaches students and prepares them for college. Adamo was emphatic that “that’s only going to help them excel in college when they can advocate for themselves and … make a certain contact or be in somebody’s face to exhibit that persistent pursuit of trying to really get what it is that you want.”

*Portfolio panel presentations.* Adamo also believed that the culmination of the portfolio process—the panel presentation and discussion—also prepared Spirit students for college. Although students begin creating their portfolios in 9th grade, they begin their panel presentations and discussions in 10th grade, which consists of students choosing a particular exhibition and presenting it in front of a panel of students, teachers, and administrators. In presenting their chosen exhibition, they defend the research behind it and the merits of it, and answer questions from the panel. Adamo believed that the portfolio along with the exhibition presentation and discussion is “definitely more aligned with what’s expected of the college-going culture than test prepping them to *death* so that they can pass their mathematics Regents exam.” Students
preparing a body of inquiry-based research work, reflection, presentation, and defense prepared them for the research and writing expectations and rigors of college.

*Real-world, collegiate and professional experiences.* On top of the portfolio process and student self-advocacy, Adamo also believed that continuous exposure to real-world, collegiate and professional experiences helped to prepare Spirit students for college. NFSS provides these experiences through their corporate partnerships with foundations and companies such as the Teagle Foundation, JP Morgan Chase, Madison Square Garden, and others that help shape students’ outlook on life for college-going and college-persisting. Students gain myriad skills and experiences, such as coding and computer programming, designing websites, working in corporate offices, participating in mock job interviews, interviewing sports professionals, creating their own sportscast, or seeing the production side of a Madison Square Garden event. Before participating in these programs, many students were unaware that such career opportunities even existed, and if they did, even what was necessary to pursue and achieve them. Adamo reflected on the scope of impact that these programs make on students, their self-perception, and their future:

What does it say to them when they get to travel from [their neighborhood] and go to [a major university] campus and be in the [city] and interact with [university] students and professors and see that, you know what, not only is there something more, but I can also flourish in this type of environment. And I think that does wonders to their confidence, right, in saying, you know what, nobody’d ever gone to college before but wow, I sat here with [a professor] and I sat here for four weeks…I have a finished product that I can call my own…exposed to these new opportunities that I didn’t know six weeks ago, you know?
College admissions test preparation. In addition to Spirit and NFSS’s efforts to support students holistically and in their college-going goals, they also provided students support in test preparation for such tests as the PSAT, SAT, and ACT. Through NFSS’s partnership with test prep companies like A-LIST, students could learn test-taking strategies during the summer with A-LIST. Understanding the need to be prepared for the college entrance standardized assessments students will face, NFSS wanted to expose students to test preparation as soon as possible, which according to Adamo, has proven effective for some students: “A-LIST is actually really, really good and we’ve seen some considerable gains in some cases 300, 400 point differences from pre-A-LIST to post A-LIST.” Because test preparation was different from their normal form of performance-based assessment, many students enjoyed the experience and were excited about it. Adamo often heard positive feedback from the students about their test prep experience:

And they’re like, ‘oh, we don’t get to do this kind of stuff!’ So it’s kind of fresh to them.

And it’s a little different. When you’re doing it all the time, it becomes redundant, you get sick of it. But you know, we’ve noticed that our rising seniors, our 11th graders that are rising seniors they actually get excited about it because they’ve never done it before.”

Students who could take advantage of A-LIST during the summer gained standardized test-taking skills that non-participating students did not. Although the test prep experiences with A-LIST helped some students with regards to standardized testing for college entrance, it did not prepare students for the traditional assessment students would face during their freshman year in college, as quite simply, that was not the purpose for A-LIST.
Alumni’s Perspectives

Major themes in this section reflect alumni’s perspectives of how Spirit did not prepare them for college and college science: lack of broad science background or understanding; not ready for traditional school assessments; not ready for standardized assessments; and, perceived lack of accountability and urgency.

*Not a broad science background or understanding.* Nigel, throughout the interview prided himself on having “destroyed” (i.e., done exceedingly well on) many projects, assignments, or panel presentations during his tenure at Spirit. However, he could not say the same for his performance in his freshman Anatomy & Physiology (A&P) course at a SUNY college. He believed he only knew or was familiar with a small percentage of the content—much less than many others in the class:

…but my first class in A&P, like my first lecture, [I was] ready, prepared, blank paper and all that. Like when [the professor] was talking, he asked a couple questions, I literally couldn’t like raise my hand as much as some people. I was like, are we really supposed to know this? It was like crazy because most the time, I was just writing and some people already knew it because maybe they went to like nursing high school. I probably knew 15% of the material, if anything.

Since Spirit, like other portfolio schools, does not follow prescribed curricula for the subjects, it stands to reason that there would be content and concepts that Nigel or any student in a portfolio school would not know compared to students attending non-portfolio schools with prescribed curricula. These prescribed curricula often reflect the full science scope and sequence
established by the DOE and the foundation of what college freshman science courses cover (i.e., Biology, Chemistry, Physics, Geology, and Physics).

*Not ready for traditional school assessments.* Although Maria experienced assessment via portfolios and quizzes through a few of her Spirit teachers, most of the alumni of this study did not. They only experienced assessment via their portfolios. They believed that not taking traditional (multiple choice, short answer) quizzes and tests in science at Spirit did not help them in their freshman year where their classmates were quite familiar with traditional assessments and the expectations and requirements of preparing for them. Although Alejandro and Nigel both believed that Spirit made them “extremely adept writers,” they were both upset about not being equipped to manage the traditional science tests they took during their freshman year in college. They shared what they and other alumni felt. Alejandro said he felt “extremely handicapped in test taking”:

I was extremely adept in writing and extremely handicapped in test taking. And it was because of the portfolios in Spirit. And it was something that me and Vicente and a bunch of people that graduated from Spirit felt very upset about Spirit because we were extremely good at vocalizing things involving presentations, a project, but because colleges didn’t follow the same strategy on things at Spirit…we can’t do this test… I can talk about what I did. But I can’t simplify it by saying A, B, or C. We ended up failing a lot of our tests the first years in college because we didn’t know how to take a test.

Further, Alejandro lamented his initial learning experiences in college, especially his first college science course, Astronomy, which was a shock to him. He did “horrible the first part of that semester because the professor wasn’t like Gary and Noah [his Spirit teachers who were] very vocal. They were very passionate.” Alejandro was not ready for a professor who “just
came in and said read chapters like six and seven, and then we’re going to take a test on it Wednesday, and then we’re going to take an exam on it at the end of the month. Bye.” He struggled to “memorize a particular, very detailed, and absolute answer, for something that was beyond [his] comprehension.” He earned a B+ in the class but would have “failed horrifically” had it not been for the projects. Nigel suggested Spirit science teachers needed to give traditional assessments in addition to the portfolios. He believed “if a majority of kids that were used to Spirit and then went to a testing school, they would all fail…”

Not ready for standardized assessments. Even before entering college, Vicente did not feel that Spirit prepared him for taking the Regents exams. Although students at Spirit only had to take the ELA Regents to graduate, Vicente felt like he was not taught enough mathematics to perform well in college. Because of his late arriving Regents scores and subsequent college entrance exam scores, he was placed in a remedial mathematics course. However, when his scores finally arrived and he was able to withdraw from the course, he stayed because he “didn’t learn this stuff in high school.” In addition, he knew that if he wanted to “go onto the next mathematics class, [he] would put [himself] at a disadvantage if [he didn’t] take it.” He further believed that he “probably wouldn’t have graduated high school just based on what [he] was being taught and what tests [he] would have to take.” He, like Maria, would have preferred a combination of portfolio and traditional assessments at Spirit to aptly prepare him for the Regents exams and college assessments:

Yeah, there wasn’t much connection between what you was learning in the classroom and what was on the Regents exam. A lot of it was like formulas. What formula does it take to write a successful essay? What formula do you have to write a mathematics research paper? A lot of it was like that, teaching formulas to make a successful piece of work
Perceived lack of accountability and urgency. Nigel bemoaned what seemed to him as a lack of accountability and urgency of completing one’s assignments on time so much so that people “can do it whenever, and it doesn’t matter. They’ll just take off five or 10 points….it’s like, okay, you didn’t do your work, so alright now it’s the whole end of the year, this work was due in September and you can still do it.” Testing and accountability were important to him and he was very specific in his belief about how Spirit students should be tested. He believed that giving traditional assessments like quizzes (announced or unannounced) once every two weeks and a “big 30 question test” would not hurt the students but help them and prepare them for the academic and work expectations and demands of “the real world”:

And then probably even once every two months or just once a month, like a big 30-question test, and have us go over it together to see what we need to work on. You know, you can’t avoid tests. It’s like kids that go to non-portfolio schools and take all those tests, they have information that people in portfolio schools, we don’t really have. There’s tests. Tests cover so much because you only can ask one question, so they have to make it so broad. They just do it to narrow down who’s stronger and who’s weaker. In sum, alumni saw the lack of a broad science background or understanding and lack of traditional assessments as ways Spirit did not prepare them for college.

Spirit Administrators’ Perspectives

Major themes in this section reflect administrator’s perspectives of how Spirit did not prepare students for college and college science: lack of traditional assessments; traditional assessments allowed but portfolio prioritized; CUNY failing to serve urban youth; and, need to prepare students for broader life choices.
Lack of traditional assessments. Megan acknowledged the lack of traditional assessments at Spirit. Although teachers could give quizzes, multiple-choice tests, or short answer tests if they wanted, she, like Elvin, did not see it really happening, and especially in science. She recognized that sometimes there was direct instruction of vocabulary, laws, and theories, which would prompt science teachers to tell students to “write them down, you’re going to learn them.” However, she also knew that such instruction included varied and appropriate learning and application context and not just the admonition to “memorize what they are.” Although she saw vocabulary quizzes in English more so than science, she also did not see bigger tests like unit tests in either subject. Administrators and teachers at Spirit were aware that alumni “know how to write but they don’t feel comfortable taking tests.”

Interestingly, although Megan recognized the broader challenge of society and higher institutions in accepting portfolio-based schools and their performance-based assessments, she believed that performance-based assessments align more closely with how she believed one is assessed in life or on the job in one’s career. To her, if “the ultimate goal of school is to prepare you for the world and beyond,” then in the real world, “you’re not taking tests, but can you be a good writer? ...Can you question things and not take everything for granted because somebody told you?” Having those skills are important in the real world and not how well students can “memorize for the test and take it and forget everything [afterward].” Although people do take professional assessments in the real world in numerous fields (i.e., medicine, accounting, engineering, actuarial science, architecture, risk management), Megan may not have considered professional assessments at all or even in the same light as public school standardized tests when thinking about how to best prepare Spirit students for college and career opportunities.
Traditional assessments allowed but prioritize the portfolio. Elvin acknowledged the lack of traditional assessments at Spirit and very rarely saw teachers giving quizzes and tests since “it just doesn’t fit” into the portfolio-based assessment culture. He recalled one science teacher who indicated that he would like to give more quizzes and, in fact, he “does give quizzes sometimes, which is fine, whatever. He feels like it’s a good way to kind of see where kids are.” Teachers know they have leeway to give traditional assessments to a certain point: “You want to give them quizzes once in a while, give a quiz. You want to give a test? Give a test. You want to give four tests a semester? Are you sure that’s the best way? You want to not do a portfolio and only do a midterm? No.”

CUNY failing to serve urban youth. Interestingly, Elvin said that he did not hear many complaints about science but he did hear a lot of complaints about mathematics in terms of how students did not feel they were prepared for college. He said, “You do hear kids come back and say like mathematics is like kicking my ass.” However, he believed those complaints were similar to complaints from students who attended traditional high schools that followed the prescribed NYDOE mathematics scope and sequence. With the sheer percentage of students needing remedial education upon entering CUNY, Elvin believed the gap between student high school performance in mathematics and their performance in CUNY was a reflection on CUNY and its mathematics teaching and student support processes:

And they’ll say like, ‘you guys didn’t prepare me for math.’ Now, is that true? I mean is their experience true? Yes, their experience is true. Schools that do linear, sequential mathematics, which is the majority of high schools in New York, are also not [preparing their students for college mathematics] … Kids from those schools are going to college and having difficult times in math… So it’s like 90% of CUNY students need remedial
math…We are one tiny school of 300 or like 400 almost 500. ..And we send maybe 30 kids, maybe 40 kids a year to CUNY, right? So we’re a sliver of that 90% of kids who need remediation… I think CUNY Math is doing something wrong. Not us.

Megan admitted that CUNY has complained that Spirit and other portfolio schools are not preparing students for mathematics “because when they go to CUNY, they fail mathematics. Well, we actually do teach mathematics very differently here than most places, but actually when you look at statistics, everybody [she emphasized] going to CUNY is failing mathematics.”

Reciting poor graduation rates across the board of all students in CUNY’s community colleges, she questioned CUNY’s commitment to helping all of their students be successful, especially since historically it had served the city’s high school graduates with free tuition—students who normally would not be able to afford college.

Megan saw CUNY as not serving the city’s youth of color and poor youth anymore because now “it’s decided it wants to become the Harvard of New York City” and charge tuition, especially increased out-of-state tuition, which supposedly brings “a certain eliteness to the school that they’re looking to prove they have …and…this beautiful idea of let’s set up a real city college is no more in terms of our kids keep getting relegated to two-year colleges.” She believed CUNY has created “a pretty elitist, racist system here in terms of what they’re doing” and has no motive to change because (1) “there are plenty of people who can come here, they can pay the money, and it is still a bargain of any schooling system” and (2) “[they] have the hedge fund folk, and all types of corporations and private citizens with beaucoup dollars saying ‘I’ll give you money, but I just need you to change a few things’.” These changes were what Megan believed prevented not only Spirit students but city high school students as well from entering and succeeding at CUNY colleges.
Need to prepare students for broader life choices. Frankly, Megan would rather not measure college readiness through CUNY’s measures or any college’s measures or even the DOE’s measures as her belief is that school should prepare students to be “prepared for whatever is next” in life. While students may be ready to go to college, she questioned a number of things:

- Are they ready to go into employment? Do I feel like we’ve prepared our students to do that?
- Is the work good enough? Do they have the skills that we want them to have? Work around more pride of our work. Is it good? But we always want to make it better.

With Spirit’s graduation rates comparable to the city’s, she questioned what else should Spirit be doing to improve that rate, especially in “this type of struggling environment [community surrounding Spirit].” Her measures of readiness for college and beyond not only included graduation rates, which she was striving to increase, but she also wanted Spirit students “to come out of here happier…do something that they enjoy or at least don’t hate. Not that we all love our jobs every single day but you want them to be generally content in their life choices. Isn’t that the purpose of life?” Megan wanted Spirit students to graduate with the skills and tools to “figure[e] out at least what makes [them] content, and trying to find it and make it happen.”

In sum, even though traditional assessments were allowed at Spirit, they were not prioritized. Also, in the face of CUNY failing to serve NYC youth, administrators believed they should be preparing students for broader life choices rather than tests.

NFSS Administrators’ Perspectives

Major themes in this section reflect NFSS administrators’ perspectives of how Spirit did not prepare students for college and college science: Spirit students were not test takers; weakness of dual subjects; and no Advanced Placement courses.
Not test takers. Mariana heard the same criticism of not being prepared for traditional assessments from the alumni who returned to share their experiences with her and Spirit students. She recalled their immediate criticisms and concerns:

Some of the criticisms off the bat, obviously, is the test taking. A lot of them that first year have to really use resources on campus to learn how to strategize and test take, right, because there’s no test taking here. You know, it’s so much more easier for them to get an A on a project where they have to write a 20 page paper and present and do all the things that they do here. And then when it comes to take a final exam, they’re like, uhhh, what is this? I’m not used to now having the whole course work put onto a test and now have to answer A, B, or C. So, I think for them that’s always been their biggest criticism.

