

Getting to the Matter of Matter: A Grounded Theory Study on  
How Students Navigate Texts in an Introductory Chemistry Course at a  
Community College in New York City

Minkyung Choi

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## ABSTRACT

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Several studies indicate that more than half of all college freshmen are not prepared to read and analyze college-level texts. The problem of college reading becomes more formidable when it comes to community college students, who often enter college with socio-linguistic factors that pose challenges to literacy learning. Historically, interventions have consisted of developmental, or remedial, courses after which students are expected to demonstrate college-level literacy. While extensive studies have been conducted on the efficacy of remedial programs in community colleges, few studies have examined how students navigate texts in courses that presuppose proficiency in reading. This grounded theory study investigated ways in which students in an introductory chemistry course at a community college in New York City navigated texts. It documented and analyzed both the students' beliefs and decisions in the chemistry classroom and outside-of-school spaces as well as the professor's perspectives of the students. The findings revealed that the notion of literacy reaches beyond the text (Moje, 1996; Rosenblatt, 1988); literacy and intertextuality necessitate the consideration of disciplinary context, instruction, and a larger sociocultural context of the reader. Because of the constantly evolving nature of literacy in context, the findings highlight a need to rethink literacy instruction in the college classroom.

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## DEDICATION

I would like to dedicate this work to my students, whose lives continue to astound, challenge, and inspire me. You remind me that teaching must be personal, authentic, and ever-evolving. Your ability to push past the challenges of life never fail to humble me as a teacher. I am deeply appreciative of your willingness to allow me to be a part of your educational journey.

## CHAPTER I – INTRODUCTION

I spent the first 10 years of my life in Highland Park, New Jersey, which was predominantly Jewish. Although there were very few Korean families in our immediate neighborhood, my family was part of a Korean community through a church located half an hour away. Although I learned early on to read Korean, I found it to be a task and rarely read texts in the language. When I moved to South Korea in fifth grade, I enrolled in a local school where I took classes like Korean history, social studies, and ethics, among others. While I could phonetically read words from my textbooks and identify vowels and consonants, it was nearly impossible to make sense of the history, science, and math texts that I was required to read. Terms like *supply and demand*, *law of gravity*, and *least common multiple* were unfamiliar, to say the least. The problem did not merely lie in the translation efforts of terminology. The unfamiliar use of prepositions and foreign sentence structure managed to create labyrinths that took much maneuvering to understand, and topped with the fact that I knew nothing of Korean history or the governmental structure of South Korea, the textbooks held little meaning for me. I questioned the notion of *reading to learn*—if one could not read, how to learn?

My first teacher, an elderly man in his late 60s, saw that I had much difficulty reading and taking notes from the board, much less comprehending. Each night, our homework was to create journal entries of our day. We were to bring back paragraphs that described the most memorable event that had taken place during the day with a reflection on the event. What did we learn? What were some of the emotions we felt? What were we surprised by? Each night for a week, I sat at my desk, pencil poised, and wrote nothing. I could barely write single words, much less string together coherent sentences. Upon seeing my empty notebook being submitted day after day, the teacher suggested that I write in English. He did not read or speak English, but

perhaps he could figure out my journal entries. With that permission given, the words flew. I wrote pages and pages of the culture shock that entangled me each day and the impossibly high academic expectations that this new country saw as the norm. Each day, my teacher would read and return my notebook, with notes in the margins. Some of them were questions, and others were translations of words into Korean. Slowly, as time passed, the journal entries became a hodge-podge of Konglish, or a fusion of Korean and English. Gradually, the entries were written in Korean.

It took several years to come to the understanding that reading a textbook required a specific understanding of language and communication in the particular discipline at hand. But as my understanding of the language grew, I discovered that understanding a subject was more than just acquiring the language. More significant was the recognition that texts began to make sense when *they meant something* to me. When I could draw connections to my life experiences or develop links across texts, the information became more than words on a page—they became knowledge.

As a developmental reading instructor at an urban community college, I quickly found that reading expository texts was similarly overwhelming and intimidating to many of my students. As I had experienced when I was younger, there was a resistance to reading textbooks, sometimes spurred by their sheer volume, and other times because of prior experiences that instilled in them the belief that textbooks were boring, difficult, and unrelatable. While I use the terms *developmental reading* and *remedial reading* to refer to the same practices, I clarify the terminology and nuanced differences in my literature review chapter.

Most of the students in the class had little exposure to college-level texts before matriculating and had developed perceptions that college textbooks were cryptic. Mid-semester,

I noticed that many students gave up on reading the textbook for not only my class, but other classes as well, and began to rely on Power Point slides and lecture notes. This was problematic because the Power Point slides that students used for studying were not contextualized and rather only captured pieces of information that lacked background. What I began to see was a shift away from reading. Instead, students became more interested in seeking answers on tests.

When the students in my class expressed an interest in taking courses in reading-intensive classes like psychology, history, and biology, I began to wonder what the implications of a lack of disciplinary literacy were. What was happening to reading as the main mode of learning in higher education? Was anyone reading and how were they reading dense academic texts? More importantly, how were students learning, if not through reading?

The student population at the college I taught was mostly comprised of students of color, and countless studies have shown that the challenge of navigating college-level texts is a narrative that reflects the reality of all students, but is more often associated with low-income students of color (Ladson-Billings, 2005; Lee, 1992). This made me wonder whether notions of power were also embedded in texts that excluded certain populations (Fairclough, 2010).

The definition and parameters of academic texts may differ over time and discipline, and traditional notions of academic literacy are routinely challenged by theorists who continue to expand the scope of academic literacy. Ideas on what a textbook should look like also differ according to subject. However, in this study, I define academic texts as foundational texts used in college courses that continue to hold value as the main mode of delivering information in higher education (Harris & Hodges, 1995; Street, 1995). Foundational texts are often identified as texts students are expected to read in introductory classes for courses like criminal justice, biology, and history. Many of the arguments for why reserving the term for very limited texts that perhaps

do not take into account different learning styles and background is problematic, while valid, should not undermine the importance of being able to read academic texts. Here, it is also important to note that reading does not refer simply to the act of word recognition, but to the holistic ability to comprehend, organize, and synthesize information. Freebody and Luke (1990) defined literacy as “a multifaceted set of social practices with a material technology, entailing code breaking, participation with the knowledge of the text, social uses of text and analysis and critique of the text” (p. 15). They looked at literacy through a sociocultural lens because literacy is not isolated but embedded in social interactions and literacy events surrounding the reader.

The more closely I worked with my students, I felt there was a need to examine how students were faring with college reading once they had completed the developmental sequence (and were deemed “college-ready”); more specifically, I was interested to see what skills and resources they employed to shoulder the task of reading college texts. In college-level courses in which literacy instruction is not embedded, I hoped to examine the conditions that facilitated moments of text comprehension.

A large body of research makes the case that developmental education does little to help a student and rather is an impediment to graduation and retention (Attewell, Lavin, Domina, & Levey, 2006; Bailey, Jeong, & Cho, 2009; Jaggars & Hodara, 2011). While my research does not focus on the efficacy of developmental reading courses, it calls upon the need to consider expanding and rethinking notions of developmental reading. By examining students who had already completed the developmental sequence, I wanted to gain a better understanding of the ways in which students were reading texts in non-developmental courses. By closely looking at the reading practices and strategies of students, instructors and colleges may be able to shed some insight into how reading instruction at the college level should be implemented.

The dissertation is organized into five chapters. In the remainder of Chapter I, I provide an explanation of my study, my research questions, and my rationale for and significance of the study. In Chapter II, I offer a conceptual framework for the study and a review of relevant literature. Specifically, I look at theories and issues surrounding developmental education, disciplinary literacy, and cultural relevance to address the issue of reading in the disciplines. In Chapter III, I outline my methodology and research design. I provide a framework for the research methods used in this qualitative study. I then describe the research site I used in this exploratory study and how that informed my findings for this research. I provide information on the population studied, my role as a participant-observer, and some possible biases that might have occurred as a result of my conflicting roles. In Chapter IV, I share the findings of my study. The chapter is organized according to different categories, into which the data were coded. Specifically, the chapter looks at the conditions that facilitate intimate literacy and closely examines the challenges that the participants felt were barriers in the course. In the triangulation of data, I suggest that the conditions of literacy are not always textual, but often have textual implications. In Chapter V, I summarize the findings and suggest the implications of the study for teachers and for developmental reading instruction. I conclude with an acknowledgment of the limitations of the study and implications for future research.

## **Explanation of the Study**

### **Background of the Problem**

A 2006 study by the American Institutes for Research (AIR) reported that 75% of community college students were “non-proficient” in college-level document and prose literacy. In 2015, the National Assessment on Educational Progress (NAEP) found that 37% of high school seniors were prepared for college-level reading, 1% down from 2013. The numbers



showed that the challenges in reading were not limited to community colleges, but reflected a national problem. Studies that have evaluated college readiness for reading relied on different measures for outcomes; Lexile levels were used in some (Williamson, 2008), and others employed various placement tests in which students were given passages to read and corresponding comprehension questions. Most placement tests at the college level ask students to respond to expository texts, or texts that are commonly seen in college textbooks. Placement tests themselves are sometimes seen as unreliable measures to assess reading proficiency; it must be acknowledged that test-taking skills must be accounted for, as reading proficiency and the ability to perform on standardized tests can be mutually exclusive (Kohn, 2000). Yet, even when several variables are considered, there seems to be agreement that a large portion of incoming college students struggle with college-level texts. Here, I use the term *college-level texts* to refer to the foundational texts used in introductory courses in college; this term is interchangeable with *academic texts*.

To show that they are effective college-level readers, students first need to demonstrate the ability to read comfortably from texts in a range of academic disciplines and use the understanding of those readings to participate in academic discourse (Pearlman, 2013). Second, college-level readers also need to be able to read, comprehend, and synthesize academic texts effectively, which requires an understanding of where academic texts stand in relation to each other (Rhodes, 2013). Third, in order to contribute to the academic discourse community, college-level readers must be able to conduct research, find appropriate sources, and summarize, analyze, synthesize, and cite these sources (Jamieson, 2013). Therefore, college-level reading does not end at mere comprehension, but includes higher-order critical thinking skills that require the analysis, synthesis, and evaluation of academic texts. When much of the research on

college readiness for reading reveals such low performance of students, it may be necessary to ask how incoming college students are being served by the institutions in which they enroll.

What is being done to meet the needs of the students once they matriculate?

As I discuss in further sections, developmental education, which is oftentimes used interchangeably with remedial education, was a “solution” that colleges employed to prepare students for college-level courses (Phipps, 1998). The debate on whether developmental education is effective or not is a larger issue that is raised in my literature view, but regardless of its efficacy, developmental education was considered an intervention in math, reading, and writing for unprepared students. The belief was that once students, for whom it was necessary, completed the developmental reading sequence, they would be prepared to take on college texts. This view saw reading as a technical skill and may be why literacy instruction on reading is not offered outside of developmental reading, even though writing is.

More recently, developmental education programs, which include developmental reading programs, are being eliminated from colleges nationwide. According to the National Education Association (Fain, 2013), states including Florida, Georgia, Tennessee, and Connecticut have either eliminated or reduced developmental math and reading programs. More recently, Florida and New York have also announced plans to reduce developmental education in public colleges. With developmental education being removed from many public colleges or shifted into non-course intervention programs, the mechanisms once relied on to ensure that students have the foundational reading skills to take on college texts no longer exist (Merisotis & Phipps, 2000). Although the recent changes may be policy-driven, the question of whether literacy instruction is available—or is even needed—for students in higher education remains.

## Statement of the Problem

Several studies have indicated that incoming college freshmen are not prepared to read college-level texts. Compared to the amount of research corroborating these statistics, however, little research has been done on how students navigate texts once they are in college courses. According to the *Merriam-Webster Dictionary*, the word “navigate” means *to make one’s way over or through*. Without much evidence shedding light on how students are finding their way (if they are) through college-level texts, it is difficult to know where to begin with a solution. Much of the focus when it comes to college-level reading is on quantitative data showing various metrics that revealed students’ inability to make sense of academic texts (NAEP, 2015) or research on the desired outcomes and performance levels of students (Common Core State Standards [CCSS]). I find this to be limiting for several reasons. First, the numbers do not reflect the unique circumstances and histories of the students that impact literacy. Second, they provide an evaluation without an examination of the conditions that foster literacy. Third, they limit any definition of literacy, thereby restricting the possibilities of literacy instruction.

I was interested in how students navigate college-level texts in an introductory chemistry course. I selected a chemistry course because for many students at my research site, chemistry is a gateway course necessary to become a nursing major, which is one of the two most desired majors selected by students; the other is criminal justice. Many students at my research site view nursing as a favorable career because of the high pay and because it is service-oriented. Many students expressed that nursing is an occupation that pays well but also one that helps people. Moreover, it is a major in which many students enroll with little or no exposure to chemistry. Because chemistry is required for all nursing majors, many students face challenges in demonstrating an understanding of the concepts.

In order to examine the literacy practices, beliefs, and development of students taking the chemistry course, I chose to become a participant observer in the class for one semester. Through the research study, I hoped to have a better understanding of:

**RQ1: How do students navigate college-level texts in an introductory chemistry course at an urban community college?**

- What facilitates understanding of texts?

**RQ2: Using a framework of developmental education, what reading strategies and skills were students using to comprehend texts?**

- What opportunities were given, if any, to activate background knowledge?

### **Approach**

To conduct this research study, I used qualitative research methods that included participant observations, interviews, and document analysis. As this qualitative study focused on the tools students use to make sense of texts as well as the conditions that facilitate literacy incidents, I selected methods that focused on the participants' actions, choices, and beliefs rather than placing emphasis on the instructor or the textbooks and documents students are required to read. In doing so, I hope to have a better understanding of students' perceptions and involvement regarding academic texts. I used grounded theory (Glaser & Strauss, 1967) as a foundation, which includes practices like memo writing, simultaneous involvement in data collection and analysis, and coding, but leans more toward flexible methods (Charmaz, 2006). Charmaz (2006) viewed grounded theory methods as a "set of principles and practices, not as prescriptions or packages" (p. 9) and emphasized guidelines over rules. Because my research study focused on the processes of reading, which are anything but formulaic, having a flexible methodology that invites unexpected findings was more appropriate. Other qualitative methods such as

ethnography also seek to focus on a particular population or problem (LeCompte & Schensul, 2010). Unlike ethnography, however, which focuses on offering “thick descriptions” of a culture or group primarily through participant observation, grounded theory methods focus more on studying processes (Charmaz, 2006).

### **Researcher Subjectivity**

I identify as a Korean American female and teacher with a commitment to equitable reading instruction in the college classroom. Emigrating to Korea from the United States during my formative years has had a profound influence on the way I look at literacy instruction and the embedded biases that exist in instruction, in the expectations of the instructors, and in the texts themselves (Morrell & Duncan-Andrade, 2002). In particular, I am sensitive to the power dynamics that guide student-teacher relationships, especially when the student and teacher are from different racial groups. While I view research as a way to create equitable learning environments for students whose stories are often unheard, I also recognize that researchers’ multiple and varied subjectivities and roles are inextricably embedded in the process and outcomes of education research (Chapman, 2007; Ladson-Billings, 2000; Milner, 2007; Stanley, 2007). I reflect on my own experiences of being an outsider and therefore adopt an etic perspective (Headland, Pike, & Harris, 1990) on culture and language in relation to my own teaching, which contributes to my understanding of the sociocultural and sociopolitical forces that impact literacy practices and instruction. As a female and minority in a school of mostly Black and Latino students, I understand that I am viewed differently from my White male colleagues, which I recognize in student interactions. I am often asked if I am Chinese. Many students have asked what the difference between being Chinese and Korean is, which further emphasizes my foreign-ness. It is pointed out that culture is often minimized in education

research (Siddle Walker, 1999), but when we consider that the nature of interpretation is inherently biased by one's subjectivities, it is necessary for me to reflect on my cultural self and the resulting subjectivities.

At the same time, I recognize that I possess a certain amount of power as a professor and I am in a particular place of privilege that separates me from my participants. Villenas (2009) posited that researchers, even those who consider themselves "native," are also implicated as colonizers when they claim authenticity of interpreting their subjects' voices and experiences under the guise of authority. According to Van Galen and Eaker (1995), as long as the political structures that lend legitimacy to researchers exist, the particular privileges that are inseparable from the role are "highly inaccessible to those on whose behalf we claim to write" (p. 114).

While we push the borders of research and equity, seeking to level the playing field for all students, the role and position of educator and scholar place us in a unique space in which we observe participants through our own lens of subjectivities. As a researcher, I recognize these inherent power structures at play, and look to reflexivity as a way to acknowledge them. Torom Schwandt (2001), in *Qualitative Inquiry: A Dictionary of Terms*, defined reflexivity as:

a) the process of critical self-reflection on one's biases, theoretical predispositions, preferences; b) an acknowledgment that the inquirer is part of the setting, context, and social phenomenon he or she seeks to understand; and c) a means for critically inspecting the entire research process. (p. 224)

It is my hope that this research will contribute to how we look at learning and recognize that learning often involves a hierarchical attitude in which students are expected to accomplish certain tasks or possess particular abilities. Through this research, I hope that we can begin to see learning as a discourse in which instructors can become more vulnerable to the individual needs of students. Particularly in the realm of literacy and reading instruction, shedding light on the

practices and conditions of reading texts may provide insight into what the challenges are (if any) when it comes to reading and how students take agency to overcome them.

### **Significance of the Study**

Research has shown that there is increasing interest in the correlation between math, science, and literacy (Douglas, Klentschy, Worth, & Binder, 2006). Growing interest in this area is reflected in shifts in policy and educational standards. The Common Core State Standards outline literacy standards in science and technical subjects, further emphasizing the need for paired instruction in science and reading. According to the English Language Arts Standards in Science and Technical Subjects Grade 9-10, students should be able to:

- Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *Grade 9-10 texts and topics*.
- Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., *force, friction, reaction force, energy*).
- Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
- Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.

- Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.

Understanding that developing reading skills and techniques specifically geared toward science texts and scientific discourse will offer students support in courses like biology, chemistry, and physics, a movement to incorporate disciplinary literacy instruction is expanding at the secondary level (Shanahan & Shanahan, 2008). Various models of paired instruction that use a literacy framework to teach science have been developed and are used in the classroom.

One example of such a model is Science IDEAS, in which instructors use systematic scaffolding strategies that emphasize text structure, vocabulary, and making inferences to enhance comprehension of science texts. This method has been proven to be effective for high school students, as evidenced in higher levels of student achievement on nationally normed science tests (Hapgood & Palincsar, 2007). In a 2015 study that was conducted at a community college in New York, a biology faculty member collaborated with a reading specialist to see if developing literacy skills with a focus in the science discipline would enhance student success in biology. By employing active reading skills like summarizing, asking questions, and organizing, students were able to better comprehend the science textbook. Based on pretest/posttest results that measured students' performance on biology exams, an increase was noted (Huffman-Kelley, Perin, & Liu, 2015). A similar observation was made by Antonenko, Jahanzad, and Greenwood (2014) when using the DEEPER method.

In 2016, Stanford University offered an online course titled *Read to Learn in Science*. The course description emphasizes the effectiveness of incorporating reading strategies in science instruction, and stresses that pedagogical shifts in the science classroom can greatly



benefit students. Despite the growing recognition for literacy instruction in the sciences in middle and secondary education, literacy instruction has not developed in higher education. On all assessments, American college students perform worse than their Asian counterparts in science and are simultaneously evaluated as unprepared for college reading; yet, the need to redesign literacy instruction with particular attention to science has not been addressed.

Two important distinctions between paired literacy instruction in science and literacy in the secondary and postsecondary setting may be worth considering: the difference in text readability and the ways in which teaching adult literacy is different from adolescent or childhood literacy. Because texts become more complex in college compared to high school (Williamson, 2008), the reading strategies required to overcome the gap in text demand are discipline-specific and specialized. Adult literacy also differs from childhood literacy in that there is less emphasis on the phonetic reading process than there is on applying critical thinking skills. However, such differences do not imply that there should be any less attention to reading instruction at the college level. In fact, guided reading instruction is even more crucial, due to the more complex and challenging texts students are expected to read, analyze, and respond to.

Pearson, Moje, and Greenleaf (2011) argued that “identity is dependent on knowledge, which in turn helps to develop or even produce new knowledge” (p. 51). When students do not see themselves as producers of knowledge or even possessing knowledge in a particular discipline, it is unlikely that they will see themselves in a new identity. Moje’s research, although largely focused on secondary literacy education, raises important points for college students. Her study highlighted the need for recognition of the role that identity plays in literacy instruction and knowledge-in-practice. Examining the population of community college students which is

often considered “unprepared” raises questions about how students’ identities are also influenced by the perceived lack of preparation.

More than 70% of all entering college students are considered unprepared to read at a college level (ACT, 2008, 2011, 2013). While many, especially at the community colleges, are placed in developmental reading courses, it has long been argued that developmental reading courses do little to actually prepare students to take on college-level texts in their credit-bearing courses, even after they successfully complete the developmental reading sequence. While many factors contribute to the problems with developmental reading courses, the biggest challenge facing developmental reading programs is that they are not anchored to specific disciplines. This makes it difficult for students to build prior knowledge that can be transferrable to content-specific disciplines because each discipline differs in terms of how knowledge is collected, interpreted, and disseminated. According to research, while it is widely agreed that most students do need to take college-level reading courses, current developmental reading courses have not had much success in developing better readers. By refocusing college-level reading courses to center on disciplinary literacy, reading programs can provide specific strategies that students can utilize in the social sciences, natural sciences, and humanities.

Science literacy has historically been a challenging area for students because science texts are usually dense and written in the passive tone. Science texts contain difficult vocabulary and syntax, and also place greater emphasis on inferential thinking and the use of prior knowledge (Allington, 2002). At the elementary and secondary level, reading instruction is increasingly being integrated into science classes in an attempt to enhance disciplinary literacy in the sciences. However, such attempts are much less visible at the college level, perhaps because

it is assumed that having completed the developmental reading sequence, students will have the reading strategies to navigate discipline-specific texts effectively.

The few studies that have incorporated reading instruction into science courses in colleges have been shown to be successful, but more studies need to be done to examine where reading can increase disciplinary literacy, the specific strategies that can be applied to the science field, and the ways in which instructors can encourage students to develop a metacognitive understanding about reading in the sciences.

## **CHAPTER II – LITERATURE REVIEW**

### **Introduction**

The purpose of this study was to explore how students navigate college-level texts in an introductory chemistry course at an urban community college. Specifically, I was interested in looking at the perceptions students (many of whom are deemed not to be college-ready) have when presented with college-level texts and the choices they make to navigate those texts. I also explored whether opportunities to activate culturally relevant background information were present, and how students utilized such opportunities. To view the problem from both a sociocultural perspective as well as a sociolinguistic perspective, I drew upon different concepts and theories that may provide an accurate frame for looking at academic literacy and the community college student. This literature review focused on three main concepts: the remedial reader, disciplinary literacy, and culturally relevant background knowledge. I paid particular attention to how all of the three concepts combined provide a theoretical framework which I used to view the conditions of the students enrolled in a chemistry course at my research site. I then present a review of the relevant literature: first, the history of remedial education with a close focus on deficit theory; next, disciplinary literacy and the particular challenges of texts in the sciences; third, culturally relevant pedagogy in the college classroom; and finally, the impact of background information on informational texts.

### **Conceptual Framework**

Maxwell (2013) viewed a conceptual framework as:

a concept map of a theory that is a visual display of that theory—a picture of what the theory says is going on with the phenomenon you're studying.... Concept mapping is a tool for developing and presenting the conceptual framework for your design. (p. 54)

As such, I looked closely at the work that highlights the importance of context, cultural relevance, and social constructions when it comes to how people experience texts and perceive themselves as readers and, ultimately, the choices they make to navigate texts. Miles, Huberman, and Saldana (2014) defined a conceptual framework as “the current version of the researcher’s map of the territory being investigated” (p. 20). As a map, the work in this chapter provides an idea of what is being studied and the theoretical underpinnings of the research study.

### **The Remedial Reader**

The term *remedial education* is based on a medical model of providing prescriptive “remedies” to students’ academic “illnesses” (Arendale, 2005; Mayher, 1992). The view sees students needing remedial education as carrying a deficit or needing to be fixed. A sense of shame is associated with being a remedial student, one that can have discouraging effects. “Developmental education,” on the other hand, refers to “the current educational process as transformational, taking the student from one state and developing his or her abilities into those of a more capable, self-confident, and resourceful learner” (Boroch et al., 2007, p. 9). It is meant to convey a more “value-added” perspective of students’ skills and knowledge (Arendale, 2005).

It is understood that the term *developmental* is preferred because of the more comprehensive nature with which it describes the efforts of students enrolled in such courses; however, the primary research on this topic has referred to these services and the students who benefit from them as “remedial.” Hence, I used the terms *remedial* and *developmental* interchangeably.

Community colleges have become one of the major providers of basic skills education (Attewell et al., 2006; Boylan, 1999; National Center for Education Statistics [NCES], 2003; RP Group, 2005). Two-thirds of the nation’s students participating in basic skills education

attend community colleges (Boylan, 1999). It is important to recognize that shift changes are being made in this regard; many 4-year colleges have already reduced or eliminated remedial programs, and even community colleges are moving to reduce remediation (Attewell et al., 2006). This means that students, while considered unprepared to take on college-level reading and writing, are either placed in college-level courses or in non-course-based intervention (NCBI) classes before matriculation. The effects and politics behind such a move are controversial, but what is important here is that eliminating remediation does not erase some of the negative perceptions and ideas that have great impacts on student success.

Deficit theory highlights that students of color and students from impoverished backgrounds do not experience success in schools because they have cognitive and motivational deficiencies that hinder them from learning (Ronda & Valencia, 1994; Valencia & Black, 2002). Deficit theory focuses on the students and their families as having a particular problem instead of investigating how sociopolitical and economic structures create an inequitable learning environment. While one of the reasons for removing remediation is cited as more equity for students of color, whether such a policy change will actual result in changes in deficient theory is questionable. According to Apple (2004), education is not an apolitical institution; rather, it serves as a place and space for the social reproduction of a dominant culture.

In this research, I do not argue that remedial education has a positive effect on student learning or even that it should be mandated. In many cases, remedial education has proven to be ineffective on a number of measures, and has caused problems in terms of retention, graduation rates, and student motivation (Adelman, 1999; Rosenbaum, 2001). Many opponents of remediation will agree that remediation is too costly when we weigh it against the benefits it brings. At the same time, eliminating remediation removes a crucial intervention mechanism for

students who are not able to handle academic texts at the college level, which is also problematic. In this research study, I referred to remedial reading for two reasons. First, I asked whether this study may suggest future directions for more effective reading instructions in developmental education. An examination of how students navigate texts in college courses may have implications for developmental reading instruction. Second, I questioned how literacy instruction can extend beyond developmental education and into the disciplines.

### **Reading Across the Disciplines**

The *Merriam-Webster Dictionary* defined *literacy* as: “1) the ability to read and write, and 2) knowledge that relates to a specified subject.” The scope as set in this definition is quite broad and invites multiple interpretations, perspectives, and positions on literacy. Sociocultural perspectives on literacy have examined sociolinguistic conceptualizations of how language embodies culture (Gee, 1996) and the relationship between language and power (Bourdieu, 1991). According to Gee (2001):

reading and writing cannot be separated from speaking, listening, and interacting, on the one hand, or using language to think about and act on the world, on the other. Thus, it is necessary to start with a viewpoint on language (oral and written) itself, a viewpoint that ties language to embodied action in the material and social world. (p. 714)

Sociolinguists have described how literacy is shaped by context, which highlights the social and political practices underlying language and literacy.

The need for literacy instruction at the college level is often challenged because reading is sometimes seen as a skill that one is expected to acquire at the primary level. This perspective views reading as a static activity, one that does not take into account the fact that the texts we encounter are dynamic and exist on a spectrum. Because texts that students encounter in college are different from texts that students read in middle school and high school and therefore require different reading strategies, continuous instruction is needed for students entering college

(Williamson, 2008). In secondary education, the fundamental need for instruction in content area reading is recognized and reading should be “taught mainly in the subject fields with regular content materials and regular daily lessons” (Niles, 1965, p. 36). Here, content literacy is defined as “the ability to use reading and writing to learn subject matter in a given discipline” (Vacca & Vacca, 2002, p. 15). While the notion of content area literacy highlights that there is a need to pay particular attention to different texts, I used the framework of disciplinary literacy in this research study. The needs of college are more complex, as are the knowledge demands across disciplines.

An important distinction to make is the difference between content area literacy and disciplinary literacy. Content area reading proponents believe that the cognitive requirements of learning are the same for all subject matters and focus on the content as major distinctions among the disciplines (Shanahan & Shanahan, 2012). Advocates of content area literacy promote three-level guides (Herber, 1970): general reading comprehension strategies (e.g., summarizing, questioning, monitoring, visualizing), such as those considered by the National Reading Panel (National Institute of Child Health and Human Development, 2000); and the use of tutorial support and technological innovations that develop metacognition and interpretive interactions with disciplinary texts (Graesser, McNamara, & VanLehn, 2005; Magliano et al., 2005). Shanahan and Shanahan (2012) highlighted that disciplinary literacy holds to the idea that disciplines differ in their fundamental purposes, traditions and methods of communication, evaluation standards of quality, views of the reader, and use of language. Such underlying differences manifest themselves in how discourses are structured, how vocabulary is used and developed, and which grammatical choices are made. Compared to content area literacy, which



looks more at *what* the differences apparent in a text are, disciplinary literacy values an understanding of *why* those differences exist.