Weakness of dual subjects. In addition to the lack of test exposure and practice, Adamo further believed that Spirit’s mathematics and science curricula were also “grow areas of the school” such that one of his criticisms is that “you’ll have teachers that will teach dual subjects, so your mathematics and science teacher will be the same person. Your humanities teacher will teach you English and history.” As a former 7th grade mathematics teacher, and 8th and 11th grade American History teacher, Adamo believed that “any given person is going to really favor one [subject] more than the other. So, you’ll either be stronger at mathematics and weaker at science, and vice versa. And I think that ultimately that gets passed onto the students as well.” He believed it is very difficult to master both disciplines and to teach both equally and effectively, and therefore, Spirit needed to revisit the practice of combined subjects and figure out how to improve the teaching of each subject.

No Advanced Placement courses. Although they have gradually offered more intense courses, they still do not offer Advanced Placement courses, which Adamo saw as a
disadvantage: “That really puts our students at a disadvantage when they’re competing with students that have high SAT scores, an abundance of AP courses, and college credits, you know.” As such, Spirit tries to compensate by offering more college-based and college-preparation programs and NFSS works to develop more corporate partnerships to “really give them that additional exposure that kind of, you know, will separate them from their peers that are doing all of these other wonderful things.” NFSS works within Spirit’s school vision, structure, and culture to support its students’ pathways to college readiness as much as possible. Adamo said he has seen small changes over the years with the mathematics curriculum but nothing drastic, and since NFSS is not involved in Spirit’s curriculum development or the professional development of their teachers, it is not something that he or NFSS can influence firsthand.

In sum, NFSS administrators knew that Spirit students were not test takers and believed that there was a weakness in Spirit having dual subjects and no Advanced Placement courses.

**Portfolio-Based Assessment in Science: A Researcher’s Narrative**

To explore science assessment in an urban portfolio community high school, I participated on four 12th grade science portfolio presentation panels with Spirit faculty. As a participant observer (Merriam, 2009), I observed and participated in the culmination of the portfolio process for graduating seniors and record both descriptive field notes and reflective notes from my experiences. These narratives detail a chemistry panel (one of the four science panels presented) wrapped in the following context: the administration of the panel presentations and assessment rubrics; my participation on the panel; the team panel presentation; each member’s individual part of the presentation; and my reflections on the panel.

Over the course of seven years or more, I had successfully collaborated with Spirit through their community schools partnership. When learning about my background and
experiences in science education, especially as it pertained to middle and high school grades, the school administration invited me to participate on several science portfolio presentation panels for 12th grade students at Spirit. These presentation panels are critical because they represent the final assessments towards high school completion, graduation, and college entrance. For this study, as a participant observer on the panel, I focused my observation on the portfolio presentation and assessment processes, which included the individual student performance (demonstration, presentation and discussion) and the student/student (group members) and student/panelist interactions.

**Administration of the Panel and Assessment Rubrics**

Organized and operating like a well-oiled machine, one assistant principal leads the entire coordination process for all of the portfolio panel presentations during the assessment period in June. The coordination efforts also include the confirmation of all internal and external panelists for each discipline and/or content area. After I confirmed my participation as a panelist for specific science presentations (chemistry and physics), I received a folder containing the following materials: (a) weekly panel presentation schedule (listing dates/times/room location, subject/teacher, students, and internal faculty readers/participants); (b) New York Performance Standards Consortium (NYPSC) Extended Science Project or Original Experiment Evaluation Rubric (Appendix 8); (c) Oral Presentation Rubric (Appendix 9): Literary Analysis Evaluation Rubric (Appendix 10); and (d) the Final Portfolio Grade Rubric (Appendix 11) for the specific subject or content area that captures the calculations for the written grade, oral grade, and the final grade. For external panelists, student’s individual written work (science concept/content paper and investigation reflection letter) may be distributed electronically in advance of the presentation or at the exhibition/presentation.
The assessment process is dependent upon proper application of the rubrics, which include a description of the rating categories and is reinforced on the Final Portfolio Grade document that includes the numerical equivalent, weighted average equation, and score conversion table. It is important to note that the grades for this process are not the traditional letters (i.e. A, B, C, D and F) or their traditional numerical equivalents (i.e. 100-90, 89-80, etc.). Instead, the scoring is applied in order of the highest rating (D for Distinguished) to the lowest rating (U for Unsatisfactory) (Table 5.1).

Table 5.1
Scoring of Portfolio Scale

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Term/Description</th>
<th>Performance Indicator</th>
<th>Numerical Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Distinguished</td>
<td>Outstanding</td>
<td>4.0 – 3.6</td>
</tr>
<tr>
<td>S+</td>
<td>Satisfactory Plus</td>
<td>Proficient</td>
<td>3.5 – 2.6</td>
</tr>
<tr>
<td>S</td>
<td>Satisfactory</td>
<td>Competent</td>
<td>2.5 – 1.6</td>
</tr>
<tr>
<td>S-</td>
<td>Less than Satisfactory</td>
<td>Less than Satisfactory</td>
<td>1.5 – 1.0</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>Unsatisfactory - Needs</td>
<td>&lt;1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revision</td>
<td></td>
</tr>
</tbody>
</table>

The NYPSC Assessment Science Rubric (Appendix 8) serves as the lens in which I observed and assessed the science performance and content mastery of each student. This included their abilities and competencies exhibited within their included written work and presentation (i.e., concept demonstrations, experiments or investigations; content knowledge; written reflection; interactions during scientific discussions).

**Participation on the Panel**

It is a sunny day in June and I am scheduled for two science panels. I enter the lobby at Spirit where the school leader, safety agents, a sprinkle of school staff, and student leaders were
moving about. My presence is acknowledged and received with a hearty reception—smiles, hugs, and laughter—denoting the caring culture and theme that emerged from students’ experiences at Spirit. Before heading to the 2nd floor to my classroom assignment indicated on the panel schedule located at the lobby desk, I take the time to engage in meaningful check-ins with various school members as a reinforcing means of continued connectedness.

Not spending my normal extended amount of time chatting and catching up with various folks in the lobby about their lives, I engage in important, lively conversation with the principal and the lead safety agent. The principal shows his appreciation and excitement for my participation on the chemistry and physics panels, and is very interested to hear my perspective of the students learning of science and the assessment experience. In response, I express my own appreciation to observe and engage students in science and my excitement to gain an understanding of the experiences connected to the philosophy, practice and implementation of the portfolio assessment approach and the culture it seeks to sustain.

After a brief review of the panelists’ responsibilities and an overview of the portfolio assessment process, I receive my folders from the assistant principal coordinating this. She has extensive experience, gained over the many years, in developing and implementing a smooth experience for all (students, faculty, and external participants). Entering the room for the first panel focused on Chemistry scheduled for 9:30am-11am, I greet the two Spirit teachers facilitating this exhibition and presentation process. It should be noted that the teachers do not facilitate (or participate in) the student panels for their current students. Instead, science teachers at Spirit facilitate science panels of students outside of their current class roster, which holds true for all subjects/disciplines. Thus, this arrangement is supporting and promoting assessment validation efforts, a culture of objectivity, and constructive feedback. The teachers begin a final
countdown to call the presentation to order, instructing the three panelists and team of five students to take their places. I sit at the table designated for panelists, located in the center of the classroom. Three students move to the side of the classroom where the teacher’s lab station is located to fortify their equipment for the laboratory demonstration on chemical reactions, and two students stand in front of the classroom at the Smartboard to ready the technology for the PowerPoint presentation following the lab demonstrations.

**Team Panel Presentations**

For this chemistry presentation, which is the focus of this narrative, there is a team of five seniors consisting of two females and three males. They are Tara (Latina), Olga (Latina), Olin (Black/Latino), Greg (Latino) and Nigel (Black Caribbean). The content focus on chemical reactions stems from their curriculum unit featuring forensics under the essential question, “How can forensics help scientist solve crimes?” Each team is responsible for aligning with and connecting to the essential question, content focus, and unit standards. For this unit/project, the students were provided with an investigation procedure and checklist tool consisting of six mandatory elements to support the navigation and completion of this forensics exercise.

Furthermore, to demonstrate concept/content mastery, each student crafted a research and analysis paper and a reflection letter. The requirements for science portfolio panel presentation for the chemistry unit are as follows: a lab demonstration; oral presentation; research and analysis paper; and a reflection letter.

I am drawn into the world of forensic science as I follow along with Olga’s dramatic reading of the team’s constructed scenario/introduction for this unit (serving as the premise for the laboratory investigation and content/concept inquiries). After clearing her throat, she begins:
A long time ago, a science student at Spirit was misbehaving in science lab. He was sent to the principal’s office. That was the last anyone saw of him. No one knows which principal’s office he went to, and none of the principals claimed he came to their office. It was a mystery. There seemed to be a struggle in the cafeteria with bite and scratch marks on different objects. Some blood was also found in the cafeteria along with many fingerprints. There was a burnt rubber tire track out in the front of the school which showed a car speeding away. A note was found saying, “Help me.” It could have been written by the student with the principal’s pen. Will you be able to solve the crime? Who did it? You will investigate many clues and hopefully put the correct principal behind bars.

We follow along as Nigel briefly touches on specific details and instructions assigned to each of the six elements outlined on the procedure and checklist (Table 5.2).

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Details, Descriptions &amp; Prompts</th>
<th>Corresponding Action Checklist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fingerprints</td>
<td>A print was found in the cafeteria and it was carefully lifted.</td>
<td>• Write a detailed description about the type of patterns that occur on fingerprints and what pattern you observe.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Identify, draw (or insert images) and describe at least five ridge characteristics to assume a match.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Research (cite sources) the history of fingerprinting and describe its accuracy or inaccuracy (you can cite former real cases).</td>
</tr>
</tbody>
</table>

Table 5.2
Team Procedures and Actions
Table 5.2 (cont’d)
Team Procedures and Actions

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Details, Descriptions &amp; Prompts</th>
<th>Corresponding Action Checklist</th>
</tr>
</thead>
</table>
| Blood       | Blood was found in the cafeteria and each of the principals’ shirts had some blood from a certain angle. From a hidden camera, it can be see that blood splattered off a body at a certain angle that looks like the student. What makes up our blood? | • Investigate and explain whose blood it is and blood types.  
• Explain blood pattern analysis (insert images).  
• Research and cite how blood was used as evidence in a famous crime. |
| Impressions | Burnt rubber tire tracks were found in front of the school. Whose car is it? How does the tread pattern help? Can you identify some unique characteristics?                                                                 | • Research, analyze and cite two other ways that forensic scientists use impressions to solve crimes (insert image). |
| Chromatography | A note was found. Whose pen was it written with? Explain the process of running a chromatography analysis. How does chromatography work?                                                                 | • Research, analyze and cite different methods of chromatography (insert images).               |
| Forensics   | What is DNA? What is a DNA profile? How do you process DNA? What is anthropology, entomology and how it is used to solve crimes?                                                                                                         | • Research and analyze; describe the reliability of eyewitnesses and gun analysis.             |
| Reflection Letter | Explain the entire process you went through so the police gain an understanding of your thoroughness. Include a discussion of what you feel is important from the labs.                                                                                   | • Serving as a summary of all of your investigative work, write a formal business letter to the police explaining your hypothesis with supporting evidence. Include a detailed persuasive explanation. |

To provide the chemistry students with a more authentic, inquiry-based, hands-on experience, there was an actual crime scene created during the semester that contained blood spatter on the walls, paint droppings, fingerprints, and other props or objects to promote a more practical forensics exercise. Whispering, I ask the teacher sitting beside me if the crime scene
was still in place for me to observe. He is very apologetic when he informed me that it had already been dismantled and cleaned up and no pictures were available either. It would have been quite interesting to see. I thought it might give me a glimpse of the students’ investigative thinking, processing, and application of content/concept knowledge via this exercise.

After handing each panelist safety goggles to wear and instructing us to gather around the main lab station, the student team begins the lab demonstrations on chemical reactions—featuring pH levels of a solution (a measure of hydrogen ion concentration; a measure of acidity or alkalinity). A number used in expressing acidity or alkalinity on a scale whose values run from 0 to 14 with seven representing neutrality, numbers less than seven increasing acidity, and numbers greater than seven increasing alkalinity). Each student actively contributes by providing individual demonstrations that feature mixing two chemicals and testing the pH level; discussing the results of the pH test and identifying if it is an acid or base; and discussing the end state of the product composed from the mixture.

After each student completes their demonstration, they transition into the presentation phase to further discuss their results and the related science concepts and content through prepared slides and visual simulations. This is where each team member is responsible for and assessed on an individual presentation that demonstrates their knowledge of the science content, scientific skills and processes, theme investigation linkages, and real-world connections and applications. Students pre-selected various science concepts that they wanted to share, on which they were subsequently assessed.

*Tara’s presentation.* Framing her presentation focus on the blood evidence found during the investigation, Tara starts with a detailed scientific discussion on the composition, types and processes in reference to blood. Next, she moves to a simulation slide that highlights three types
of blood stains. She is very well-spoken and has prepared extensive and detailed presentation
notes that she uses to support her talking points. As Tara continues, I note some of the highlights
from her presentation, for example, her expansion on blood evidence by introducing the notion
of spatter. She explains:

Bloodstains created from the application of force to the area where the blood originated is
the spatter. This origin is the place from where the blood spatter came from or
originated. An investigator can analyze a lot by the blood stain spatter…like the type of
weapon, the velocity, number of blows, types of injuries, timeframes, position, and
movements of the victims and assailants during and after the attack.

Other highlights include her discussion on passive, projected, and transfer bloodstain patterns,
supported by a simulation slide. She demonstrates and states:

Passive bloodstains are patterns created from a force of gravity like drops, series of drops,
flow patterns. Projected bloodstains are patterns that happened when force is applied to
the source of blood. Transfer bloodstains are when patterns that created when wet,
bloody objects come in contact with a target surface.

To draw a connection to real-world occurrences, Tara discusses a 2003 case where blood
spatter helped investigators to exonerate a teen by proving that she did not murder her parents.
And for her closing, to connect her content knowledge and the investigative steps she used to
solve the mystery at Spirit, Tara discussed her written statement on how she examined the blood
evidence from the crime:

In order to determine what angle the blood splattered from by using blood drops, I used a
binder and set it up in different angles given where 60, 45, 75 and 30 degrees (°) each
angle represented the bloodstain on each suspects shirt. Suspect Antonio’s blood spatter
was 60°, suspect Elvin’s was 45°, suspect Megan’s was 75°, and suspect Ursula was 30°. After dropping blood from each angle, I came to the conclusion that suspect Megan was a match (75°).

Olga’s presentation. Olga starts her presentation by emphasizing, “At Spirit CSI, we have a top notch forensic team that will test the evidence, to eliminate suspects and find who committed this crime. The first place I started was by lifting fingerprints in the library.” Using slides to illustrate important information about fingerprints, she discusses how

…no one on earth has identical fingerprints, not even identical twins. There are three main types of fingerprints—the whorl, the arch, and the loop. The loop is a pattern that has free curving ridges, horizontal or vertical from each other. There are four types of arch patterns. And the whorls consist of at least one rise that makes a complete circuit, and they also have at least two deltas. It has been figured that at least 60% of fingerprint patterns are loops, 35% are whorls, and 5% are arches….This combined with other evidence allows forensic scientist and crime scene investigators to deduce the suspects. This means to narrow down the suspects so detectives can arrest the perpetrator.

Fingerprints can be lifted by investigators using tape and then analyzing the pattern. This is what was done with the suspects in the murder of the student.

Olin’s presentation. Olin’s presentation focused on the nature of bonding and the four types of chemical reactions. He discusses and demonstrates his knowledge of covalent bonding (noting that this occurs between two non-elements) and ionic bonding (noting that this occurs between metal and non-metal) through the simulation slides he created, while expanding further on metallic bonding by drawing relevance to heat. Olin takes a deeper dive into ionic bonding by stating, “An ionic bond is a type of chemical bond formed through an electrostatic attraction
between two oppositely charged ions.” Next slide, the heading displayed “Electrostatic attraction: Na+ Cl-“, accompanied by another simulation that demonstrates how a bond forms when the valence (outermost) electrons of one atom are transferred permanently to another atom. Throughout this exhibition, Olin has injected bits of humor into various points of his discussions. And so, for the conclusion in the final portion of his discussion, maintaining consistency in presentation style, he drew relevance and connections through witty storytelling and the use of mathematics as it pertained to his imaginary girlfriend (the famous actress Angelina Jolie), to cleverly elaborate on the four types of chemical reactions (Figure 5.1).

<table>
<thead>
<tr>
<th>Name</th>
<th>General Reaction Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination or synthesis</td>
<td>A + B → AB</td>
</tr>
<tr>
<td>Decomposition</td>
<td>AB → A + B</td>
</tr>
<tr>
<td>Substitution or Single Replacement</td>
<td>A + BC → B + AC</td>
</tr>
<tr>
<td>Metathesis or Double Displacement</td>
<td>AB + CD → AD + CB</td>
</tr>
</tbody>
</table>

*Figure 5.1* Four types of chemical reactions discussed in Olin’s presentation

*Nigel’s presentation.* Framing his focus under acids, bases and the pH scale, Nigel’s presentation picks up the discussion on chemical reactions by first reiterating the parts of the atom (protons, neutrons, electrons, and nucleus). \( \text{Na}_2(\text{CO}_3) + \text{CaCl}_2 \rightarrow \text{Ca(} \text{CO}_3) + 2\text{NaCl} \) serves as the heading illustration for the next simulation slide, which leads into the discussion on balanced chemical equations. He describes “what reactants produce what products and how much is produced by each…and basically, how much energy is consumed and released, which tells the strength of bonds broken and formed.” Most of Nigel’s presentation focuses on the science content he learned throughout the semester during the project, demonstrating good mastery of the science concepts, while incorporating connections to the mystery/investigation.
For Nigel, it seems that he is excited about substances and mixtures, from the wide smile on his face as he enters a deeper discussion related to the mystery/investigation. He begins a discussion on chromatography and describes it as a scientific process that is used to separate compound mixtures. He actually uses the term “scientific method” because this is the language that teachers use at Spirit in reference to science processes. The terms and language used in and for science at Spirit have influenced how students understand and communicate in science. Nigel continues by pointing to the relevance for this investigation: “A mixture is two or more substances that are mixed together, but not chemically combined. We use chromatography to separate the components of ink and dyes found in markers, pens, clothing and even candy shells.”

From a simulation slide, Nigel demonstrates some examples of chromatography (liquid, gas, paper, and thin-layer), for example, “Gas chromatography is used to determine the chemical composition of unknown substances like the different compounds in gasoline,” and “Paper chromatography is used to separate the components of ink, dyes, plant compounds, makeup, and many other substances.” In conclusion, Nigel sums up their process of chromatography analysis from the four pens (as evidence, possibly used to write the ‘help me’ note) that belonged to each of the suspects: “We test all of the four pens and found that one of them matched to the pen at the crime scene. In this case, Megan’s pen was the one that matched.”

Greg’s presentation. Greg begins by reconnecting to the mystery investigation by zoning in on the impression evidence. Throughout, he works to weave in his knowledge of the science content he learned from this project, which is a key assessment indicator for mastery. He starts with a picture slide of the various types of impressions, and begins: “Impressions are created when one object is pressed against another material with enough force to leave an impression of
the object. Tire tracks, bite marks, and shoe prints are examples of impression evidence.” He describes how impressions differ based on the type of material: “The quality of the impression depends on the object making the impression and the surface conditions, such as how hard or soft it is and what type of material it is (soil, mud, dust, concrete, grass, skin, etc.). Scientists use impressions like shoe print and tire track evidence.”

Greg is interested in the tire track evidence at the crime scene: “Tire tracks are usually found on road accident scenes or in the access and escape routes of other crime scenes. This helps investigators identify what type of car it is. To identify, investigators may use prints of a tire or plaster cast of a track…also photographs taken can also be used later to prove a match.” He continues by providing more specific details about the analysis process: “Some features to analyze is the trend pattern. The trend pattern helps because it helps you observe each vehicle’s tire for each car and see the similar tire pattern to determine the owner. Also the width and the depth of the tread pattern helps. Wear patterns and defects, can produce unique characteristics.” Finally, Greg pulls it together by illustrating the tire identification process and providing a conclusion: “We put ink on each of the tires and recorded it on a piece of computer paper and observed each pattern carefully. We had to see what tire looked like the tire that was left at the scene. We concluded that it was the silver car that belonged to suspect Antonio.”

**My Reflections on the Panel**

The panel discussion reflections, remarks, questions, and exchanges between panelists and students focused on what the students presented. The students developed an excellent PowerPoint presentation that contained simulations and interactive sections. They could utilize the Smartboard and other technologies very well when presenting and this aided in making a dynamic presentation. This suggests that they have had extensive classroom experience using
advanced technology in science. The team discussed the relevant science concepts and content with clarity as they presented the data and findings from their mystery.

I also noted the questions from panelists and the responses from the students. For example, from the panelists questions such as “In your investigation on which assistant principal killed the principal, what’s the connection to chemistry?” There were also content specific questions asked such as “What is the relationship between atomic number and the number of protons?” and “Please expand on your PowerPoint slide on hydronium (H₃O) and hydroxide ion (HO-) and how they become neutral.” In all these questions, students took turns answering the questions with understanding and confidence.

As a final question, I asked the students to reflect on how they thought they did, in which areas they experienced challenges; what they would do better; and, what they did well. All students agreed that they thoroughly prepared for the demonstration and presentation. They also stated that their PowerPoint presentation was well developed and demonstrated their knowledge of simulation software and the use of advanced technology. In asking the students how science is relevant to them, most had some difficulties in drawing deeper connections and expanding on or making real-world applications. For example, Nigel said, “I’m cool with science and math, but I don’t feel that you always need all aspects of it in life.” Conversely, Olin’s response was “I like science because it shows me how things work. And I’m interested in going to college to study the body and how it relates to sports. I’m interested in sports medicine or training.” In doing better, students stated it would be necessary to hold a firmer grasp on content. Finally, the panelists gave constructive and motivational feedback and recommendations on how to improve.

When working together to determine the assessment scores for each student, I must keep certain things under consideration. For example, for the written grade, 12th graders can use the
chemistry work they completed the previous year. A possible challenge here is that the student may not make the effort or take the opportunity to improve their document based on the teachers’ feedback. Therefore, they can resubmit that same work for this assessment without revisions. Overall, all five students were successful in meeting all aspects of this assessment process. Based on the NYPSC Assessment Rubrics, four students received a final portfolio grade of S or S+. One student received a D. The final portfolio grade indicates the science performance and content mastery of each student.

Given that the current climate is hyper-focused on standardized tests, there is a missed opportunity in amply capturing the extent to which students might apply specific competencies towards authentic and real-life tasks. Standardized tests do not serve as a full proof forecaster of student success in college. Just because a student receives a high score on a standardized test, it does not automatically signal guaranteed success in college or vice versa. It is not about lifting and crowning a sole winner out of the cast of assessment contestants, but more about cultivating and advancing learning experiences and school environments that take an integrated and balanced approach to assessment.

Finally, it is important to emphasize that because this study is about science assessment and college science, I must consider all aspects of the science panel presentations and the processes therein. The presentations are based on significant unit projects that are infused with and anchored by Regents-level science content, inquiry, and skills. Per the evaluation process, I considered everything from the PPTs, laboratory demonstrations, the discussions, and the written pieces. But ultimately, after experiencing all of this—the question still remained—are they ready for college level science coursework (including classroom/lecture learning), laboratory work, and assessment?
I am impressed with the portfolio-based approach at Spirit, particularly the high level of expectations and rigor of the science panel presentations/exhibitions. Portfolio assessments, tasks/works, and conditions that shape them are not standardized; the scoring is standardized. However, students who are only practiced or proficient in portfolio assessments can face substantial hurdles or difficulties when tasked with standardized exams in college science. Another hurdle in college science would be the lack of necessary skills and strategies to effectively navigate the traditional, lecture-style class and all its demands (i.e. efficient notetaking to accompany good study habits, and a solid test preparation repertoire).

I would conclude that Spirit students are ready for college level laboratory investigations and the attached on-demand or hands-on (practicum) assessments along with sufficiently meeting the standards, expectations, and the load of required writing (lab reports and investigations, research and course papers). This is due, in large part, to the extensive research and report writing requirements bound to the portfolio-based approach and processes in science at Spirit. However, when it pertains to test capacity and performance, I would conclude that Spirit students are not ready for college science assessments as most are traditional and/or standardized in nature (i.e. constructed-response, multiple choice, quizzes, mid-terms, finals). For this, I emphasize the importance of a balanced and integrated approach to science assessment for urban portfolio high schools to support students’ readiness for all aspects of college science.
CHAPTER VI

FINDINGS

College Readiness by the Numbers

Since colleges and universities judge a high school student’s college readiness by the numbers (i.e., Regents scores, standardized test scores, course completion), the third research question explored Spirit students’ college readiness by the numbers and the relationships that may exist between Spirit alumni’s science and mathematics performance and college readiness. What follows is the data analysis conducted on the transcripts for the classes of 2014 and 2015.

College Readiness Criteria

Since most Spirit students gain admission to the CUNY (whether its two-year or four-year colleges), I analyzed the transcripts of 242 alumni in relation to CUNY’s college readiness criteria vis-à-vis the ELA and Algebra Regents exam scores only as noted in Chapter III. To explore any relationships between science and mathematics coursework with college readiness, I compared their science and mathematics grades, overall percentages, and credits against CUNY criteria. I looked at their overall performance and class performance to explore their college readiness. Recall CUNY’s primary Regents criteria and secondary CUNY Assessments criteria from Chapter II. The Regents criteria and mathematics and science courses and credits are important to keep in mind as the question of college readiness is explored throughout the data analyses for the Spirit alumni scores assessed here.

Overall Transcript Analysis

Overall, of the 242 Spirit alumni transcripts analyzed, 110 were of 2015 graduating seniors and 132 were of 2014 graduating seniors. For the graduating seniors of 2015, there were
57 (or 51.8%) girls and 53 (or 48.2%) boys. For the graduating seniors of 2014, there were 58 girls (or 43.9%) and 74 boys (or 56.1%). No racial/ethnic percentages were calculated since this information was not indicated on the transcripts.

Although a Mathematics Regents was not required for students of the Consortium schools as a graduation requirement, the majority (88.8%, or 215 out of 242) of Spirit students across the two graduating classes (2014 and 2015) took the Algebra Regents exam. Of that high majority, five students took the Geometry Regents exam in addition to the Algebra Regents exam, one of whom took the Trigonometry Regents as well. This particular student was from the 2015 graduating class and of the three mathematics Regents taken, passed the Algebra Regents. Although the overall average Algebra Regents score was 61.7 (SD = 9.4), over one in three students at Spirit within those two years passed the Algebra Regents, where passing is a score of 65 and above. Only six students in all scored at least an 80 on the Algebra Regents, indicating college readiness for these six students, or 2.5% of 242 students, with respect to mathematics. See Table 6.1 below for overall scores and scores by graduating class for the Algebra Regents.

Regarding the ELA Regents, nearly 100% (241 out of 242) of the students across the two years took it. The average score was 66.6 (SD = 14.2). Nearly three in 10 students scored at least a 75 on the ELA Regents, indicating college readiness for this criterion for these students. In all, nearly two in three students also passed the ELA Regents in those two years. Overall, the average Spirit graduate across 2014 to 2015 passed the ELA Regents but failed the Algebra Regents. Table 6.1 contains overall scores and scores by graduating class for the ELA Regents, and Table 6.2 provides overall scores and scores by gender for the ELA and Algebra Regents.
Table 6.1
*Overall Regents Performance Categorized by Subject Scores and Graduating Class*

<table>
<thead>
<tr>
<th>Score (x)</th>
<th>Failed</th>
<th>Passed</th>
<th>College Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x&lt;65</td>
<td>65 ≤ x &lt;75</td>
<td>x≥75</td>
</tr>
<tr>
<td>Students</td>
<td>93 (38.6%)</td>
<td>82 (34.0%)</td>
<td>66 (27.4%)</td>
</tr>
<tr>
<td>2015</td>
<td>49 (20.3%)</td>
<td>39 (16.2%)</td>
<td>21 (8.7%)</td>
</tr>
<tr>
<td>2014</td>
<td>44 (18.3%)</td>
<td>43 (17.8%)</td>
<td>45 (18.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score (x)</th>
<th>Failed</th>
<th>Passed</th>
<th>College Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x&lt;65</td>
<td>65 ≤ x &lt;80</td>
<td>x≥80</td>
</tr>
<tr>
<td>Students</td>
<td>133 (61.9%)</td>
<td>76 (35.3%)</td>
<td>6 (2.8%)</td>
</tr>
<tr>
<td>2015</td>
<td>72 (33.5%)</td>
<td>23 (10.7%)</td>
<td>2 (0.9%)</td>
</tr>
<tr>
<td>2014</td>
<td>61 (28.4%)</td>
<td>53 (24.6%)</td>
<td>4 (1.9%)</td>
</tr>
</tbody>
</table>

| Students  | 133 (61.9%) | 76 (35.3%) | 6 (2.8%)     |
| 2015      | 72 (33.5%) | 23 (10.7%) | 2 (0.9%)   |
| 2014      | 61 (28.4%) | 53 (24.6%) | 4 (1.9%)   |


Table 6.2
*Overall Regents Performance Categorized by Subject Scores and Gender*

<table>
<thead>
<tr>
<th>Score (x)</th>
<th>Failed</th>
<th>Passed</th>
<th>College Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x&lt;65</td>
<td>65 ≤ x &lt;75</td>
<td>x≥75</td>
</tr>
<tr>
<td>Students</td>
<td>93 (38.6%)</td>
<td>82 (34.0%)</td>
<td>66 (27.4%)</td>
</tr>
<tr>
<td>Girls</td>
<td>40 (16.6%)</td>
<td>46 (19.1%)</td>
<td>28 (11.7%)</td>
</tr>
<tr>
<td>Boys</td>
<td>53 (22.0%)</td>
<td>36 (14.9%)</td>
<td>38 (15.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Score (x)</th>
<th>Failed</th>
<th>Passed</th>
<th>College Ready</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x&lt;65</td>
<td>65 ≤ x &lt;80</td>
<td>x≥80</td>
</tr>
<tr>
<td>Students</td>
<td>133 (61.9%)</td>
<td>76 (35.3%)</td>
<td>6 (2.8%)</td>
</tr>
<tr>
<td>Girls</td>
<td>63 (29.3%)</td>
<td>30 (14.0%)</td>
<td>5 (2.3%)</td>
</tr>
<tr>
<td>Boys</td>
<td>70 (32.6%)</td>
<td>46 (21.3%)</td>
<td>1 (0.5%)</td>
</tr>
</tbody>
</table>


**Graduating Class of 2015**

Looking at the 2015 graduating class, the highest mathematics courses alumni had taken were Advanced Algebra, Advanced Geometry 1, Advanced Geometry 2, Integrated Algebra, and Mathematical Modelling. Nearly all the 110 students (96.4%) took Mathematical Modelling as one of their highest two mathematics courses, followed by Advanced Algebra (94 or 85.5%). Less than 10 students took Integrated Algebra and Advanced Geometry 1. Percentages are reported in Table 6.3. The total percentages do not sum to 100% since students could choose
their next mathematics course with the advice of their advisor and teacher. As such, some students may have taken two semesters of mathematical modeling.