For college students, developing disciplinary literacy may be more critical than content area literacy. The disciplines in which courses and therefore texts are embedded are placed in a larger historical, political context. Without recognizing the forces that shape a discipline, knowing how to read and interpret a text becomes a formidable challenge. When we consider that the purpose of education is to prepare students for citizenship where individuals are expected to make informed decisions, the importance of strengthening disciplinary literacy seems very obvious. Because the objectives, strategies, and methods associated with disciplinary literacy are content-specific and therefore differ depending on the disciplines to which they are tied, it is necessary to reinforce conceptions of reading as a meaning-making process (Lee & Spratley, 2010).

### **Culturally Relevant Background Knowledge**

Background knowledge, also referred to as prior knowledge, has long been recognized as important to reading comprehension (Kintsch & Kintsch, 1995; McNamara, 2001; McNamara & Kintsch, 1996; McNamara, Kintsch, Songer, & Kintsch, 1996). How to classify and develop background knowledge differs across studies, however. Graesser, Singer, and Trabasso (1994) related background knowledge to common experiences individuals encounter in everyday life—this understanding of background knowledge is used more commonly in relation to narrative texts. Other researchers have pointed to knowledge gained from other expository texts as background knowledge (Lundeberg, 1987; McNamara & Kintsch, 1996; Means & Voss, 1985; O'Reilly & McNamara, 2002). In this study, I did not make a distinction between types or

categories of background knowledge, but I did pose the question of whether the background knowledge needed to be activated to understand scientific texts is culturally relevant.

I used Ladson-Billings's (2005) definition of culturally relevant pedagogy here, which focuses on instruction that understands that students' cultural backgrounds are integral to their identity. By acknowledging and embracing the cultural capital students bring to the classroom, instructors can not only empower students, but also create a dynamic learning environment for all students. In this research, I viewed background knowledge as being a living object, one that can be assumed to have cultural value. In subsequent sections, I draw on the literature to highlight what culturally relevant background knowledge is and the outcomes it can have.

### **Review of Relevant Literature**

This review of relevant literature drew from theoretical and empirical work related to remedial education, disciplinary literacy, and culturally responsive teaching. I begin with an overview of the history of remedial education in the United States. This body of literature illustrates the trajectory of remedial education and examines the current state of remediation as well as its impact on students. I also discuss the arguments of both proponents and opponents of remedial education to frame accurately the larger sociopolitical environment of the research study. Next, I draw on literature on the theory of disciplinary literacy in relation to a chemistry course and the implications that a disciplinary literacy approach would have in the discipline of chemistry. Finally, I review the literature on culturally responsive teaching and why activating background knowledge is only beneficial to student learning but is socially just.

### **Remediation**

**The history of remediation.** Postsecondary remediation dates back to the 1600s, when Harvard College provided Latin and Greek tutors for unprepared students (Spann &

McCrimmon, 1993). In 1849, the University of Wisconsin offered the first remedial education programs in reading, writing, and arithmetic (Breneman & Haarlow, 1998). From its initiation, the purpose of remedial education has been to prepare students to take on college-level academic work. While remediation has remained a part of the postsecondary education structure for over a century, it has changed considerably in terms of demographics and institutional policies.

Open admissions in the United States began in the 19th century as a result of the Morrill Act, which Congress passed so that colleges could offer classes on agriculture and mechanical arts to state residents who had completed high school. Open admissions (also referred to as open enrollment) is a type of non-selective, non-competitive college admissions process that requires nothing more than a high school diploma or General Education Development (GED) certificate (Fullinwider, 1999). In the early 20th century, 2-year colleges were established to make junior colleges more accessible, financially, academically, and geographically, to students who had little access to 4-year senior colleges. Around the same time, competition for students among higher education institutions increased, which meant that universities began accepting more underprepared students. At institutions like Harvard and Yale, more than half of all incoming students were placed in remediation.

Moreover, due to the G.I. Bill, created after World War II, there was a sharp increase of veterans, many of whom had not been in school for several years, enrolling in colleges and universities and furthering the need for remediation. In the two decades between the 1960s and 1980s, the passage of the Civil Rights Act of 1964 and the Higher Education Act of 1965 led to an influx of Black and Latino students, as the recognition grew that the demographics in higher education did not reflect the nation's demographics. As selectivity became second priority to

equal access, an even greater influx of underprepared students enrolled in colleges across the United States (Payne & Lyman, 1998).

In New York City, the Free Academy, which is known as City College today, was established in 1847, with a curriculum comparable to that of the Ivy League. The Free Academy, like its name, was tuition-free to New York City residents who met the selective admissions criteria and was dubbed “the Harvard of the proletariat” (Fullinwider, 1999). After the Civil Rights movement of the 1960s, minority students protested the majority-White ethnic composition at City College, which led directly to an open admission policy at CUNY by the Board of Higher Education in 1970. According to the newly implemented policy, high school students who graduated in the top 50% of their class could enroll in any of the senior colleges, and all other students could enroll in the junior colleges. As a result, the proportion of minority students in the entering class of 1970 nearly tripled, and the number of freshmen jumped from 20,000 in 1969 to 35,000 in 1970 (Lavin, Alba, & Silberstein, 1981).

As the number of students enrolled multiplied, the number of students placed in remediation became more pronounced as well. In 1976, when CUNY raised entrance standards for the senior colleges as a means of making them more selective, that number grew even more. According to the *CUNY Student Data Book*, 78% of all entering CUNY students in 1997 were in need of one or more of the three areas of remediation: math, reading, and writing. By this time, the CUNY system was surrounded by much controversy and criticism; as a result, the CUNY system eliminated remedial education from its senior colleges. This ended a 30-year open admissions policy, and students who could not meet the admissions standards of the senior colleges were directed to the community colleges (Parker & Richardson, 2005).

According to a 1995 survey by the NCES on remediation in higher education, 29% of freshmen enrolled in at least one remedial reading, writing, or mathematics course in Fall 1995 (U.S. Department of Education [USDOE], 1996). Generally, students are placed into one or more of three areas of remediation: writing, reading, and mathematics. Remedial education programs have become controversial for a number of reasons, and the political nature and economic cost of these programs are inextricably tied to such arguments. Generally, the effectiveness of developmental education programs is measured by retention and students' grades in credit-bearing courses (Attewell et al., 2006). However, other factors, such as standards for remediation as well as cost-benefit analysis, are also widely debated (Jaggars & Hodara, 2011).

#### **Criticisms against formal remediation programs.**

*Standards for placement.* Many opponents of remediation claim that there is no clear definition of what constitutes preparedness for college or “college readiness” and, therefore, the standards for remediation are problematic (Attewell et al., 2006; Bailey et al., 2009). The regulations, policies, and standards for placement into developmental education programs differ from state to state and from institution from institution, which blurs the line between who should and should not be placed in developmental courses. For example, Conley (2007) defined college readiness operationally as having a level of preparation that will allow students to succeed in credit-bearing courses without remediation. In order to achieve this, he proposed that students should be able to demonstrate, among others, key cognitive strategies such as the ability to analyze, interpret, and reason. Moreover, students should possess contextual knowledge rather than simple facts that do not connect to a larger theme as well as have a disposition that displays inquisitiveness and intellectual curiosity. ACT (2013) also defined what it means to be college- and career-ready, setting specific benchmarks for English, reading, mathematics, and science. While

it is true that the definition of college readiness is contested and differs between scholars and academic institutions, there is large agreement that many incoming college students are not college-ready. When only a third of American high school students meet or exceed proficiency levels in mathematics, science, reading and writing, it is argued that students need some kind of preparation before taking college-level courses. Proponents of remediation stress that remediation is very effective in improving the chances of success in college for underprepared students (Merisotis & Phipps, 2000).

***Performance and retention after remediation.*** Another case against remediation is the argument that students placed in remedial courses become so overloaded with courses that they eventually drop out of college, most of them without being able to gain credits in the courses that are required for their major (Adelman, 1999; Rosenbaum, 2001). Critics of developmental education claim that one of the reasons students drop out of remediation is because they get discouraged by having to take so many remedial courses (Richardson, Fisk, & Okun, 1983). For a vast majority of students, this means taking over a year of remedial courses before being able to take courses in their major. However, proponents of developmental education have argued that students in developmental courses deal with numerous challenges that are not limited to the developmental courses themselves. A large number of students placed in remediation experience challenges outside the classroom that are a result of low socioeconomic levels, which, coupled with the academic expectations of college, make it difficult to pass courses. A study done by Boatman and Long (2010) found that developmental education actually has positive results on persistence and degree attainment. The study followed students taking different levels of remedial courses and found that the dropout rate was considerable for students who were in the margins of remediation, meaning that they were placed in remediation by only a few points.

Conversely, the students in the lower level of remediation courses showed much higher levels of retention, compared to their non-remedial counterparts (Boatman & Long, 2010).

According to research from the Community College Research Center (CCRC) at Teachers College, Columbia University, only 38% of students placed in math remediation completed the sequence with only 20% passing the gatekeeper class, and while two-thirds of the students taking developmental writing complete the developmental sequence, only one-third pass the gatekeeper class (Jaggars & Hodara, 2011). This view would expect students placed in remediation to outperform students who were not in need of remediation to begin with, which may contradict the purpose of developmental education—to get students taking developmental courses to the level of non-remedial students in those particular subjects (Cross, 1971).

***The cost of remediation.*** Finally, the cost of remediation is a huge burden for many states, as hundreds of millions of dollars are spent to support remedial programs (Collins, 2009). A 2008 study estimated that the annual cost of remediation at community colleges was between \$1.9 and \$2.3 billion, and \$500 million at 4-year colleges (Strong American Schools, 2008). In Ohio, public colleges spent approximately \$15 million for 260,000 credit hours of instruction that focused on high school-level courses to freshmen in 2000 (Ohio Board of Regents, 2001). In addition, the 20,000 students who were enrolled in the courses paid \$15 million in tuition as well as used financial aid resources. With an estimated annual cost of over \$1 billion nationally at public higher education institutions (Breneman & Haarlow, 1998), many states question whether and, if so, how remediation should be offered. Remediation typically costs less than 10% of education as a whole, and, in most cases, this figure is in the 1% to 2% range. Still, the main criticism lies in the use of federal and state funds, whatever the amount (Saxon & Boylan, 2001).

**A push to eliminate remediation.** Studies have shown that mounting pushback against remedial programs in public colleges has led to the reduction or elimination of remediation programs across the country (Parker & Richardson, 2005). The controversial case of CUNY's removal of remedial coursework at its 4-year colleges is indicative of similar initiatives across the country. As of 1999, nine states (Arizona, Georgia, Kansas, Kentucky, Louisiana, Maine, Massachusetts, New York, and Oregon) raised the standards to enter college for freshmen. Yet, by 2007, approximately 22 states or higher education systems (particularly in 4-year colleges) reduced or eliminated college remedial coursework. Parker and Richardson (2005) found that this has the largest impact on minorities and low-income students.

### **Developmental Reading**

While remediation itself is contentious, debate also exists around developmental reading, one of the areas in which students are tested and deemed needing remediation. Remediation courses are offered in reading, writing, and math; many will acknowledge that students do need some kind of preparation in writing and especially math, but the importance of developmental reading as an academic discipline is less recognized by comparison. Much of the criticism revolves around questions of why reading needs to be taught at the college level, as most students enter college knowing how to read; the argument is that reading is a skill students learn in elementary school and there is nothing else to teach after the third grade (Holschuh & Paulson, 2013). Reading is widely perceived as a basic set of skills, widely adaptable across genres and disciplines.

In the 1990s, there was a push to improve children's reading skills because of the assumption that once children were equipped with basic literacy skills, they would be prepared for more advanced literacy-related tasks later in life (Blair, 1999). While it is true that decoding



of words and phonetic applications are continuously used in reading across all levels, it is difficult to imagine that a child's literacy skills are adequate to sustain one throughout one's academic and professional career. Shanahan and Shanahan (2008) argued:

As one moves along the continuum of literacy learning, what is learned becomes less generally useful. Take one very simple example: Children in kindergarten and first grade may learn to read words like of, is, and the. These words are ubiquitous; they appear not only in primers but in the *New York Times*, U.S. State Department documents, medical books, and so on. As learning progresses, instruction necessarily focuses attention on words in more constrained and specific contexts. (p. 41)

Many researchers agree that continued literacy instruction in postsecondary education should be provided (Holschuh & Paulson, 2013; Shanahan & Shanahan, 2008). Because texts that students encounter in college are different from texts that students read in middle school and high school and therefore require different reading strategies, continuous instruction is needed for students entering college (Williamson, 2008). Williamson (2008) argued that there is a readability continuum upon which texts become more complex in college compared to high school, and therefore students must learn the reading strategies that will help them overcome the gap in text demand. High school students should be given more challenging texts to read so that they are better prepared for college reading, but it is also important for colleges to provide adequate reading courses for students who need to develop higher reading skills. For example, most science texts that are used by non-science majors are written at a reading level that is supposedly higher than that of the average college student.

A 2006 study by the AIR reported that 75% of community college students were "non-proficient" in college-level document and prose literacy. When students come across texts that are beyond their reading level, they are not able to employ the necessary reading strategies that can help them understand the content matter (Simms & Leonard, 1986). Proponents of remediation have argued that the aim should not merely be to remediate or "fill" a literacy

deficit; rather, the goal of developmental reading programs should be to develop the academic literacy required of students in college.

This is not to say that proponents of reading instruction agree on how developmental reading should be taught. At the college level, most practitioners and researchers would argue that reading is a social act—one that is shaped by the social context in which it is learned as well as the values that are embedded in that context. Researchers and practitioners who believe that reading must be taught as a social act push for reading instruction that focuses on “meaning-making” of text—that texts must be seen as complex and bearing social beliefs and values (Fairclough, 2010). In order to instruct students effectively in reading such texts, teaching the underlying processes of textual understanding is crucial. This would include strategies that help students to organize, analyze, and summarize texts (Simpson & Nist, 2000). By understanding that a text does not stand alone but is always connected to a larger social context, students will be able to not only read words on a page, but also critically question the world and their place in it (Freire, 1970). The question, then, is what this means for developmental reading instruction at the college level. Holschuh and Paulson (2013) argued that reading instruction in college should not focus on discrete skills and drills, which echo a secondary education language arts curriculum. Reading instruction in college should not center on filling in the gaps that students carry on from high school, but rather should seek to build reading skills that will enable students to excel in college. They found that most developmental reading courses in colleges follow a generic method of instruction that teaches reading skills outside of a larger context and therefore does not serve any purpose outside of the particular course (Maxwell, 1997). In fact, such skills-based instruction showed little improvement in students’ overall reading skills (Merisotis & Phipps, 2000). Once students begin courses in their major, they are required to read texts of

different disciplines, for which skills-based instruction does not prepare them. Wood (1997) surmised that the reason traditional models of teaching reading are still common in college teaching might be reflective of the way reading textbooks are structured—in a linear or sequential fashion.

### **Basic Skills and Critical Thinking**

While the objective of developmental reading has always been to develop a criticality in students that will enrich their academic journey, completely removing skills-based teaching from developmental reading programs is also problematic. Delpit (2006) argued that skills can be defined as useful knowledge that helps students communicate their ideas effectively. Without skills, students may not always have the tools with which to communicate meaningfully. Having said that, it is critical that skills be taught within meaningful contexts that do not dismiss the need to teach basic skills. Delpit postulated that researchers who have argued for developing “fluency” and believed that teaching skills undermine fluency must recognize that such an attitude contributes to and is responsible for reproducing the lack of skills prevalent in low-income, minority schools. She highlighted the need to learn basic skills such as grammar, sentence structure, and structural analysis, just to name a few—the very skills that a lot of reading and writing programs are moving away from in favor of a writing process approach to literacy development. A skills-based approach to reading instruction has always been highly controversial, with opponents referring to it as the “drill-and-kill” method, whereby students typically fill out worksheet upon worksheet and learn isolated skills that they are not able to apply outside the class.

Many instructors of developmental reading programs would argue that developmental reading courses serve as preparatory courses for credit-bearing courses. In other words, by taking

developmental reading courses, students will learn reading strategies that will benefit them in credit-bearing courses. Similarly, Carillo (2015) believed that a transfer of knowledge can occur when students recognize or generalize knowledge in one course and are able to apply it to another. One thing she noted is that metacognition determines the transfer of knowledge. In the process of thinking about thinking, one is able to make generalizations about knowledge and can identify the application of that knowledge elsewhere. This also requires a high level of critical thinking (Carillo, 2015). In a slightly different vein, Robertson, Taczak, and Yancey (2012) asked how students' prior knowledge might challenge or strengthen their writing in a composition course. Their studies found that most students coming into a freshman composition course begin with absent prior knowledge. They asserted that having prior knowledge in a discipline or on a topic does contribute to their writing, but this differs from Carillo's view in that they looked more at factual knowledge than at the ability to think about knowledge.

### **Challenges Facing Developmental Reading**

The challenges that developmental reading programs in 2-year colleges face are many. First and foremost is whether there is a need that can be addressed by developmental reading programs. With such a large number of students getting lost in the developmental reading sequence and not completing, many question whether developmental reading is yet another obstacle that keeps students in school and farther away from graduation. Many factors contribute to these numbers: underpreparedness at the secondary level, methods of instruction, and, more recently, the influx of English Language Learners (ELLs). Bedore and Peña (2008) affirmed in their findings that second language speakers may experience some gaps in comparison to their monolingual peers. While second language speakers may have the ability to navigate between different languages at home or at work, it seems that they struggle with English in an academic

setting. On the whole, ELLs are more likely to live in lower-income households, compared to their monolingual English-speaking peers. In 2007, 66% of ELLs had a family income of 200% lower than the federal poverty level, compared to 37% of monolingual English-speaking students. Yet it is also true that many students attending 2-year colleges work while attending college as full-time students. While 44% of English-speaking students had parents who either had a 2-year or 4-year postsecondary degree, only 22% of the ELLs did (American Youth Policy Forum, 2009). These statistics call for a growing need to understand what students are bringing to a typical developmental reading class—the cultural assets and experience that they can build on with the academic strategies they develop in the program. Currently, much of the focus when it comes to developmental reading is on whether reading programs are effective in (a) preparing students to meet the rigorous academic demands of college, (b) assisting students in moving through the developmental sequence, and (c) playing a positive role in strengthening critical thinking and academic literacy over simple skills.

### **Disciplinary Literacy**

Shanahan and Shanahan (2012) made a point to discern between content area literacy and disciplinary literacy. They stated:

Content area literacy focuses on study skills that can be used to help students learn from subject matter specific texts. Disciplinary literacy, in contrast, is an emphasis on the knowledge and abilities possessed by those who create, communicate, and use knowledge within the disciplines. The difference is that content literacy emphasizes techniques that a novice might use to make sense of a disciplinary text (such as how to study a history book for an examination), whereas disciplinary literacy emphasizes the unique tools that the experts in a discipline use to engage in the work of that discipline. (p. 8)

Efforts to develop content area literacy are not new; the push to develop identification of vocabulary in content areas dates back to the National Committee on Reading, which explored this topic in the classic *24th Yearbook of the National Society for the Study of Education*

(Whipple, 1925). Funded by the National Committee of Reading, Moore, Readence, and Rickelman (1983) examined instruction in content area and found that in most of the early experiments, similar approaches were applied to the reading of different subjects. The focus remained on vocabulary words, procedural measures, and general reading comprehension that used similar objectives as a tool of measurement. However, later, the studies concluded that such approaches were limited because fundamental differences in the disciplines existed, which could not be addressed through general reading instruction. Shanahan, Shanahan, and Misichia (2011) studied experts in various disciplines. The team of researchers identified both experts and novices in the fields of science, history, and literature. By asking the individuals to perform a task like reading from a text in their field of expertise and then thinking aloud, Shanahan et al. were able to uncover a series of findings. First, they found that the experts and novices read in different ways, but also that experts in different disciplines used different methods to read texts. In their research, Shanahan et al. (2011) showed that:

Studies of the reading of physicists (Bazerman, 1985) revealed that they tended to pay particular attention to information that they did not already know and information that violated their expectations. The physicists separated reading to learn from critical reading, reserving the latter for work that was directly applicable to their own work. Historians were found to engage in sourcing (paying attention to the author), contextualization (connecting texts to the circumstances of the time), and corroboration (making comparisons across texts). Furthermore, unlike scientists, historians did not suspend their critical stance when they read information about which they knew little (Wineburg, 1991). (p. 13)

The findings of Shanahan and Shanahan were corroborated by Nokes, Dole, and Hacker (2007), who evaluated “whether high school students could learn to use the heuristic (sourcing, corroboration, contextualization) used by historians and also learn historical context” (p. 492). After 3 weeks of observation, they concluded that when texts were selected thoughtfully and instructors were intentional and prepared in instruction, students’ learning of historical content

was enhanced. Hynd-Shanahan, Holschuh, and Hubbard (2004) did a similar study in which they examined how students engaged in a history text once they developed disciplinary knowledge, or “knowledge of the field of history and the tasks in which historians engage” (p. 142), and received specific instruction on reading strategies that were specific to the field of history. Based on the surveys they conducted, Hynd-Shanahan et al. found a positive correlation between disciplinary knowledge coupled with strategy and reading history texts. They also found that when students had a better understanding of what a historian’s job was, they demonstrated better comprehension of the history texts—evidence that having knowledge of the discipline contributed to better comprehension of texts produced in the subject or field.

While Shanahan’s earlier works distinguished disciplinary literacy from content area literacy and were successful in producing studies that proved that developing disciplinary literacy rather than content area literacy contributes to better reading comprehension, they were not so successful in their implementation in schools (O’Brien, Stewart, & Moje, 1995). In their research, O’Brien, Stewart, and Moje (1995) highlighted the socioconstructivist nature of content literacy and argued that presenting literacy as a dynamic practice that explores the very nature of a discipline contradicts a more traditional schooling model akin to the “banking” model of teaching (Freire, 1970). Therefore, the idea is that teachers are not prepared or may not wish to teach disciplinary literacy. Yet, CCSS suggest middle and high school students must develop an understanding of subject matter and literacy skills to be successful. The English Language Arts (ELA) CCSS include: (a) regular practice with complex texts and their academic language; (b) reading, writing, and speaking grounded in textual evidence, both literary and informational; and (c) building knowledge through content-rich nonfiction (<http://www.corestandards.org/ELA-Literacy>). Wilder and Herro (2015) found that collaboration among teachers positively

influenced the way they were able to approach disciplinary literacy. The teachers in their study were able to develop instruction methods that aimed to develop disciplinary literacy in their students.

### **Literacy “Incidents” and Transactions**

It was long believed that language was a self-contained system for which one had the burden of making sense. In traditional school settings, students are viewed as collectors of knowledge rather than as creators of meaning during the reading process. According to this model, texts serve as keepers of knowledge from which information is extracted and transmitted to the reader (Smith, 1985; Straw & Sadowy, 1990). According to Rosenblatt (1988), language is a “public system of understanding,” one that is internalized in the life experiences of the reader. Rosenblatt’s work on transactional theory looked at the reader as one who employs social and personal contexts to make sense of a word or transaction. In this process, prior understandings may shift, but there is the recognition that the reader brings with him or her a reservoir of experience and agency when reading a text. There is the implication that the meaning the reader attaches to language or texts is not absolute and standard, but rather is subjective to the experiences the reader uses to interpret a text. In this process, a transaction takes place. The reader brings background experiences and knowledge to the text while the text also yields possible interpretations that can be made in the reading of the text. I look to Rosenblatt’s theory of transaction to frame the idea of a “literacy incident”—a particular event or moment in which understanding is facilitated through a personal and authentic connection to social discourses, which often include forms of written or spoken language.

Rosenblatt (1988) noted that it is essential for readers to approach a text with one of two stances—aesthetic or efferent. Having such a stance would allow readers to search actively for



the author's purpose, which demonstrates a higher level of comprehension. The idea here is that meaning making resides in the transaction itself rather than in the text alone. Rosenblatt's model of transactional theory elicits that three factors contribute to the meaning-making process: the reader, the text, and the context (Beers & Probst, 2013; Kucan & Palincsar, 2013). This active negotiation taking place between the reader and the text results in a constructed meaning, which, together with an awareness of the context, allows the reader to participate in a discourse (Spivey, 1995).

More recently, Moje (2010) argued that in addition to the textual and cognitive demands that are made on readers and writers in various content areas, literacy educators have begun to notice the social and cultural demands made of readers. Specifically, Moje, Dillon, and O'Brien (2000) asserted that "teachers' and learners' beliefs and ways of knowing and doing outside of the content also are considered to be important aspects of literacy learning and use" (p. 165). This view posited that the teachers' beliefs and practices influence the social organization of the class as well as decisions about literacy. Moje wrote:

Recently, we focused on individual learners' beliefs and practices, how those are shaped by in-school and out-of-school experiences and contexts, and how individual practices shape classroom teaching and learning practices. Throughout those studies, we examined how issues of difference and power shape literacy teaching and learning practices in schools. (p. 166)

Citing Scribner and Cole (1981), Moje wrote that literacy events are defined as "acts or moments that involve reading, writing, speaking, and performing many kinds of texts, but these acts or moments are situated in specific social, cultural, historical, and institutional contexts and are engaged in for specific purposes relative to those contexts" (p. 166). Both Rosenblatt and Moje underscored an important aspect of reading: the idea that there is an authentic interaction between the reader, the text, and the context. This view challenged prior views of reading, in

which the reader had little agency and the text served as an object for which the reader was left with the burden to decipher or decode.

### **The Challenges of Chemistry Texts**

Performance in science, technology, engineering, and mathematics (STEM) is considered critical to a nation's economy and has a direct connection to advancements in medicine, engineering, and scientific research. However, recent studies have shown that elementary and secondary students in the United States lag behind their Asian and European counterparts in STEM-related subjects (Fleischman, Hopstock, Pelczar, & Shelley, 2010; Gonzales et al., 2008; Provasnik et al., 2012). In 2015, the Programme for International Student Assessment (PISA) placed the United States at 38th out of 71 countries in math and 24th in science. Among the 35 members of the Organization for Economic Cooperation and Development (OECD), the United States ranked 30th in math and 19th in science. The 2015 NAEP reported that 40% of fourth graders, 33% of eighth graders, and 25% of 12th graders were “proficient” or “advanced” in math. Moreover, the study showed that improvement at the top levels have stalled. What may be worrisome about the lack of preparedness in STEM is that weak basic skills do not end at the secondary level, but follow students into the postsecondary realm and beyond. This is especially the case for students hoping to pursue careers in STEM-related fields or the health sciences. National data revealed that more than half of freshmen who declared STEM majors at the start of college left these fields before graduation (Chen, 2009; Higher Education Research Institute [HERI], 2010), and more than half of STEM bachelor's degree recipients switched to non-STEM fields when they entered graduate school or the labor market (Lowell, Salzman, Bernstein, & Henderson, 2009; National Science Board [NSB], 2012). To produce more graduates in STEM fields, some recent U.S. policies have focused on reducing students' attrition from STEM fields

in college, arguing that increasing STEM retention by even a small percentage can contribute substantially to the supply of STEM workers (Ehrenberg, 2010; Haag & Collofello, 2008; President's Council of Advisors on Science and Technology [PCAST], 2012).

At the community colleges, the challenges of students in the STEM fields are even more pronounced because of the overall need for remediation in both STEM and non-STEM areas, like reading and writing. Although approximately two-thirds of recent high school graduates enter college each year, many of these students are unprepared academically for college-level courses (Greene & Foster, 2003). In 2001, colleges required nearly one-third of first-year students to take a remedial course in reading, writing, or mathematics (NCES, 2003). Many blame the pervasive need for college remediation on poor K-12 quality and lack of rigor. Remedial education programs themselves have become highly controversial in terms of their effectiveness, but the idea that most entering freshmen at community colleges are unprepared to take on college-level work has been widely recognized. In a 2017 *New York Times* article, executive vice chancellor and university provost at the City University of New York (CUNY) Vita C. Rabinowitz stated that “community college structures were built around the need for remediation, a large need for remediation,” highlighting that remediation remains one of the fundamental pillars of community college education. While the need for remediation is acknowledged by most, discussion on how to move students past remediation appears to differ on the matter of approach and methods.

The language used in chemistry is highly conceptual, disconnected from everyday language (Coll & Treagust, 2001). Compounded by its highly mathematical nature, chemistry becomes a formidable discipline for students. Having an understanding of the nature of chemistry or developing the literacy skills that are required in the field of chemistry may ease

some of the challenges presented (Shanahan & Shanahan, 2008). Concepts covered in basic or remedial chemistry courses are particularly important because more advanced chemistry/science concepts or theories cannot be easily understood if these underpinning concepts are not sufficiently grasped by the student (Coll & Treagust, 2001; Nakhleh, 1992; Zoller, 1990). Because of these factors, chemistry classes require a high-level skill set, which often repels students (Fensham, 1988; Taber, 2002; Zoller, 1990). Here, I briefly look at the three major challenges; in subsequent sections, I focus more on reading and chemistry.

### **Conceptual Challenges**

Chemistry is a branch of science that is concerned with the nature of matter. This concept is fundamental to learning chemistry (Nakhleh, 1992). All topics in chemistry, including reaction rate, chemical reactions, chemical equilibrium, and acid and bases, are built on the understanding of matter, and without a fundamental idea of the nature of matter, learning other topics will be difficult (Peterson & Treagust, 1989; Stavy, 1988). Real understanding requires not only the grasp of key concepts but also the establishment of meaningful links to bring the concepts into a coherent whole. Ausubel (1968) defined meaningful learning as the ability to link new knowledge onto the network of concepts that already exist in the learner's mind. Misconceptions may occur when newer concepts are linked together incorrectly by the learner.