Table 6.3
Last Two Mathematics Courses Taken By 2015 Graduating Class (in descending numerical order)

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical Modelling</td>
<td>106</td>
<td>96.4</td>
</tr>
<tr>
<td>Advanced Algebra</td>
<td>94</td>
<td>85.5</td>
</tr>
<tr>
<td>Advanced Geometry 2</td>
<td>12</td>
<td>10.9</td>
</tr>
<tr>
<td>Integrated Algebra</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Advanced Geometry 1</td>
<td>3</td>
<td>2.7</td>
</tr>
</tbody>
</table>

With respect to the Regents exams, 109 students (or 99.1%) of the 2015 graduating class took the ELA Regents while fewer students (97 out of 110 or 88.2%) took the Algebra Regents. Students did not have to take the Regents their senior year as some students took the Regents their junior or sophomore year. The timing of students taking their Regents exams often depended on when the students took the corresponding course. For 2015 graduates, the mean ELA Regents score was 64.4 (SD = 12.2) while the mean Algebra Regents score was 58.4 (SD = 9.6). Table 6.4 provides the descriptive statistics for the ELA and Algebra Regents exams overall, and for girls and boys.

Table 6.4
Regents Scores of 2015 Graduating Class by Gender

<table>
<thead>
<tr>
<th>Regents</th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA</td>
<td>Girls</td>
<td>56</td>
<td>67.3</td>
<td>10.2</td>
<td>34</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>53</td>
<td>61.4</td>
<td>13.4</td>
<td>32</td>
<td>89</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>109</td>
<td>64.4</td>
<td>12.2</td>
<td>32</td>
<td>89</td>
</tr>
<tr>
<td>Algebra</td>
<td>Girls</td>
<td>49</td>
<td>58.4</td>
<td>9.9</td>
<td>37</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>48</td>
<td>58.4</td>
<td>9.5</td>
<td>41</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>97</td>
<td>58.4</td>
<td>9.6</td>
<td>37</td>
<td>84</td>
</tr>
</tbody>
</table>
Based on the means, the average student of the 2015 graduating class scored below a 65 on both the ELA (64.4) and Algebra Regents (58.4). Interestingly, the mean Algebra Regents scores for girls and boys were almost the same (58.4) even though the highest score for girls (84) was six points higher than for boys (78) and the lowest score for girls was four points lower than for boys. However, for 2015 graduates, a statistically significant difference emerged between average ELA Regents scores for girls and boys at \( \alpha = .05 \) level, with girls scoring on average 5.9 points higher than boys \((t(109) = 2.59, p = 0.01, d = 0.50)\). The effect size \( d = 0.50 \) was typical for this topic. The 95% CI [1.4, 10.4] indicates the difference on average between girls and boys could be a little less than one and a half points and no greater than 10.4 points. These higher ELA scores for girls at Spirit reflected the long held, at-large findings in the literature that girls perform better at reading and writing than boys (Kibby, 1993; NCES, 2003, 2012b; Senn, 2012); however, the near equal Algebra Regent scores between girls and boys at Spirit did not reflect the stereotype that boys are better than girls in mathematics.

Of the 109 students who took the ELA Regents, 21 students (19.3%) scored 75 or higher (12 girls and 9 boys) while only two (2.1%) of the 97 students who took the Algebra Regents scored 80 or higher (2 girls and 0 boys). Thirty-nine (39) or 35.8% passed the ELA Regents but with a score below 75—24 girls and 15 boys. Of the 97 students who took the Algebra Regents, 23 or 23.7% passed it but with a score below 80—10 girls and 13 boys. Looking even closer, only one student—a girl—attained both criteria, scoring 86 on the ELA Regents and an 84 on the Algebra Regents. Thus, by the Regents criteria of college readiness for CUNY, only one student from Spirit’s 2015 graduating class would be considered college ready even though over half (55%) passed the ELA Regents and one in four passed the Algebra Regents.
Graduating Class of 2014

Looking at the 2014 graduating class, the statistical picture looks somewhat different from that of the 2015 graduating class (Table 6.5). The highest mathematics courses that 2014 graduating seniors had taken were Advanced Algebra, Advanced Geometry 1, Advanced Geometry 2, Algebra 2/Trigonometry, CUNY Mathematics 1, CUNY Mathematics 2, and Mathematical Modelling.

Table 6.5
Last Two Mathematics Courses Taken By 2014 Graduating Class (in descending numerical order)

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Geometry 1</td>
<td>71</td>
<td>53.8</td>
</tr>
<tr>
<td>Advanced Algebra</td>
<td>70</td>
<td>53.0</td>
</tr>
<tr>
<td>Mathematical Modelling</td>
<td>52</td>
<td>39.4</td>
</tr>
<tr>
<td>Algebra 2/Trigonometry</td>
<td>27</td>
<td>20.5</td>
</tr>
<tr>
<td>CUNY Mathematics 1</td>
<td>21</td>
<td>15.9</td>
</tr>
<tr>
<td>CUNY Mathematics 2</td>
<td>18</td>
<td>13.6</td>
</tr>
<tr>
<td>Advanced Geometry 2</td>
<td>1</td>
<td>0.7</td>
</tr>
</tbody>
</table>

The total percentages do not sum to 100%, because students could choose with the advice of their advisor and teacher their next mathematics course. Thus, over half of the 132 graduating seniors of 2014 took either Advanced Algebra (53.0%) or Advanced Geometry 1 (53.8%) as one of their highest two (last two) mathematics courses at Spirit. It is important to note that one in five students (20.5%) took Algebra 2/Trigonometry—a course requirement in CUNY’s college readiness criteria. Fewer students took CUNY Mathematics 1 and 2 as their last two mathematics courses at Spirit.

With respect to the Regents exams, 100% of the 2014 graduating class took the ELA Regents while fewer students (118 out of 132 or 89.4%) took the Algebra Regents. For 2014 graduates, the mean ELA Regents score was 68.4 (SD = 15.5) while the mean Algebra Regents
score was 64.3 (SD = 8.3). Table 6.6 reports the descriptive statistics for the ELA and Algebra Regents exams overall and for girls and boys.

Table 6.6
Regents Scores of 2014 Graduating Class by Gender

<table>
<thead>
<tr>
<th>Regents</th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
<th>St. Dev.</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA</td>
<td>Girls</td>
<td>57</td>
<td>68.4</td>
<td>13.2</td>
<td>22</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>75</td>
<td>68.3</td>
<td>17.1</td>
<td>9</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>132</td>
<td>68.4</td>
<td>15.5</td>
<td>9</td>
<td>99</td>
</tr>
<tr>
<td>Algebra</td>
<td>Girls</td>
<td>48</td>
<td>64.7</td>
<td>8.1</td>
<td>52</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Boys</td>
<td>70</td>
<td>64.1</td>
<td>8.5</td>
<td>45</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>118</td>
<td>64.3</td>
<td>8.3</td>
<td>45</td>
<td>86</td>
</tr>
</tbody>
</table>

Based on the means, the average student of the 2014 graduating class scored above 65 on both the ELA (68.4) but below 65 on the Algebra Regents (64.3). Interestingly, the mean ELA and Algebra Regents scores for girls and boys were almost the same even though the highest score for girls (92) was seven points lower than for boys (99), and the highest score for girls (86) on the Algebra Regents was four points higher than for boys (82). Neither ELA Regents nor Algebra Regents scores were statistically different between girls and boys in 2014.

Of the 132 students who took the ELA Regents, 45 students (38.1%) scored 75 or higher (21 girls and 24 boys) while only four (3.4%) of the 118 students who took the Algebra Regents scored 80 or higher (3 girls and 1 boy). Further, 43 students (32.6%) passed the ELA Regents (22 girls and 21 boys) but with scores lower than 75 while 53 students (44.9%) passed the Algebra Regents (21 girls and 32 boys) but with scores lower than 80. Looking even closer, only three students (2 girls and 1 boy) attained both criteria: boy (ELA 86, Algebra 82) and two girls (ELA 92, Algebra 80; ELA 90, Algebra 86). Thus, by the Regents criteria of college readiness for CUNY, only three students from Spirit’s 2014 graduating class would be considered college
ready even though two in three passed the ELA Regents and over four in 10 passed the Algebra Regents.

**Demographic Comparisons: Graduating Years**

Taking a closer look at comparisons between graduating years, some interesting differences emerge (Table 6.7). For instance, the graduating class of 2014 scored, on average, four points higher than for 2015 on the ELA Regents, and nearly six points higher, on average, on the Algebra Regents. The effect sizes \( d \) for both mean differences were smaller than typical.

**Table 6.7**

<table>
<thead>
<tr>
<th>Graduating Class</th>
<th>2015</th>
<th>2014</th>
<th>( T )</th>
<th>( df )</th>
<th>Cohen’s ( d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELA</td>
<td>64.4 (12.2)</td>
<td>68.4 (15.5)</td>
<td>-2.17*</td>
<td>239</td>
<td>0.28</td>
</tr>
<tr>
<td>Algebra</td>
<td>58.4 (9.6)</td>
<td>64.3 (8.3)</td>
<td>-4.85**</td>
<td>213</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Note: Standard Deviations appear in parentheses below means. * \( p < .05 \). ** \( p < .01 \).

From 2014 to 2015, ELA Regents scores decreased on average four points while Algebra Regents scores decreased on average nearly six points. For ELA Regents scores, the 95% CI [-7.5, -0.4] indicates that, on average, the ELA Regents scores from 2015 were anywhere from 0.4 to 7.5 points lower than scores from 2014 graduates. For Algebra Regents scores, the 95% CI [-8.3, -3.5] indicates that, on average, the Algebra Regents scores from 2015 were anywhere from 3.5 to 8.3 points lower than scores from 2014 graduates. By the CUNY ELA and Algebra Regents criteria, the average student from those two years would not be seen as college ready although that student from 2014 would have passed the ELA Regents.
Relationships between Regents Scores and Course Data

Correlation coefficients were calculated for each relationship at \( \alpha = .05 \) to see if any relationships existed between Regents scores and any of the numerical variables regarding students’ science and mathematics performance at Spirit for both graduating classes of 2014 and 2015. There were no significant correlations between Regents exam scores and gender, actual mathematics credits, mathematics credits averaged, actual science credits, science credits earned, or science credit average. However, there were statistically significant relationships between both Regents exams scores and 11 of the other science or mathematics related variables. All 11 variables emerged relationships for 2015 graduates; however, because transcripts for 2014 graduates did not have subject area percentages, three of the 11 variables (overall mathematics average, mathematics credits earned, and overall science average) could not be included in the overall correlation calculations. Tables 6.8 and 6.9 show statistically significant relationships (two-tailed \( p \) values) and the strength of those relationships (Pearson correlation coefficient \( r \) and Spearman correlation coefficient \( r_s \) as indicated in Chapter III).

Table 6.8
Pearson Product-Moment Correlations of 2014 and 2015 Graduates’ Regents Scores, Overall and Subject Area Variables Related to ELA and Algebra Regents Scores

<table>
<thead>
<tr>
<th>Variables(^a)</th>
<th>M</th>
<th>SD</th>
<th>ELA Regents Score</th>
<th>Algebra Regents Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade of Last Mathematics Class(^b)</td>
<td>74.10</td>
<td>13.75</td>
<td>.35**</td>
<td>.30**</td>
</tr>
<tr>
<td>Grade of 2(^{nd}) to Last Mathematics Class(^b)</td>
<td>73.71</td>
<td>12.59</td>
<td>.37**</td>
<td>.36**</td>
</tr>
<tr>
<td>Grade of Last Science Class(^b)</td>
<td>74.64</td>
<td>11.72</td>
<td>.40**</td>
<td>.35**</td>
</tr>
<tr>
<td>Grade of 2(^{nd}) to Last Science Class(^b)</td>
<td>75.06</td>
<td>12.07</td>
<td>.43**</td>
<td>.36**</td>
</tr>
<tr>
<td>Cumulative Average</td>
<td>76.09</td>
<td>7.80</td>
<td>.53**</td>
<td>.42**</td>
</tr>
<tr>
<td>Cumulative Actual Credits</td>
<td>53.15</td>
<td>7.87</td>
<td>-.19**</td>
<td>-.06</td>
</tr>
<tr>
<td>Cumulative Credits Earned</td>
<td>44.58</td>
<td>7.50</td>
<td>.30**</td>
<td>.32**</td>
</tr>
<tr>
<td>Cumulative Credit Average</td>
<td>50.28</td>
<td>7.11</td>
<td>-.16*</td>
<td>-.05</td>
</tr>
</tbody>
</table>

\( ^a \)\( n = 242. \)
\( ^b \) Spearman \( r_s \) is indicated for these variables.

\( ^* p < .05. \) \( ^{**} p < .01. \)
The relationships between both the ELA and Algebra Regents scores and all of the other subject averages and credits indicated in Table 6.8 were statistically significant either at $\alpha = .05$ or $\alpha = .01$ and positive except for cumulative actual credits and cumulative credits averaged for which ELA Regents scores were negatively and weakly correlated. This indicated that as cumulative actual credits ($r = -.19$) and cumulative credits averaged ($r = -.16$) decreased, ELA Regents scores increased, or put another way, the more credits students gained overall, ELA Regents scores decreased. This was also the case for Algebra Regents scores but not statistically significantly so.

Table 6.9

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>ELA Regents Score</th>
<th>Algebra Regents Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mathematics Average</td>
<td>73.75</td>
<td>9.27</td>
<td>.53**</td>
<td>.40**</td>
</tr>
<tr>
<td>Mathematics Credits Earned</td>
<td>6.30</td>
<td>1.86</td>
<td>.29**</td>
<td>.34**</td>
</tr>
<tr>
<td>Overall Science Average</td>
<td>75.54</td>
<td>8.62</td>
<td>.49**</td>
<td>.36**</td>
</tr>
</tbody>
</table>

$a$ n = 110.  
$p < .05$.  
**$p < .01$.  

On the positive side, the strength of the statistically significant, positive relationships between the Regents scores and the subject averages and credits ranged from $r = .29$ (medium or typical effect size) to $r = .53$ (strong or larger than typical effect size). The strongest three relationships were between the ELA and Algebra Regents scores respectively and the following student data: the cumulative average ($r = .53$ and $r = .42$) (Table 6.8), the overall mathematics average ($r = .53$ and $r = .40$) (see Table 6.9), and the overall science average ($r = .49$ and $r = .36$) (Table 6.9). This indicated that the higher the students’ cumulative averages, the higher their ELA and Algebra Regents scores. Further, the higher the students’ overall mathematics and science averages, the higher their ELA and Algebra Regents scores (Table 6.9). In addition, the
more mathematics courses students took and passed, the higher their ELA and Algebra Regents score were (Table 6.9).