Making inferences is a critical feature of understanding the meaning in scientific texts (Kintsch, 1988) because inferences holistically look at ideas and sentences distributed across the text into a coherent structure (Gernsbacher, 1997). In other words, the meaning of a text and the concepts in it often remain fragmented and disconnected without inferences because texts normally do not state all the information relevant to events. Therefore, students can successfully

comprehend texts when they are able to generate inferences to fill in “missing” information and build a coherent mental model of all the information in the text (Zwaan & Singer, 2003).

## **Language**

Language problems include unfamiliar or misleading vocabulary, familiar vocabulary which changes its meaning as it moves into chemistry, use of complicated-sounding language, and use of double or triple negatives (Cassels & Johnstone, 1985). A study by Cassels and Johnstone (1980) showed that the non-technical words associated with science were a cause of misunderstanding for pupils and students. Words that were understandable in normal English usage changed their meaning (sometimes quite subtly) when transferred into, or out of, a science situation. For example, the word “volatile” was assumed by students to mean “unstable,” “explosive,” or “flammable”; its scientific meaning of “easily vaporised” was unknown. The reason for the confusion was that “volatile,” applied to a person, does imply instability or excitability, and this meaning was naturally carried over into the science context with consequent confusion (Cassels & Johnstone, 1980).

Another language-related difficulty is terminology. In science texts, vocabulary words often have Greek or Latin roots, and becoming familiar with more commonly found word parts in chemistry is a way for students to gain knowledge of the text (Shanahan & Shanahan, 2008). Sometimes words are used differently than they are in everyday exchanges. Clearly, there is a set of rules and systems that is often found in science and math texts that differ from a novel. Other challenges for students taking science or math courses might include syntax and the use of scientific register. The sentence structure often used to define terms in a science text might be very different from a newspaper article, and if students are not familiar with the syntax, the text

may end up feeling too difficult to understand. Finally, scientific research reports include graphs, tables, diagrams, and endnotes that may seem unfamiliar to students.

### **Prior Knowledge and Text Cohesion**

The preceding two challenges tend to focus more on the nature of chemistry and the difficulties that arise because of issues that are commonly associated with texts in the sciences. Prior knowledge and text cohesion, however, make a stronger connection between the reader and the text (Best, Rowe, Ozuru, & McNamara, 2005; Kintsch, 1988). Best, Rowe, Ozuru, and McNamara (2005) classified cohesion as follows:

Cohesion is important at both the global and local levels of text. The term global cohesion refers to the overall cohesion of the text. Signals for global cohesion include introductory paragraphs, headers, summary paragraphs, and the semantic overlap between paragraphs. Local cohesion concerns the relations between adjacent sentences. (p. 67)

They argued that texts are locally cohesive to the extent that there exists a relationship between sentences, and one can look to linguistic cues to make those connections. Another aspect of text cohesion, *explanatory cohesion*, concerns the background knowledge that is available in the text for the reader (Best et al., 2005). A common problem identified in many science textbooks is that the authors often leave out information they assume to be common or prior knowledge for the reader (Beck, McKeown, Sinatra, & Loxterman, 1991).

### **Culturally Responsive Background Knowledge**

While deficit thinking reproduces the dominant culture, culturally responsive pedagogy works against social reproduction by acknowledging and affirming students' cultures and the value they bring to the classroom (Ladson-Billings, 2009). Culturally responsive teachers do not view their students' identities as being separated or isolated from their cultures. Rather, they understand that culture and identity are interdependent processes of human development

(Rogoff, 2003). The primary goal of culturally responsive pedagogy is to empower students in their intellectual, social, cultural, and political capacities by capitalizing on the cultural knowledge and abilities they bring (Ladson-Billings, 2009). In this particular study, cultural responsiveness was used as a measure to investigate whether opportunities to build background knowledge in chemistry texts are available and to what degree. Much of the research on culturally relevant or culturally responsive pedagogy has focused on the K-12 classrooms, but a growing body of research also points to the necessity of culturally responsive pedagogy in adult learning. Sealey-Ruiz (2007) found that when Black women's unique roles as mothers, daughters, sisters, and wives were embraced in the curriculum in a composition class at a liberal arts college, it not only validated the women's life experiences but also had a positive impact on academic attainment and literacy practices. A study by González, Moll, and Amanti (2005) highlighted different categories of funds of knowledge that were found to be linked to students' out-of-school literacies. They identified one category as scientific knowledge and found that the activities and experiences of students in their homes mirrored scientific literacy practices.

As stated in the previous section, comprehension of scientific texts is more than interpretation of sentences—it requires the reader to construct a larger meaning that integrates information from multiple sentences (Kintsch, 1988). I state that this level of inference and text cohesion is possible when the reader is able to activate background knowledge. Neuman, Kaefer, and Pinkham (2014) conducted three experiments to test the effects of background knowledge on the reading comprehension levels of students from low socioeconomic status (SES) background. All three studies found that when students had background knowledge, they were able to demonstrate a better grasp of texts. They concluded that “differences in low-SES children's comprehension skills may be attributed, in part, to limitations in their preexisting knowledge

base” (p. 146). While I agree with Neuman et al. in that background knowledge is critical to comprehension of texts, I problematize the framing of their findings. Rather than viewing students’ knowledge base as limited, recognizing that students have a knowledge base that has not been activated provides opportunities for culturally responsive pedagogy.

Studies on building background knowledge have noted many methods and strategies to build background knowledge (Fisher, Grant, & Frey, 2009; Fisher, Ross, & Grant, 2010; Marzano, 2004). Fisher, Ross, and Grant (2010) particularly pointed to wide reading as an effective way to develop background knowledge in readers. While the methods and studies that support wide reading are valid and have been proved effective, this research study focused more on the available resources in the particular class the participants are enrolled in as sources that can potentially activate background knowledge—the instructor, the textbook, tutors, and supplemental readings. Most of the studies available on building background knowledge are based on middle and high school students and curriculum, which I believe allow for more exploration with wide reading as opposed to the college classroom.



### CHAPTER III – METHODOLOGY

This study used the qualitative method to investigate the question of how students at an urban community college navigate college-level texts in a basic chemistry course. As mentioned in the previous section, I defined *navigate* loosely, with both a focus on the literacy experiences as well as the out-of-class resources that facilitate comprehension of a text. Specifically, the study aimed to examine students' navigation of texts in the discipline of chemistry and what happens in those moments. Due to the nature of the questions, a qualitative approach allows the research process to remain open-ended (Jahoda, Deutsch, & Cook, 1951) and flexible (Whyte, 1979). The design of the study was deep-rooted in the belief that qualitative research is naturalistic, uses descriptive data, is inductive, and is concerned with process and meaning making (Bogdan & Biklen, 2007).

In particular, I found it critical to observe the varied and unique individual experiences of the participants taking the same chemistry course as well as the instructor. While the research was mainly focused on the experiences of the students, examining the instructor's and tutor's perspectives of chemistry texts may offer valuable insights into the unique and personal relationships that individuals have with literacy. While the perspectives of the participants may reveal differences and discrepancies, I hope that the data will inform the way instructors view adult literacy.

Chapter II looked at research on culturally relevant pedagogy, which emphasizes the necessity of taking into consideration the diverse experiences of students in teaching and learning practices. The framework of culturally relevant pedagogy is fundamental to the discussion of the literary development of marginalized populations and is particularly salient when one considers the implications for a student population that is oftentimes seen as entering

college with developmental needs in reading. By using a more open approach to looking at the data, this study sought to make connections between the real-life practices of the participants and implications for teaching.

In this section, I first provide a rationale for taking a constructivist grounded theory (Charmaz, 2006) approach to qualitative research and why the flexible guidelines highlighted in a constructivist approach are well-suited to examine the research questions posed. Charmaz (2006) identified qualitative research as existing very much in a political and social reality, acknowledging the hierarchies of power inherent in the research and between researcher and participant. Next, I provide a detailed description of my research site and the rationale for selecting Urban Community College (UCC) as my research site. I next introduce the participants in the study and discuss why the particular section of the chemistry course was selected. Also, the methods of data collection and strategy for data analysis are explained in the chapter. Finally, a brief explanation of my own background and how it influences the methodology is provided.

### **Grounded Theory**

Grounded theory was first developed in 1967 by Barney Glaser and Anselm Strauss, who felt a need for a research design that generated theory based on the interactions, perspectives, and actions of participants. Rather than mere description, theories that were “grounded” would provide more accurate yet general enough explanations for social processes (Creswell, 2013). While Glaser and Strauss placed emphasis on building analysis, studying processes, and examining how people create and view worlds, their actual work tended to have fewer constructivist features and more objectivist leanings (Charmaz, 2008). Eventually, Strauss and Glaser parted ways, after which Corbin collaborated with Strauss, yet positivistic inclinations were evident in their work. Charmaz (2008) identified the following as most problematic in their

work: “the creation of an external reality, the discovery of provisional truths in this reality, the role of the observer, and an unproblematic representation of research participants” (p. 401).

This study used Charmaz’s definition of grounded theory as its methodology. Charmaz (2006, 2008) viewed grounded theory strategies as ways to interrogate and interpret data, rather than as a method to create an objective reality. This qualitative study sought to explore the literacy moments that contribute to the participants’ understanding and navigation of texts in a chemistry class. Given the complex nature of the different variables and sociocultural and sociolinguistic influences involved, I used a methodology that acknowledges the possibility of partial or limited data, multiple readings of data, and more than one single reality (Charmaz, 2008; Clarke, 2005). In particular, Charmaz’s interpretation of grounded theory rests on the following assumptions: (a) reality is multiple and constructed; (b) the research process emerges from interaction; (c) the researcher’s and participants’ positionality is important; and (d) the researcher and researched co-construct the data.

The term *navigate* is qualitative and open-ended—it does not presume that a particular method or strategy will be used, and instead seeks to examine the different resources and actions used by the participants. To try to induce one particular narrative or conclusion from the collected data would undermine the very idea of students navigating a text. Therefore, taking a constructivist grounded theory perspective invites diverse and rich interpretations of the data.

### **Overview of Data Collection**

In this qualitative study, I used participant observation, artifact-based student interviews, instructor/tutor interviews, document review, and student lab reports as data. Analysis of the study was based on thematic findings. I also engaged in analysis of artifacts and thematic coding

to make sense of my qualitative data. Table 1 below provides the purpose of each data point as it relates to the larger research questions. My research questions are:

**RQ1: How do students navigate college-level texts in an introductory chemistry course at an urban community college?**

- What facilitates understanding of texts?

**RQ2: Using a framework of developmental education, what reading strategies and skills were students using to comprehend texts?**

- What opportunities were given, if any, to activate background knowledge?

Table 1

*Methods of Data Collection as Linked to Research Questions*

Methods of Data Collection	Methods of Data Analysis	Research Questions Addressed
Classroom Observation	Coding for themes	RQ2
Student Interviews	Coding for themes, critical artifactual analysis	RQ1, RQ2
Instructor Interview	Coding for themes	RQ1, RQ2
Document Review	Coding for themes	RQ2
Student Lab Report Review	Coding for themes, critical artifactual analysis	RQ1

### **Research Design Overview**

This study sought to explore how students navigate college-level texts in an introductory chemistry course at an urban community college. Even after accounting for similarities among my participants in terms of cultural/linguistic backgrounds, educational trajectories, and socioeconomic factors, I wanted to recognize the diverse and multimodal strategies used to make sense of texts. In this sense, I hoped to collect data not with a particular intent in mind, but to

examine different (or similar) literacy practices in the lives of the participants in the terrain of academia. Charmaz (2008) emphasized the importance of listening to voices other than the researcher—one of the objectives of this study was to work “with” the participants in imagining ways to enhance understanding of scientific texts rather than evaluating and reporting the problem (Farrell, Pequero, Lindsey, & White, 1998; Siddle Walker, 1999). Through multiple interviews and interactions with the participants, I hoped to reflect on their personal and academic experiences, providing a picture of the “whole” individual (see Table 2 for more detailed information on data collection).

Table 2

*Activities and Frequency of Activities*

Name of Activity	Number of Times the Activity Occurs	Duration of Activity per Instance	Total Time Period of Active Participation per Subject (days, weeks, etc.)	Describe the Data Collected
Classroom Observations	15	3 hours	15 weeks	Field notes, observational notes, artifacts (PPT slides)
Student Interviews	4 participants*3	1 hour	15 weeks	Audio-recordings, artifacts, notes
Instructor Interview	1 participant *2	1 hour	15 weeks	Audio-recordings, artifacts, notes
Document Review	15 (one for each class) <sup>1</sup>	N/A	15 weeks	Lecture notes, textbook excerpts, handouts
Student Lab Report Review	10 (one for each lab) <sup>2</sup>	N/A	15 weeks	Lab reports

**Total hours of researcher participation: 59 hours**

**Duration of participation: 15 weeks**

<sup>1</sup> I hoped to collect documents for each of the 15 weeks of the class.

<sup>2</sup> I hoped to collect 10 lab reports for each of the 10 weeks of chemistry lab.

## **Research Site and Population**

My research took place at Urban Community College (UCC), located in New York City. Latino/a students represent 61% of the population and African American students, or students of the African Diaspora via the Caribbean, South America, or Africa itself, represent nearly the remainder of the student body, at 33%. A small fraction of the balance of student body is comprised of various South Asian, Asian, and Eastern European origins. UCC students are actively employed, with over 58% of the student body working at least part-time. Yet, despite the many hours students spend working, UCC students earn incomes disproportionately below the poverty line. The students' median household income is under \$20,000, a majority of which is generated by the student. In addition to these factors, language complicates academic achievement since nearly half of the student body (48%) is ELLs. The personal, social, cultural, and linguistic obstacles are both complex and interconnected.

I selected UCC as a focal site for several reasons. UCC has been part of a larger dialogue that questions whether developmental education is necessary. Part of the conversation has revolved around the more fundamental question of whether incoming students are able to take on the challenges of college-level reading. The number of incoming freshmen at UCC who are placed in developmental courses is very high. In Fall of 2016, 83% of all incoming freshman students required remediation in at least one of three areas (English, reading, mathematics), while 17% required remediation in all three areas. By the time students take chemistry, they must have completed the developmental sequence and be considered "college-ready." By focusing more on the personal connections students have to texts, however, the research may show that comprehension of academic texts may involve more than simply learned reading skills. Also, my position as an instructor at UCC allowed me easy access to students, faculty, and tutors.

Although I was an outside observer in the chemistry course, my relationship to the tutorial program and to the chemistry professor allowed me to be observe and interview students more comfortably. An insider understanding of the courses and university system was also helpful in contextualization. Finally, UCC was selected for the students it serves. A better understanding of the textual moments that cement a text-to-reader relationship in marginalized populations often dubbed as having developmental needs may shed new light on literacy development.

According to the Institutional Research Center at UCC, the most declared majors in Spring 2016 were criminal justice, liberal arts and sciences, business administration, and pre-nursing. Among these, the pre-nursing program is perceived to be the most challenging, as the percentage of pre-nursing students who gain acceptance to the nursing program consistently hovers around 10% each year. Even though the competitive math, chemistry, and biology standards required to be accepted to the nursing program automatically disqualify many students, the graduation rate of students who make it into the program is still considerably low. The number of students enrolled in the nursing program in 2012 was 1,077, and the number of graduates in 2016 was 37. For students majoring in science for forensics, the number of students graduating was consistently 1 from 2011 to 2014. UCC overall has low retention and graduation rates (the average 1-year retention rate is 50% while the 2-year retention rate drops to 30%), which put the numbers for nursing and science for forensics within a context (Office of Institutional Research, 2016). Still, seeking ways to boost retention and graduation rates in STEM-related fields will have not only value for individual student success, but also long-term impacts on both community and national levels.

CHM 101 is a basic chemistry course into which students are placed after taking an assessment test in the department. Students do not receive credit for the course, which is made up

of three components—recitation, lecture, and lab. CHM 101 covers basic concepts and skills in chemistry that students would be expected to know in the next level of chemistry, CHM 12 or CHM 13, depending on their major. In Spring 2016, the number of students enrolled in CHM 101 was 344, out of which 52.3% passed and 23.3% withdrew; 119 students were enrolled in CHM 12, out of which 57.1% passed and 24.4% withdrew. The pass rate for CHM 13 was a bit higher, at 73.6% out of 212 and a 15.1% withdrawal rate (Office of Institutional Research, 2016). However, CHM 13, which is the chemistry required for non-STEM majors and health service students, is also considered to be less challenging. The enrollment and pass rates are relatively consistent from year to year, which highlights some important findings. First, when students pass CHM 101 but still do not have a fundamental grasp on the content, the chances of being successful in CHM 12 drastically drop. Also, the low pass rates for CHM 101 reflect unpreparedness of entering students. Therefore, when students experience failure in remedial chemistry, they are not only discouraged but they are forced to rethink career choices. Even when students pass CHM 101, unless they have a strong understanding of the concepts, the advanced chemistry courses prove to be challenging.

### **Description of Participants**

The participants in this study included:

1. A chemistry professor at Urban Community College—Of the 22 sections of CHM 101 that are offered, this research study focused on one section. The section is taught by Billy Romano, a Caucasian Italian American professor who, like many of the students at UCC, was born and raised near UCC, although in very different circumstances. Billy is in his 60s and shares that the high school he attended, a private Catholic high school, is made up of a very different demographic compared to



when he was a teenager. At the time he was a student there, the majority of the students were Italian American, as was the residential area surrounding the school; today, the school population is predominantly Latino. In interviewing the student participants, I later learn that even though Billy implied that the high school he attended lacks the rigor it used to have, it is still considered to be one of the better schools in the area. Billy taught CHM 101 for several years and has some authority over implementing changes in the program and the text. Before I asked Billy to use his classroom as a research site, he voiced to me several times that he felt students were not reading the textbook but did not know exactly why—he attributed it to weak study skills and a lack of interest.

2. Four student participants who were taking or had recently taken the CHM 101 at UCC—I wanted to select a purposeful yet representative sample of students who were taking or had taken CHM 101 with Professor Romano. Two students volunteered after receiving the recruitment flyer in class, and I selected two other students. I recognized these two students from my developmental reading class and felt they would contribute to creating a range of experiences. Specifically, the student participants were reflective of the class with respect to gender and ethnic distribution, developmental/non-developmental placement upon enrollment, language proficiency (two students were recent immigrants), family responsibilities (one of the participants was a new mother), and college aspirations. The greater female-to-male ratio was also representative of the larger number of female students in the chemistry courses, given that nursing is still more heavily female-populated. While the lack of male students in

the nursing field is a problem, to select an equal number of female and male representatives would be a misrepresentation. The four participating students are:

**Milly Williams.** Milly was a second-generation Dominican student who was born and raised in New York. She shared with me that her parents sent her to private schools in the city throughout elementary and middle school. Milly is 25 years old and has experience attending college elsewhere. She works as a hair stylist and hopes to become a nurse.

**Trina Hernandez.** Trina was also a second-generation Dominican student who was born in New York, grew up in South Carolina, and moved back to New York just before the semester began. In her interviews, she mentioned that she was at UCC to complete her foundational courses and intended to transfer to a 4-year university afterward. At the time of the interview, she lived near campus with her great-grandmother, while her parents and siblings lived in South Carolina. Trina hopes to become a psychiatrist.

**Salma Chowdhury.** Salma was a Bengali student who immigrated from Bangladesh when she was 15. Before taking the chemistry course, she was a developmental reading student. Salma came from a family of pharmacists, doctors, and nurses. Several times, she mentioned that both she and her family expected that she would also pursue a career in pharmacy. Salma applied to and enrolled in UCC without knowing the difference between a 2-year college and a 4-year university. At the time of acceptance to UCC, she had also been accepted to a 4-year college but was not able to make an informed decision. Thus, she planned to transfer from UCC to a 4-year college with a pharmacy program as soon as she had enough credits.

**Kadiatou Diallo.** Kadiatou was a recent immigrant to the United States. She was born in Guinea but spent 8 years in Brussels. She attended university there for a few years before marrying someone from the United States. About 7 months into moving to the United States, she enrolled in UCC, hoping to major in nursing. She started as a developmental reading student and became a new mother to a 6-month-old daughter. New to the English language, Kadiatou experienced the most linguistic challenges among all the participants.

### **Recruitment Methods**

I circulated a recruitment flyer in which I described the purpose of the study and the process. The flyer was circulated for the first 3 weeks of class. I described and presented the flyer at the beginning of class for 3 consecutive weeks. The professor also allowed me to post the flyer on his Blackboard page, where students logged on each week to download Power Point slides and complete homework assignments. In the first week, two students responded by email, showing interest in being participants. One student responded to me in the second week, and two more students responded in the third week. I asked the five students to meet with me three different times in the semester for a 1-hour-long interview. I selected participants on a first-come, first-served basis since I was exposed to very little of their information. Along with the interviews, I also asked students if I could observe them during tutoring sessions that were available to the students in the department, if they chose to go to tutoring. I rewarded the students with a \$15 gift card for their time. Aside from the four students whom I looked at very closely, I also heard the perspectives of other students, but this was limited by the nature of the class. The class is a traditional lecture-style class with little to no room for interaction. Ideally, I attempted to find participants at different levels of reading comprehension to obtain a range of

perspectives and responses. However, this was difficult given the many hours I asked of the participants, many of whom had a job and a family outside of school.

### **Data Collection**

In order to formulate my analysis, I collected and used the following sources of data.

#### **Field Notes**

During my involvement with the project, I recorded over 80 pages of observational notes. I observed the chemistry classes in which the participants were students. My primary aim was to examine the students' engagement with the texts and their demonstration of academic literacies in a classroom setting. I was able to sit in the back of the class without being involved in direct instruction and took traditional notes on both my laptop and my notebook. In other instances, like meetings with the participants, taking notes would have been too unnatural; in these cases, I wrote down my notes immediately after the event.

Although I tried to take in as much as I could, a researcher cannot take in everything (Emerson, Fretz, & Shaw, 2011). Rather, certain beliefs will guide the researcher to engage in particular activities or observations. As a result, the task of the researcher is not necessarily to unearth truths, but to reveal the multiple truths in participants' lives. In my field notes, I tried to pay close attention to descriptions of people, dialogue, and space. Emerson, Fretz, and Shaw (2011) stated that writing field note descriptions is not a matter of passively copying down "facts" about "what happened" (p. 9). They wrote:

These descriptive accounts select and emphasize different features and actions while ignoring and marginalizing others. Some fieldworkers habitually attend to aspects of people and situations that others do not, closely describing dress, or hair, or demeanor, or speech hesitations that others ignore or recount in less detail. In this way, descriptions differ in what their creators note and write down as "significant," and, more implicitly, in what they note but ignore as "not significant" and in what other possibly significant things they may have missed altogether. (p. 9)

As such, I hoped to develop particular perspectives that would guide my decisions of what was to be considered significant without overlooking important details. Understanding that field notes are products of active interpretation, I also sought to consider carefully not only what was written but also how it had been written.

## **Interviews**

I decided to use interviews as my main mode of data because I believed that the use of informal, conversational interviews would be exploratory (Patton, 2002; Seidman, 1998; Spradley, 1979). I followed Seidman's recommendation to conduct a series of three separate interviews with open-ended questions. The first interview established context on which the subsequent interviews would build. In the first interviews, I hoped to gain a better understanding of the students' lives that I would not have access to only by observing them in the classroom. The first interviews rarely asked questions about the chemistry course, but more about students' journeys leading to their enrollment at UCC and, consequently, in the chemistry course. The second interview focused on concrete details of the students' current experiences in the classroom. In the third interview, the participants were asked to reflect on the meaning of their experiences. I found that each interview created a foundation on which the next interview was situated. Kvale (1996) wrote that the nature of qualitative studies, and particularly interviews, are "emergent" in nature and therefore they require an open mind on the part of the researcher. Following this view, I kept in mind that my open-ended questions might lead to unexpected findings and answers.

Flinders (1997) offered several limitations to interviews. People may not have an opinion or be unwilling to discuss what they know. Interviewing requires a high level of active interpretation, which the interviewer may not have. Ethical issues are another reason for the

opposition of using interviews as a valid data source (Punch, 1986). While such objections raise concerns about the validity of interviews, the value that interviews bring to qualitative research is that the participant is no longer a distant “other” that is “aseptic, quantified, sterilized, measured, categorized, and catalogued” (Fontana & Frey, 1994, p. 373). Rather, the participant becomes a human being with complex experience and stories, contributing to the multiple truths that constitute his or her reality. While I used interviews as the main data source of this research study, I looked to a multimethod approach that relied on the triangulation of data (Denzin, 1989)—namely, interviews, observations, and document analysis.

### **Transcription of Interviews**

Focal students as well as the instructor of the course were interviewed. The main purpose of interviewing the instructor was to ascertain his beliefs, expectations, and assumptions when it came to students’ academic literacies. The interviews with the students were meant to explore these issues further. In particular, I asked participants about their experience and exposure to science literacy and reading in general. By asking open-ended questions about the participants’ literacy journeys as well as their relationship with chemistry, I sought to get a glimpse of the textual moments through which students were able to engage with the texts. Also, I examined how participants were navigating the chemistry text—in other words, what sources they were relying on to build background knowledge and make meaning of the text.

### **Data Analysis**

As my main mode of data analysis, I looked to Rosenblatt’s (1988) notion of literacy and Moje’s (1996) perspective on text and textuality. With regard to this research study, texts referred to several things: (a) the texts that students are expected to read in the course, which are produced as mediums to convey information in the discipline of chemistry; (b) the transcripts of

interviews, for which I used a thematic lens to make interpretations and develop perspectives; and (c) the textual conditions through which the students sought to navigate the discipline of chemistry. Although the three different “texts” served different purposes and audiences, they were similar in that within them existed a clear structure which connects language, power, and the larger sociocultural context.

With particular attention to educational institutions, Fairclough (2010) wrote that educational practices “constitute a core domain of linguistic and discursive power and of the engineering of discursive practices” (p. 532). He also noted that many other domains are mediated by educational institutions. This entails the particular expectations regarding the dialogical capacities of workers in the labor market, and the associated expectation of educational institutions to meet those demands. Finally, educational institutions are expected to educate people about the sociolinguistic order in which they live. Here, the texts and the contexts in which they are used become important to note. They ask the question of how the texts and the instruction of those texts meet the demands of work, and how the context allows for participation of historically marginalized populations.

Using a broad and inclusive lens to examine the texts, and particularly the transcripts of interviews, provided opportunities to see the dialectical relationship that such discourse and structures have, for while discourse is shaped by structures, discourse also has the power to reproduce structures. By coding for themes dealing with power structures and a dominant culture that may be isolating the participants, I hoped to uncover some systematic obstacles that appear both in the artifacts as well as in the interview transcripts. In particular, I hoped to examine whether the language used by both the students and the professor reinforced some of the beliefs that challenge literacy learning.

I also needed to be cautious of the limitations of capturing lived experiences during the process of coding and interpreting the data. Rather than studying reality, I study lived textuality, or how reality observes lives in a text (Denzin, 1995). Second, visual representations are also prone to interpretations by researchers as they can be seen as textual constructions. Third, more value is placed on voice than writing, which is not always transparent. Overall, “no text or utterance can be repeated without a change in context and in meaning. The reproduction of the text is a new, unrepeatable event in the life of the text: “a new link to the historical moment that produced it” (Denzin, 1995, p. 10). A written text, then, is not a representation of one of such voices, but a space where many voices merge—the original voices, the text’s voice, and the interpretation of the researcher.

### **Ethical Issues**

The risks involved in this research study were minimal and the study was voluntary. While I provided a \$15 gift card compensation to all participants at the end of the three interviews, they were not mandated to complete all three interviews and were not penalized for deciding to stop participating at any time. All participants were given an informed consent form that was approved by the Institutional Review Board (IRB) and read and signed (participants must be 18 or older) before any data collection began. The consent form included detailed information of the study. The consent form also included information about the audio-recording. No participant was audio-recorded without consent. Because audio-recordings were a requirement of the study, if a participant refused to be audio-recorded, he or she was no longer a participant. I also let the participants know that I would not be revealing their names at any point in the study and would destroy the original audio-recordings upon transcription.



Participants also met with me before we proceeded with the interviews so that they were fully aware of the research and its purpose and goals. All participants were given the option to withdraw at any time. All participants were de-identified in the study and I used pseudonyms for their names. All documentation associated with the project was kept in digital form in a password-protected folder on my personal computer. All hard copies were locked in a file cabinet in my office.

Potential risks for the participants might have included discomfort when they were asked about their difficulties in navigating chemistry texts. To minimize this risk, I ensured the students that I did not have input on students' grades as an observer, and that the participants may withdraw from the study or express discomfort at any time. I informed the participants that as soon as they expressed any discomfort, I would stop the interview. There were no direct benefits of this study to the subjects, as stated in the informed consent form. However, because part of the project focused on exploring more effective ways to help students navigate course texts, there may be direct benefits for the instructor regarding instructional methods or practices, which may indirectly also benefit students.

### **Revision of Methods**

By the third week of circulating the recruitment flyer, five students expressed interest in participating in the research study. Four were female students, and one was male. The interviews began the fourth week of the semester. Initially, each of the participants agreed on an interview schedule, most of them taking place every 2 weeks. However, sometimes the participants contacted me to reschedule the interviews due to family obligations, work schedules, and personal issues. One of the participants, the male student, was only able to complete one

interview. Before the second interview, he informed me that he was dropping out of all of his classes at UCC that semester due to a heavier workload.

One of the students, Salma, left in the middle of the semester for a month-long pilgrimage and was not able to keep in contact with me during her absence. She informed me that she would be leaving and contacted me once she returned. Another student, Milly, completed her interviews, but later informed me that she planned to withdraw from the course before the final exam because she was not confident that she would pass, and preferred to retake the course the following semester rather than fail. Through the professor, I learned that she did withdraw from the course a couple of weeks before the end of the semester, but her interviews and documents reflected her thoughts and work during the time she was enrolled in the class.

### **Issues of Trustworthiness**

Because of my close proximity to UCC and my relationship to Billy as a colleague, I questioned whether I entered the project with inherent biases. Prior to the project, I had worked with Billy to teach a linked course, in which one group of students were enrolled in both my reading course and his chemistry course. I also knew two of the participants, Salma and Kadiatou, from a developmental reading course I taught two semesters prior to the research study. I did not want to project my beliefs and impressions of them in the study based on my experience with them in another class, which I felt would put the credibility of the interview accounts and subsequent data analysis at risk.

Initially, the idea of working on a research study at a site that was familiar to me, and with participants I knew, was appealing because I began the study with a vested interest in the topic. However, I began to wonder whether the research would be of interest to others outside of UCC and/or the discipline of reading or chemistry. While the topic was of great interest to me, I

was uncertain about its implications and significance to the field. There was also concern regarding the findings of the study. Glesne and Peshkin (1992) cautioned researchers about justifying their own experience by keeping an open and exploratory attitude in the data collection and analysis process. Once data collection began, I found that the students spoke much more about their personal histories and backgrounds, which I had not expected. At different points, I wondered how the details they shared would create a larger narrative; in these moments, the issue of trustworthiness challenged me the most.

Russell and Kelly (2002) noted that the key to maintaining authenticity and using personal experiences as an asset is to recognize how our own subjectivity both privileges and limits us. Rather than viewing my position as a reading instructor to be a liability in the research project, I began to think of ways in which my experience as a reading teacher would shed light on a broader issue surrounding the students' literacy learning. In order to ensure that the data illuminated as much of the students' lives as possible rather than my own interpretation of them, I strove to let the participants speak for themselves as a way to *show* readers instead of explain. Through the triangulation of data (Creswell, 1998; Merriam, 1998; Wolcott, 1994), I attempted to provide "a confluence of evidence that breeds credibility" (Eisner, 1991, p. 110).

Additionally, I regularly brought my concerns to a colleague who was a professor in my department. He had been teaching at the research site for much longer than I had and was familiar with the history of the college, the needs of the students, and the views of other professors toward students. Because he was a professor in the discipline of education, he also was engaged in the literacy learning process and encouraged me to consider the larger significance of the study for developmental education instructors as well as disciplinary literacy.

## Member Checking

In addition to my own trustworthiness, I wanted to validate the credibility of the participants and affirm that I was not *doing* research on them, but rather correctly selecting and making sense of the data. Lincoln and Guba (1985) described member checks as “the most crucial technique for establishing credibility” (p. 314). Member checks involve taking data and interpretations back to the participants so they can confirm the information and the data interpretation. Lincoln and Guba wrote that participants “may be able to agree that reconstructions are fair even if they are not in total agreement with them” (p. 315).

The member-checking process in this study consisted of communicating my findings periodically with Billy and a few of the participants. Due to the busy schedules of the students, I was not able to member check with all four of them. However, one of the participants, Kadiatou, was working in the reading lab as a work study. Because the lab was situated next door to my office space, I saw her on a weekly basis. In short and informal meetings, I shared with Kadiatou my findings and the information that was given by the other participants. Through our discussions, I found that while Kadiatou did not necessarily share the experiences and views of all the participants, she did confirm that the narratives were similar to those of other peers she knew. Salma also echoed some of the beliefs of the other participants during our member-checking discussions, although they were not articulated in her interviews.

When I played back some of the information to Billy, he acknowledged that the students were justified in their beliefs. He still held to his own views and perspectives but did recognize that there seemed to be a disconnect between the students’ narratives and his observations. Through a process of member checking, I found that both the students and Billy agreed that the challenge of literacy learning in a college-level chemistry classroom was complex.

## CHAPTER IV – FINDINGS

### Introduction

During the Spring 2018 semester, I conducted weekly observations of a section of the basic chemistry class, conducted personal interviews with the focal students and instructor, and facilitated post-observation conferences and group meetings. Through these data collection methods, my goal was to answer the following research questions:

**RQ1: How do students navigate college-level texts in an introductory chemistry course at an urban community college?**

- What facilitates the understanding of texts?

**RQ2: Using a framework of developmental education, what reading strategies and skills were students using to comprehend texts?**

- What opportunities were given, if any, to activate background knowledge?

In this chapter, I first describe the motivations for enrolling in the chemistry course as well as the initial expectations of the course. In this section, students' beliefs about school, learning, and reading are described. An observation of the instructor's view of students' attitudes toward learning and reading provides a deeper context. Then, the chapter looks at the students' understanding of academic literacies and the role of academic literacy in chemistry. Next, the chapter examines literary moments during the semester that sparked engagement and rich opportunities for academic and critical literacies. Here, I also explore non-literary factors, sometimes external to school, that influenced students' literary moments.

#### **The Instructor's Beliefs About the Students**

Billy, the instructor of the course, expressed three major beliefs about learning and reading when it came to the UCC students who were taking his CHM 02 course: (a) they were

unprepared for college, (b) they lacked motivation, and (c) they lacked the logic and ability to “make connections” essential in the field of chemistry.

### **Unprepared for College**

The AIR and the NAEP are among many other entities that deem the majority of high school graduates as unprepared for college. Despite widespread disagreement about what constitutes readiness, there is general agreement that, at the time of college entry, students lack the academic skills needed in writing, reading, and math to be successful in college. A 2009 report by ACT stated, for example, that the percentage of graduates ready to earn at least a C or higher in first-year college courses in English, math, reading, and science was 23% in 2009. This increased to 25% by 2011 (ACT, 2011).

In his interview, Billy’s responses on college readiness were reflective of the literature. He believed that the students were “ill-prepared” because they went through the New York City school system that did not prepare them properly. He emphasized that “they’re ill prepared, they’re not college-ready, ill prepared in reading skills, writing skills and in math. And we try to address that through the remedial courses, of which CHM 02 is one of those.” Conley (2013) posited that the college readiness problem can be attributed to a number of factors, including misalignment of standards between high school and college, lack of guidance and advisement in high schools, and lack of academic resources. The report *The Forgotten Middle* argued that students who do not demonstrate readiness in eighth grade are less likely to become college-ready by graduation (ACT, 2008). By these standards, college readiness has deep roots that call for a multi-approach that incorporates instruction in reading, writing, and math as well as support in the form of advisement and mentoring. In this case, “addressing” the college readiness problem that Billy referred to hints at more of a review of the basic concepts in chemistry.

Referring to the non-traditional students—often older, working students—Billy responded: “They did [chemistry] five years ago or they never did it, they did it in Africa or India twenty years ago. So all of that put together puts the population behind.” In his responses, Billy shared that it was often these students, who had either taken chemistry earlier in their lives or had immigrated from other countries, who tended to be more successful in the class.

### **Lack of Motivation**

Billy attributed students’ lack of college readiness to the New York City high schools, implying that much of the problem was due to external factors that were outside of the students’ intrinsic character traits. In 2016, over 58% of the student body worked at least part-time, and a considerable number of the students also had childcare responsibilities, compounding the challenges they faced. Billy mentioned: “I mean they’re moms, they’re dads, they’re workers, some of them are working in hospitals, some of them are working in law enforcement. Their main priority is not chemistry or history or math, whatever subject that they’re taking. That’s not their main priority.” While an understanding exists about the obligations students have outside the classroom, there is also the assumption that such factors lead to low motivation.

On the other hand, Billy differentiated international or foreign students from the local students, stating that their immigrant status was a source of motivation: “I’ve talked to a lot of these [international] students. How did you get here? They got here on grants, on scholarships on various things and they have to live up to some, some minimum standard. Otherwise they go back home, so they’re motivated, so they’re going to spend the extra time working.” In his responses, Billy made clear that while both the local students and the international students came to college with obligations and responsibilities, the responsibilities with which the local students were tasked had a debilitating effect on their learning and motivation, while the international

students became more motivated by the external pressures they had. The instructor distinguished international students from local students, positing that the international students had more of an incentive to work harder, while the local students were shouldering several other responsibilities and were therefore less motivated.

Research has shown that when middle school students are motivated, they are more likely to engage in literacy activities and demonstrate enthusiasm in reading and writing (Mizelle, Hart, & Carr, 1993; Oldfather, 1993). Mizelle (1992) revealed that eighth grade students, when interested, “got it” and wanted to learn more, but resisted learning when they were bored. While extensive research exists on motivation as it relates to young adolescent literacy, motivation in adult literacy has not been studied as much. Here, I looked to the definition by McCombs and Pope (1994) to think about motivation: a natural desire to learn in positive ways. Reflecting on Stipek’s work, Mizelle (1997) wrote:

Motivation is not viewed as something that needs to be fixed or done to a student; rather it is something that needs to be fostered. Motivation to learn varies from student to student and is based on students’ conscious beliefs and values. (Stipek, 1993, as cited in Mizelle, 1997, p. 17)

In his interviews, Billy articulated that the students in his class lacked motivation. During the examination of how he himself became motivated in the field of chemistry, he shared the following:

I had a teacher who was a brother, an Irish Christian brother and he was very, very forceful in making you understand not only the definition but how one definition relates to another definition. And he, he was really my motivation for that. So I have to say part of it was him, why it was me, I was motivated to learn and part of it was the fact that I liked to making these connections. I thought it was fun.

Billy attributed his motivation to understanding how ideas connected to other ideas. This made learning fun for him, which further fostered his motivation. When asked about how he, as an instructor, was facilitating the kind of connections that his own teacher did for him, he made



references to the examples he provided in class to help students make a personal connection to the content. To Billy, the concept of knowledge was a static product, one that was conveyed from teacher to student. In order to attain it, students had to work hard. He had a set view on “studenting” (Green, Kantor, & Rogers, 1990) that was based on his own experience of being successful in school and viewed students with a different approach to learning as unmotivated or unprepared. While he referred to himself as being “motivated to learn,” Billy believed that the students, because of their absences in class or employment status, did not share the same desire to learn.

### **Lack of Logic**

Billy believed that logic was an important part of academic success. Outside of chemistry, logic was needed in areas like math and writing. “Writing is a logical subject and you can’t be just dancing all over the place. You have to create a stream, you know, kind of stream of thought and people have to follow that and there’s a bit of logic involved in that,” he shared. When it came to chemistry, he emphasized that “the entire course of chemistry, no matter where you are, is based on facts and then connecting the facts together in some logical pattern to understand the next step.”

When asked about the students in his class, Billy stated that the students “either can’t make the connections, they don’t understand how to make connections of any kind.” He expressed his frustration at this and wondered if he was “oversimplifying” the problem. When I asked whether he thought it was possible for students to attain this higher level of connection building or logic he described, Billy returned to the topic of motivation, affirming that it could be done but only through motivation.

To Billy, logical thinking seemed to be a component of cultural capital in the field of chemistry. That is, logic had symbolic capital in chemistry; those who had it had a substantially higher chance at success, but whether one possessed logic or not was contingent upon the societal and institutional definitions of logic. In this case, students were considered to have logic if they were able to make connections between and across different chemistry topics. As Bourdieu (1990) articulated, “the kinds of capital, like trumps in a game of cards, are powers that define the chances of profit in a given field.” Therefore, the position of a person in society is “defined by the position he or she occupies in the different fields, that is, in the distribution of the powers that are active in each of them” (p. 230). Billy’s understanding of logic framed students as either incapable of having logic or lacking the desire to have logic, both which reinforce notions of power, knowledge, and dominance.

### **Inaccurate Self-evaluation**

It seemed that Billy wanted to know more about why students were not successful in the class and why they did not purchase the textbook. In an attempt to find answers, he shared that he and a colleague were conducting research on the students. He explained that the research involved distributing a survey at the end of the semester as an addition to the course evaluations that the students filled out. He reasoned that professors are evaluated by students, yet “no part of the form has anything to do with what the students are doing or what their responsibility is.” Billy’s colleague had created a form that listed 10 questions addressing student responsibility. Pointing to the summary of the survey they collected from the previous semester, Billy said:

The first question is, did you read the syllabus thoroughly? And it’s surprising how many yes and no answers, here’s a yes, blue, and a no answer in red. But the next question is, am I really doing my part? Am I expending enough time studying and taking advantage of office hours and questions like that. These are things that students should be doing. Many students give yes answers to these all right, you see that, but I want to show

how honest they are, that's one of the things, you know, if I asked you, do you go to the tutoring, what's your answer going to be? Yes, of course I go to tutoring?

In his description of the summary, Billy highlighted that he felt that students were not accurately assessing themselves. He did not feel that students were honest in their responses about how prepared they were for the class or how often they sought tutorial help. There seemed to be a sense of distrust when it came to students and their evaluation of themselves as learners. Also, although not intentionally, it seemed that the survey results provided Billy with an explanation for why students were not reading or studying, but placed blame solely on students.

While the instructor's beliefs about the students did not have a direct relationship to students' choices or actions when navigating texts, the findings provided insight into the second research question, which asked what reading strategies and skills students were using to comprehend texts and what opportunities, if any, were given to activate background knowledge. The instructor's beliefs highlighted motivations for his actions that opened opportunities, if at all, for students to employ navigational strategies to comprehend texts.

### **Beliefs About Chemistry**

The five students who were interviewed took CHM 02 because the course was required for their degree programs. However, their beliefs about and expectations of chemistry varied. Some of the participants spoke about their prior experiences with chemistry guiding their current beliefs about chemistry, while others spoke about the influence of family as having an impact on their views of chemistry.

#### **“I'm just bad at it”**

In her interviews, Trina, a biology major, spoke of her dislike of chemistry. The course was required for Trina, who wanted to become a psychiatrist. When asked about where her

feelings of dislike stemmed from, she spoke about her prior experiences with chemistry, which shaped how she felt about the subject now as a college student.

Trina: Yes, because I like biology way more than chemistry. I hate chemistry so much.

Min: Why?

Trina: Because it's just so...it's basically like...it's just the math, and I think that it's just that I'm bad. I don't know, I'm bad at it, and so that's where my "I don't like it" comes from. I'm just so bad at it.

Min: Where did you get this idea?

Trina: Even in high school, I barely passed [chemistry]. I think I got somewhere in the 70s in high school. Even then it was simple chemistry. And then I had to take CHM 02 and it's kind of the same, I'm learning the same thing again. And I'm like "Oh my gosh, I learned this already." But then I go to the test and I don't...I learned it already but I didn't retain it, and so then that's where my frustration comes from because I have to learn it all over again. And I'm just sitting there complaining instead of learning it again. I'm just not good at it. So that's why I don't like it.

Several times, Trina repeated that she was not good at chemistry and therefore she did not like it. Here, it is evident that negative experiences with chemistry from high school have shaped the way she views chemistry and, consequently, her perspective of her potential to do well in chemistry. Fairclough (2010) noted that educational institutions exert power in society by deciding whether the sociolinguistic performance of individuals is socially accepted. In Trina's case, her high school experience of not passing chemistry clearly stated to her that she did not have the capacity to be successful in chemistry at the time. Even years later, the discursive practices that determined her inability to do well in chemistry continued into her college life. The language through which Trina's performance in chemistry has already been decided, along with the institutional and social power structures that define success in chemistry, shaped Trina's identity development in both the chemistry course and college.

When I asked her whether she had been keeping up with the reading assignments in class, Trina said that the textbook was difficult to understand and she tended to "zone out" when she sat down to read it. She stated that the purpose of reading the textbook was to "basically just

know for a test,” but that the concepts were not “real” to her and, therefore, were easy to forget.

In her answers, Trina revealed that retention and comprehension are closely connected. In

contrast, when asked about biology, Trina displayed a different perspective:

Min: What makes you like biology more?

Trina: I like animals. That’s mainly the only thing. I like animals. I just remember biology class was more fun than chemistry. I know we did chemistry labs but the biology labs, they were just more fun.

Min: What’d you do?

Trina: I don’t know specifically. I think it was senior year that I took biology, or it was biology two, whatever. I just did not like dissecting the pig. I cried.

Although Trina could not recall the specific details of dissecting a pig for a biology lab in high school, it did leave a strong impression on her. The memory of working with animals, even though emotional, was one she was able to associate with the subject of biology.

Moje (2010) argued that in order to advance literacy in students, there is a need to change the social and cultural contexts of secondary schools. In particular, she noted that the identity students develop in different disciplines plays an important role in students’ relationships and attitudes to disciplinary literacy. Moje’s research focused on the secondary level, but is applicable to college students as well, particularly those who feel challenged in basic chemistry courses because they are “bad at it.” Gee (2008) posited that educators must see themselves, too, as members of a literacy discourse community and consider how their literacy instruction may support or undermine the literacy learning and experience of their students.

Later, Trina mentioned, “My life with chemistry has been barely passing. Staying under the radar.” Clearly, she did not see in her identity someone who had the potential to excel in chemistry, leading to questions about her earlier experiences in chemistry and the support she received in high school. The discursive practices that Trina demonstrated in the present as a

college student were impacted by her understanding of what constitutes knowledge and her perspective of herself within that understanding.

**“It was like you already had to know chemistry to take the class”**

Milly, unlike Trina, had never taken chemistry in high school. While she had taken physics and biology, she did not take chemistry. In her first interview, she shared her frustration about not having prior exposure to a chemistry course. On CHM 02, she said:

I feel like it was just so cut-throat. It was like you had to know chemistry a little bit already to have to take this class. So for a person like me that's coming in that had no idea is about, you're going to be lost from Day One. I was lost from day one. I'm like, "I don't understand."

Later in her responses, she made reference to the public school system in New York and mentioned that “the public schools here don't really offer that.” She wondered why chemistry was not offered to her when it is such an important part of science. Milly felt like the professor should be more understanding of the fact that many students come to the course without any exposure or knowledge of the subject. This shed interesting light on a reflection made by the professor, who said that when he asked students whether they have read the textbook, they replied, ““Of course I read the textbook,’ you know? And yet the grades don't reflect that.” His next assumption was that students do not actually read the textbook when they say they have. However, Milly's argument was that she has read the textbook several times but was not able to understand it because she lacked a deeper knowledge of the subject.

Milly expressed that she did not see herself as having a chemist identity, but described herself as a strong student, largely due to her Catholic school upbringing. From preschool to ninth grade, she attended Catholic schools in the New York, then transferred to a public high school. According to Milly, Catholic schools are 2 to 3 years ahead of all public schools. In Catholic school, she learned to create flashcards and develop study habits. Because of the strict

environment, she was able to stay focused. When asked if the skills she mentioned were transferrable to the current chemistry course she was taking, she replied:

This semester is the one semester that flashcards has not been working for me. I'm like, "But that's the only way I study. I can't study any other way." I'm thinking, "Okay, study the flashcards. It's going to help in class." The first test I failed with like a sixty-four or a sixty. I'm just like, "I studied for this. What are you talking about?" It was so many different things wrong. He's like, "We're not trying to trick you." I'm like, "But you kind of are trying to trick us."

Milly admitted that flashcards, which had been "working" for her through high school, were not working in the chemistry course. Like Trina, she mentioned studying. Trina related studying to reading the text, while Milly connected studying to creating flashcards. When Milly found that she received a low grade on her quiz, she felt as though the professor was tricking the students with the questions.

Several times, she mentioned that it was not fair she was taught in class as if she had basic knowledge of the language and concepts in chemistry. Meanwhile, the professor made it clear that the CHM 02 course is a remedial chemistry course, designed for students who have no prior knowledge or experience in chemistry. This discrepancy in Milly's and Billy's understanding of the level of the course highlighted a fundamental gap that may point to the effectiveness of instruction.

CHM 02 was Milly's first introduction to the subject of chemistry, which meant that the experiences thus far in the semester were shaping her views of both chemistry and her abilities in chemistry. She expressed the following:

But then that day opened up a can of worms for me. It's like you failed that one, then you get scared about failing the second one. And you fail the second one, then you get even more scared about failing the third one that you do pass by the skin. But it's like it's not passing enough, whereas you know that...I don't feel safe in this class right now. I feel like I'm going to have to take it again, because I don't understand anything.

Here, Milly made clear that the conditions surrounding her literacy learning have set her up for failure, because each experience reinforces her ability in the discipline, her identity, and her potential to be successful. The sense of insecurity she felt was a result of Milly's feeling of ineptitude around the symbolic capital from which she felt excluded. Fairclough (2010) wrote about schools as spaces that can wield and reproduce power structures that continue to marginalize particular populations. When Milly expressed that she did not feel safe, it was evident that she felt she was the victim of an oppressive system that was established to fail students like herself.

**“All the A students are in the sciences”**

Salma, one of the participants, immigrated to the United States from Bangladesh after her uncle petitioned for Salma, her parents, and her brother when she was in tenth grade. There was a Bengali teacher at the high school she attended in New York, and she was able to receive academic support. Upon immigrating to the United States and enrolling in high school, Salma came across two challenges: English and the onset of migraines. She attributed her initial low grades to these two factors. “So that’s the problem. I have to take pills. I always take Tylenol. That’s it. But one time I was senseless, then I have to go to the hospital,” she explained.

I interviewed Salma in her third semester at UCC and she was majoring in chemistry. She hoped to later become a pharmacy major when she transferred to a 4-year university. Salma told me that in the previous semester, she left the country for a month for a pilgrimage to Saudi Arabia. A Muslim student, Salma always wears a hijab to school. While she expressed no regrets about going to Saudi Arabia, she did admit that her grades suffered as a result of her month-long absence.



When asked about her family, Salma shared that her uncle was a doctor in Long Island and her cousin was a medical student. I asked why she, too, had chosen a major in science. “I don’t know. I just love science,” she replied matter-of-factly. I prodded, asking what might have influenced this.

In Bangladesh, after eighth grade, you have to choose which concentration you want to focus on—science, arts, or commerce. So I chose science. In my country, if you want to study science, you have to be a good student. If you choose something else, it means you are not a good student. Only A+ students are in science. The arts and commerce students are B and C students.

There seemed to be several cultural factors that contributed to the particular value being a science student held in Salma’s country. She stressed that there was cultural capital in being a science student, and the power that was linked to that “truth” established a desire in Salma to pursue studies in science. Moje (1996) wrote of second content classrooms:

Each classroom culture is defined by the teachers’ and students’ (a) beliefs about the nature of knowledge; (b) philosophies and knowledge about the discipline, teaching and learning in that discipline, and teaching and learning in general; (c) past school experiences and their role in schools and schooling; (d) home and community experiences; and (e) feelings and emotions about school and about themselves in general. (p. 175)

The complex nature of literacy learning and its use in the classroom highlight the fact that literacy is more than simple acts of reading, writing, and speaking. Rather, the socially constructed beliefs and values embedded in these acts, which are often unveiled in instruction methods and engagement, reveal that literacy itself is a discourse in the classroom (Gee, 1990/1996/1997).

In Salma’s case, it was evident that her past school experience as well as the cultural value science held in her home community played a considerable role in her attraction to chemistry. Students who chose to study the sciences were considered “good” students, which meant that a certain morality was associated with studying science. Therefore, science was more

than just a field or subject to be studied; embedded in the study of science was an expectation of intrinsic other values that were not associated with students who studied commerce or the arts. In her description, Salma made it clear that the choice to pursue one of the three academic paths had more to do with academic ability rather than individual choice or aptitude.

Salma had several family members who were involved in the sciences. She told me that “everybody” in her family studied science, which was why she, too, was majoring in the sciences. In her first interview, she shared that she failed the placement test, which allows students to be exempt from CHM 02. “I got 23,” she said. “I have to be—have to get 25, but I got 23. So that’s why I am taking CHM 02.” She said this was good because it gave her an opportunity to review the material so that she would be more prepared when taking the next chemistry course in her program.

While Salma expressed that she loved chemistry, this did not necessarily indicate that chemistry was easy for her. She revealed that on one quiz early in the semester, she scored a 65. “So when I got 65, that time I know that I did...when I finish my test, I come out and then I think that ‘Oh, no, I did wrong.’”

Toward the end of our first interview, I asked Salma to recall a childhood memory that had a positive association to chemistry. She described a memory from when she was about 5 years old and her older brother was a high school student. Salma, not yet able to read, would open his chemistry textbooks and mimic the images of molecules on a separate sheet of paper. She described feeling like an adult and having the desire to read and understand the symbols and letters in her book. Now, she said, her brother is a doctor in Bangladesh.

## Summary

All the participants began the chemistry course with certain beliefs about chemistry and/or chemists. For some, these perspectives were a result of past experiences they had in prior chemistry classes in high school. For others, they were guided by lived experiences through employment opportunities. In some cases, the beliefs they held came from cultural views that were deep-rooted. Unlike the professor's belief, in which he shared that many students came to the chemistry course without experience or knowledge of chemistry, all of the students in the study did come in with beliefs, biases, and experiences with chemistry that were largely socially and culturally constructed.

Unlike Billy's experience, in which he articulated that an interest for chemistry was passed down from a particular teacher, the students' entry into the chemistry course seemed to be more complex and textually challenged by negative experiences and/or positive experiences that were not necessarily aligned with the disciplinary structures that dominated the college classroom. Further complicating these perspectives was the role that Billy played in the students' literacy learning.

### **Beliefs About Professors (Instructional Methods)**

*[Observation field notes, November 17, 2018]*

*The classroom is rectangular, with beige concrete walls. 19 students are sporadically seated in the room. 10 are female, 9 are male. Some sit near the window, others toward the back. Ceiling tiles are badly in need of repair. Many are dangling by one side. There is a large periodic table on the left side of the room. The whiteboard is in the front of the class. The professor has Power Point slides projecting on half the board. Few students drift in late.*

*The topic of the day is electron orbitals. The professor is explaining how different elements will react when you excite them with electricity or heat. Examples include sodium, helium, neon, etc. The professor gives the example of Long Island changing to their lights to sodium lights. They were yellow, but people did not like them, so they changed back to white lights. One student responds by nodding his head and responding, "Mm-hmm."*

*"What other kind of energy is going on around?" the professor asks. "UV rays?" a student asks. He is an older student, the one who asks questions several times each class. "Let's think of examples in the room," the professor says. "Like your cell phones."*

*"When you go to get an X-ray, is that why they say no cell phones?" Asks a female student near the window, taking notes on her tablet.*

*The professor turns to her. "Yes, because you will distort the x-ray and your cell phone might get damaged."*

*The professor knocks on the chair in the front row. "Why is this seat red?" he asks. "Whatever is in the pigment absorb all of the colors in the rainbow except red. Prof points to a student in the back wearing a neon yellow shirt. Look at that shirt. It is absorbing everything except for the yellow. So we interpret that as yellow." The professor goes on the point at various objects—a student's shoe, bag. Goes back to the board—talks about projected light (admitted light) and how the color is manufactured.*

*"Chemistry has to do all about electron, and light is about electrons," he says.*

*A student next to me takes out her cell phone, and opens a social media app.*

*[one hour later]*

*The same three students are asking questions, of which only 1-2 ask content-related questions. The other questions are more targeted at the examples (‘what about this example?’ ‘would that apply to this, too?’). One of the students has a bag on her desk, but no notebook or pen out. She is sitting with her chin on her bag. The professor doesn’t stop to ask whether students understand the concepts, nor does he refer back to the textbook chapters that were assigned for homework.*

Gloria Ladson-Billings (1995) wrote about her inquiry into teaching excellence in her research on culturally responsive teaching. Specifically, her study found that, particularly for the African American students she observed, several factors contributed to teaching excellence, including teachers with concrete experiences, dialectical relationships between teachers and students, an ethic of caring, and personal accountability. While Ladson-Billings’s work focused on high school students, teaching excellence can similarly be applied to college-age students, despite the common belief that college classrooms are not as dialectical nor do they require a culture of caring.

While observing the class for 15 weeks, I found a pattern emerging. The 3-hour lecture consisted of the professor explaining concepts and formulas, much like what one would expect in a traditional college course. Several times, the professor attempted to draw connections between the topics and the students by providing examples (“like your cell phones”), but there were very few exchanges in which the professor asked explicitly for students to share their understandings of the topic. It was difficult to observe to what degree literacy learning was taking place in the classroom. Much of the student response was engaged with the examples, but this did not necessarily mean that strong connections were being made between the examples and the concepts they were intended to support. It was even more unclear whether the students were

actively engaged. Two or three particular students continued to ask questions and respond to the professor, but the other students were not as engaged, as evidenced through their use of cell phones, absences, and long breaks from the classroom.

Moje (1997) asserted the following:

If, as classroom researchers, we acknowledge the influence of discourses on the construction of what counts as knowledge, on relations between people, and on identity shaping, then we need to be concerned with more than just what students are learning about disciplinary concepts when we study the discourses that are valued and validates in schools. (p. 35)

However, in my observations, the discourses Moje wrote about were not as apparent. In my interview with the professor, he articulated that instructional methods in high school and college were different. It was evident that there was more of a vertical relationship between professor and student, and that a top-down lecturing style was dominant among the chemistry courses.

### **“These professors are making us fail”**

In her interviews, Milly pointed to her professor’s lack of organization and structure for her low performance on the quizzes. She noted that he had assigned the wrong homework once and he had not posted an assignment properly on Blackboard. “You have to be more organized,” she said. “I feel like I’m organized this semester, but all my professors are not. They are all over the place.” Although the research focused on the lecture portion of the course, Milly also brought up her chemistry lab professor on the topic of instruction.

He calls people names. Yeah, he told me that I needed to go back to elementary school. He another girl that she shouldn’t be a nurse because she’s going to kill a lot of people. He told another guy that he was a bum because he got a question wrong. And he yells at us constantly. I’m just like, “This man is so rude.” He says things. He told me that I couldn’t write an eight, right? He’s like, “Is that an eight? What is that? What is that? You need to learn how to write an eight.” I’m like, “Oh my God.” I had to white out all the eights on my paper and rewrite them. I’m like, you know.... He’s like, “If I can’t read it, it’s wrong.” If I did the work right, why is it wrong? These professors are making us fail.