Interestingly, the last two science course grades overall had a stronger relationship with ELA Regents scores than the last two mathematics course grades. The relationship between the last science grade and the ELA Regents score \((r = .44)\) was stronger than the relationship between the last mathematics grade and the ELA Regents score \((r = .36)\). On the other hand, the relationship between the overall mathematics average and the Algebra Regents score \((r = .40)\) was stronger, but only slightly, than the relationship between the overall science average and the Algebra Regents score \((r = .36)\).

**Science and Mathematics Courses Supporting College and Career Readiness**

Recall that New York City Department of Education indicated subject course sequences believed to support students’ transitioning to college or career readiness. To be considered as transitioning to college or career readiness for mathematics, students needed to take eight Regents-level credits, including a sequence that consists of at least Algebra I, Geometry, and Algebra II. Across the two graduating classes, two in three Spirit students were transitioning to being college ready by taking Advanced Algebra and Mathematical Modelling. For science, students needed to take eight Regents-level credits, including a sequence that consists of at least three of the following: Living Environment, Chemistry, Physics, or an AP science course. Over half of the alumni took Chemistry and nearly half took Physics. Tables 6.10 and 6.11 summarize statistics for the last two mathematics and science courses that graduates took at Spirit.
Table 6.10
*Last Two Mathematics Courses Taken by 2014 and 2015 Graduating Classes Combined (in descending numerical order)*

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Algebra</td>
<td>164</td>
<td>67.8</td>
</tr>
<tr>
<td>Mathematical Modelling</td>
<td>158</td>
<td>65.3</td>
</tr>
<tr>
<td>Advanced Geometry 1</td>
<td>74</td>
<td>30.6</td>
</tr>
<tr>
<td>Algebra 2/Trigonometry</td>
<td>27</td>
<td>11.2</td>
</tr>
<tr>
<td>CUNY Mathematics 1</td>
<td>21</td>
<td>8.7</td>
</tr>
<tr>
<td>CUNY Mathematics 2</td>
<td>18</td>
<td>7.4</td>
</tr>
<tr>
<td>Advanced Geometry 2</td>
<td>13</td>
<td>5.4</td>
</tr>
<tr>
<td>Integrated Algebra</td>
<td>4</td>
<td>1.7</td>
</tr>
</tbody>
</table>

Table 6.11
*Last Two Science Courses Taken by 2014 and 2015 Graduating Classes Combined (in descending numerical order)*

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 1</td>
<td>131</td>
<td>54.1</td>
</tr>
<tr>
<td>Physics 1</td>
<td>112</td>
<td>46.3</td>
</tr>
<tr>
<td>Chemistry 2</td>
<td>107</td>
<td>44.2</td>
</tr>
<tr>
<td>Physics 2</td>
<td>83</td>
<td>34.3</td>
</tr>
<tr>
<td>Living Environment</td>
<td>17</td>
<td>7.0</td>
</tr>
<tr>
<td>Biology 2</td>
<td>13</td>
<td>5.4</td>
</tr>
<tr>
<td>Living Environment 2</td>
<td>10</td>
<td>4.1</td>
</tr>
<tr>
<td>Biology 1</td>
<td>6</td>
<td>2.5</td>
</tr>
<tr>
<td>Living Environment 1</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Living Environment 3</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>Living Environment 4</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>STEM Physics</td>
<td>1</td>
<td>0.4</td>
</tr>
<tr>
<td>STEM Neurobiology</td>
<td>1</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Students during their first and second years at Spirit would typically take Living Environment and Biology while during their third and fourth years, they would typically take Chemistry and Physics. AP Science was not offered at Spirit. The order that these courses were taken was not considered because it depended on the offerings, which courses the students, their teachers, and their advisors decided they should take, and remaining graduation requirements.

For the 2014 graduates, the highest two (last two) science courses these students took at Spirit spanned from Living Environment and Biology 1 to Physics 1 and Physics 2 with the bulk of the students taking Chemistry 2 (80.3%), Physics 1 (59.1%), and Chemistry 1 (43.2%) while the highest two (last two) science courses 2015 graduates took at Spirit spanned from Living Environment and Biology 2 to Physics 1 and Physics 2 with the bulk of the students taking Physics 2 (69.1%), Chemistry 1 (67.3%), and Physics 1 (30.9%). Tables 6.12 and 6.13 report

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the frequencies and percentages. The high enrollment in Chemistry and Science stands to reason since in their junior and senior years, students are slated to take at least one of these two courses. However, depending on their science pathway, Biology and Living Environment may be the highest science courses taken by some students.

Table 6.12
*Last Two Science Courses Taken by 2014 Graduating Class (in descending numerical order)*

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry 2</td>
<td>106</td>
<td>80.3</td>
</tr>
<tr>
<td>Physics 1</td>
<td>78</td>
<td>59.1</td>
</tr>
<tr>
<td>Chemistry 1</td>
<td>57</td>
<td>43.2</td>
</tr>
<tr>
<td>Living Environment 2</td>
<td>10</td>
<td>7.6</td>
</tr>
<tr>
<td>Physics 2</td>
<td>7</td>
<td>5.3</td>
</tr>
<tr>
<td>Biology 1</td>
<td>4</td>
<td>3.0</td>
</tr>
<tr>
<td>Living Environment 1</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>STEM Neurobiology</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Table 6.13
*Last Two Science Courses Taken by 2015 Graduating Class (in descending numerical order)*

<table>
<thead>
<tr>
<th>Courses</th>
<th>Total N</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics 2</td>
<td>76</td>
<td>69.1</td>
</tr>
<tr>
<td>Chemistry 1</td>
<td>74</td>
<td>67.3</td>
</tr>
<tr>
<td>Physics 1</td>
<td>34</td>
<td>30.9</td>
</tr>
<tr>
<td>Living Environment</td>
<td>16</td>
<td>14.5</td>
</tr>
<tr>
<td>Biology 2</td>
<td>13</td>
<td>11.8</td>
</tr>
<tr>
<td>Chemistry 2</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Living Environment 3</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Living Environment 4</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Biology 1</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>STEM Physics</td>
<td>1</td>
<td>0.9</td>
</tr>
</tbody>
</table>

In sum, although only four (1.7%) of 242 students from graduating classes of 2014 and 2015 would be considered college ready by CUNY Regents criteria, two in three were transitioning to being college ready by taking Regents-level math courses (i.e., Advanced Algebra and Mathematical Modelling) and over half by taking Regents-level science courses (i.e., Chemistry and Physics). As suggested by the correlational analyses, the higher their cumulative average, overall science and mathematics averages, last two science and mathematics course grades, cumulative credits earned, and mathematics credits earned, the higher their ELA and Algebra Regents scores were as they transitioned to college readiness.
CHAPTER VII
DISCUSSION OF FINDINGS

This chapter discusses the findings of this case study relative to the research questions and the literature reviewed. Recall, the research questions for the study are as follows:

1. What science teaching and learning processes, perspectives, and cultures exist within the science classroom of an urban portfolio community high school?
2. In what ways does the portfolio-based approach prepare high school students of color for college level science coursework, laboratory work, and assessment?
3. Are portfolio community high school students of color college ready? Is there a relationship between students’ science and mathematics performance and college readiness?

Existing Science Classroom Processes, Perspectives, and Cultures

Teachers enlivened science through enactments of Spirit’s HOM, SRL triggers (Boekaerts & Cascallar, 2006), and good feedback practices (Macfarlane-Dick, 2006) in the delivery of their teacher-created curriculum in the following ways: their humor and enthusiasm for science in class; how they structured the class but gave students autonomy to explore and conduct authentic investigations; how they engaged students in meaningful class discussions; how they gave consistent feedback on student investigations and portfolios; and, how they taught and engaged students in scientific inquiry processes inside and outside of class.

Also evident in the classroom was an ethic of care. It manifested in how teachers persisted in caring for, encouraging, and helping students learn and grow as they matriculated through Spirit (Antrop-González & De Jesús, 2006; Thompson, 1998) even when students
resisted at times and struggled with note-taking (i.e., SRL strategy of keeping records and monitoring as noted in Nota, Soresia, & Zimmerman, 2004), risk-taking, independent discovery in science class, and completion of their portfolios. Teachers also struggled with requiring students to take notes. Persistent care, SRL triggers, good feedback practices, and the HOM were critical elements of the science classroom and culture of high expectations and college-going that manifested in how students approached and completed their portfolios.

**The Portfolio-Based Approach and College Preparation**

In exploring ways that Spirit prepared students for college and college science, Spirit alumni, staff, and administration and NFSS administration and staff converged on four perspectives and diverged on two. What follows is that convergence and divergence of perspectives between the participants of this study.

*Convergence of College and College Science Preparation.* For the first convergence, all participants agreed that the repetition and extensiveness of the portfolio process prepared Spirit students for the rigors of college writing far better than a traditional high school. Further, the “on-demands” or hands-on performance assessments constructed and conducted by the science teachers also prepared students for college science lab work (Bellochi et al, 2016). Although only one student mentioned these “on-demands” during her interview, science teachers saw these skills and their assessed performances as putting Spirit students “ahead of traditional students that didn’t have time for that.” The portfolio panel presentation for seniors—the culmination of the portfolio assessment at Spirit—well demonstrated the level of expectations and rigor in the students’ science exhibitions, corresponding group PowerPoint and inquiry presentations, and discussions with the panelists. Although NGSS does not provide a specific definition of college or college science readiness, these performance-based assessments reflect some of NGSS
expectations and emphasis of science practice, modeling, and application over mere acquisition and transmission of knowledge and the ability to conduct meaningful research (NGSS, 2013).

The second convergence was on Spirit’s ethic of care (Knight-Diop, 2013; Thompson, 1998) and nurture that the adults (i.e., Spirit administrators and teachers, and NFSS administrators and staff) consistently rendered to the alumni when they were students at Spirit—the same as indicated in the findings for the first research question. Spirit and NFSS through combined and consistent effort did not let students’ backgrounds, personal situations, and fears deter them from instilling in the alumni and students the five HOM, the expectations and reality of graduating from Spirit and going to college if they chose, and envisioning new possibilities out of and above their struggles (Creswell, 2013; Hargreaves, Fernandes, & Dinanthompson, 2003).

The third convergence was on the alumni’s particular SRL strategies, HOM, teachers’ SRL triggers, and good feedback practices—the same as indicated in the findings for the first research question. Even if students did not immediately remember the science they learned in Spirit, they remembered and applied SRL strategies such as goal setting and planning, self-advocacy, and seeking social assistance that helped them gain ground in freshman science. Although it may seem common sense for students to ask for help when they are struggling, often students do not ask because either they do not know how or who to ask or they are paralyzed with fear, embarrassment, or other self-defeating emotions (Harper, 2014).

The fourth convergence was on the lack of traditional assessments at Spirit, which several participants believed handicapped the alumni in their first year of college, especially with traditional science course assessments. Alumni were not prepared for the difference in expected science class behavior: in Spirit, they did not necessarily take notes and were not necessarily
encouraged by their teachers to take notes; in college, they were confused and surprised, and struggled to take copious notes in class while following the lecture. They did not have some of the academic behaviors and contextual awareness (Conley, 2008; Harper, 2014) necessary for processing a college science lecture and taking traditional science assessments—sentiments and experiences common to many Black and Latino students in their freshman year (Harper, 2014).

_Divergence of College and College Science Preparation._ The only divergences emerged around Spirit’s science and mathematics curricula and perceived lack of student accountability. The first divergence was the NFSS administrator’s belief that Spirit could and needed to structure the teaching of the science and mathematics curricula differently. Because science and mathematics were often taught together or by the same teacher at Spirit, he believed the teaching of one or both subjects suffered and that the subject weakness of the teacher was passed on to the students. He also thought the absence of AP mathematics and science courses was problematic and put Spirit students at a disadvantage when competing for college admission against students with AP courses on their transcripts.

The second divergence was one alum’s perception that students were not being held accountable to completing their assignments or exhibitions for their portfolios on time. He did not see a sense of urgency in completing them in all students, as he knew of students who had not completed their assignments from the beginning of the year but were still allowed to submit them towards the end of the year with point deductions as the only consequence. More than likely, he did not know of students’ learning abilities and needs, whether they had IEPs or not, as nearly 28% of Spirit’s student population has IEPs, and research has shown how students with learning disabilities struggle with all three phrases of SRL (Ness & Middleton, 2012). As such, the planning, completion, and reflection strategies involved in the portfolio process semester
after semester may prove quite challenging for many students, whom may need the extra time and persistence from their teachers and in-class portfolio tutors from NFSS to help them complete their portfolio assignments.

**By the Numbers, Portfolio Community High School Students and College Readiness**

By the numbers, only four (1.7%) of 242 students from Spirit’s graduating classes of 2014 and 2015 combined would be considered college ready by CUNY Regents criteria, having scored at least a 75 on the ELA Regents and an 80 on the Algebra Regents exams. Although 148 students (61.4%) passed the ELA Regents with at least a 65, 133 students (61.9%) failed the Algebra Regents, having scored less than a 65. These quantitative findings may support Kuh’s (2007) finding and Conley’s (2008) assertion that many high school seniors are not academically prepared for college-level work. However, Spirit students were only required to take the ELA Regents although many took the Algebra Regents anyway to better their chances of gaining admissions to their colleges of choice. As such, students may have focused more on performing well on the ELA Regents than the Algebra Regents. In terms of college readiness for portfolio school students, research from the New York Performance Consortium found that the majority of consortium students—mostly Black, Latino, and economically disadvantaged—were college ready (by ACT standards) with 84% of students who entered a 4-year college and 59% who entered a 2-year college within one year of high school graduation enrolling for a second year (Foote, 2005) as compared to national percentages (73%, 4-year college vs. 56%, 2-year college) (Mortenson, 1998 as cited in Foote, 2005).

Regarding Spirit students’ coursework, a strong, positive relationship existed between their cumulative average and their science and mathematics courses and college readiness vis-à-vis their ELA and Algebra Regents scores. Specifically, the higher their cumulative average, the
higher their overall science and mathematics averages, the higher their last two science and mathematics course grades, or the more mathematics credits earned, the higher their ELA and Algebra Regents scores were. The stronger relationships of the last two science courses with ELA Regents over Algebra Regents may be explained by the reading comprehension and writing skills these Spirit students learned to conduct and report in-depth on their scientific and mathematics inquiries through the cyclical and iterative portfolio process. These skills may have transferred to their performance on the ELA Regents more so than on the Algebra Regents. As such, a strength of portfolio or contextual assessment seen in this study is that it reaches across disciplines and applications such that the learning of one subject is not done in isolation of other subjects (Klassen, 2006).