Milly was frustrated by her lab professor's attitude and response to her. She articulated that she felt like a victim. Clearly, a dialectical relationship was not developing in the lab portion of the chemistry course. On dialogue, Ladson-Billings (1995) posited that when teachers use the voice of authority to convey concepts, students do not learn. Knowledge, or meaning making, flourishes when authentic, reciprocal dialogue takes place between the teacher and student. When Milly recalled the time her lab professor became critical of her lab report, she reasoned that she had attended Catholic schools and therefore was a good student. She felt as though the lab professor did not know her nor did he try to get to know her and was making accusations that were not constructive or founded on any evidence.

According to Milly, many students have expressed their intention to stop attending the lab because they, too, felt insulted or intimidated by the lab professor. When I asked her why the professor may want her or her classmates to fail, she did not have an answer, but she did not feel that the professor was creating an environment that was conducive to literacy learning.

**“The classroom setting, it gets me nervous to ask questions”**

Compared to Milly, Trina did not have any particularly negative encounters with the professors. However, when I asked about the instructional methods of Billy, her professor, she had difficulty remembering his name. “I forgot his name. I’m sorry...,” she apologized. She admitted that she would “zone out” and miss parts of the class. Other times, she would vaguely remember a topic that was covered in an earlier class, but would not be able to recall the details accurately. “I just don’t ask about it, it just stays a mystery,” she said. She explained that the classroom setting made her nervous to ask questions. She preferred not knowing to asking the professor to clarify his lecture. She made a comparison to high school, when she was more “open” and would ask questions. While Trina did not feel in any way that the professor was

hostile, she felt reluctant about approaching him with questions. The environment in a college classroom was different from high school, where more dialogue between teachers and students was encouraged by the teachers. Trina also shared that she did not know any of her classmates in the chemistry class. There was no interaction among students in the class, either in the form of discussions or group activities. Trina did bring up an interaction with a classmate during chemistry lab:

Yeah, that's the thing. I know it's supposed to be, I know that, but sometimes I don't...I remember doing it with my lab partner and she was like, "Oh, we just do this...we did this in class." And I was like, "I don't remember doing that in class." And she would explain to me how it was related to something the professor talked about in the lecture class. And I'd be like, "All right, well."

In her response, Trina described an experience in which working with a classmate allowed her to reinforce a topic covered in class. In a natural and authentic way, Trina was able to receive feedback from a peer. For a student like Trina, who had difficulty addressing the professor for help, facilitating peer dialogue can be a form of literacy support, but this opportunity was not available during the lecture. Because there were no peer activities or discussions and Trina was reluctant to approach the professor with questions, she felt that the Power Point slides, which were uploaded to the class Blackboard, were the most helpful resource for her. She explained, "That's how all of high school was. It was just Power Points. So I think that's how I remember...and they're easy to write down." Here, Trina equated learning to memorization and recall, rather than a transformative discourse that leads to identity change. Trina, although hesitant to build a relationship with the professor, did not feel that it was a huge impediment to her learning.



### **“I like how he helps us study”**

In contrast to Trina and Milly, who felt that the professor was either unorganized or unapproachable, Salma believed that the chemistry professor was a valuable resource and support in her literacy development in chemistry.

I mean, in class, he takes a quiz every Tuesday. Is the main thing that I like. Because if I started to take test, then I know which one I get and which one I don't know. So I can study more about the ones I did not do well. So that's why I like quiz.

For Salma, the weekly quizzes that were given at the beginning of class served as avenues of communication. Salma expressed that the feedback given through the quizzes either affirmed to her that her understanding was correct or served as a reminder to review certain topics. In my interviews with Milly and Trina, they shared that they did not look forward to the tests because they felt that sometimes they were not accurate. In Milly's case, she told me that she had “done all the work correctly” on a question on a particular quiz, but because her decimal point was “off” by one place, she had gotten it wrong. She felt it was not fair of the professor to mark her answer wrong. Trina felt as though the tests were keeping her overall grade down, and commented that as long as she could maintain over a 70, she was “good.” Trina saw the quizzes as a form of assessment which she hoped to pass just barely.

Salma's view of the quizzes was starkly different in that she saw them as a method of communication rather than an evaluation of her performance. She spoke about one of the quizzes on which she received a 65. After receiving the score, she reviewed the work and visited the professor during his office hours. Salma shared that as a result of using the professor's feedback to address the areas she did not fully understand, she felt she was able to get a 90 on the next quiz. Salma saw the quizzes as a process of learning and alluded to the idea that the quizzes were connected. Because of her efforts to better understand the quiz on Chapter 3, she believed she

was able to get a much higher score on the quiz for Chapter 4. Her response echoed Billy's emphasis on connections in chemistry—that being able to see those connections was the most important aspect in gaining literacy in chemistry.

Salma also spoke about the professor's way of teaching in the classroom:

Min: What are some things that he did for—that helped you really understand the content?

Salma: He always tries to give examples. If he tells anything, so he, after finish this, then he will explain and he will give the example how we have to do, which is helpful for me. And also sometimes, he makes questions for us in class, and then he explains. And sometimes he asks, "If you guys have any questions, ask." The homework is too tough, so we have to ask him. So many things. If I ask him, he's gonna explain. Every quiz, before every quiz, he asks question that "You guys have any questions?" So I will have.

Min: Did you ever go to tutoring?

Salma: For chemistry? No.

Min: But you talked a lot to the professor?

Salma: Yes. I bother him too much. (Laughs)

Unlike Milly and Trina, Salma sought out the professor's help several times while taking the course. She felt that there were ample opportunities to ask questions, although she did admit that not many students asked questions. For Salma, the examples that the professor provided in class were helpful and related to the concepts they were meant to illustrate. She did not see them as an attempt on the professor's part to be "funny," as Milly thought.

### **"They generalize about us"**

Kadiatou believed that sometimes, professors tended to make assumptions about students and sometimes thought students were just lazy or procrastinated. Kadiatou did not talk specifically about the chemistry professor but used the example of her biology professor. At the beginning of the semester, it was evident that her experience with the biology professor had given her reservations about the chemistry professor.

"Sometimes they tend to generalize," she said, and added:

The problem is like me, I have language issue. For me it was really difficult to understand what my lecture professor was talking [about] to me. One day, I made an appointment with her. I went to her, I explained to her, “I’m a student here but English is my second language. It’s just like one year since I’m here, and I have a little bit problem understanding with your course.”

The professor suggested that Kadiatou either take a crash course taught by another professor or go to tutoring. Frustrated, Kadiatou asked the professor if she could speak a little slowly during the lecture. The professor refused because she could not make an accommodation for one student. Salma shared a similar experience with a sociology professor. She approached him after the first day of class, explaining that English was not her first language and asked if he could speak more slowly in class. The professor told her that he could not change the way he spoke and suggested that Salma sit closer to the front of the class.

For humans, texts are not just objects that are used to carry out a fixed role; rather, texts are the instances through which socially constructed and contested identities, or subjectivities, are made and remade (Henriques, Hollway, Urwin, Venn, & Walkerdine, 1984). It is through these texts that one learns how to “be” and comes to understand what is “normal.” In my reading of Salma and Kadiatou’s experience with teachers who refused to compromise a strict standard or language, I found that the two students felt pressured by the hegemonic expectations that were affirmed by social and institutional expectations.

### **Intimate Literacy**

Freebody and Luke (1990) defined literacy as “a multifaceted set of social practices with a material technology, entailing code breaking, participation with the knowledge of the text, social uses of text and analysis and critique of the text” (p. 15). This sociocultural view of literacy reveals that literacy is not isolated but embedded in social interactions and literacy events surrounding the reader. The research study sought to examine the literacy moments that

students encountered as students in the chemistry class and investigate the factors that may have contributed to those intimate textual moments. Here, literacy moments are those in which participants are able to develop an intimate connection to the discourse.

I use the term *intimate literacy* here not only to describe literacy events that are shaped by participation in the social practices that surround a particular discipline, but also to imply that the participants are able to bring a level of the disciplinary discourse to their personal, out-of-school sphere. Intimate literacy is accompanied by a shift in identity and recognition of the possibilities one has, academically, socially, and personally. At various points in the interviews, the participants shared examples in which they had experienced such moments of scientific literacy in their out-of-school lives; in some cases, as in Milly's, this was the impetus for her decision to become a nursing major.

### **Merging the Personal and the Academic Space**

In the interviews, I found that the participants were able to demonstrate the highest level of understanding—when they were able to move seamlessly between their personal spaces (home, work, family) and the academic space, using the knowledge to make sense of the world—when they could develop an intimate literacy of the concepts they learned in class.

Freire (1970) proposed that a nutritionist view of knowledge, where educators seek to deposit information into deprived students, presupposes that the student is passive, and that his object is to “study the so-called reading lessons, which in fact are almost completely alienating and alienated, having so little, if anything, to do with the student's socio-cultural reality” (p. 208). When educators fail to make connections between texts and students' real-life experiences as well as practical understanding of the world, the text has little value for students. Linguistic contexts, when acquired through rote memorization and repetition, “are deprived of

their authentic dimension as thought-language in dynamic interplay with reality. Thus impoverished, they are not authentic expressions of the world” (p. 210). In the participants’ descriptions of moments where things “clicked,” it was evident that an active dialogue between the reality of the students’ lives and the academic text occurred.

### **“I embalmed people, yeah”**

While she was in high school, Milly worked for a funeral home, assisting in administrative duties—“regular computer work, putting obituaries together, cute stuff like that, doing death certificates.” Her work there was part of an internship program in her high school in which students were required to complete a certain number of hours of interning in a field or job that might lead to a future job. After attending a funeral at the home, Milly contacted an administrator to ask if she could fill her internship requirement there. Her expectation was that she would continue to fulfill administrative tasks.

“One day the embalmer guy gets really drunk, and he couldn’t do it,” she said, explaining how she transitioned into her new position at the job. “I was like, ‘I know how to embalm,’ and I did it.” Milly had learned how to embalm bodies after observing the embalming process several times. As she described the process to me, Milly became more animated, using her hands to guide me through the process.

Milly: I knew where everything was. I knew how to find the vein. I knew how to do everything. I knew how to pump the body, wash the body, and then bring it upstairs in the elevator so [the body] could get dressed and then get the makeup done. It only takes about twenty-five minutes to embalm a body. Child bodies are different.

They’re a lot quicker, so you don’t have to put as much fluid in them. And there’s like three different types of fluid. They have a clearish, white one, a kind of pinkish one, and they have a really purple one.

Min: What are these fluids?

Milly: The embalming fluid. The fluids depend on how they died, if they have any diseases that can alter the way they look. Embalming fluid just gives you back your skin tone and everything, because you turn gray. You turn really gray. That has to settle through the body, and you have to massage the fluid through the body to bring

back the rosiness in the cheeks and all the plumpness in the skin. And then the eyes are different, because it sinks in the back of your head. You have to put the caps on the eyes to make it look like you're sleeping. You have to take a dull needle with this, like, leathery thread and go through the top of the lip and bring it down, and plug up the ears so that the embalming fluid doesn't come out. Yeah. I've done everything. So I'm not afraid to be a nurse. I know that some people are going to die on the job, and that's something I'm already prepared for. My grandmother died in front of me, so it didn't really freak me out too bad. I had to tell [the doctors]. I was like, "Oh no, she died." "Like, what do you mean?" I'm like, "Look, the rigor mortis is settling in already." The rigor mortis is when you just start stiffening up. That's the hardness. If somebody dies in a weird position, it's so hard to put them down, to get them in a flat frontal position. It's really hard.

Min: You learned all of this at the funeral home?

Milly: Yeah, just working there for a while. Reading books and looking at YouTube videos to further explain it. I had all different types of people in the funeral. My first one was a nine-year-old boy. My boss was like, "You cry, you're fired." So I just became so stoned. I was like, "Yeah, I'm good." I didn't cry not once when I worked there. But it made me stronger working there, because it's like if I could do that, I could do any job.

Milly's description of her experience at the funeral home highlighted three significant findings: intimate literacy in an out-of-school setting, her motivation for wanting to study nursing, and a transformative experience. First, Milly clearly demonstrated an understanding of the difference between the embalming fluids and how they react when injected into the body. She was sure of herself, using her hands to gesture as she explained the different colors of the fluids and which body parts they are used for. She had firsthand experience with the work and was able to make a personal connection, referring to her own grandmother and the warning she received not to cry. Clearly, she was an active participant in the social practices and discourse surrounding the work. Second, she made the connection between pricking bodies with a needle to being a nurse ("so I'm not afraid to be a nurse"). For Milly, the experience of working with bodies, fluids, and needles cemented her desire to become a nurse. She saw similarities between the work she did in the funeral home and the expectations she had of becoming a nurse. Later, she also brought up having to administer daily insulin shots for her grandmother, who was a

diabetic, citing this as another reason for wanting to become a nurse. Finally, Milly articulated that the experience made her stronger because of the emotional and psychological challenges she was able to endure. She gained a new level of confidence as a result of experiencing a transformation in herself; she was able to witness an inner strength she had.

Later, Milly brought up her work at the funeral home again to describe a disconnect between the learning process there and the learning process in the chemistry course. She told me that learning was easy for her, but she was frustrated in the chemistry course because she just “doesn’t get it.” Contrary to Milly’s initial belief that working at a funeral home and administering insulin to her grandmother would inform her as a student in the chemistry course, she had difficulty navigating the text, the class, and the concepts. She saw the examples given in class as attempts on the professor’s part to be funny and she did not feel they were relevant.

### **“It just clicked”**

Unlike Milly, Trina could not recall an out-of-school experience which she felt motivated her desire to become a psychiatrist, but she did talk about a recent experience in which reading a text made sense to her. This response followed Trina’s frustration about not being able to understand her own notes taken in the chemistry class. She referred to her chemistry notes as a “whole block of nothing” and questioned why she had not taken more constructive notes in class. She compared the difficulty of decoding her chemistry notes to a recent event in which she read a math problem and “it clicked, because of something that the tutor had told me.” She could “see” it in the problem and told herself, “Okay, I know how to do this one.” When asked to elaborate further on what it means when something “clicks,” Trina described:

When I was reading the problem...it had something to do with a ball going this way and you had to graph it, and the two things I had to find were the vertex and the Y and X intercepts, and [the tutor and I] had done one problem that was like, “Find the vertex.” And another problem, “Find the Y and X.” And then I was reading the problem. It didn’t

say, “Find the vertex.” But I was reading the problem and I was like, “That looks like...” and so I was like, “Oh, okay, I know how to do this one.” It felt good.

Kucer (2009) indicated that when one’s background information, which refers to existing knowledge, is activated and integrated with new information, reading comprehension can be enriched and new knowledge can be cultivated. In Trina’s case, the existing knowledge was not a personal experience, but knowledge gained from a tutoring session. It was not evident whether there was an intimate understanding of this knowledge at the time the tutoring session took place, but when it was activated some time later, while she was reading another math problem, Trina demonstrated an intimate literacy event. In her response, Trina articulated that the math problem did not explicitly use the terms (vertex) that were used during her tutoring session. Yet, she was able to connect the term, the concept, and the application of the concept in her math book. She described this moment as a time when reading “clicked,” when she was able to use existing knowledge, apply it to a current event, and build additional knowledge.

Kadiatou described similar experiences in which there was a “clicking” moment in both her biology and chemistry classes. In Kadiatou’s case, she spoke about her biology professor, who introduced the concept of osmosis and diffusion to her. She excitedly recalled an example that he used:

He said, “When you are doing your tea, you are making your tea with sugar, and you just put water and you put your sugar. You take your tea, you put inside. You see how the way the elements, they mix together? That means diffusion.”

For Kadiatou, the example that her biology professor had given to her was one that she could relate to, but also bridged her personal experience and the scientific concept to create an intimate literacy event. Later, she was able to activate this example when the topic of diffusion was brought up in her class. It was evident that the example of tea was more than an illustration of an



unfamiliar concept; it seemed to connect her out-of-school experiences with an academic concept.

In another interview, Kadiatou shared that the chemistry professor used the example of Pedialyte to explain the effect of salt water on the body in relation to dehydration. He asked the class whether they knew what Pedialyte was made of, and immediately Kadiatou, who had a 1-year-old daughter, was engaged. The professor told the class that Pedialyte was basically a mixture of salt and water, with added flavor. He told the class that if there was no Pedialyte in a situation where there was a vomiting baby, one could recreate the solution with water and salt. Kadiatou had a “clicking” moment:

I was like, “Oh my God.” And then I remembered this, and I made it one day when my baby was sick. I tasted it, and I was worried if I give this to my baby, is it going to help? I didn’t know because in my country we used to do that when the baby is sick or having diarrhea or vomiting a lot. We used to put some salt in water, warm it a little bit, and give it to the baby. She was fine. I remembered it.

González, Moll, and Amanti (2005) highlighted different categories of funds of knowledge that were found to be linked to students’ out-of-school literacies and found that the activities and experiences of students in their homes, when invited in the school space, greatly enhanced students’ learning experiences. In the example that Kadiatou spoke about, she was not only able to make a connection to a personal experience, but also demonstrated a deeper understanding by applying it to an out-of-school situation. She was able to call upon this knowledge outside of the classroom, which in turn was also activated in the classroom by a personal experience. This cyclical understanding and application highlighted how intimate literacy takes form in students’ lives.

Moll (1992) stated that the goal of developing meaning-based literacy instruction is to have students examine, read, and discuss texts as they would personal relationships or a novella.

Here, meaning-centered can be used interchangeably with the term *intimately* in that students are able to make personal connections to the text, and the text is able to invite students into a discourse. In Kadiatou's description about Pedialyte, it is possible to see that the professor, in using an example that was applicable to the student's personal circumstances, was able to develop meaning-based literacy.

### **Unsuccessful Attempts at Intimate Literacy**

Of the four students who were interviewed, Milly and Trina struggled the most in the course. Milly felt that the professor did not make the content accessible for the students, and Trina voiced that she did not know "how to study." Both participants also stated that the course was required for their majors and therefore they needed to pass in order to advance in their programs. Over the course of the interviews, Milly and Trina told me about attempts they had made on their own to support them in the course. Many of the tools involved various technological platforms and channels.

#### **"I just go online"**

Both Milly and Trina immediately made references to Khan Academy and You Tube when I asked through which methods they supplemented the class. Trina explained that Khan Academy had a website onto which videos were uploaded. A user could type in a word or phrase and search for tutorials on the topic. Trina talked about how "personally frustrated" she became when she read the same paragraph in her chemistry book over and over again and still was not able to understand what it meant. "It's like, well, I'll just go look it up [online]," she said. The first time Trina was introduced to Khan Academy was in high school, when one of her teachers would tell the class to "go on Khan Academy and finish the work." Reflecting on the memory, Trina commented that "It [the teacher] wasn't really teaching."

When asked about how Khan Academy delivered information and whether it was an effective way of learning, Trina brought up the visual aspect of the videos several times. The colors drew the viewer in, and the videos were not as drawn out and detailed as the textbook, making it easier to cram the information in a short amount of time. “I could understand at least what I was supposed to do,” Trina explained, and continued to tell me that sometimes she could not determine the point of a textbook chapter. However, Khan Academy made clear what the program thought was important and formulated assessment questions that they believed students would be tested on. For Trina, the program seemed to provide a quick review of the material, and the fact that it saved her time held an appeal for her.

Milly preferred to use Khan Academy first and then later expand her search through YouTube videos. “Khan Academy is connected to YouTube but I would type in at Khan Academy what I needed and then it would pop up a YouTube video for me to go slow,” she said. Milly told me that YouTube was “very, very helpful” and the “only reason” why she passed the second chemistry quiz. She expressed that she taught herself the concepts through YouTube and many of her other classmates also taught themselves. Milly attributed YouTube’s effectiveness to its accessible language, paced tutorials, and replay feature:

It’s they take it step-by-step a little bit slower ‘cause we only have but so much time in class and once it’s over, class is over, the next class is like rushing in and the next teacher is rushing in. So, even if you’re sitting in class, spaced out, you don’t understand what he’s saying, you just take the topics that he talked about or she talked about and you type it in and you keep replaying it and keep replaying it. It’s like a never-ending session for teaching and you can pause it, go back. You keep going back, keep going back and you keep doing the practice questions.

In another interview, Milly contrasted the YouTube videos to her chemistry textbook, citing that the chemistry textbook went into too much detail, while the YouTube video was “elementary-like” and “taught the basics as if you’re like, eight or seven years old.” She

described it as being “kind of like Hooked on Phonics.” In her response, she revealed that the chemistry textbook was too difficult for her to understand. Her use of flashcards and highlighting, while helpful to a degree, were not effective ways for her to develop an intimate understanding of the text. As the semester progressed, Milly voiced that the chapters were getting more and more difficult, and that not even You Tube or Khan Academy, which were helpful to a degree in giving her the information to pass short chapter quizzes, could not help connect the chapters as she prepared for the midterm exam. Freire (1970) argued that decodification, which is the act of problematizing a codified object or situation, is necessary in order for students to reach a critical level of knowing. This process allows students to look more deeply at codified texts, making connections to reality and deeper theoretical contexts. In Milly’s case, she hoped to achieve an understanding of concepts through You Tube tutorials, but because the attaining of definitions and formulas did not translate into an ability to decode the text, there were limits to reaching a critical level of understanding.

In Trina’s case, she had not purchased the book and used copies of chapter pages she had obtained through her classmates. Trina’s encounters with the discipline were through the Power Point slides that the professor had uploaded to the class Blackboard and the Khan Academy tutorials on which she relied. The videos, which streamlined the information for Trina, while convenient at times, did not help her gain an intimate knowledge of the discipline and course.

### **Tutoring**

All of the four participants I interviewed expressed a desire to use the tutoring services that were available at the college. At UCC, each department has a tutoring lab, although each of the labs has a different system. The chemistry tutor lab has a walk-in system; students can come any time during tutoring hours. At any time, a number of tutors sit at tables to assist students.

During exam period, there are often more students than tutors, which means that students are grouped with other students. This may mean that students in the same group are taking different chemistry courses or need assistance on different topics. Students are welcome to make appointments, but securing an appointment only guarantees that students can work with the tutor of their choice. It does not ensure that a student will be working individually with the tutor; other students may join the group.

### **“I was a little salty”**

In her first interview, about a week before her first tutoring session, Trina described her experience with a math tutor at the college:

I think the most there's ever been in there is four tutors, and it's we all go in there, and it's basically a whole bunch of people sitting there, and the tutors are trying to help everyone. And usually, I get a one-on-one tutor, but them sometimes, if there's a lot of people, my tutor will have to do two of us at the same time. But I just bring whatever I need to study, learn. I bring a study guide and then they just go through the problems. And if I have a question I'm like, “Hey, I don't know what that is,” and they show me and stuff like that.

Her expectation was that chemistry tutoring would be similar to math. The next time we met, Trina told me that she did not go to her tutoring session because she spent the week with her family, who was visiting from South Carolina. During the week, she admitted that she was in “sleep mode” and needed to “get back into it.” Trina talked about her expectations for the upcoming tutoring session, particularly ways in which she felt tutoring would help to fill some of the gaps that Khan Academy was not able to do. In her response, she admitted that Khan Academy felt limiting sometimes because “you can't really ask a video a question, and if it answers, that's all it's going to give you. And if you need...it's like I don't understand that, it doesn't really give you a different way to explain it. But another person can. I think that tutoring is better that way.”

Trina and Milly both used the tutoring lab in the chemistry department. Kadiatou and Salma chose not to seek tutorial support through the department but contacted a tutor from their developmental reading class. They knew that the tutor had already taken the chemistry course and the professor's class and felt he could assist them better. After one session, Salma stopped going to tutoring and began visiting Billy during his office hours. Kadiatou, however, continued to meet with the tutor from the reading course.

Initially, Trina planned to go to the tutoring lab every week, to prepare for the weekly quizzes that were given during the lecture part of the course. Throughout the 15 weeks, however, she attended twice. Before the first session, Trina told me that she planned to ask the tutor to explain a specific topic, Lewis structure, because her professor told the class that it would be the focus of their next quiz. Trina had attempted to look up Lewis structure on Khan Academy, but still had difficulty understanding both the concept and application. She referred to it as "the dots." We met one day after her tutoring session, also the day of her chemistry quiz. Trina seemed frustrated because there was not enough time in the tutoring session to get to Lewis structure, which was the reason why she originally went to seek a tutor's help. She also shared that she was part of a group of eight students who were working with one tutor.

Trina: So I went in there and I just asked. I was like, "Is this tutoring?" And there was no tutors at first. And then the tutor, he walked in, and he asked me what chemistry I was taking. And then I said Chem 02. And then he said, "Okay, what do you want to do?" And I showed him the practice test for unit five, and I said I also wanna do Lewis structures, but we didn't get to that. And so yeah. He basically just went over the practice test.

Min: Was it helpful?

Trina: Yeah, but not for the test today. 'Cause the test today was Lewis structures, and I didn't get to go over it. So yeah, I was kind of upset when I was taking the test because I didn't get to study that, but yeah.

Trina, usually cheerful and smiling, seemed upset. She spoke about the upcoming midterm exam and her concerns about not passing the course. Her expectation for tutoring was

that, coupled with her use of Khan Academy, it would help her to form an understanding of the different concepts integral to passing the course, but she shared that this expectation was not met. To this point, Trina mostly spoke about the structure of the lab and the lack of individual attention and interaction that arose as a result. In particular, she described one of the students in her group as “stressin’ out.” She could see that the student had several problems he wanted to go over with the tutor. Trina did not feel comfortable asking about her own material because the other student seemed visibly distressed. She also inferred that the other student was in a higher-level chemistry course, based on the textbook he had. The tutor ended up spending more time with the other student, only glancing over Trina’s work now and then to tell her what she got wrong.

On the topic of the quiz, which was on Lewis structure—the topic that the tutor did not have enough time to cover in the session—Trina articulated that she “was salty about that test so much.” When asked about the word “salty,” Trina explained that she was “a little bit angry. Just low angry.” She laughed a little, reflecting on her feelings toward the class. I asked her what it was specifically that she was angry about.

That all those people came in. ‘Cause in the beginning, it was nice. It was just me and the tutor, and it was just like I got all this attention and I was good. And then all those people came in that I didn’t get to ask about that one thing. That’s what I went in there for. I probably should’ve started with that. That was my mistake. I should’ve started.

After the quiz, the professor went into the lecture. Trina, disappointed over the quiz, “zoned out of the whole class.” Having observed Trina in class, I noticed that she had taken out her phone in class. “For me, once I get on my phone, it’s over. There’s no coming back,” she affirmed. In her interviews, Trina used the expression “zoning out” several times, often to describe moments in which she lost concentration in the class. She later stated that if she could

“just not zone out,” she would do so much better. For Trina, being engaged in the class was a challenge, and even when she willed herself to focus, it did not last long.

If I catch myself zoning out, it gets into a thing like, “Oh, I need to pay attention,” and then I’m so focused on trying to pay attention that I’m not paying attention. If I zone out or something, then I can always bring myself back in, but yeah, once I get on my phone, it’s over. I can always find something to do on there. And yeah, he doesn’t say anything. But me, I’m kind of a goody-two-shoes, if he walks up too close, I’m like, “Oh, yes. I was paying attention.”

For Trina, it seemed that the act of appearing to focus was more important than her actual engagement. As long as the professor felt she was on task, Trina did not feel much remorse about spending much of the class on her phone. More than once, she commented that the professor did not care whether students were on their phones or not.

#### **“I feel more comfortable with my tutor”**

During our first interview, Milly was determined to frequent the tutoring lab. “I’m going to be living in the tutoring lab,” she told me. However, due to her job as an on-call hair stylist, her schedule was not as flexible as she initially thought it would be. She was only able to go to tutoring once. Milly went to tutoring for the first time after learning that one of her quiz scores was low. Before going to tutoring, she read the textbook chapter, reviewed the Power Point slides the Professor distributed, and looked for supplemental resources on You Tube and Khan Academy. After her tutoring session, Milly told me that the chapter about electrons “made better sense” because the tutor’s explanation supplemented the information in the book. She did point out that the tutor also had to “go on Google” to check his understanding of the topic. In Milly’s responses, sense making of the text or the class was often linked to the quizzes. When a quiz question confirmed her understanding of the material, Milly often identified the instruction as “making sense.”



Milly felt more comfortable with the tutor and preferred the tutor's method of teaching to her professor's because the professor "sometimes goes too deep and it's like I'm not gonna understand that." She confessed that it was confusing when the professor elaborated on a detail that was not in the textbook. "I will respect it if [the professor] just goes through the book and just sticks to the book, I could pass if you just give me the book. I can't pass when you're giving me three different things to study and then I'm just over here like what do I...and then you have to pretty much play Russian roulette," Milly said. Milly felt that the professor was not being upfront with the students and contributed to her confusion.

Despite Milly's belief that she felt more at ease with the tutor than her professor, she did not return to the tutoring lab, citing her mother's health and work schedule conflicts. While she felt that the tutoring session was somewhat helpful, Milly did not mention a moment of sense making outside of being able to place the tutor's explanation in the book or in a quiz.

### **Authentic Dialogue**

Freire (1970) posited that the act of knowing, which is central in adult literacy, "demands among teachers and students a relationship of authentic dialogue" (p. 212). Without authentic dialogue, which in turn contributed to the formation of discourses, students are not able to engage fully with texts and, more importantly, with the disciplines in which the texts are embedded. To speak the word, then, "is associated with the right of self-expression and world-expression, of creating and recreating, of deciding and choosing and ultimately participating in society's historical process" (p. 212). Therefore, by speaking to reflect on the world, one is participating in the act of knowing, which "involves a dialectical movement which goes from action to reflection and from reflection upon action to a new action" (p. 213). Freire wrote about a transformation that can only take place when an individual's reality is radically altered, which

only happens with full engagement with and participation in text. In observing the classroom and throughout the interviews, I looked for evidence of such authentic dialogue, which is not necessarily always a spoken conversation, but can also occur through written feedback and instruction in class.

### **Getting to Know Students' Home Circumstances**

In thinking about authentic dialogue, two points might be taken into consideration. First, literacy instruction must be situated in the lives of students. Moll (1992) wrote:

Thus, consistent with our theoretical orientation, we are attempting to situate the study of children and of literacy within the social contexts created by these complex household relationships. These relationships, in turn, are influenced by a variety of factors, such as the personal and labor history of the family. Particularly important in our work has been understanding the households as economic units, how they function as part of a wider changing economy, and how their material and intellectual resources are obtained and distributed through both internal and external social relationships (Velez-Ibanez, 1988).  
(p. 4)

By mobilizing and tapping into students' funds of knowledge, Moll argued that teachers can take advantage of the social capital of the community. As a teacher, this would require a willingness and action to be knowledgeable about the complex household relationships and circumstances of students. Without this awareness, it can be easy to make assumptions about students that are not entirely correct. The household environments of students contain knowledge and, more importantly, social relationships through which students teach and learn. Moll referred to these as the "systematic strategies that enhance survival within harsh social conditions" of students (p. 225), which can be tapped into by teachers.

From Moll's perspective, literacy practices begin in the household, through gradual understanding, awareness, participation of economic practices, labor activities, and social relationships. Such involvement includes different forms of spoken and written language, with which students become familiar. This involvement, while different from disciplinary literacy in

content, also requires a scaffolded and systematic acquiring of language, skills, and application. When educators see the household and out-of-school environments as foundations of literacy as well as spaces holding future implications for literacy, authentic dialogue becomes an essential part of literacy instruction, and a tool that instructors can use to create moments of intimate literacy.

In my interview with Billy, he seemed to think that his students simply did not see college as a priority. “I mean they’re moms, they’re dads, they’re workers, some of them are working in hospitals, some of them are working in a law enforcement or whatever they do. Their main priority is not chemistry or history or math, whatever subject that they’re taking. That’s not their main priority,” he said. In his response, there seemed to be an assumption that the students were bearing responsibilities that took precedence over their academic studies. Some of the assumptions may be true, but the students’ interviews revealed that their home circumstances were much more complex, many of them juggling several roles simultaneously.

**Milly.** Milly was 24 years old, a bit older than students who enrolled in UCC straight out of high school. She told that she had started “doing hair” when she was 16 years old. Having graduated high school at the age of 16, Milly was not sure about what she wanted to do, so she decided to become a licensed hairstylist while considering her options. Afterwards, she was admitted to a 4-year college in Utica, where she stayed for a semester. Toward the end of her first semester, she learned that her grandmother, to whom she was close, had cancer. She immediately dropped out and returned home, determined to get a job to offset some of her grandmother’s medical costs. Milly’s grandmother passed away a year after Milly came to live with her.

Milly continued to work as a hairstylist but began to feel that there was a limit to the amount of money she could make dyeing and curling hair. There was the hourly pay she received and the tip, but hardly any other way to make money. She did mention that selling products was a way of increasing her revenue, but by very little. “If a client buys a hair product, you get probably what? Like two dollars off of it. But that hair product costs like thirty-something dollars.” This incentivized Milly to enroll in UCC as a pre-nursing student. She felt that nursing was a stable field with strong career prospects. She spoke about taking care of her grandmother while she had cancer. She also spoke about her mother, who had gestational diabetes.

Throughout the semester, Milly worked in order to pay her rent and bills. She worked at a hair salon, but also made house visits for clients on the side. One of her clients was a speech writer for celebrities; Milly explained. “I did her hair at like 5 a.m., 5 o’clock in the morning I did her hair. Yeah, I had to get up at 3:30, my dad drove me because he didn’t want me to be outside by myself.” I asked how she was able to manage working all hours and then coming to school to take classes. “It’s an open market because I know people have to catch flights and you wanna look cute when you get off the plane, so it’s like...I understand.” The hours were a part of the job that Milly saw as part of her duties.

As the semester drew to an end, Milly wondered if she should withdraw from all her classes and return the following semester. For our last interview, Milly came without a backpack or any of her books, just a small purse and her phone clutched in her hand. “My whole family was trying to take the ride up here so I was late,” she said apologetically. Milly’s mother had undergone a surgical procedure, posing challenges to her day-to-day operations. “She can’t even shower by herself, I’ve been sponge bathing her for the past like two weeks,” Milly said. She felt pressured to make a decision within the week, before she would face financial aid consequences.

Milly had spoken to her academic advisor, who initially suggested that she not drop the classes. Upon hearing about her situation, however, he agreed that she needed some time away from school. “I had to literally put everything on hold. Like just stop, cold turkey just like literally had to put the brake on,” Milly said.

**Trina.** Trina was born in New York but grew up in South Carolina, in a small town called Travelers Rest. She was not sure where she wanted to go for college, so her mother suggested that she move in with her great-grandmother and great-aunt, who were living in New York. She agreed, wanting to move away from home, and decided to register for classes at UCC. Because this decision came 2 weeks before the semester began, Trina had to go through the late registration process.

During our second interview, Trina told me that her family was visiting from South Carolina the following week. Her mother and her three siblings—two sisters and a brother—would be driving to New York to visit her. They had already purchased tickets to a Yankees game. Trina was looking forward to the visit, sharing that she missed her family a lot. Her great-grandmother was sick and not very mobile. Trina did not have many friends in New York, and she often thought about her friends and family back in South Carolina. When I asked whether she had made friends in college, she told me that making friends in college was more difficult than making friends in high school. “Everyone sort of just does their own thing,” she said. “Or they know each other from high school.” Because Trina had not attended high school in the area, or even the state, she felt like it was harder for her to make friends.

When we met the week after her family returned to South Carolina, Trina confessed that she was not able to get any studying done during the week. She also missed classes to spend time

with her family. She and her family visited the Metropolitan Museum of Art and went to the Yankees game. She described the visit as being “really nice” and was sad that the family had left.

Trina did not purchase the chemistry textbook until well into the fourth week of school. When I asked her about this, she told me that she could not afford to buy the textbook, and felt bad about asking her great-grandmother or great-aunt for money because she knew that they were struggling financially. She had to wait until either her mother was able to send her some money or she could find a job. When her mother was able to finally send her the money, a third of the semester was almost already over.

**Kadiatou.** Kadiatou was born and raised in Guinea. At the age of 16, she immigrated to Brussels, where she lived for almost 7 years before coming to the United States 2 years ago. She moved to Brussels as a high school student. After completing high school in 2 years, she started university as a law school student, but quickly found that law school was not well-suited for her. “I don’t know what you call it,” she said, gesturing with her hands. “The...constitution. In French, it’s five books. It’s too much. Also, because I was an immigrant, it wasn’t easy for me to go and to be easily a lawyer...a lawyer among those White people.” Even though Kadiatou had become a legal resident in Brussels, she said she never felt like she was accepted as a person of color, and particularly as a Muslim woman who wore a hijab. She contrasted the freedom she had in Brussels to that of New York. Kadiatou felt that people of color had more challenges in Europe than in the United States.

Having grown up in Kenya, Kadiatou had learned French since she was 4. She was fluent in the language, and had no difficulty reading or writing in law school, yet as one of only two Black students in the law program, she felt discouraged by her professors and peers to continue her studies. “They knew I was from Africa,” she said. “They knew I was not like them.” Around

the time when Kadiatou began to have doubts about her prospects as a female law student of colors in Brussels, her sister introduced her to a man who was visiting Brussels from New York. If she agreed to marry him, she would move back to the United States with him.

Min: Were you excited?

Kadiatou: Yeah. Also stressed because I didn't know how it's going to be, being in America. In my religion, we are not allowed to date each other, like in relationship before the marriage. So I didn't know him. I didn't know him enough to explain to someone, "Oh, my husband is like this, is like that." I didn't know him exactly because I was living everything in Europe, like my six years life. I learned a lot of things there, so I was living it and coming in America with a new language, new culture, everything. It was really stressful for me.

Kadiatou experienced culture shock upon arriving in New York. Compared to Brussels, the city was crowded and loud. She missed the quiet back home and the food. "Even the croissants are so good," she recalled wistfully.

Still, she felt that what she liked most about living in the United States was the freedom. In Europe, she was not allowed to wear her hijab in school. Every morning, she had to remove it from her head in front of the school gate. After school, she would put it back on. "It was difficult. It was really, really, really difficult. Yeah. Really," she said, shaking her head.

Despite some of her reservations about life in New York, Kadiatou began to feel at home in New York after she and her husband settled in and recently gave birth to a baby girl. "I speak a little bit of English now. I can practice my religion like I want. I can speak like I want. I can go to school. And they help me to pay for school." Part of the reason why Kadiatou quit law school was because she was not able to pay for her tuition. Even though she was a legal resident of the country, there were certain majors that financial aid would not cover. At UCC, Kadiatou was receiving full financial aid, which she said was a great motivation to study. Two years ago, Kadiatou barely spoke any English. "Actually, I did ESL when I came. I spent six months to do it, but I left because I was pregnant. It wasn't easy for me to get out from my home and go to

school every day. I got diabetes. Gestational diabetes. I had to take my insulin three times a day. It was too much.”

When Kadiatou started school at UCC, her daughter was 6 months. When I interviewed Kadiatou, her daughter was 1 year, 7 months old. She told me it was a lot of work, juggling her role as a mother and a full-time student.

**Salma.** Salma’s family immigrated to the United States from Bangladesh through her uncle, who is a U.S. citizen. Salma did not speak English when she arrived in the United States as a tenth grade student. She did not have many friends, but she did have a cousin who was similar in age and lived on Long Island. The families would gather each weekend, and Salma was able to learn English through her cousin, who learned Bangla from Salma. When she graduated, Salma did not know the difference between a 4-year college and a 2-year college, and applied to both a 4-year state university as a computer science major and UCC, a 2-year community college, as a chemistry major. Because Salma’s passion was chemistry and also because UCC had a more convenient location—it was the college closest to her apartment—she chose UCC. Only after classes started did she realize that coming to a 2-year college meant that, eventually, she would transfer to a 4-year college.

In her first semester, Salma took developmental reading and English courses, in which she did well, and was able to successfully move on to college-level courses. In her second semester, she had to leave the country for a month for a pilgrimage to Saudi Arabia. A devout Muslim, Salma felt that the month-long pilgrimage was something important not only to herself but to her family, who accompanied her. She described the pilgrimage as an opportunity that so many Muslims look forward to and an experience that is remembered forever. She said that it had been a special time for her and her family, and she had no regrets about going. This,



however, resulted in her not attending classes for a month, which negatively impacted her assignments and midterm exams. While she did explain to one professor why she had left, she did not tell her other professors, thinking they would not understand or would think that she was just making excuses for not coming to class. She brushed it off, saying that she would make it up later.

Salma also shared she had chronic migraines that sometimes were so severe they impacted her studies. She took medication now and then, and wore glasses to alleviate the pain. Sometimes, the migraines became so bad that she had to miss classes and work. Salma worked for a Dunkin Donuts not too far away from UCC. She worked there 5 days a week in the afternoons and into the evenings. She was responsible for paying her phone bill and earning her spending money. She also contributed to the family's rent periodically.

**Summary.** Across the interviews, I found that the lives of all four participants were as complex as they were varied. While all four participants lived in New York and attended UCC, their life stories spanned different countries, life circumstances, roles, and challenges. In many ways, the details of their stories made them non-traditional students, but even that label did not adequately capture the complexities that made up their identities and colored their literacy lives. So often community college students are seen as underperforming students from low-income communities, yet those statistics do not fully reflect the artistic skills, linguistic backgrounds, cultural knowledge, and professional experiences of the students. Over the semester, it was very evident that the lives of all four participants were filled with literacy practices—in navigating the workplace, different languages, and even different countries, the participants were required to use language as a way to participate in specific discourses.

Each of the stories that the participants shared opened rich opportunities for authentic dialogue and an understanding of students' literacy journeys. Without a willingness of effort to learn about the students' life experiences and circumstances, learning would remain at a superficial level that fails to merge the boundaries of the personal and academic.

### **Using the Classroom Space as Meaning-making Space**

The second consideration in authentic dialogue in literacy instruction is an effort to make the classroom space conducive to meaning making. Even in the absence of an understanding and awareness of students' personal circumstances, the classroom space can still serve as an opportunity to engage in meaning making. In an attempt to examine instances of authentic dialogue in the classroom space, I looked at one of my observation field notes from one of the lectures:

*[from field notes]*

*There are 17 students seated in the class. One more student rushes in and takes a seat near the door.*

*The first topic of class is thermal chemistry.*

*The professor turns to the students. "Take a piece of paper, for example. Let's say I light it on fire. The paper will keep burning until there is no more paper. Here's another example: let's say I want to bake a cake. I put that into a pan and into the oven. Now what? Is it a cake? No, I gotta turn the oven on. Let's say the recipe says I need to put it in the oven. Let's say I turn on the oven for a few minutes. Is it a cake? No. There are two different mathematical processes for the chemical process that happens with the burning paper and the cake. In one, we take away heat—in the other, we are adding heat. The mathematics involved is thermal chemistry."*

*The heater is rattling loudly. I am sitting toward the back of the classroom with three other students. I have to strain my ears to hear the professor clearly. The female student on the left is reading through other unrelated papers and texting on the phone. The male student on the right has nothing on the desk except his cell phone. He leans back in his chair, looking at the professor. The male student in front of me to the right is using a tablet. He is on the Amazon website.*

*The professor, referring to last class's topic, says, "Let's go back to conversions. We are going to put this in practical terms. A woman is 5 feet 7 inches tall. What is her height in inches? There is a piece of information that is missing that should be in your head. This is an embedded question—meaning that they are more detailed than what you had in your test." He waits for anyone to offer an answer, but the class is silent. A few students are busily writing the question down. One student is taking a picture of the board. Most students do not write.*

*The professor continues. "We know that 1 inch is 2.54 centimeters. We know that 1 foot is 12 inches. How would we go about doing this?" The professor demonstrates on the board. "170 cm. How many meters is that? We have to divide by 100 = 1.70 meters. That's how we do metric conversions. To minimize human error, you want to put everything in one long calculation. Let me ask you another question. A man weighs 158 pounds. What is his weight in grams? Single conversion. Do you see the single conversion? Just write down the answer and we are finished. I'm just going to do a string calculation, not going to put an equal sign." The professor continues to write on the board.*

*The professor then moves on to a new topic: density.*

*The student on my right packs his bag and leaves. The professor draws two squares on the board. Trina, who is sitting near the window in the third row, takes out her phone.*

*The professor continues. "These are metals. They are the same metal. One is 20 grams and 5 mL. How do I measure volume? The next one is 160 g and it occupies 40 mL. Here's the question. Which one has the higher density or are they the same?"*

*The Power Point slide reads, "Density is the ratio of the mass of a substance to the volume occupied by that substance. The density of a substance is a physical property of a substance that does not depend on how much of the substance is present."*

*The professor asks, "What about in the case of an irregularly shaped object?" He draws a shape on the board. Now that we know the density of this metal, I wonder what kind of metal that was. So we have to look on the chart."*

*Another student leaves with her bag. The professor doesn't look her way although she is well within his peripheral.*

*"So what metal did I just discover? So what do we know about lead?" he asks. "We know that it has a density of 11.3. These numbers (density) is constant. Does not matter where you take it. That is a physical property. My sister, when we go swimming, she can float. Me, my feet sink. What does that mean? I am more dense than the water, and my sister is less dense than the water. It's like a piece of wood floating on water."*

*A student raises his hand. "What about salt water?" This is the same student who asks questions every week. Oftentimes, the professor will direct his questions to this particular student. He is a male student who seems older than most of the students in the class.*

*The professor shakes his head. "Salt water is different. Salt water has a higher density. See?" He writes the density of salt water and water on the board.*

*"What about the Dead Sea?"*

*The professor walks closer to the student. "The Dead Sea has so much salt." He gestures with his hands to show the volume. "If you walk through it, you can see chunks of salt. You will float in the Dead Sea. My friend went to the Dead Sea and sent a picture. He was just floating on water." He laughs.*

The class in the notes above captured moments that occur similarly in other classes. In this example, the professor provided different examples in the class. Presumably, this was to provide relatable examples to students to bolster their understanding of the content. In his interview, Billy emphasized the importance of making connections between examples and concepts. This may be his way of extending an invitation to apply concepts to an example that students can easily place or visualize. Billy used the example of baking a cake, posing questions that students were able to respond to (*"Let's say I want to bake a cake. I put that into a pan and into the oven. Now what? Is it a cake? No, I gotta turn the oven on."*).

The concept of authentic dialogue suggests that it is understood as an authentic encounter with another person and plays an important role in literacy instruction (Freire, 1970). In Billy's class, an effort to provide examples was evident, but this in itself did not constitute an authentic encounter. As the class, several students became disinterested and distracted. In the few minutes captured in the scene above, two students left the class. The lack of authentic dialogue did not seem to bother one student who continued to ask questions, but the majority of the class was unresponsive, many of them surfing the Internet on their phones and tablets.

## Dialogue With the Text

As part of the research, I asked students to submit lecture notes, textbook chapter copies, and lab reports. The purpose for collecting these documents was to examine student engagement with the text. I sought to observe any evidence of “dialogue” students had with the text.

Specifically, I hoped to find attempts or moments of decodification, the act of problematizing a codified object or situation, which Freire (1970) argued is necessary in order for students to reach a critical level of knowing. This process allows students to look more deeply at codified texts, making connections to reality and deeper theoretical contexts. At the end of the 15 weeks, I was able to collect the following, as presented in Table 3.

Table 3

### *Collected Literary Artifacts*

Participant	Lecture Notes	Textbook Copies	Lab Reports	Other
Milly	6	Chapters 1, 2, 4, 5	4	Index cards
Trina	9	No textbook	7	Photos
Kadiatou	12	Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9, 10	12	Copies of study guide with notes, notes from tutoring
Salma	8	Chapters 1, 2, 3, 4, 5, 10	8	Photos, Power Point copies

**Milly.** Milly’s textbook chapters were highlighted in yellow, orange, and pink. Most of the lines were highlighted. When I asked whether she had a system or method for highlighting, she said, “What I feel is important, like how I do it. This one is a bit excessive because, like, his definitions were so in depth that I felt like if I didn’t... If I missed one word, it would probably throw me off, ‘cause normally I’ll write out the whole thing and then I highlight one sentence that stands out to me that to me defines the whole word by itself.” Throughout the chapters,

whole paragraphs were highlighted. Some sentences were both highlighted and underlined with blue pen. Milly submitted four chapters, citing her frustration with the textbook as the reason for her no longer using it. Milly went back to the areas she had highlighted to prepare for the quizzes, but felt that the professor did not directly cite the textbook in the quizzes, which “threw her off.” After the third quiz, she said, “Still failed that one. I’m like I don’t understand.” When I asked whether it was possible to understand the content using only the textbook and lecture notes, Milly shook her head emphatically. “No,” she said without hesitation. Later in the semester, Milly stopped using her textbook, choosing to search for the topics in You Tube and Khan Academy. She continued to use index cards as flash cards, writing down concepts on one side and their definitions on the other side.

Milly grew increasingly unhappy about her lab professor and felt that this attitude toward the students was becoming a barrier for her in the class. After he told her that he could not read her handwriting, her attendance in the lab became spotty and she did not hand in several of her lab reports. After her mother’s surgery, Milly stopped going to the lab altogether, voicing concerns that her long absence would be openly criticized by the lab professor. She started to calculate the percentage of the lab component in the course and tried to figure out if she could still pass the class without attending the lab.

**Trina.** Trina did not purchase a textbook until later in the semester. When she did buy it, she did not use it. The lecture notes that she submitted were notes of the Power Point slides that the professor distributed to the class. In her first interview, Trina confessed that she did not look at her lecture notes because she had difficulty interpreting them. Sometimes, she was not able to complete the notes because the professor moved on to the next slide and she was not able to keep up. She did continue to take notes, though, because she felt that she should. When the Power

Point slides were too long, she would take pictures of the screen and save them on her phone. She told me that she sometimes looked through the pictures, but they were not very helpful. “Sometimes I have no idea what day they are from or, like, what order they are in. It’s confusing,” she said.

**Kadiatou.** Kadiatou’s textbook was filled with symbols that she said she learned from a developmental reading class she took when she first enrolled at UCC. Central concepts were underlined, examples were marked with “ex,” and arrows indicated relationships. There were also notes in the margins. Sometimes the notes were questions like “What is this?” “How does this relate to the idea?” Other times, notes were written in French. Kadiatou referred to the notes as a “conversation with herself.” She laughed and said, “No one can understand it but me. It’s like a code, you see?” she pointed to the scribbled notes on the side. She had one notebook for all her chemistry notes, the first half of her notebook from the class and the second half from her tutoring sessions.

Most of Kadiatou’s lecture notes were annotated, like her textbook, of which she said, “I have to read it with the textbook and all of the papers I have. It’s like reading, reading, reading and thinking, thinking, reading, reading, thinking. Just read and then you will continue reading. You will be able to understand.” When Kadiatou came across an item in her lecture notes that she did not understand, she would go to see a tutor or visit the professor during his office hours to ask about the particular topic.

**Salma.** Salma’s textbook was sparsely marked, as Salma said that annotating distracted her. However, a few chapters had sentences underlined and minimal margin notes. Salma’s lecture notes were mostly filled with application problems the professor posed in the class. Her notes showed that she attempted to solve the problems by herself, and then added notes based on



the professor's solution. Salma did not write much about the concepts but did print out all the Power Point slides and kept them for reference in her folder. Like Trina, Salma also had photos of the whiteboard stored in her phone. "I am lazy," she told me. "Sometimes I don't feel like writing all the things," she said. There were about four chapters of missing lecture notes, which was due to her absence in the class when Salma traveled to Saudi Arabia.

### **Summary**

Compared to the students' interviews, the literary artifacts were not as revelatory. Some of the students took more detailed notes than others, but the notes alone did not reveal thoughts or questions they might have had. Initially, I had hoped to observe a process of decodification, but in the underlined passages and lecture notes, such interpretation of text was not apparent. One point of interest was the choice to take photographs of Power Point slides and the teachers' notes on the board instead of writing down notes. When the photos were sent to me through email, I found that it was difficult to arrange the photos in the order they were taken. This challenge raised questions about how the students navigated and/or returned to the photos they took. In some cases, the photos were taken in addition to notes they recorded in their notebooks, making the task of reviewing notes even more formidable. In addition, several of the notes were reiterations of the Power Point slides that the professor posted on Blackboard, which the students already had. Many felt obligated to take notes of the information on the white board, born out of habits that preceded college, but it was also clear that many of the notes were incomplete and had not been revised after the class. The lecture notes also highlighted that the writings did not necessarily show a processing of the information, but rather a literal documentation of the writings on the board.

However, the notes and photos did show a tactile manifestation of the students' motivations. Even in moments in which the students said they were not following the class or were "zoned out," there were clearly actions that were taken on the part of the students to be a part of the classroom conversation. It was evident that the students' conscious decisions to document lecture notes, annotate texts, and record photographs of the white board reflected a desire on the students' part to preserve literary documents. In this, I observed a valuing and affirmation of literary documents and texts as having value, or capital, in the classroom and in the discipline of chemistry.

## CHAPTER V – DISCUSSION

### Introduction

The need to examine, challenge, and strengthen literacy instruction at the college level continues to be critical. As research across states have shown that the majority of students entering college are not proficient in reading, the reality and consequences for community college students, who face more socioeconomic and academic challenges than their 4-year college counterparts, become even more serious. Even with an awareness that college students are unprepared to take on college-level texts, there is a hesitation about addressing literacy instruction or even considering the factors that may facilitate literacy learning. Many professors still hold fast to the notion that reading is a basic technical skill students should have mastered before coming to college and, therefore, it is not the responsibility of college professors (Gough, 1983). College professors think of themselves as experts in their field and tend to defer much of literacy instruction to English professors. My study examined the notion of intimate literacy, which transcends the basic ability to read and write, but is close participation in disciplinary discourse where a student makes personal connections to spoken and written forms of texts. More specifically, the research sought to identify the factors that facilitate students' intimate literacy in a chemistry course. By examining and describing the beliefs and practices that shed light on these factors, my study aimed to contribute to the body of research in literacy instruction in higher education. Most importantly, I hoped to highlight strategies that can increase the course success rates of community college students.

This chapter summarizes the study's findings. I then discuss the significance of the findings and describe the implications of my study on practice and research. Next, I acknowledge

the limitations of my study and discuss directions for future research. Finally, I conclude with a reflection of the participants involved in my study.

### **Summary of Findings**

The research study began with two research questions that I hoped to investigate through interviews, observations, and document analysis. I wanted to examine how students navigated college-level texts in an introductory chemistry course at an urban community college, and what reading strategies and skills students used to comprehend texts. Through a random sampling based on voluntary participation, I identified four students taking the same basic chemistry course at UCC to participate in the study. The recruitment process began with a recruitment email and flyer that were distributed to the class at the beginning of the semester. I described the study and the number of hours volunteers were expected to commit to interviews. I also explained that various artifacts, like lectures and textbook copies, would be collected. I met with all four participants three times each for 1 hour each time. All interviews were audio-recorded and later transcribed. The timing of the interviews varied; some took place early in the semester while some of them were held later, near the end of the semester. Due to the participants' personal schedules, travel plans, and personal issues, we scheduled the interviews according to their availability. Throughout the 15-week semester, I observed the 3-hour chemistry course, recoding field notes and developing them into observation memos. The professor teaching the class met with me casually on several occasions, but only twice for a formal interview. While the class and the students were brought up in conversation outside of the formal interviews, I used only data from the audio-recorded interviews.

Through the triangulation of data from interviews, classroom observations, and document review, the participants revealed their beliefs on learning and literacy. Several of them shed light

on literacy practices both in and outside of the school, expanding and reshaping notions of literacy. Over the semester, the participants also shared their educational and personal backgrounds, which greatly shaped their academic experiences. As I hoped to look at literacy not just as the ability to read but as a more authentic social discourse in a discipline, the personal experiences of the participants were integral to shaping my understanding. The students' involvement in the chemistry class and, simultaneously, in formal interviews revealed three central themes that have significant implications for literacy instruction at the college level: valuing students' out-of-school literacies, facilitating authentic dialogue, and envisioning literacy instruction across the curriculum.

### **Valuing Students' Out-of-school Literacies**

Through the analysis of data, the participants shared that they had complex and rich lives outside of the school. They were taking care of parents who were dealing with illnesses, they were parents to young children, and they had relocated from different countries and cultures. They also had religious duties and employment that were not always compatible with the expectations and schedule of school. I found that navigating these complex lives and roles afforded the students' opportunities to develop various literacies. In examining how students navigated college-level texts, I learned that the recognition of students' out-of-school lives and literacy practices is essential, as they largely guide the literacy practices demonstrated in school.

In large classrooms, it is easy to overlook the fact that each student carries with him or her a unique history and background that shape his or her beliefs, participation, and decisions in the classroom. Moje et al. (2000) wrote:

First, we often lump learners into a one-dimensional mold called individual, or we classify them in a group with all members having the same characteristics. Instead, one needs to understand the learner as a person with multiple identities: an individual that is

at one moment a daughter; in another instant, a girlfriend; a disengaged learner in chemistry class; and a focused learner in psychology class. (p. 166)

For example, Milly had experience working at a funeral home, but also was a caretaker for her grandmother who had cancer. Her motivation to study nursing was inspired by these experiences, in which she had taken a hands-on approach. As a college student, she also was working as a licensed hair stylist, juggling a demanding schedule with her studies. Through the many roles she was managing, Milly was developing an understanding of her own abilities and interests. During the semester, Milly's mother underwent a surgical procedure, which placed Milly in a position to take care of her mother. This required Milly to assist in her mother's day-to-day functioning, from helping her bathe to preparing meals for her. Milly never shared this with her professor because she did not feel she had a relationship with him. Instead, she went to her adviser to discuss the possibility of withdrawing from her classes.

Trina had grown up in South Carolina, and recently decided to move to New York to attend UCC. Trina was living with an aging and ailing great-grandmother and great-aunt. It was her own decision to move to New York, yet she felt lonely and homesick. She did not know anyone else in New York and felt self-conscious in class. When her family visited from South Carolina, Trina missed a week of school. Trina also shared the love for reading that she had as a high school student, one that waned when it became "uncool" to like reading.

Kadiatou was a new mother and had only been in the United States for 2 years. She had lived in Europe for many years and was a former law school student. As a Muslim student, she had experienced feeling oppressed by school rules that did not allow her to wear a hijab in Europe. With all four students I interviewed, I found that their sense of identity came from the roles they managed, their backgrounds, and the experiences that enriched their lives. At the time of the interviews, Kadiatou's daughter was not yet 2 years old, which meant that Kadiatou had to

spend many hours a day taking care of her baby. For Kadiatou, English was a foreign language, one that she was still trying to learn, but she was fluent in French and Fulani.

Salma enrolled in UCC without knowing how a 2-year college was different from a 4-year college. She was majoring in chemistry because members of her family had occupations in medicine, engineering, and pharmacy. She told me about a stigma that existed in her home country of Bangladesh: all the “smart” students studied science while the “B and C students” chose art or commerce. This stereotype guided much of Salma’s insistence to study science. Salma worked 5 days a week and also traveled to Long Island every weekend to participate in family gatherings that included uncles, aunts, and cousins. As a Muslim, Salma’s month-long absence from school was due to a pilgrimage to Saudi Arabia with her family.