A Question of Standards and (Un)Necessary Coursework

As the Common Core State Standards set learning expectations of mathematics attainment at the Algebra II level, fewer than half of states in the U.S. require it for high school graduation. Algebra II as a gateway to higher education seems arbitrary and unjust for several reasons: (1) there is not and has never been a consistent definition of Algebra II (Robelen, 2013), (2) many urban or poorly resourced schools may not offer Algebra II (USDOE Office for Civil Rights, 2014), and (3) some research shows that Algebra II is not a true prerequisite for success in 2-year, technical, or vocational colleges and the workforce (NCEE, 2013b). This is important since nearly half of students in the U.S. attend a 2-year college for at least part of their secondary education and 52% of community college students are recent high school graduates (NCEE, 2013a). In New York City from 2006 to 2012, immediate enrollment in 4-year colleges dropped from 44% to 38% while immediate enrollment in 2-year colleges increased from 15% to 27% (Coca, 2014). Some research suggests that the mathematics coursework necessary for success at
the community college level, the immediate workforce, and subsequent well-paying careers includes Algebra I but also coursework that is not taught in mainstream high schools such as mathematical modeling (i.e., framing real-world problems in mathematical terms), statistics, data analysis, probability, and complex applications of measurement, geometry, and schematic diagrams (NCEE, 2013b). Of note, Spirit offers mathematical modeling with nearly two in three students across 2014 and 2015 graduating classes having taken it as their highest level of mathematics. Therefore, Spirit offers mathematics courses to support students’ transition to and readiness for both 2-year and 4-year institutions.

Regarding science, over half of Spirit students were transitioning to being college ready by taking Regents-level science courses (i.e., Chemistry and Physics) as their highest levels of science coursework. The fact that the majority of Spirit students—Black and Latino from economically disadvantaged communities—took advanced science coursework taught by science-credentialed teachers past the foundational subjects of life science stands starkly against the USDOE Office for Civil Rights (2014) and Hudley’s (2013) findings to the contrary but not against the National Center for Education Statistics (2012c) which found 70.5% of Black and 71.1% of Latino high school students took Algebra II and the following science coursework, Black and Latino students respectively: Biology (96.3% and 94.8%), Chemistry (65.3% and 65.7%), and Physics (26.9% and 28.6%). Interestingly, where Engineering was offered, 10.1% of Blacks and 7.1% of Latinos took the course while 8.2% of whites took the course (NCES, 2012c). This is important as the NGSS are based on the core ideas in the major fields of natural science (life, physical, earth, space) plus engineering (Pratt, 2012).

Of note, higher percentages of Spirit students took Chemistry (67.1% of 2015 graduates, 80.3% of 2014 graduates) and most notably Physics (69.1% of 2015 graduates, 59.1% of 2014
graduates) than the national percentages above. In terms of readiness for college science, numerical criteria from the Regents and CUNY assessments do not exist. There are no minimum science Regents scores that indicate readiness for college level science and there are no similar CUNY science assessments. Thus, the only criteria that may indicate or even suggest to students and schools that students may be ready for college science, or at least on the right track, are their high school science coursework, laboratory work, and science mastery portfolio exhibitions.

However, these statistics belie the persistent and destructive myth that Black and Latino students lack interest, aspirations, and ability in mathematics (Walker, 2007) and science as well. Wherever disparity exists, questions of (in)equality with regards to course (un)availability (i.e., resources, expectations and stereotypes of students’ aspirations and abilities) and proper equipment and technologies first need to be asked and answered (Walker, 2007). Recall that one Spirit teacher admitted that, even though she enjoyed teaching their teacher-created curriculum, her small classroom did not have the proper lab stations she believed every high school science classroom should have. Although Spirit has three classrooms with lab stations—one on each of Spirit’s three floors—other science teachers occupy those classrooms. Even still, Spirit administration, faculty, and staff in close partnership with NFSS and its integrative services persist against the daunting and palpable effects of economic, political, and social injustice on their students and within the community, and persist in caring and fighting for its students—their present and their future.

**Black Ethic of Care and College Readiness in a Racist Society**

To a certain extent, Black ethic of care was demonstrated at Spirit as three of the five dimensions suggested by Thompson (1998)—teachers showing their students respect, treating their viewpoints with respect, and teachers and students alike contributing to and embracing
inquiry—emerged from the data. Thompson’s other two dimensions—helping students develop survival strategies to flourish in a racist society and being versed in a variety of cultural narratives, contexts, and the telling of those narratives—did not emerge in the qualitative data, quite possibly, because Spirit has no Black or Latino teachers. All of Spirit’s teachers and administrators are white, and although they enact interpersonal and instructional structures of care that encompass school-based student-teacher relationships, enact high academic, personal, and social expectations that strengthen students’ perspectives toward schooling, and demonstrate political clarity [to a certain degree through its social and community activism] (Knight-Diop, 2010), evidence of the remaining dimensions did not surface in these participant interviews.

The only Black and Latino adults these Black and Latino students see at Spirit are the NFSS administrators and staff and the Spirit office staff, security officers, cafeteria staff, and custodial staff. As Spirit has a culture of college going and care, these adults engage, encourage, and support the students with a nurturing approach but also a tough love approach in their academic (i.e., portfolio completion) and non-academic goals. Students often even seek advice about their personal situations from these very same adults. Even though the white science teachers work assiduously to connect “what goes on in the classrooms to their [students’] everyday lives” (Giroux, 2003, p. 11) and the school itself is driven as a place of democracy (Hargreaves, Fernandes, & Dinanthompson, 2003), the long absence of Black and Latino administrative leadership and faculty within Spirit speaks to the reproduction of dominant societal power structures and dynamics, whether consciously or subconsciously, at Spirit (Hargreaves, Fernandes, & Dinanthompson, 2003).

The institutional and interpersonal structures of Black ethic of care as it relates to students’ college-going and college and career readiness is demonstrated through Spirit’s
college-going culture; its holistic approach to serving the academic, social, emotional, and economic needs of its students; and, its interactions with the community (Knight-Diop, 2010) via its long-term and close partnership with NFSS and NFSS’s integrative services, College Center, portfolio tutoring, and college preparatory and test preparation programs. The white Spirit administrators recognize the racism in society and its oppressive efforts on Spirit students and their families, in terms of their present and their futures, and work hard to support students in pursuing their college and career goals. The assistant principal believed that CUNY had created “a pretty elitist, racist system” that caters to the have and creates barriers (i.e., assessment, economic, access) for the have nots (Hargreaves, Fernandes, & Dinanthompson, 2003).

Critical theory lays out the larger structures and institutions that oppress the lives of these students, their families, and their academic futures, even when that institution is one of higher education (Giroux, 2003; Hargreaves, Fernandes, & Dinanthompson, 2003). However, to what extent can white teachers and administrators help Black and Latino students develop survival strategies against a white, racist society that supports and perpetuates the very whiteness of their teachers and administrators? Just as the question of advanced course and equipment availability must be asked and answered, so must the human resource question of the absence of Black and Latino administrators and teachers be asked and answered for there to be serious conversation around Black ethic of care at Spirit especially since these “school conditions impact the nature, quality, and potential of these structure for more equitable outcomes (Knight-Diop, 2010, p. 171). Questions of equity must be posed to NFSS as well: Is NFSS, with its majority Black and Latino administrators and staff, teaching Spirit students not just survival skills in college as students but as Black and Latino students where they will experience inequities precisely because of their race and ethnicities? Although the College Center works tirelessly to match
students with colleges and universities that are best fits, walks them through each step of the application, acceptance, and enrollment process, provides guidance and resources on college support systems, and understands and speaks to the cultural issues that may prevent students from going to college, are we teaching our Black and Latino students the skills necessary for survival and success in a racist society as Thompson and Knight-Diop recommended, especially if they will more than likely attend predominantly white campuses?

To be clear, many students chose Spirit as their high school precisely because of the absence of burdensome traditional assessments and the use of portfolio assessment. At Spirit, these constructivist assessments shift the focus of learning from the teacher to the students and their knowledge constructions, reflections, and revisions through consistent teacher feedback (Mishra, 2014). Students (and science teachers) experienced the value-added benefits of portfolio assessment (Davis & Le Mahieu, 2003; Paulson, Paulson, & Meyer, 1991), choosing to more accurately portray their learning and development through portfolios (Davis & Le Mahieu, 2003; Paulson, Paulson, & Meyer, 1991) and connect and apply their new knowledge to their surrounding environments and communities (Mishra, 2014). Thus, lower test scores may be expected for students who are test averse, unpracticed, or possibly unskilled in traditional testing but demonstrably more skilled in contextual assessments like these Spirit alumni who applied science concepts to both familiar and unfamiliar situations when they investigated air and river pollution issues in their community (Bellochi et al, 2016) and were allowed the space and time to create and refine their learning exhibitions with teacher feedback reflective of their in-class and out-of-class science learning experiences (Klassen, 2006).

However, an integrated approach to science assessment is necessary where opportunities for traditional assessments (i.e., multiple choice and short answer quizzes, tests, midterms, and
final exams) are incorporated into meaningful science learning and assessment experiences. A coupling of traditional and portfolio assessments would greatly benefit alumni from portfolio schools in traditional college science courses. Whether the scores are high, low, or average, they never tell the whole story of any student’s academic performance, achievement, or college readiness, or even a fair portion of the internal and external processes involved before and during the test for the student to produce those answers later calculated as scores that determine, in large part, a student’s next academic steps.

To some degree, the findings of this study reflect Harper’s (2014) alumni interview findings from Black and Latino men about college choice, college readiness (quantitative measures versus reality), college/campus realities, support systems, and persistence in terms of needs and supports. It also reflects Conley’s (2008) areas for college readiness, to some degree, where alumni from this study demonstrated readiness in two of the areas (key cognitive strategies and contextual skills and awareness) and less so in the other two (i.e., key content knowledge and academic behaviors). Key cognitive strategies of problem solving and argument formation were embedded in Spirit’s HOM, scientific inquiry, and portfolio construction and presentation. Regarding contextual skills and awareness, the College Center helped alumni during their junior and senior years at Spirit with its college-prep programs, which included campus tours and workshops, and during their freshman year of college, with phone calls of support and advice. Key content knowledge was inconsistent along with academic behaviors that were not learned as a part of a non-traditional assessment environment at Spirit.

Although there is a college-going mindset at Spirit, there is also a tension of what is occurring in the school and classrooms in regard to the notion and difference between getting students through high school and meeting the necessary credit accumulation mandate and getting
students to college. There are specific cognitive skills that students must possess for both academic stations. It was evident the Spirit teachers were intentionally employing strategies to support the development and cultivation of the necessary cognitive skills for high school matriculation and for transitioning to college. Still, a recommendation for Spirit would be for the administration to develop a mechanism or system that would allow for consistent and on-going productive dialogue and constructive exchange between the Spirit faculty, CBO leadership, and a cohort of colleges on what is needed for success in college and beyond. Perhaps, through a sustainable partnership coalition or workgroup, or through an effective professional learning community, a consistent flow of collective thinking and conversation can be generated towards identifying the needs of students for both academic stations and developing and implementing the appropriate practices.

The difference between the robust pictures that the Spirit alumni shared and painted about themselves, their science learning experiences, their cyclical and iterative portfolio assessment experiences therein, and their readiness for college and college science versus what the numbers said about Spirit students’ college readiness is like day and night. Only together do they tell a fuller story about Spirit’s strengths and weaknesses in preparing its students for college and college science. The theories that framed this study, particularly critical theory, Black ethic of care, and SRL theory, can help Spirit examine its dominant structures and cultures more closely to better support its Black and Latino students’ portfolio assessment experience, matriculation, and readiness for college and career. What follows are conclusions and next steps for further research on urban portfolio high schools (community and non-community), science teaching and learning, and readiness for college and college science.
CHAPTER VII

CONCLUSIONS AND NEXT STEPS

This research study emerged important and rich answers about urban portfolio community high school students and their preparation and readiness for college and college science. Since urban portfolio high schools tend to show higher graduation rates and better college-retention rates than traditional high schools (Foote, 2005; Kamenetz, 2015), gaining deeper understanding of the science teaching, learning, assessment, and culture in these schools is necessary to better support students’ transition from high school to and throughout college. This is critical for portfolio community high schools and for portfolio high schools that are considering partnering with CBOs as well as this study showed the administrative, material, financial, and collaborative supports NFSS has provided Spirit to support its portfolio assessment process (i.e., in-class/portfolio tutors) and college-going culture and efforts (i.e., College Center, college prep programs and partnerships). What follows are questions to be explored for community and non-community schools to understand how to better serve students in their college-going and readiness process. These could also serve as questions for future inquiry as they relate to the findings of this study.

Science Teaching and Learning Practices:

- How does science teaching and learning in urban portfolio high schools compare to science teaching and learning in colleges that use non-traditional or portfolio-based assessments?
- What are differences and similarities between urban and non-urban portfolio high schools, particularly in science teaching and learning?
• Which urban portfolio high school science and mathematics courses, if any, predict college admission, performance, and persistence in general and in science?

• What differences and similarities in science teaching and learning exist between portfolio community high schools, portfolio high schools, and traditional high schools?

\textit{Teacher-Student Relationships:}

• How do White teachers define, perceive, and enact an ethic of care for their Black and Latino students? In what ways does their ethic of care affect the educational and career goals of their Black and Latino students?

• How do White teachers see themselves in relation to their Black and Latino students in supporting their students’ academic and career goals?

\textit{Assessments and Coursework:}

• How can traditional assessment(s) be incorporated in the assessment structure of the urban portfolio high school to prepare and support students in their engagement with traditional assessments in college science coursework and lab work?

• How might undergraduate institutions assess and provide non-traditional assessments in coursework, and in the sciences and lab work specifically?

\textit{Preparation of Readiness:}

• What systems of communication and action may be created to agree or negotiate more appropriately the criteria and standards for career readiness; how might conflicting views be negotiated for better informing college and career readiness?

• What does it mean when there are disconnections along the way, in terms of definitions, perceptions, and preparation of readiness? What, why, and who are the gatekeepers for preparation and readiness that affect access for students from urban communities?
Policies and Partnerships

- What policies can be developed and enacted to close the gap between the academic requirements of institutions of higher learning and urban portfolio high schools?
- How do urban portfolio schools without partnerships with CBOs cultivate and support a college-going culture?
- How will schools address the implications for free college under the NYS free tuition scholarship initiative? How will this impact the college preparation and readiness work of high schools, partnering CBOs, and colleges?

In conclusion, knowing the answers and contexts for these answers will help urban portfolio high school students from community and non-community schools have more successful learning and assessment experiences in college and college science during and beyond their freshman year.
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Appendix 1

Teachers College IRB Approval Notification

To: Robin Fleshman
From: Karen Froud, IRB Chair
Subject: IRB Approval: 15-407 Protocol
Date: 11/24/2015

Please be informed that as of the date of this letter, the Institutional Review Board for the Protection of Human Subjects at Teachers College, Columbia University has given full approval to your study, entitled "Exploring Science Assessment and College Readiness of Students from an Urban Portfolio High School," under Expedited Review (Category 7 Research on individual or group characteristics or behavior).

The approval is effective until 11/23/2016.

The IRB Committee must be contacted if there are any changes to the protocol during this period. Please note: If you are planning to continue your study, a Continuing Review report must be submitted to either close the protocol or request permission to continue for another year. Please submit your report by 10/26/2016 so that the IRB has time to review and approve your report if you wish to continue your study. The IRB number assigned to your protocol is 15-407. Feel free to contact the IRB Office (212-678-4105 or irb@tc.edu) if you have any questions.

Please note that your Consent form bears an official IRB authorization stamp. Copies of this form with the IRB stamp must be used for your research work. Further, all research recruitment materials must include the study's IRB-approved protocol number. You can retrieve a PDF copy of this approval letter as well as the stamped consent(s) and recruitment materials from the IRB Mentor site.

When your study ends, please visit the IRB Mentor site. Go to the Continuing Review tab and select "terminate" from the drop-down menu.