In different ways, the participants demonstrated that their backgrounds had shaped their beliefs and were continuously shifting. In the interviews, they shared that their out-of-school lives were critical in their learning, as they involved family, work, and health issues. Langer (1987) suggested, “As learners assume ownership for their literacy activities...they are in a sense learning to master themselves—they gain control of their own abilities as literate thinkers and doers, using language to serve their own needs” (p. 7). As such, the students’ stories were as diverse and unique as the participants themselves were, yet the wealth of information and resources their personal lives afforded were not invited into the academic space.

The professor shared his beliefs of the students, which painted a different picture from the one the students shared with me: they were unmotivated and lacked logic. This belief was based on his observations of the students’ failure to complete homework assignments and perform well on quizzes. He also pointed to the fact that many students did not purchase the textbook. On the subject of the multiple roles the students juggled, the professor believed that the

students were “busy,” but he was not aware of the complexity of the students’ lives. There were assumptions about their study habits, capabilities, and motivations that overlooked the literacies they demonstrated in other areas of their lives. At one point, the professor confessed that he did not know what to do and wondered how he could get the students more involved and engaged.

### **Facilitating Authentic Dialogue**

Of the four participants, Salma was the only one who actively sought out continued interaction with the professor. She went to see him during his office hours and also waited after class to ask him questions about the lecture. She was persistent in seeking him out because she felt that he was best suited to provide her explanations. Salma described her interactions with the professor positively, attributing them to her success in the class, despite her long absence toward the end of the class. While Salma did not ask questions in class or used the classroom space to initiate dialogue, she was comfortable about talking to the professor. Salma felt that she had an identity in the discipline of chemistry, evidenced by her childhood fascination with chemistry and her family’s history of scientists. She was determined to do well because she rationalized that she had “always liked chemistry.” She did not feel that her questions were irrelevant nor was she embarrassed or self-conscious about asking the professor questions. Salma always facilitated the interactions with the professor.

Milly, Trina, and Kadiatou did not have incidents of authentic dialogue, particularly Milly and Trina, who did not have any interaction with the professor and often forgot his name. They viewed him as an imposing figure who was not necessarily committed to the students’ success. Milly brought up the fact that he was purposely trying to keep the students from progressing in the course, as evidenced in his method of posing quiz problems. Milly felt that the examples the professor offered in the class were not relatable and she did not feel that he was



supportive of their learning. She voiced frustration about his lack of awareness of the students' level. This was highlighted in the way he did not take breaks during the 3-hour class and the cryptic way in which he explained concepts. Milly believed that the professor did not know many of the students did not have prior exposure to chemistry. Trina did not ask questions, even when she did not understand the lecture, preferring to "look it up later." She pointed out that she was shy and did not feel comfortable asking questions in class.

In my observations of the class, it was difficult to see authentic dialogue take place. The 3-hour lectures mostly consisted of the professor explaining concepts, during which he did not ask students for feedback. When he did ask for questions, students mostly did not respond, to which the professor would nod and move on. One student in the class of 24 students continued to raise questions in class, but most of the students did not. At the beginning of class, the professor called attendance, during which he did not facilitate conversation with the students. Over the 15 weeks of classroom observation, the professor seldom referred to the students by their names.

The definition of authentic dialogue orbits around a fundamental understanding that there is a willingness on the part of the teacher to become a learner (Rogers, 1983). Through mutual trust and interest, both student and teacher create an atmosphere in which authentic dialogue takes place. While most teachers would agree that they are invested in students' academic learning, it is important to note the distinction between wanting students to perform well in a course because teachers feel that students' performance is a reflection of their teaching and having a genuine intent to affirm and foster students' identities. In the interviews with the professor, he expressed several times that he was not sure what to do in order to raise students' quiz scores.

The professor spoke about an experiment in which students completed a self-evaluation about their study practices, which he hoped would shed light on how students viewed themselves as students. Here, the teacher continued to question problems and areas of improvement in the students, viewing them as individuals coming to college with deficits. More problematic is the view that the problem solely lies in the students, and not in the beliefs and teaching practices of the professors. If literacy incidents are the product of the social practices and conditions that facilitate an authentic transaction between the reader and the text, then the role of the teacher becomes essential in this process. Yet, the professor did not ask for opportunities he had as a teacher to facilitate authentic dialogue in which a trust relationship can be established. This kind of authentic dialogue was cultivated in the case of Salma, but this was due to the agency the student, not the teacher, demonstrated.

### **Literacy Instruction Across the Curriculum**

Each participant depicted a different relationship with reading. Some were explicit in stating that they did not like to read, while others described reading as a hobby. Here, the participants were referring to reading for pleasure, as the examples they provided were young adult novels and fantasy novels. Whether they enjoyed reading or not, all four of the participants acknowledged that reading the chemistry textbook was a challenge. All of the participants identified topics and chapters that were especially confusing for them. Like most secondary students who struggle with academic reading, the problem was not decoding. Most struggling readers at the secondary level require knowledge of the world, texts, and disciplinary discourses needed to understanding texts (Allington, 2001; Delpit, 1995; Freedman, Flower, Hull, & Hayes, 1995; Hillocks, 1995; Pearson, 1996). Through transactions between readers and texts in particular contexts, meaning making occurs which, in turn, develops students' metacognitive

awareness (Rosenblatt, 1978). While the argument persists that transactional processes predominantly take place in fiction novels, in which an interpretation of the literature is central, I argue that there is a place for interpretation and inquiry in chemistry as well. In Kadiatou's questioning of the application of saline solution to her daughter's dehydration, it was evident that science, too, was a discipline rich with inquiry and claims.

Many secondary teachers resist teaching reading either because they believe that teaching reading is not their job or because their discipline poses contextual constraints (Alvermann & Moore, 1991; Moje & Wade, 1997). At the college level, this sentiment proved to be even stronger. Even the professor referred to himself as "not a reading person," identifying only as a chemist. Yet, there was a shared recognition among the participants and the professor that some form of literacy instruction was needed. In an attempt to develop the skills to navigate the text and, more largely, the course, the participants relied on different forms of supplemental resources. Milly and Trina turned to You Tube and Khan Academy, through which they were able to access simpler definitions and explanations of concepts. While this temporarily seemed helpful (Milly was able to bring up one of her quiz scores), the online resources and platforms did not sustain any authentic textual relationship. The example highlights that literacy is more than the simple acquisition of knowledge, but involves a critical reflection on assumptions, values, and beliefs that ultimately leads to a transformative process (Mezirow, 2000).

In analyzing the interviews, I learned that the participants also went to the tutoring lab to seek assistance in the course. Compared to online resources, tutorial support theoretically did offer opportunities for authentic literacy learning, but because of the constraints posed by the crowded nature of the tutorial lab, and the fact that most of the tutors were peers themselves rather than experts, tutoring was not effective in facilitating the same kind of dialogue that the

professor could have. This was problematic when a student went to the tutorial lab with a particular topic in mind, and the tutor was able to provide a description of the topic but failed to make a larger connection between the topic and the discipline.

### **Significance of Findings**

The findings of this study highlighted the conditions that facilitate intimate literacy—an authentic dialogue between students and texts and, more largely, disciplinary discourse. The students in the study represented a diverse population of students at UCC, a community college in New York. The students were enrolled in a basic chemistry course, which is required for students in the pre-nursing program, one of the two most sought-after majors. The course, which ran 22 sections in the semester I conducted the study, historically had low passing grades. A large number of the students who passed the course passed with a D, which did not prepare them well for the next course in the sequence. The study's findings illuminated the need to rethink literacy instruction in higher education, which is currently only offered formally through developmental education. In the data that I analyzed, it was evident that literacy instruction was not a component of the chemistry course, although the need to cultivate it was recognized.

Literacy is often viewed as a literary term, and while it is true that literacy refers to reading, writing, and speaking practices, it applies to all disciplines which, inherently, are communicated, articulated, and organized through a system of written or spoken language. Therefore, the development of literacy across disciplines is vital yet difficult to observe. I could see that over the semester, students grew increasingly concerned about their test scores and whether they would pass or fail the course, but there was not nearly the same kind of concern about whether students had developed an identity in chemistry or whether an authentic relationship with the discipline had been cultivated.

Literacy and reading instruction have been studied extensively at the middle and secondary level (Allington, 2001; Alvermann & Moore, 1991; Atwell, 1998; Moje & Wade, 1997). However, literacy research for college students tends to focus more on basic skills. While developmental reading is an area rich in opportunities for literacy instruction, continued and sustained education is needed across the curriculum, not just in reading classes. The findings showed that even in chemistry courses, higher critical thinking skills need to be taught rather than technical skills. Delpit (1995) confirmed:

Students need technical skills to open doors, but they need to be able to think critically and creatively to participate in meaningful and potentially liberating work inside those doors.... Yes, if minority people are to effect the change which will allow them to truly progress we must insist on “skills” within the context of critical and creative thinking. (p. 19)

In the interviews with the professor, I found that he did have a genuine interest in learning how students learn and did want the students to perform well. At the same time, there seemed to be a lack of understanding of the role and importance of authentic dialogue between teacher and student, student and text, and student and discipline. I found that this was not unique to Billy, the professor I interviewed, but it was a common issue with many science professors in higher education. Many science professors consider themselves experts in their field, having become professors after working in research, but do not see themselves as literacy teachers. Therefore, they see their job as teaching content. This seems to pose a tension between the expectations of the professor and the instruction.

On one hand, the expectation is that students would read the textbook and, consequently, comprehend the subject matter. The professor in this study referred to the act of reading the chemistry textbook as making connections; as students read, the text would activate recall of other concepts, and a web would be established in the students' minds. Yet, this expectation is

premised on the idea that students are engaging in a transactional relationship with the text, forming understandings and responding to the text rather than simply decoding words. Even when it was believed that students were not making the kind of critical connections that demonstrate literacy of the discipline, the instruction methods did not change. The findings illuminated that simply turning to online resources that reiterate the text in simpler language does not increase critical engagement with the subject matter. In the absence of authentic dialogue and intimate literacy moments, engagement continues to be a challenge.

Some of the participants grew increasingly frustrated and uninterested as the semester progressed. They did not understand the concepts, they were not performing well on the weekly quizzes, and they were bored in the class. They did not see the professor as someone who was dedicated to their learning. In turn, the professor also had not learned their names. The students who felt they learned a lot from the class developed a system for navigating the course; they established a system for communicating regularly with the professor or were motivated by the support they received from their families. Even so, when the student was missing from the class for a month, the professor did not contact the student. This study highlighted the importance of and necessity for authentic dialogue in developing literacy in higher education. Such authentic dialogue is not defined by discussions or conversations that revolve only around personal circumstances, although such circumstances should be of interest to the teacher. Rather, an engagement of questions of how teachers can help students grow and develop (Noddings, 2003) and a conveyance of why and how the subject matter holds currency in the real world or in the lives of students can draw students into authentic dialogue. Rather than teaching chemistry as an unmovable set of concepts that are not contextualized, teachers can view chemistry through the lens of literacy. By posing questions about the discourse of chemists and ongoing inquiries in the

field, students can begin to view the discipline as evolving and constantly shifting. Instead of searching for answers, students can focus on meaning making.

Another area of tension that surfaced during the interviews was the issue of motivation. The professor, who was born and raised in New York like many of the students, compared his own upbringing and experience to those of the students. He shared with me that he, too, had faced economic and academic challenges, and had to juggle work and school. At one point, he was unemployed and had to apply for government assistance. He had attended a local Catholic high school in New York that many of the UCC students also attended. Reflecting on the similarities he and the students shared, the professor concluded that because he was able to be successful, the students should be able to be so as well. The only thing, he believed, that kept the students from attaining that success was lack of motivation. This assumption was problematic because it did not contextualize living in New York. The racial, social, and political circumstances of the area around UCC, not to mention the individual differences between the students and the professor, are different today than they were more than 40 years ago. The findings of this study showed that the backgrounds of the students are vastly different and require contextualization. By understanding that the experiences and backgrounds of students not only play a critical role in the development of their identities, but also have a considerable impact on their beliefs, attitudes, and decisions in their academic lives, teachers can rethink teaching practices and methods. Without a sufficient understanding of students' backgrounds and histories, it is almost impossible for teachers to tap into their funds of knowledge (Moll, 2000). For college professors, this may require a rethinking of the role of the instructor. In interviews and conversations with professors, it was clear that, for many, the role of college professors was different from that of secondary teachers because of the distant nature of professors. There

seemed to be an understanding that college-level instruction does not require a more intimate and authentic relationship between professors and students because of the expectation that college students do not need the level of guidance and individual instruction that middle and high school students do.

### **Implications for Teachers**

Many theorists have examined how knowledge, identities, and beliefs are constructed both in the classroom and through classroom discourse (Gee, 1993, 1996; Gee, Michaels, & O'Connor, 1992; Hicks, 1995; Kelly & Crawford, 1996; Luke, 1995). By recognizing that discourses shape the construction of what counts as knowledge, the dynamics between people, and identity, then the acquisition of disciplinary concepts becomes secondary to understanding the way in which discourses are shaping students' beliefs, attitudes, and actions. Language in this context is more than a written or spoken form of communication; it is shaped by and shapes students' participation in disciplinary discourse. Moje (1997) suggested the following: "We should examine how, as teachers and students engage in these discourses, they reproduce or construct particular assumptions about what counts as knowledge in a discipline and about how teachers and students should interact in classrooms and schools" (p. 35).

One of the challenges for teachers may be that in the traditional classroom setting, teachers often do not make their beliefs and assumptions explicit; they simply see themselves as conveyers of disciplinary knowledge. As a result, they themselves may be oblivious to how their perspectives and instructional methods may be shaped by a particular discourse in academia that does not always take into consideration the unique populations of students in their classroom. This further alienates and isolates students whose social networks value different kinds of discourses (Gee, 1996). Particularly at UCC, an institution that has a majority-white faculty



teaching a student population largely of color, the disconnect between the expectation of the teachers and students became a problem.

In this research study, the student participants shared different views of the professor. Most of the students did not see the professor as someone who had a vested interest in them and their learning. One student did actively interact with the professor outside of class, but even in this case, the student had initiated communication. Rather than an authentic dialogue in which the teacher also considered rethinking this instructional method and how students' identities could be influenced by the discourse when taught in meaningful ways, the teacher remained a distanced figure who provided disciplinary knowledge to those students who sought it. The professor, who was aware that students were struggling in the class, attempted to examine some of the barriers the students faced in his class. In doing so, he focused on the weaknesses in the students. While his beliefs of the students did highlight some of the challenges that many community college students face, exposing these problems does not answer the question of how, as teachers, we can enhance students' literacy learning. With the understanding that literacy is shaped not only by student-text relationships but by social discourses, in which teachers play an integral part, it is necessary for teachers to re-examine their beliefs and how those beliefs shape the way content is delivered and students' identities are affirmed in the classroom space.

Intimate literacy incidents occurred when students felt a personal connection to the course, subject matter, or text. Most of them were facilitated by the professor, when he was able to use chemistry to shed light on the students' lives and circumstances. This kind of authentic dialogue requires a commitment on the part of the teacher to learn more about his or her students and the willingness to take on a student lens. When the teacher becomes a learner, the teacher is able to acknowledge some of the challenges students encounter as they wade through unfamiliar

spaces. By getting to know about students, their histories, and the social, political, cultural backgrounds that shape who they are, teachers are able to gain new perspectives of the implications of their disciplines for students. The academic discipline and the discourses embedded in them become real and applicable, rather than remain as foreign concepts. Only when this happens can we create conditions that facilitate literacy events, which shape students' literacy learning and identities as students in various disciplines.

### **Implications for Developmental Reading Instruction**

Throughout the data collection and analysis process, I became certain that teaching isolated reading skills and strategies does not increase students' literacy. Many reading programs state that critical thinking is one of the goals and objectives of developmental reading instruction, and highlight that specific reading strategies will prepare students to think and analyze texts critically. However, when thinking about how the goal of literacy instruction is not simply to comprehend and make inferences in a text, but to be able to participate in a larger discourse, it is necessary to expand notions of critical thinking. In order for meaningful literacy and deep learning to take place, an identity shift must take place. Gee (2007) wrote:

All deep learning—that is, active, critical learning—is inextricably caught up with identity in a variety of ways.... People cannot learn in a deep way within a semiotic domain if they are not willing to commit themselves fully to the learning in terms of time, effort, and active engagement. Such a commitment requires that they are willing to see themselves in terms of a new identity, that is, to see themselves as the kind of person who can learn, use, and value the new semiotic domain. (p. 54)

If it can be acknowledged that these identities cannot be separated from the discourses in which they are participants, then this calls for the need to rethink developmental reading instruction. Of course, participation in disciplinary discourses requires knowledge and the skills and strategies needed to navigate them, but when developmental education is criticized for placing too much emphasis on decontextualized skills and strategies, it is worth asking how to

teach developmental reading with the aim of identity shift. For so long, developmental reading has been viewed as a way of helping students “catch up,” yet this study showed that even when students were “caught up,” they were not always ready to participate in the discourses of the sciences. The four participants in the study, as well as all the students registered in the chemistry course, were proficient readers as far as reading assessments were concerned. While they were able to decode and extract information from the texts, this did not necessarily mean that they all had a level of literacy in the chemistry course.

Developmental reading instructors, rather than focusing only on *how* students read, should be equally concerned with *what* students read. While the goal of reading instructors is not to teach content, all texts must be contextualized. In the student interviews, I found that the participants, to varying degrees, applied basic reading strategies that developmental reading courses are centered on, like highlighting, identifying main ideas, and annotating. Moreover, while these habits can be seen positively, the more urgent and critical question is: Are students employing contextual knowledge and situating the text in a larger discourse? In order to achieve this, developmental reading instruction can be taught in new and interesting ways that reflect disciplinary discourse. By employing the use of multiple texts (Shanahan & Shanahan, 2012), instructors can reveal a textual dialogue between and across texts. These kinds of multiple perspectives allow students to see that what counts as knowledge is not unmovable but is shifting and constantly challenged. Some of the participants in the study saw chemistry as a subject that involved a number of concepts and theories they had to memorize. Their beliefs and participation only mattered to the degree that they were able to acquire the concepts.

If we are to accept that reading is a challenge for college students, and particularly community college students, it is imperative that we begin to reimagine ways in which

developmental reading instruction espouses the idea that reading is more than just a set of skills; rather, it is a part of the language that students understand and wield as participants of a larger disciplinary discourse.

### **Research Limitations**

I acknowledge that this research project has its limitations. Nevertheless, the limitations of this study do not minimize the significance of the findings or the implications it has for the field. The first limitation in the study regarded the participants in my study—the sample size, the lack of male students participating in the study, and the different levels of exposure the students had to chemistry make it difficult to generalize the findings. Since the sample size was small and limited to one setting, the findings cannot be generalized to every community college. However, due to the thick descriptions of the findings of my study (Merriam, 2009), some of the findings may be applicable to different school contexts. In addition, the professor I selected in this study was a Caucasian male professor. A study with a professor of color or a female professor may have yielded different findings. This factor, however, does not change the study's findings that highlight a fundamental problem that exists in the way many science professors view their role in the development of students' literacies.

Another limitation was the nature of the class, which allowed for very little interaction between students. Peer interaction can be an important factor in learning, yet the classroom space did not afford students opportunities to engage with one another. I later learned that students interacted more with each other during the lab class, which I did not observe. A study examining peer interaction in the labs might reveal interesting findings on how peers can support each other's literacy learning.

A deeper understanding of how students navigate texts in college courses could have been developed if the study looked at different course sections of the same class, or if it had spanned several semesters. A longitudinal study with multiple interviews with students, instructors, and tutors would have shown rich data of what facilitates intimate literacy events in a chemistry course. Nonetheless, in 15 weeks, the students and professor shared a great number of their personal, cultural, and social beliefs on learning, reading, and teaching.

### **Directions for Future Research**

The findings from my study represent the beliefs and practices of a small number of participants at a particular site during one semester. Future studies could be conducted with different professors, different students, and different courses. An examination of a more advanced chemistry course might reveal interesting findings that offer new strategies and methods to teach chemistry with a focus on literacy. Additionally, a longitudinal study of the students who begin in developmental reading and progress to the basic chemistry course observed in the research study, then to the advanced chemistry course would illuminate the long-term literacy learning processes of students.

When I learned of some of the participants deciding to drop or withdraw from the course, I wondered whether additional support in the form of tutors or advisement might have influenced the decision to leave. A qualitative study examining the correlation between lack of support and withdrawal rates for students withdrawing from courses would look closely at these factors. These studies would shed light on a challenge that is widespread at UCC, and the results may initiate a change in the way that chemistry is taught at the college level. More importantly, they may call for a change in the way reading at the college level is viewed. Rather than believing that

reading instruction is limited to instructors with literacy backgrounds, such research may call for a need to teach literacy in all disciplines.

### **Conclusion**

It was a privilege to participate in the research project with the student participants. I gained so much knowledge by listening to their beliefs, histories, and experiences, and was greatly inspired by them. In their honest sharing of the responsibilities and roles they juggle each day, the students exhibited a wealth of knowledge and navigational skills. It was evident that they had out-of-school literacies that were often unacknowledged in the school space. Although the course was only 15 weeks, I was able to get to know many of the participants personally due to their willingness to share, even when the examples were not always positive. Discovering the students' passions, fears, and goals revealed to me their hopes and dreams as students; their concerns demonstrated the barriers they encountered. In the process of hearing their stories and observing them in the classroom, I became more aware of and sensitive to the challenging external conditions that make schooling difficult for students. In addition, I was able to reflect on myself as a teacher. I wondered if I, too, without intending, had imposed false assumptions on students and their potential to succeed.

The findings from my study offer a look into the beliefs and practices that shape the literacy experience of students in a chemistry course at a community college. I hope that this study can shed light on the literacy journey of other students across the nation who feel frustrated in college courses. More information is needed on literacy instruction at the college level, and particularly for students in content area courses. It is my desire that this study contribute to a redefining of the notion of literacy and a growing number of studies that recognize that true and authentic literacy can only be achieved when students' identities are affirmed and fostered.

## REFERENCES

- ACT. (2008). *The forgotten middle: Ensuring that all students are on target for college and career readiness*. Iowa City, IA: Author.
- ACT. (2011). The condition of college and career readiness 2011. Retrieved November 12, 2011, from <http://research/policymakers/cccr11/pdf/ConditionofCollegeandCareerReadiness2011.pdf>
- ACT. (2013). The condition of college and career readiness. Retrieved from [www.act.org/condition/2013](http://www.act.org/condition/2013)
- Adelman, C. (1999). *Answers in the toolbox: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC: Office of Educational Research and Improvement, U.S. Department of Education. Retrieved from <http://www.ed.gov/pubs/Toolbox/toolbox.html>
- Allington, R. (2001). *What really matters for struggling readers: Designing research-based programs*. New York, NY: Longman.
- Allington, R. L. (2002). What I've learned about effective reading instruction from a decade of studying exemplary elementary classroom teachers. *Phi Delta Kappan*, 83, 740-747.
- Alvermann D., & Moore, D. (1991). Secondary school reading. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research* (Vol. 2, pp. 951-983). New York, NY: Longman.
- American Institutes for Research (AIR). (2006). New study of the literacy of college students finds some are graduating with only basic skills. Retrieved from <http://www.air.org/news/documents/Release200601pew.htm>
- American Youth Policy Forum. (2009, August). *Moving English language learners to college- and career-readiness*. Issue Brief. Washington, DC: Author.
- Antonenko, P., Jahanzad, F., & Greenwood, C. (2014). Fostering collaborative problem solving and 21st century skills using the DEEPER scaffolding framework. *Journal of College Science Teaching*, 43(6), 78-87.
- Apple, M. W. (2004). *Ideology and curriculum*. New York, NY: Routledge Falmer.
- Arendale, D. (2005). Terms of endearment: Words that define and guide developmental education. *Journal of College Reading and Learning*, 35(2), 66-82.
- Atwell, N. (1998). *In the middle: New understanding about writing, reading, and learning*. Upper Montclair, NJ: Boynton/Cook.

- Attewell, P. A., Lavin, D. E., Domina, T., & Levey, T. (2006). New evidence on college remediation. *Journal of Higher Education, 77*(5), 886-924.
- Ausubel, D. P. (1968). *Educational psychology: A cognitive view*. New York, NY: Holt, Rinehart & Winston.
- Bailey, T., Jeong, D. W., & Cho, S. (2009). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review, 29*, 255-270.
- Bazerman, C. (1985). Physicists reading physics: Schema-laden purposes and purpose-laden schema. *Written Communication, 2*, 3-23.
- Beck, I. L., McKeown, M. G., Sinatra, G. M., & Loxterman, J. A. (1991). Revising social studies text from a text processing perspective: Evidence of improved comprehensibility. *Reading Research Quarterly, 26*, 251-276.
- Bedore, L., & Peña, E. (2008). Assessment of bilingual children for identification of language impairment: Current findings and implications for practice. *International Journal of Bilingual Education and Bilingualism, 11*, 1-29.
- Beers, K., & Probst, R. E. (2013). *Notice and note: Strategies for close reading*. Portsmouth, NH: Heinemann.
- Best, R. M., Rowe, M., Ozuru, Y., & McNamara, D. (2005). Deep-level comprehension of science texts: The role of the reader and the text. *Topics in Language Disorders, 25*(1), 65-83.
- Blair, L. (1999). Reading across the region. *SEDLetter, 11*(1). Retrieved October 31, 2007, from <http://www.sedl.org/pubs/sedletter/v11n01/>
- Boatman, A., & Long, B. T. (2010) Does remediation work for all students? How the effects of postsecondary remedial and developmental courses vary by level of academic preparation (NCPR Working Paper). New York, NY. National Center for Postsecondary Research, Teachers College, Columbia University.
- Bogdan, R., & Biklen, S. (2007). *Qualitative research for education: An introduction to theories and method* (5th ed.). Boston, MA: Allyn and Bacon.
- Boroch, D., Fillpot, J., Hope, L., Johnstone, R., Mery, P., Serban, A., Smith, B., & Gabriner, R. S. (2007). *Basic skills as a foundation for student success in California community colleges*. Research and Planning Group for California Community Colleges (RP Group), Sacramento, CA.
- Bourdieu, P. (1990). *In other words: Essays towards a reflexive sociology* (M. Adamson, Trans.). Stanford, CA: Stanford University Press.



- Bourdieu, P. (1991). *Language and symbolic power*. Cambridge, MA: Polity Press.
- Boylan, H. R. (1999). Demographics, outcomes, and activities. *Journal of Developmental Education*, 23(2), 2-8.
- Breneman D. W., & Haarlow, W. N. (1998). *Remediation in higher education*. Washington, DC: Thomas B. Fordham Foundation.
- Carillo, E. C. (2015). *Securing a place for reading in composition: The importance of teaching for transfer*. Logan, UT: Utah State University Press.
- Cassels, J. R. T., & Johnstone, A. H. (1980). *Understanding of non-technical words in science*. London, UK: The Chemical Society.
- Cassels, J. R. T., & Johnstone, A. H. (1985). *Words that matter in science*. London, UK: Royal Society of Chemistry.
- Chapman, T. K. (2007). Interrogating classroom relationships and events: Using portraiture and critical race theory in education research. *Educational Researcher*, 36(3), 156-162.
- Charmaz, K. (2006). *Constructing grounded theory: A practical guide through qualitative analysis*. London, UK: Sage.
- Charmaz, K. (2008). The legacy of Anselm Strauss for constructivist grounded theory. In N. Denzin (Ed.), *Studies in symbolic interaction* (Vol. 32, pp. 127-141). Bingley, UK: Emerald Group.
- Chen, X. (2009). *Students who study science, technology, engineering, and mathematics (STEM) in postsecondary education (NCES 2009-161)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Clarke, A. E. (2005). *Situational analysis: Grounded theory after the postmodern turn*. Thousand Oaks, CA: Sage.
- Coll, R. K., & Treagust, D. F. (2001). Learners' use of analogy and alternative conceptions for chemical bonding. *Australian Science Teachers Journal*, 48(1), 24-32.
- Collins, M. L. (2009). *Setting up success in developmental education: How state policy can help community colleges improve student outcomes (An Achieving the Dream Policy Brief)*. Boston, MA: Jobs for the Future.
- Conley, D. T. (2007). *Toward a more comprehensive conception of college readiness*. Eugene, OR: Educational.

- Conley, D. T. (2013). Proficiency approaches for making more students college and career ready. In L. W. Perna & A. P. Jones (Eds.), *The state of college access and completion* (pp. 57-76). New York, NY: Routledge.
- Creswell, J. W. (1998). *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: Sage.
- Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches*. Los Angeles, CA: Sage.
- Cross, K. P. (1971). *Beyond the open door: New student to higher education*. San Francisco, CA: Jossey-Bass.
- Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York, NY: New Press.
- Delpit, L. D. (2006). *Other people's children: Cultural conflict in the classroom* (2nd ed.). New York, NY: New Press.
- Denzin, N. K. (1989). *The research act* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Denzin, N. K. (1995). The experiential text and the limits of visual understanding. *Educational Theory*, 45(1), 7-18.
- Douglas, R., Klentschy, M. P., Worth, K., & Binder, W. (Eds.). (2006). *Linking science and literacy in the K-8 classroom*. Arlington, VA: National Science Teachers Association.
- Ehrenberg, R. G. (2010). Analyzing the factors that influence persistence rates in STEM field majors: Introduction to the symposium. *Economics of Education Review*, 29(6), 888-891.
- Eisner, E. W. (1991). *The enlightened eye: Qualitative inquiry and the enhancement of educational practice*. Toronto, Ontario, Canada: Collier Macmillan Canada.
- Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2011). *Writing ethnographic fieldnotes* (2nd ed.). Chicago, IL: The University of Chicago Press.
- Fain, P. (2013, June 3). Remediation if you want it. Retrieved from <http://www.insidehighered.com>
- Fairclough, N. (2010). *Critical discourse analysis: The critical study of language* (2nd ed.). London, UK: Pearson Education.
- Farrell, E., Pequero, G., Lindsey, R., & White, R. (1998). Giving voice to high school students: Pressure and boredom, ya know what I'm sayin'? *American Educational Research Journal*, 25(4), 489-502.

- Fensham, P. (1988). *Development and dilemmas in science education* (5th ed.). London, UK: Falmer.
- Fisher, D., Grant, M., & Frey, N. (2009). Science literacy is > strategies. *The Clearing House*, 82, 183-186.
- Fisher, D., Ross, D., & Grant, M. (2010). Building background knowledge. *The Science Teacher*, 77(1), 23-26.
- Fleischman, H. L., Hopstock, P. J., Pelczar, M. P., & Shelley, B. E. (2010). *Highlights from PISA 2009: Performance of U.S. 15-year-old students in reading, mathematics, and science literacy in an international context (NCES 2011-004)*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Flinders, D. J. (1997). Review of the book *InterViews: An introduction to qualitative research interviewing*. *Evaluation and Program Planning*, 20(3), 287-288.
- Fontana, A., & Frey, J. H. (1994). Interviewing: The art of science. In D. Denzin & Y. Lincoln (Eds.), *Handbook of qualitative research* (pp. 361-376). Thousand Oaks, CA: Sage.
- Freebody, P., & Luke, A. (1990). Literacies programs: Debates and demands in cultural context. *Prospect: Australian Journal of TESOL*, 5(7), 7-16.
- Freedman, S., Flower, L, Hull, G., & Hayes, J. (1995). Ten years of research: Achievements of the National Center for the Study of Writing and Literacy (Technical Report No. 1-C). Berkeley, CA: National Center for the Study of Writing.
- Freire, P. (1970). The adult literacy process as cultural action for freedom. *Harvard Educational Review*, 40(2), 205-225.
- Fullinwider, R. K. (1999, Winter). Open admissions and remedial education at CUNY. *Report from the Institute for Philosophy and Public Policy*, 19.
- Gee, J. P. (1990/1996/2007). *Social linguistics and literacies: Ideology in discourses*. London, UK: Taylor & Francis (2nd ed., 1996; 3rd ed., 2007).
- Gee, J. P. (1993). Postmodernism and literacies. In C. Lankshear & P. L. McLaren (Eds.), *Critical literacy: Politics, praxis, and the postmodern* (pp. 271-295). Albany, NY: State University of New York Press.
- Gee, J. P. (1996). *Social linguistics and literacies: Ideology in discourses*. (2nd ed.). London, UK: Falmer.
- Gee, J. P. (2001). Reading as situated language: A sociocognitive perspective. *Journal of Adolescent and Adult Literacy*, 44, 714-725.

- Gee, J. P. (2007). *Good video games and good learning: Collected essays on video games, learning, and literacy*. New York, NY: Peter Lang.
- Gee, J. (2008). A sociocultural perspective on opportunity to learn. In P. A. Moss, D. C. Pullin, J. P. Gee, E. H. Haertel, & L. J. Young (Eds.), *Assessment, equity, and opportunity to learn* (pp. 76-108). New York, NY: Cambridge University Press. <https://doi.org/10.1017/CBO9780511802157.004>
- Gee, J. P., Michaels, S., & O'Connor, M. C. (1992). Discourse analysis. In M. D. LeCompte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 227-291). San Diego, CA: Academic Press.
- Gernsbacher, M. A. (1997). Coherence cues mapping during comprehension. In J. Costermans & M. Fayol (Eds.), *Processing interclausal relationships in the production and comprehension of text* (pp. 3-21). Hillsdale, NJ: Erlbaum.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Chicago, IL: Aldine.
- Glesne, C., & Peshkin, A. (1992). *Becoming qualitative researchers: An introduction*. White Plains, NY: Longman.
- Gonzales, P., Williams, T., Jocelyn, L., Roey, S., Kastberg, D., and Brenwald, S. (2008). *Mathematics and science achievement of U.S. fourth- and eighth-grade students in an international context* (NCES 2009-001). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- González, N., Moll, L., & Amanti, C. (2005). *Funds of knowledge: Theorizing practices in households, communities, and classrooms*. Hillsdale, NJ: Lawrence Erlbaum.
- Gough, P. (1983). The beginning of decoding. *Reading and Writing: An Interdisciplinary Journal*, 5, 181-192.
- Graesser, A. C., McNamara, D. S., & VanLehn, K. (2005). Scaffolding deep comprehension strategies through Point&Query, AutoTutor, and iStart. *Educational Psychologist*, 40, 225-234.
- Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review*, 101, 371-395.
- Green, J. L., Kantor, R., & Rogers, T. (1990). Exploring the complexity of language and learning in the classroom. In B. Jones & L. Idol (Eds.), *Educational values and cognitive instruction: implications for reform* (Vol. II, pp. 333-364). Hillsdale, NJ: Erlbaum.

- Greene, J., & Foster, G. (2003, September). *Public high school graduation and college readiness rates in the United States*. New York, NY: Manhattan Institute, Center for Civic Information, Education Working Paper, 3.
- Haag, S., & Collofello, J. (2008, October 22-25). Engineering undergraduate persistence and contributing factors. Paper presented at the 38th ASEE/IEEE Annual Frontiers in Education Conference, Saratoga Springs, NY.
- Hapgood, S., & Palincsar, A. S. (2007). Where literacy and science intersect. *Education Leadership*, 64(4), 56-60.
- Harris, T. L., & Hodges, R. E. (Eds.). (1995). *The literacy dictionary: The vocabulary of reading and writing*. Newark, DE: The International Reading Association.
- Headland, N. T., Pike, K., & Harris, M. (Eds.). (1990). *Etics and emics: The insider/outsider debate*. Thousand Oaks, CA: Sage.
- Henriques, J., Hollway, W., Urwin, C., Venn, C., & Walkerdine, V. (Eds.). (1984). *Changing the subject: Psychology, social regulation and subjectivity*. London, UK: Methuen.
- Herber, H. (1970). *Teaching reading in the content areas*. Englewood Cliffs, NJ: Prentice-Hall.
- Hicks, D. (1995). Discourse, learning, and teaching. In M. W. Apple (Ed.), *Review of research in education* (vol. 21, pp. 49-95). Washington, DC: American Educational Research Association.
- Higher Education Research Institute (HERI). (2010). *Degrees of success: Bachelor's degree completion rates among initial STEM majors*. Los Angeles, CA: Author.
- Hillocks, G. (1995). *Teaching writing as reflective practice*. New York, NY: Teachers College Press.
- Holschuh, J. L., & Paulson, E. (2013). *The terrain of college developmental reading*. San Marcos, TX: College Reading & Learning Association.
- Huffman-Kelley, K., Perin, D., & Liu, X. (2015). Integrating reading skills in an introductory science classroom. *Journal of College Science Teaching*, 44(5), 10-15.
- Hynd-Shanahan, C., Holschuh, J., & Hubbard, B. (2004). Thinking like a historian: College students' reading of multiple historical documents. *Journal of Literacy Research*, 36, 141-176.
- Jaggars, S., & Hodara, M. (2011). The competing aims of developmental education: Assessment, placement, and progression and CUNY community colleges. Draft CCRC Working paper. New York, NY: Teachers College, Columbia University.

- Jahoda, M., Deutsch, M., & Cook, S. W. (1951). *Research methods in social relations with special reference to prejudice*. Ft. Worth, TX: Dryden Press.
- Jamieson, S. (2013). Reading and engaging sources: What students' use of sources reveals about advanced reading skills. *Across the Disciplines*, 10(4).
- Kelly, G. J., & Crawford, T. (1996). Students' interaction with computer representations: Analysis of discourse in laboratory groups. *Journal of Research in Science Teaching*, 33, 693-700.
- Kintsch, E., & Kintsch, W. (1995). Strategies to promote active learning from text: Individual differences in background knowledge. *Swiss Journal of Psychology*, 54(2), 141-151.
- Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction integration model. *Psychological Review*, 95(2), 163-182.
- Kohn, A. (2000). *The case against standardized testing: Raising the scores, ruining the schools*. Portsmouth, NH: Heinemann.
- Kucan, L., & Palincsar, A. S. (2013). *Comprehension instruction through text-based discussion*. Newark, DE: International Reading Association.
- Kucer, S. (2009). *Dimensions of literacy: A conceptual base for teaching reading and writing in school settings* (3rd ed.). Mahwah, NJ: Erlbaum.
- Kvale, S. (1996). *InterViews: An introduction to qualitative research interviewing*. Thousand Oaks, CA: Sage.
- Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. *American Educational Research Journal*, 32, 465-491. doi:10.3102/00028312032003465
- Ladson-Billings, G. (2000). *Racialized discourses and ethnic epistemologies: Handbook of qualitative research* (pp. 257-277). Thousand Oaks, CA: Sage.
- Ladson-Billings, G. (2005). The evolving role of critical race theory in educational scholarship. *Race Ethnicity and Education*, 8(1), 115-119.
- Ladson-Billings, G. (2009). *The dreamkeepers: Successful teachers of African American children* (2nd ed.). San Francisco, CA: Jossey-Bass.
- Langer, J. A. (1987). A sociocognitive perspective on literacy. In J. Langer (Ed.), *Language, literacy, and culture: Issues of society and schooling*. Norwood, NJ: Ablex.
- Lavin, D., Alba, R., & Silberstein, R. (1981). *Right versus privilege: The open admissions experiment at the City University of New York*. New York, NY: Free Press.

- LeCompte, M. D., & Schensul, J. J. (2010). *Designing and conducting ethnographic research: An introduction*. Lanham, MD: AltaMira Press.
- Lee, C. D. (1992) Literacy, cultural diversity, and instruction, *Education and Urban Society*, 24, 279-291.
- Lee, C. D., & Spratley, A. (2010). *Reading in the disciplines: The challenges of adolescent literacy*. New York, NY: Carnegie Corporation of New York.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Beverly Hill, CA: Sage.
- Lowell, B. L., Salzman, H., Bernstein, H., & Henderson, E. (2009, November 7). Steady as she goes? Three generations of students through the science and engineering pipeline. Paper presented at the Annual Meetings of the Association for Public Policy Analysis and Management, Washington, DC.
- Luke, A. (1995). Text and discourse in education: An introduction to critical discourse analysis. In M. W. Apple (Ed.), *Review of research in education* (vol. 21, pp. 3-48). Washington, DC: American Educational Research Association.
- Lundeberg, M. (1987). Metacognitive aspects of reading comprehension: Studying understanding in legal case analysis. *Reading Research Quarterly*, 22, 407-432.
- Magliano, J. P., Todaro, S., Millis, K., Wiemer-Hastings, K., Kim, H., & McNamara, D. S. (2005). Changes in reading strategies as a function of reading training: A comparison of live and computerized training. *Journal of Educational Computing Research*, 32, 185-208.
- Marzano, R. J. (2004). The developing vision of vocabulary instruction. In J. F. Baumann & E. J. Kame'enui (Eds.), *Vocabulary instruction: Research to practice* (pp. 100-117). New York, NY: The Guilford Press.
- Maxwell, J. A. (2013). *Qualitative research design: An interactive approach* (3rd ed.). Thousand Oaks, CA: Sage.
- Maxwell, M. (1997). *Improving student learning skills: A new edition*. Clearwater, FL: H & H Publishers.
- Mayher, J. S. (1992). "Uncommon sense" in the writing center. *Journal of Basic Writing*, 11(1), 47-57.
- McCombs, B. L., & Pope, J. E. (1994). *Motivating hard to reach students*. Washington, DC: American Psychological Association.
- McNamara, D. S. (2001). Reading both high coherence and low coherence texts: Effects of text sequence and prior knowledge. *Canadian Journal of Experimental Psychology*, 55, 51-62.

- McNamara, D. S., & Kintsch, W. (1996). Learning from texts: Effects of prior knowledge and text coherence. *Discourse Processes*, 22, 247-288.
- McNamara, D. S., Kintsch, E., Songer, N. B., & Kintsch, W. (1996). Are good texts always better? Interactions of text coherence, background knowledge, and levels of understanding in learning from text. *Cognition and Instruction*, 14(1), 1-43.
- Means, M. L., & Voss, J. F. (1985). Star wars: A developmental study of expert and novice knowledge structures. *Journal of Memory and Language*, 24, 746-757.
- Merisotis, J., & Phipps, R. (2000). Remedial education in colleges and universities: What's really going on? *The Review of Higher Education*, 24, 67-85.
- Merriam, S. B. (1998). *Qualitative research and case study applications in education*. San Francisco, CA: Jossey-Bass.
- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.
- Mezirow, J. (Ed.). (2000). *Learning as transformation: Critical perspectives on a theory in progress*. San Francisco, CA: Jossey Bass.
- Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*. London, UK: Sage.
- Milner, H. R. (2007). Race, narrative inquiry, and self-study in curriculum and teacher education. *Education and Urban Society*, 39(4), 584-609.
- Mizelle, N. B. (1992). *Middle grade students' motivational processes and use of strategies with expository texts*. Unpublished doctoral dissertation, University of Georgia, Athens.
- Mizelle, N. B. (1997). Enhancing young adolescents' motivation for literacy learning. *Middle School Journal*, 24(2), 5-14.
- Mizelle, N. B., Hart, L. E., & Carr, M. (1993). Middle grade students' motivational processes and use of strategies with expository text. Annual Meeting of the American Educational Research Association, Atlanta, GA, April 12-16.
- Moje, E. B. (1996). "I teach students, not subjects": Teacher-student relationships as contexts for secondary literacy. *Reading Research Quarterly*, 31, 172-195.
- Moje, E. B. (1997). Exploring discourse, subjectivity, and knowledge in chemistry class. *Journal of Classroom Interaction*, 32, 35-44.



- Moje, E. B. (2010). Developing disciplinary discourses and identities: What's knowledge got to do with it? In G. L. Bonilla & K. Englander (Eds.), *Discourses and identities in contexts of educational change* (pp. 49-74). New York, NY: Peter Lang.
- Moje, E. B., Dillon, D. R., & O'Brien, D. G. (2000). Re-examining the roles of the learner, the text, and the context in secondary literacy. *Journal of Educational Research, 93*, 165-180.
- Moje, E., & Wade, S. (1997). What case discussions reveal about teacher thinking. *Teaching and Teacher Education, 12*, 691-712.
- Moll, L. C. (1992). Bilingual classrooms and community analysis: Some recent trends. *Educational Researcher, 21*(2), 20-24.
- Moll, L. (2000). Inspired by Vygotsky: Ethnographic experiments in education. In C. Lee & P. Smagorinsky (Eds.), *Vygotskian perspectives on literacy research: Constructing meaning through collaborative inquiry* (pp. 256-268). New York, NY: Cambridge University Press.
- Moore, D. W., Readence, J. E., & Rickelman, R. J. (1983). An historical exploration of content area reading instruction. *Reading Research Quarterly, 18*, 419-438.
- Morrell, E., & Duncan-Andrade, J. (2002). What do they learn in school? Using hip-hop as a bridge between youth culture and canonical poetry texts. In J. Mahiri (Ed.), *What they don't learn in school: Literacy in the lives of urban youth* (pp. 247-268). New York, NY: Peter Lang.
- Nakhleh, M., (1992). Why some students don't learn chemistry: Chemical misconceptions. *Journal of Chemical Education, 69*(3), 191-196.
- National Assessment of Educational Progress (NAEP). (2015). 2015 mathematics assessments. *Digest of Education Statistics*. Washington, DC: U.S. Department of Education, Institute of Education Sciences. Retrieved from <https://www.nationsreportcard.gov/>
- National Center for Education Statistics (NCES). (2003). *Remedial education at degree-granting postsecondary institutions in fall 2000*. Washington, DC: U. S. Department of Education.
- National Institute of Child Health and Human Development. (2000). Report of the National Reading Panel: *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 00-4769). Washington, DC: U.S. Government Printing Office.
- National Science Board (NSB). (2012). *Science and engineering indicators 2012*. Arlington, VA: Author.

- Neuman, S. B., Kaefer, T., & Pinkham, A. (2014). Building background knowledge. *The Reading Teacher*, 68(2), 145-148.
- Niles, O. S. (1965). Developing essential reading skills in the English program. In J. A. Figurel (Ed.), *Reading and inquiry* (pp. 35-43). Newark, DE: International Reading Association.
- Noddings, N. (2003). *Caring: A feminine approach to ethics and moral education* (2nd ed.). Berkeley, CA: University of California Press.
- Nokes, J. D., Dole, J. A., & Hacker, D. J. (2007). Teaching high school students to use heuristics while reading historical texts. *Journal of Educational Psychology*, 99, 492-504.
- O'Brien, D. G., Stewart, R. A., & Moje, E. B. (1995). Why content literacy is difficult to infuse into the secondary school: Complexities of curriculum, pedagogy, and school culture. *Reading Research Quarterly*, 30, 442-463.
- O'Reilly, T., & McNamara, D. S. (2002). What's a science student to do? In *Proceedings of the Twenty-fourth Annual Meeting of the Cognitive Science Society* (pp. 726-731). Mahwah, NJ: Erlbaum.
- Ohio Board of Regents. (2001). *Ohio colleges and universities 2001: Profile of student outcomes, experiences and campus measures*. Columbus, OH: Ohio Board of Regents.
- Oldfather, P. (1993). What students say about motivating experiences in a whole language classroom. *The Reading Teacher*, 46(8), 672-681. Retrieved from <http://www.jstor.org/stable/20201166>
- Parker, T. L., & Richardson, R. C. (2005). Ending remediation at CUNY: Implications for access and excellence. *Journal of Educational Research and Policy Studies*, 5(2), 1-22.
- Patton, M. W. (2002). *Qualitative evaluation and research methods* (3rd ed.). Thousand Oaks, CA: Sage.
- Payne E., & Lyman, B. (1998). *Issues affecting the definition of developmental education*. Northport, AL: National Association of Developmental Education.
- Pearlman, S. J. (2013). It's not that they can't read; it's that they can't read: Can we create "citizen experts" through interactive assessment? *Across the Disciplines*, 10(4). Retrieved from <https://wac.colostate.edu/atd/reading/pearlman.cfm>
- Pearson, P. (1996). Reclaiming the center. In M. Graves, P. van den Broek, & B. Taylor (Eds.), *The first R: Every child's right to read* (pp. 259-274). New York, NY: Teachers College Press.
- Pearson, P. D., Moje, E. B., & Greenleaf, C. (2011). Literacy and science—Each in the service of the other. *Science*, 328, 459-463.

- Peterson, R. F., & Treagust, D. F., (1989). Grade-12 students' alternative conceptions of covalent bonding and structure. *Journal of Chemical Education*, 66(6), 459-460.
- Phipps, R. (1998). *College remediation: What it is, what it costs, what's at stake*. Washington, DC: Institute for Higher Education Policy.
- President's Council of Advisors on Science and Technology (PCAST). (2012). *Engage to excel: Producing one million additional college graduates with degrees in Science, Technology, Engineering and Mathematics*. Retrieved November 16, 2013 from <http://www.whitehouse.gov/>
- Provasnik, S., Kastberg, D., Ferraro, D., Lemanski, N., Roey, S., & Jenkins, F. (2012). *Mathematics and science achievement of U.S. fourth- and eighth-grade students in an international context*. Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Punch, M. (1986). *The politics and ethics of fieldwork*. Newbury Park, CA: Sage.
- Rhodes, L. A. (2013). When is writing also reading? *Across the Disciplines*, 10(4). Retrieved from <https://wac.colostate.edu/atd/reading/rhodes.cfm>
- Richardson, R. C., Fisk, E. C., & Okun, M. A. (1983). *Literacy in the open-access college*. San Francisco, CA: Jossey-Bass.
- Robertson, L., Taczak, K., & Yancey, K. B. (2012). Notes toward a theory of prior knowledge and its role in college composers' transfer of knowledge and practice. *Composition Forum*, 26, 1-21.
- Rogers, C. (1983). *Freedom to learn for the 80s*. Columbus, OH: Merrill.
- Rogoff, B. (2003). *The cultural nature of human development*. Oxford, UK: Oxford University Press.
- Ronda, M. A., & Valencia, R. R. (1994). "At-risk" Chicano students: The institutional and communicative life of a category. *Hispanic Journal of Behavioral Sciences*, 16(4), 363-395.
- Rosenbaum, J. (2001). *Beyond college for all*. New York, NY: Russell Sage.
- Rosenblatt, L. M. (1978). *The reader, the text, the poem: The transactional theory of the literary work*. Carbondale, IL: Southern Illinois University Press.
- Rosenblatt, L. M. (1988). Writing and reading transactional theory. In J. Mason (Ed.), *Reading and writing connections* (pp. 153-176). Boston, MA: Allyn & Bacon.

- RP Group/Center for Student Success. (2005). *Environmental scan: A summary of key issues facing California community colleges pertinent to the strategic planning process*. Sacramento, CA: Author.
- Russell, G. M., & Kelly, N. H. (2002, September). Research as interacting dialogic processes: Implications for reflexivity. *Forum: Qualitative Social Research*, 3(3). Retrieved November 10, 2003, from <http://www.qualitative-research.net/fqstexte/3-02/3-02-russellkelly-e.htm>
- Saxon, D. P., & Boylan, H. R. (2001). The cost of remedial education in higher education. *Journal of Developmental Education*, 25(2), 2-4, 6, 8.
- Schwandt, T. A. (2001). *Dictionary of qualitative inquiry* (2nd ed.). London, UK: Sage.
- Sealey-Ruiz, Y. (2007). Wrapping the curriculum around their lives: Using a culturally relevant curriculum with African American adult women. *Adult Education Quarterly*, 58(1), 44-60.
- Seidman, I. (1998). *Interviewing as qualitative research*. New York, NY: Teachers College Press.
- Shanahan, C., Shanahan, T., & Misichia, C. (2011). Analysis of expert readers in three disciplines: History, mathematics, and chemistry. *Journal of Literacy Research*, 43, 393-429.
- Shanahan, T., & Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content area literacy. *Harvard Education Review*, 78, 40-59.
- Shanahan, T., & Shanahan, C. (2012). What is disciplinary literacy and why does it matter? *Topics in Language Disorders*, 32(1), 7-18.
- Siddle Walker, V. (1999). Teaching culture and commitment: Challenges in the training of educational researchers for the 21st century. In E. Lagemann & L. Shulman (Eds.), *Issues in education research* (pp. 224-244). San Francisco, CA: Jossey-Bass.
- Simms, R. B., & Leonard, W. H. (1986). Accommodating underprepared students. *Journal of College Science Teaching*, 16(2), 110-112.
- Simpson, M. L., & Nist, S. L. (2000). An update on strategic learning: It's more than textbook reading strategies. *Journal of Adolescent and Adult Literacy*, 43(6), 528-541.
- Smith, F. (1985). A metaphor for literacy: Creating worlds or shunting information. In D. R. Olson, N. Torrance, & A. Hildyard (Eds.), *Literacy, language, and learning: The nature and consequences of reading and writing* (pp. 195-213). Cambridge, UK: Cambridge University Press.

- Spann, M. G., & McCrimmon, S. (1998). Remedial/developmental education: Past, present, and future. In J. L. Higbee & P. L. Dwinell (Eds.), *Developmental education: Preparing successful college students* (pp. 37- 47). Columbia, SC: National Resource Center for the First-Year Experience & Students in Transition, University of South Carolina.
- Spivey, N. (1995). Written discourse: A constructivist perspective. In L. Steffe (Ed.), *Constructivism in education* (pp. 313-329). Hillsdale, NJ: Erlbaum.
- Spradley, J. (1979). *The ethnographic interview*. Toronto, Ontario, Canada: Holt, Rinehart, & Winston.
- Stanley, C. A. (2007). When counter narratives meet master narratives in the journal editorial-review process. *Educational Researcher*, 36(1), 14-24.
- Stavy, R. (1988). Children's conception of gas. *International Journal of Science Education*, 20, 553-560.
- Straw, S., & Sadowy, P. (1990). Dynamics of communication: Transmission, translation, and interaction in reading comprehension. In D. Bogdan & S. Straw (Eds.), *Beyond communication: Reading comprehension and criticism* (pp. 21-47). Portsmouth, NH: Boynton & Cook.
- Street, B. (1995). *Immigrant learners and their families: Literacy to connect generations*. McHenry, IL: Center for Applied Linguistics & Delta Systems.
- Strong American Schools. (2008). *Diploma to nowhere*. Washington, DC: Author.
- Taber, K. S., (2002). *Alternative conceptions in chemistry: Prevention, diagnosis and cure?* London, UK: The Royal Society of Chemistry.
- U.S. Department of Education (USDOE) & National Center for Education Statistics (NCES). (1996). *Remedial education at higher education institutions in fall 1995*. NCES 97-584. Washington, DC: U.S. Government Printing Office.
- Vacca, R. T., & Vacca, J. L. (2002). *Content area reading* (7th ed.). Boston, MA: Allyn & Bacon.
- Valencia, R. R., & Black, M. S. (2002). "Mexican Americans don't value education!"—The basis of the myth, mythmaking, and debunking. *Journal of Latinos and Education*, 1(2), 81-103.
- Van Galen, J., & Eaker, D. J. (1995). Beyond settling for scholarship: On defining the beginning and ending points of postmodern research. In W. T. Pink & G. W. Noblit (Eds.), *Continuity and contradiction: The futures of the sociology of education* (pp. 113-132). Cresskill, NJ: Hampton Press.

- Villenas, S. (2009). The colonizer/colonized Chicana ethnographer: Identity, marginalization, and cooptation in the field. In W. Luttrell (Ed.), *Qualitative educational research: Readings in reflexive methodology and transformative practice* (pp. 345-362). New York, NY: Routledge.
- Whipple, G. M. (Ed.). (1925). Report of the National Committee on Reading (*Twenty-fourth Yearbook of the National Society for the Study of Education, Part I*). Bloomington, IL: Public School Publishing.
- Whyte, W. (1979). On making the most of participant observation. *American Sociologist*, 14, 56-66.
- Wilder, P., & Herro, D. (2015). Supporting inquiry with digital texts in school disciplines. In T. Rasinski, R. Ferdig, & K. Pytash (Eds.), *Using technology to enhance reading: Innovative approaches to literacy instruction* (pp. 1-21). Bloomington, IN: Solution Tree.
- Williamson, G. L. (2008). A text readability continuum for postsecondary readiness. *Journal of Advanced Academics*, 19(4), 602-632.
- Wineburg, S. S. (1991). On the reading of historical texts: Notes on the breach between school and academy. *American Educational Research Journal*, 28, 495-519.
- Wolcott, H. F. (1994). *Transforming qualitative data*. Thousand Oaks, CA: Sage.
- Wood, N. (2014). College reading instruction as reflected by current reading textbooks. *Journal of College Reading and Learning*, 27(3), 79-95.
- Zoller, U., (1990). Students' misunderstandings and alternative conceptions in college freshman chemistry (general and organic). *Journal of Research in Science Teaching*, 27(10), 1053-1065.
- Zwaan, R. A., & Singer, M. (2003). Text comprehension. In A. C. Graesser, M. A. Gernsbaeher, & S. R. Goldman (Eds.), *Handbook of discourse processes* (pp. 83-121). Mahwah, NJ: Erlbaum.

## Appendix A

### Instructor Interview Protocol

(Adapted from Spradley's (1970) Interview Protocol)

#### A. Grand Tour Questions

- i. Specific grand tour questions
  1. What's it like to be a professor at UCC?
  2. What's it like to teach CHM 02?
  3. What are the students like in CHM 02?
- ii. Guided grand tour questions
  1. Walk me through a typical class.

#### B. Mini-tour questions

- i. Tell me about how students engage with the text.
- ii. Tell me about students' perceptions of learning and reading in the class.

#### C. Example Questions (responds to grand tour questions and try to get the participant to share life stories and experiences)

- i. What chapter/topic is particularly challenging for students?

#### D. Experience Questions

- i. Tell me about a positive experience you've had in the class.

## Appendix B

### Student Interview Protocol

(Adapted from Seidman's (2013) Interview Protocol)

1. How did you end up in New York?
2. How did you come to UCC?
3. Tell me about a positive memory associated with reading.
  - Can you share a childhood memory?
  - Can you share an event in which reading the text in this class sparked an “ah ha!” moment?
4. Tell me about a memorable teacher you had.
5. Can you tell about a positive experience you had in the chemistry class?
  - When did you feel closest to the text or the discipline?
6. Can you tell me a bit about your professor?
  - Can you describe his teaching methods?
  - Can you describe how he conveys his interest and expertise in chemistry?
7. Given what you said about the course, how do you understand the role of chemistry to be in your life? What sense does it make to you?
8. Given what you have shared about navigating the chemistry textbook, how do you see yourself addressing the challenges?



Appendix C  
Recruitment Flyer

**TEACHERS COLLEGE**  
COLUMBIA UNIVERSITY

Hello Class,

My name is Minkyung Choi, and I am currently a doctoral student at Teachers College, Columbia University. This semester, I will be observing Dr. Romano's class as part of a study on how students navigate texts in a chemistry course. The purpose of this study is to examine how students make sense of college-level texts, and the resources they employ in order to do so.

Along with observing the class, I am also looking for a few students to participate in 3 in-depth interviews so that I can learn more about how students handle reading assignments in chemistry courses. I will be compensating all participants with a \$15 gift card. I know it is not much, but I would like to offer a small token of my appreciation for your time.

Please let me know if you are interested,

Minkyung Choi