Best wishes for your research work.

Sincerely,

Karen Froud, Ph.D.
Associate Professor of Neuroscience & Education
IRB Chair

Attachments:

• REF TC Informed Consent form (recent).pdf
Appendix 2

Protocol Title: Exploring Science Assessment and College Readiness of Students from an Urban Portfolio High School

Interview Consent

Principal Investigator: Robin Fleshman, Doctoral Candidate, Science Education Ph.D. Program, ref2134@tc.columbia.edu

WHAT IS A RESEARCH STUDY?

Research is the careful study of an issue that is not fully understood. Research studies are carried out by principal investigators to find new knowledge and reach a better understanding. Participating in a research study may not help you or others but may help researchers begin to figure out a problem. Participating in a research study is always voluntary— you decide whether you want to participate or not. If you agree to participate, you can always change your mind. Feel free to ask questions so you are comfortable about participating. The first step is reading and signing this informed consent.

INTRODUCTION

You are being invited to participate in this research study called “Exploring Science Assessment and College Readiness of Students from an Urban Portfolio High School.” You may qualify to take part in this research study because you are at least 18 years old or older, are a graduate of the urban high school and a current college student, or are a current teacher, administrator or staff member at the urban high school. Approximately twelve people will participate in this study and it will take 45 minutes of your time to complete.

WHY IS THIS STUDY BEING DONE?

This study is being done to determine in what ways the portfolio-based approach prepares urban high school students for college level science.

WHAT WILL I BE ASKED TO DO IF I AGREE TO TAKE PART IN THIS STUDY?

If you decide to participate, you will be interviewed by the principal investigator. During the interview you will be asked to discuss your education experience as a high school student and college student. For administrators, teachers and staff member, you will be asked to discuss your experience as it pertains to your role in educating and preparing high students. This interview will be audio-recorded. After the audio-recording is written down the audio-recording will be deleted. If you do not wish to be audio-recorded, you will not be able to participate. The interview will take approximately forty-five minutes. You will be given a pseudonym or false name in order to keep your identity confidential.

All participants will be interviewed at a date and time of their convenience.
WHAT POSSIBLE RISKS OR DISCOMFORTS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

This is a minimal risk study, which means the harms or discomforts that you may experience are not greater than you would ordinarily encounter in daily life while taking routine physical or psychological examinations or tests. However, there are some risks to consider. You might feel embarrassed to discuss problems that you experienced in high school, college, or while working in your school. However, you do not have to answer any questions or divulge anything you don’t want to talk about. You can stop participating in the study at any time. The principal investigator is taking precautions to keep your information confidential and prevent anyone from discovering or guessing your identity, such as using a pseudonym instead of your name and keeping all information on a password protected computer and locked in a file drawer.

WHAT POSSIBLE BENEFITS CAN I EXPECT FROM TAKING PART IN THIS STUDY?

There is no direct benefit to you for participating in this study. Participation may benefit the field of science education as it pertains to assessments and college readiness.

WILL I BE PAID FOR BEING IN THIS STUDY?

You will not be paid to participate, but you will receive a $20 Amazon gift card; and, your transportation costs (or time and effort) will be covered. There are no costs to you for taking part in this study.

WHEN IS THE STUDY OVER? CAN I LEAVE THE STUDY BEFORE IT ENDS?

The study is over when you have completed the interview. However, you can leave the study at any time even if you haven’t finished. You will still be paid for your transportation costs and receive the $20 Amazon gift card for your participation.

PROTECTION OF YOUR CONFIDENTIALITY

The investigator will keep all written materials locked in a desk drawer in a locked office. Any electronic or digital information (including audio recordings) will be stored on a computer that is password protected. What is on the audio-recording will be written down and the audio-recording will then be destroyed. There will be no record matching your real name with your pseudonym. Regulations require that research data be kept for at least three years.

HOW WILL THE RESULTS BE USED?

The results of this study will be published in journals and presented at academic conferences. Your name or any identifying information about you will not be published. This study is being conducted as part of the dissertation of the principal investigator.
CONSENT FOR AUDIO RECORDING

Audio recording is part of this research study. You can choose whether to give permission to be recorded. If you decide that you don’t wish to be recorded, you will not be able to participate in this research study.

______ I give my consent to be recorded __________________________________________

______ I do not consent to be recorded __________________________________________

WHO MAY VIEW MY PARTICIPATION IN THIS STUDY

___ I consent to allow written and/or audio taped materials viewed at an educational setting or at a conference outside of Teachers College __________________________

Signature

___ I do not consent to allow written and/or audio taped materials viewed outside of Teachers College Columbia University __________________________

Signature

OPTIONAL CONSENT FOR FUTURE CONTACT

The investigator may wish to contact you in the future. Please initial the appropriate statements to indicate whether or not you give permission for future contact.

I give permission to be contacted in the future for research purposes:

Yes _______________ No _______________

Initial Initial

I give permission to be contacted in the future for information relating to this study:

Yes _______________ No _______________

Initial Initial

WHO CAN ANSWER MY QUESTIONS ABOUT THIS STUDY?
If you have any questions about taking part in this research study, you should contact the principal investigator, Robin Fleshman, at ref2134@tc.columbia.edu.

If you have questions or concerns about your rights as a research subject, you should contact the Teachers College, Columbia University Institutional Review Board (IRB) (the human research ethics committee) at 212-678-4105 or email IRB@tc.edu. Or you can write to the IRB at Teachers College, Columbia University, 525 W. 120th Street, New York, NY 10027. The IRB is the committee that oversees human research protection for Teachers College, Columbia University.

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**PARTICIPANT’S RIGHTS**

- I have read and discussed the informed consent with the researcher. I have had ample opportunity to ask questions about the purposes, procedures, risks and benefits regarding this research study.
- I understand that my participation is voluntary. I may refuse to participate or withdraw participation at any time without penalty to future employment; student status or grades; or, services that I would otherwise receive.
- The researcher may withdraw me from the research at his or her professional discretion should I require medical attention or raise critical issues that require counseling services.
- If, during the course of the study, significant new information that has been developed becomes available which may relate to my willingness to continue my participation, the investigator will provide this information to me.
- Any information derived from the research study that personally identifies me will not be voluntarily released or disclosed without my separate consent, except as specifically required by law.
- I should receive a copy of the Informed Consent document.

*My signature means that I agree to participate in this study:*

Exploring Science Assessment and College Readiness of Students from an Urban Portfolio High School
Print name: ___________________________  Date: ___________________________

Signature: ___________________________
Appendix 3

Science Teacher Interview Questions

1. Tell me something about yourself. If you only had five words to describe yourself, what would they be? What five words would your colleagues use to describe you? What five words would your students use to describe you?

2. What type of culture have you tried to create in your classroom? How would you describe the teaching and learning processes in your classroom? Which subjects are the most challenging for you to teach, and why? What supports do you receive?

3. Describe the assessment philosophy and structure at Spirit. Do students take traditional assessments (like the Regents exam)? Have you noticed improvements in student outcomes?

4. Describe the science assessment process at Spirit. Does it differ for each grade level?

5. What are the elements of the science portfolio and how is the portfolio developed over the year? Do you see the science portfolio as a formative or summative assessment, or combination? How is your teaching affected by the portfolio-based assessment? How are students supported in their panel presentations and paper?

6. Describe the students in your class. Since many students come from the neighborhood, how do you think their socio-economic, cultural, and community issues affect how they perform in class? How do these issues affect how they respond to, develop, and present their science portfolio? How do you think these issues affect how they see themselves now and in the immediate future?

7. How do you feel about the course/discipline structure (i.e., the combining of science and math)? What are the benefits and challenges to teaching science in this structure? What
are the benefits and challenges to student performance, particularly in science, in this structure?

8. Describe your perspective on accountability and assessment. If you taught at a non-portfolio middle or high school prior to coming to Spirit, how did you adapt to PBA at Spirit? What do you see as the positives and negatives of both types of assessment?

9. What is your overall opinion on how students are performing in science at Spirit? Which courses are the most challenging for students? How are students in your class performing? Have you noticed improvements in student outcomes?

10. What is your overall opinion on student performance levels on the science portfolio-based assessments? For example, do you notice a progression in student performance over the grades?

11. In what other ways are students assessed in science? How does a student receive their final grade in a science class? And, is this different for each grade level?

12. How well do you think portfolio-based science assessment prepare your students for college level science coursework and test performance? How do students feel about portfolio-based assessment at Spirit? How do they perceive their level of preparedness for college science? Do students feel that the portfolio-based assessment prepares them for college science coursework and test performance?

13. What structure or model does Spirit implement to provide quality education for students with special needs (i.e., the inclusion model for secondary special education)? Describe how students with IEPs are performing in science as well as on the portfolio-based assessments.
14. What are your greatest challenges and successes in guiding students in the development of their science portfolio? What do you think are the students’ greatest challenges and successes in developing their science portfolio? What effect does the development of the science portfolio have on their science learning and perspective?

15. What are your hopes for you as a science teacher going forward? For the school? For your students?

16. Is there anything else you would like to say about your experience here at Spirit?
Appendix 4

Founding Principal Interview Questions (more around school environment):

1. What do you enjoy most about how science here at Spirit High School is structured and implemented? Why? What do you enjoy least? Why?
2. Describe the culture of the school.
3. Describe the students, in particular, their behaviors, attitudes, and perspectives about science.
4. What science teaching and learning practices resonate well with the students?

Founding Principal Interview Questions (more around PBA):

1. What was the rationale for selecting portfolio-based assessments for Spirit High School? What processes were involved in confirming this approach?
2. Generally, describe the assessment philosophy and structure at Spirit. Do students take traditional assessments (like the Regents exam)? Have you noticed improvements in student outcomes?
3. Describe the student population.
4. Describe the Consortium in general (perhaps the historical background, if possible)? Discuss the specifics around Spirit as it pertains to the Consortium (how did the school decide to be a part of the consortium, what supports are offered, evaluation structures, opportunities for schools-teachers-students, etc.)
5. Describe the entire assessment process as it pertains to science at Spirit. Does it differ for each grade? What are the elements of the portfolio? What does the entire process consist of (panel presentation, paper, etc)?
6. What are your hopes for the school going forward?

7. How did you determine the school structure with regards to the grade houses? What was the rationale?

8. How did you determine the course/discipline structure? For example, it seems that Spirit is implementing a modified elementary model by combining science and mathematics. What was the rationale? Benefits for student performance? Challenges for student performance?

9. Describe your perspective on accountability and assessment.

10. Overall opinion on how students are performing in science courses at Spirit. Have you noticed improvements in student outcomes?

11. Overall opinion on student performance levels on the science portfolio-based assessments. For example, do you notice a progression in student performance over the grades?

12. With regards to the scoring rubric, what is the New York Performance Standards Consortium Performance Assessment?

13. How are students assessed in science? Meaning, how does a student receive their final grade in a science class? And, is this different for each grade?

14. With regards to PBA, do you think this prepares the students for college level science coursework and test performance?

15. What structure or model does Spirit implement with regards to providing quality education for students with special needs? For example, the inclusion model for secondary special education? Describe how students with IEPs are performing in science? On the portfolio-based assessments?
16. How does the Consortium approach affect students with IEPs?

17. How is teacher performance connected to PBAs? What is the general attitude of the teachers around PBAs?
Appendix 5

Current Principal and Assistant Principal Interview Questions

1. Describe the assessment philosophy and structure at Spirit. Do students take traditional assessments like the Regents exam? Have you noticed improvements in student outcomes?

2. Describe the student population. Since many students come from the neighborhood, how do you think their socioeconomic, cultural, and community issues affect their performance in class, in particular, science class? How do these issues affect how they respond to and develop their portfolio, in particular, the science portfolio? How do you think these issues affect how they see themselves now and in the immediate future?

3. What type of school culture have you tried to create at Spirit? How were you able to do so? Specifically, how would you describe the culture, and teaching and learning processes in the science classrooms?

4. Describe the science assessment process at Spirit. Does it differ for each grade level?

5. What are the elements of the science portfolio and how is the portfolio developed over the year? Do you see the assigned portfolio as a formative or summative assessment, or combination? To what extent should teaching be impacted by the portfolio?

6. How is teaching connected to PBA? What is the general attitude of the teachers around PBA? What is the general attitude of the science teachers around the science portfolio?

7. Describe your perspective on accountability and assessment. Have you always had that perspective? Has the portfolio-based assessment approach here at spirit affected your perspective? If so, please explain.
8. What is your overall opinion on how students are performing and science courses at Spirit? Which courses are the most challenging for students? Have you noticed improvements in student outcomes?

9. What is your overall opinion on student performance levels on the science portfolio-based assessments? For example, do you notice a progression in student performance over the grades?

10. In what ways are students assessed in science? How does a student receive their final grade in a science class? And, is this different for each grade level?

11. How well does portfolio-based science assessment prepare your students for college-level science coursework and test performance? How do you know? How do students feel about portfolio-based assessment at Spirit? How do they perceive their level of preparedness for college science? Do students feel that the portfolio-based assessment prepares them for college science coursework and test performance?

12. What structure or model did Spirit implement to provide quality education for students with special needs (i.e., the inclusion model for secondary special-education)? Describe how students with IEPs are performing in science as well as on the portfolio-based assessments.

13. How does the portfolio-based approach affect students with IEPs?

14. How is teacher performance connected to PBA? What is the general attitude of the teachers around PBA? What is the general attitude of the science teachers around the science portfolio?

15. What are your hopes for the school going forward?

16. Is there anything else you would like to add?
Appendix 6

College Center Director/Community School Director Interview Questions

1. Please talk a little about the College Center here at Spirit. How did it come about? How long has it been running? What is your role with the program? How long have you been in this role?

2. How does the student success Center prepare students for college and how does it define successful preparation?

3. Describe the student population. Since many students come from the neighborhood, how do you think their socioeconomic, cultural, and community issues affect how they perform in class, in particular, science class? How do you see these issues playing out in their participation in the College Center? How do you think these issues affect how they see themselves now and in the immediate future?

4. Let’s shift gears. Describe your perspective on accountability and assessment. Have you always had that perspective? Has the portfolio-based assessment here at Spirit affected your perspective? If so, please explain.

5. What is your overall opinion on how students are performing and science courses at Spirit? Have you noticed improvements in student outcomes?

6. What is your overall opinion on student performance levels on the science portfolio-based assessments? For example, do you notice a progression in student performance over the grades?

7. Knowing that most colleges use some form of standardized or regular testing as a form of assessment, especially in science, how well do you think portfolio-based science assessment compare students in your program for college level science coursework and
test performance? How do you think students feel about portfolio-based assessment at Spirit? How do they perceive the level of preparedness for college science? Do you think students feel that the portfolio-based assessment prepares them for college science coursework and test performance?

8. What do you see as the greatest challenges that students here face at navigating Spirit? In navigating their science class? The College Center?

9. What do you see of the greatest challenges that students will face in navigating their first year of college in general? In their science classes?

10. Of the experiences they have had here at Spirit, what do you think students will take with them that will help them to successfully complete the first year of college, and do well in their science classes?

11. What are your hopes for the school going forward? For the College Center? For the students?

12. Is there anything else you would like to add?
Appendix 7

Alumni Interview Questions

1. Tell me something about yourself. If you only had five words to describe yourself, what would they be? What, five words with your friends use to describe you? What, five words would your science teacher used to describe you?

2. Describe the students in your science class. Since many students come from the neighborhood, how do you think home and neighborhood issues affected how students perform in class? How did those issues affect you, if they did? How did they affect how you developed your science portfolio over the year? For instance, did you choose projects that connected with home or the neighborhood? How do you think these issues affected how you and your classmates saw yourselves, then and in the future?

3. How did you feel about science and mathematics being combined as one class instead of taking them separately? What did you think were the benefits for you learning and doing science in the combined class? Any challenges?

4. Which do you prefer as a way to assess what you have learned science: regular testing or the portfolio? Why?

5. Which activities projects did you most enjoy doing and science, and why? Least enjoyed, and why?

6. How are you assessed in science class? How do you receive your final grade science class?

7. What did you do to prepare for your portfolio panel presentation? In what ways did you teacher support you? Why did you choose your science project?

8. What are your plans after college? What prepared you along the way for college?
9. How well do you think the portfolio-based assessment has prepared you for college science coursework in tests? What else might you have needed or wanted to hear you for college science (i.e., standardized tests, written test)?

10. What strategies did you use to navigate your first year of science? What do you think were your greatest challenges during your first year of science?

11. What are you most proud of about your science portfolio? What were your challenges and successes in developing your science portfolio?

12. What are your hopes for yourself after you graduate from college? Where do you see yourself in five years?

13. Is there anything else you would like to say about your experience here at Spirit?
## New York Performance Standards Assessment Science Rubric

**New York Performance Standards Consortium**

**Student ____________________________**

**Extended Science Project or Original Experiment**

**Title of Experiment ________________**

**Circle one: Teacher or External Evaluator __________________________ Date_________**

**Circle one: Holistic ev_________aluation __________________________ Signature ________________**

### 03/11 Performance Indicator

<table>
<thead>
<tr>
<th>Contextualize</th>
<th>Outstanding</th>
<th>Good</th>
<th>Competent</th>
<th>Needs Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background research has been thoroughly conducted using at least two original sources. Sources are all appropriately cited. The significance of the problem is clearly stated. The hypotheses/theses are grounded in the background research.</td>
<td>Background research has been thoroughly conducted. Sources are appropriately cited. The significance of the problem is stated. The hypotheses/theses are relevant to the background research.</td>
<td>Background research is included in the introduction. Sources are cited. The significance of the problem is stated. The hypotheses/theses are clearly stated.</td>
<td>Background research is not included in the introduction. Sources are not cited. The significance of the problem is not stated. The hypotheses/theses are not stated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Critique Experimental Design</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifies, describes and controls all relevant variables. Thoughtfully evaluates the procedure and/or set up. Clearly describes bias in the design.</td>
<td>Identifies, describes and controls most relevant variables. Evaluates the procedure and/or set up. Clearly describes bias in the design.</td>
<td>Identifies, describes and controls some relevant variables. Evaluates the procedure and/or set up. Attempts to describe bias in the design.</td>
<td>Does not identify, describe or control any variables. Does not evaluate the procedure and/or set up. Does not attempt to describe bias in the design.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Collect, Organize and Present Data</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Collects data in a reliable and valid manner. Presents relevant data that is consistent with the problem. Generates appropriate tables, charts and graphs with data and makes appropriate calculations. Conducts thorough mathematical analysis of the data.</td>
<td>Collects data in a reliable and valid manner. Presents relevant data that is consistent with the problem. Generates appropriate tables, charts and graphs with data and/or makes appropriate calculations. Conducts mathematical analysis of the data.</td>
<td>Collects data in a reliable and valid manner. Presents data that is consistent with the problem. Generates tables, charts and graphs with data. Conducts analysis of the data.</td>
<td>Collects data in a non-reliable and/or invalid manner. Does not present data or presents data that is not relevant to the problem. Does not generate tables, charts and graphs. Does not analyze the data.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analyze and Interpret Results</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Draws thoughtful conclusions that are supported by the data. Relates conclusions to original question. Thoroughly describes sources of error and their effects on the data.</td>
<td>Draws conclusions that are supported by the data. Relates conclusions to original question. Describes several sources of error and their effects on the data.</td>
<td>Draws conclusions that are partially supported by the data. Attempts to relate conclusions to original question. Describes sources of error and attempts to describe their effects on the data.</td>
<td>Draws no conclusions or draws conclusions that are not supported by the data. Does not attempt to relate conclusions to original question. Does not describe sources of error or does not attempt to describe their effects on the data.</td>
</tr>
</tbody>
</table>
New York Performance Standards Assessment Science Rubric (Cont’d)

<table>
<thead>
<tr>
<th>Performance Indicator</th>
<th>Outstanding</th>
<th>Good</th>
<th>Competent</th>
<th>Needs Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revise Original Design</td>
<td>Proposes effective and relevant revisions for the experimental plan to lessen the effects of bias and sources of error. Poses thoughtful and relevant questions for future research.</td>
<td>Proposes relevant revisions for the experimental plan to lessen the effects of bias and sources of error. Poses relevant questions for future research.</td>
<td>Proposes revisions for the experimental plan to lessen the effects of bias and sources of error. Poses questions for future research.</td>
<td>Does not propose revisions for the experimental plan. Does not pose questions for future research.</td>
</tr>
<tr>
<td>Defense (for oral component only)</td>
<td>Thoroughly answers questions relevant to the experiment and related topics.</td>
<td>Adequately answers questions relevant to the experiment and related topics.</td>
<td>Adequately answers questions relevant to the experiment.</td>
<td>Does not adequately answer questions relevant to the experiment.</td>
</tr>
<tr>
<td>VIEWPOINT:</td>
<td>Satisfactory</td>
<td>Unsatisfactory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>--------------</td>
<td>----------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Expresses a clear, complex viewpoint on the Essential Question</td>
<td>□ Expresses a clear viewpoint on the Essential Question</td>
<td>□ Viewpoint on the Essential Question is unclear or inconsistent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Identifies and provides a keen analysis of other viewpoints</td>
<td>□ Identifies and provides a brief analysis of other viewpoints</td>
<td>□ Analysis of other viewpoints is lacking or incomprehensible</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Demonstrates an in-depth understanding of subject/project area</td>
<td>□ Demonstrates an understanding of subject/project area</td>
<td>□ Demonstrates a lack of understanding of subject/project area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ Raises thought-provoking questions/doubts</td>
<td>□ Raises questions/doubts</td>
<td>□ Does not raise questions/doubts or they are irrelevant</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EVIDENCE:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Uses ample and relevant evidence to support his/her ideas</td>
<td>□ Uses adequate and mostly relevant evidence to support his/her ideas</td>
<td>□ Uses inadequate and/or irrelevant evidence to support his/her ideas</td>
</tr>
<tr>
<td>□ Gives astute analysis of evidence</td>
<td>□ Gives a brief analysis of evidence</td>
<td>□ Analysis of evidence is lacking or incomprehensible</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONNECTIONS:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Makes insightful connections between various ideas expressed in the panel or the mastersies</td>
<td>□ Makes connections between various ideas expressed in the panel or the mastersies</td>
<td>□ Makes superficial connections between various ideas expressed in the panel or the mastersies</td>
</tr>
<tr>
<td>□ Places ideas in a broader context and/or applies learning to a wider context</td>
<td>□ Attempts to place ideas in a broader context and/or apply learning to a wider context, making some relevant connections</td>
<td>□ Unable to place ideas in a broader context and/or apply learning to a wider context</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oral:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Uses appropriate language for audience and demonstrates solid command of vocabulary</td>
<td>□ Uses appropriate language for audience</td>
<td>□ Uses inappropriate language for audience</td>
</tr>
<tr>
<td>□ Actively engages in discussion or debate</td>
<td>□ Engages in discussion or debate</td>
<td>□ Unengaged in discussion or debate</td>
</tr>
<tr>
<td>□ Responds to questions thoughtfully and succinctly</td>
<td>□ Provides clear responses to questions</td>
<td>□ Provides inaccurate or incomprehensible responses to questions</td>
</tr>
<tr>
<td>□ Actively solicits ideas from other panel members, encourages their participation, speaks at appropriate times</td>
<td>□ Solicits ideas from other panel members, mostly speaks at appropriate times</td>
<td>□ Does not solicit ideas from other panel members or discourages their participation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visual:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Utilizes visual effectively to communicate an expansion of the ideas and learning represented in the written work</td>
<td>□ Utilizes visual to communicate the ideas and learning represented in the written work</td>
<td>□ Does not use, or is ineffective in using, a visual element to communicate relevant ideas</td>
</tr>
<tr>
<td>□ The visual is carefully designed and clearly connected to the topic</td>
<td>□ The visual is neatly designed and connected to the topic</td>
<td>□ The visual is poorly designed and/or unconnected to the topic</td>
</tr>
</tbody>
</table>

**Areas of strength:**

**Areas for Improvement:**
<table>
<thead>
<tr>
<th>Performance Indicators</th>
<th>Outstanding</th>
<th>Good</th>
<th>Competent</th>
<th>Needs Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thesis and organization</td>
<td>Efficiently organizes paper around a clear, compelling argument</td>
<td>Has a clear argument</td>
<td>Has a central idea</td>
<td>Lacks a central idea</td>
</tr>
<tr>
<td></td>
<td>Develops argument thoughtfully &amp; persuasively</td>
<td>Effectively organized &amp; developed coherently around central argument</td>
<td>Mostly organized around a central idea, but may lose focus at times</td>
<td>Unfocused organization</td>
</tr>
<tr>
<td></td>
<td>Uses relevant, convincing evidence and quotations that thoroughly support argument</td>
<td>Uses relevant evidence &amp; quotations that support central argument</td>
<td>Uses relevant evidence and quotations to support central idea</td>
<td>Little, irrelevant, or no evidence used</td>
</tr>
<tr>
<td>Analysis</td>
<td>Provides deep insight and creates meaningful interpretation of texts</td>
<td>Creates meaningful interpretation of texts</td>
<td>Provides basic interpretation of texts</td>
<td>Summarizes or uses faulty analysis</td>
</tr>
<tr>
<td></td>
<td>Elaborates on central argument and meaning of supporting evidence; answers question, So what?</td>
<td>Explores central argument and meaning of supporting evidence; answers question, So what?</td>
<td>Little or no interpretation of texts</td>
<td>Little or no use of evidence or quotations</td>
</tr>
<tr>
<td></td>
<td>Considers author's language, craft, and/or choice of genre</td>
<td>Analysis drives discussion of literary elements when relevant</td>
<td>Little or no use of evidence or quotations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analysis drives discussion of literary elements when relevant</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Style and voice</td>
<td>Evidence of ambition, passion for subject, or deep curiosity</td>
<td>Evidence of a mind at work</td>
<td>Communicates ideas clearly</td>
<td>Relies on conversational language</td>
</tr>
<tr>
<td></td>
<td>Writer willing to take risks</td>
<td>Evidence of interest in topic</td>
<td>Shows some awareness of appropriate language and word choice</td>
<td>Little or no evidence of formal or appropriate use of language and word choice</td>
</tr>
<tr>
<td></td>
<td>Displays intellectual engagement</td>
<td>Clear and appropriate use of language and word choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Creative, clear, and appropriate use of language and word choice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connections</td>
<td>Makes insightful connection between text and something outside the text:</td>
<td>Makes appropriate connection between text and something outside the text:</td>
<td>Establishes a connection between text and something outside the text:</td>
<td>Inappropriate or no connection made between the text and something outside the text</td>
</tr>
<tr>
<td></td>
<td>Another work of literature or Historical context or Biographical context or Larger issue or theme of importance (must be supported with relevant evidence) or Film version of text, or Substantial criticism</td>
<td>Another work of literature or Historical context or Biographical context or Larger issue or theme of importance (must be supported with relevant evidence) or Film version of text, or Substantial criticism</td>
<td>Another work of literature or Historical context or Biographical context or Larger issue or theme of importance (must be supported with relevant evidence) or Film version of text, or Substantial criticism</td>
<td>Communication is impaired by errors; little or no use of conventions or quotation and citations; shows little awareness of appropriate use of transitions</td>
</tr>
<tr>
<td>Conventions (for writing assignment only)</td>
<td>Mechanical and grammatical errors are rare or non-existent; follows accepted conventions of quotations and citations; uses transitions effectively</td>
<td>Few mechanical or grammatical errors; follows accepted conventions of quotations and citations; makes some use of transitions</td>
<td>Some mechanical or grammatical errors but communication is not impaired; demonstrates knowledge of accepted conventions of quotations</td>
<td></td>
</tr>
<tr>
<td>Presentation (for oral component only)</td>
<td>Communicates ideas clearly in appropriate, sophisticated, and original way to audience; able to respond to questions and expand on ideas; presents complex, accurate, substantive ideas and information clearly</td>
<td>Communicates clearly in appropriate and original way to audience; able to respond to questions and expand on ideas; presents complex, accurate, substantive ideas and information clearly</td>
<td>Communicates clearly in appropriate way to audience; able to respond accurately to questions; presents some substantive ideas and information accurately</td>
<td>Neither clear nor appropriate presentation to audience; cannot respond well to questions; does not present accurate or substantive ideas or information</td>
</tr>
</tbody>
</table>
### Final Portfolio Grade

#### Name of Student

#### Subject

<table>
<thead>
<tr>
<th>Less than Satisfactory</th>
<th>Distinguished</th>
<th>Satisfactory Plus</th>
<th>Satisfactory</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outstanding</td>
<td>Proficient</td>
<td>Competent</td>
<td>Needs Revision</td>
<td></td>
</tr>
</tbody>
</table>

#### Written Grade

<table>
<thead>
<tr>
<th>Grader</th>
<th>Letter Grade</th>
<th>Number Equivalent</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (discipline-based blue tagger)</td>
<td></td>
<td></td>
<td>D = 4</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>S+ = 3</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>S  = 2</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>S- = 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U  = 0</td>
</tr>
</tbody>
</table>

**SUM OF SCORES**

<table>
<thead>
<tr>
<th>SUM DIVIDED BY NUMBER OF GRADERS (AVERAGE)</th>
<th>AVERAGE MULTIPLIED BY .75 (Written weighted average)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Oral Grade

<table>
<thead>
<tr>
<th>Grader</th>
<th>Letter Grade</th>
<th>Number Equivalent</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>D = 4</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>S+ = 3</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>S  = 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>S- = 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>U  = 0</td>
</tr>
</tbody>
</table>

**SUM OF SCORES**

<table>
<thead>
<tr>
<th>SUM DIVIDED BY NUMBER OF GRADERS (AVERAGE)</th>
<th>AVERAGE MULTIPLIED BY .25 (Oral weighted average)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Final Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>WRITTEN WEIGHTED AVERAGE</td>
</tr>
<tr>
<td>B</td>
<td>ORAL WEIGHTED AVERAGE</td>
</tr>
<tr>
<td>C</td>
<td>SUM OF WEIGHTED AVERAGES</td>
</tr>
<tr>
<td>D</td>
<td>SCORE CONVERTED TO FINAL GRADE</td>
</tr>
<tr>
<td>3.6 – 4.0</td>
<td>Distinguished (D)</td>
</tr>
<tr>
<td>2.6 – 3.5</td>
<td>Satisfactory Plus (S+)</td>
</tr>
<tr>
<td>1.6 – 2.5</td>
<td>Satisfactory (S)</td>
</tr>
<tr>
<td>1 – 1.5</td>
<td>Less than Satisfactory (S-)</td>
</tr>
<tr>
<td>&lt;1</td>
<td>Unsatisfactory</td>
</tr>
</tbody>
</table>