Faculty views of developmental math instruction at an urban community college: A critical pedagogy analysis

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Faculty views of developmental math instruction at an urban community college:
A critical pedagogy analysis

by

Chad E. Kee

A dissertation submitted to the graduate faculty
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Major: Education (Higher Education)

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Ames, Iowa

2013
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ABSTRACT

A disproportionate number of students entering postsecondary education are considered academically unprepared and not ready for college-level work (ACT, 2011). A majority of those students are students of color, particularly those who identify as African-American or Latino and come from low-income families (Bragg, Eunyoung, & Barnett, 2006; Green, 2006; Ogbu, 1990). Due to the lack of readiness, colleges and universities, specifically community colleges, are challenged to meet the academic needs of students by offering developmental education courses such as Developmental English and/or Developmental Math. Mathematics in postsecondary education has been proven to be a gatekeeper regarding college completion due to math anxiety and lack of mathematics skills upon entry into the college. Therefore, the study was conducted to investigate developmental math instruction at an urban community college. I concluded that enhancing developmental math instruction by using concepts from critical pedagogy would improve learning, enhance classroom engagement, and subsequently promote overall retention and advancement to college-level math.

The purpose of the study, guided by principles from qualitative research, was to determine how community college teachers are preparing students to gain basic mathematics skills that will enable them to accomplish their educational goals. The research questions for the study focused on the experiences, beliefs, and attitudes of instructors who teach developmental math courses. Therefore, I conducted a case study at an urban community college located in a northeastern city. Critical pedagogy was used as
the theoretical perspective to support the study, with foundational tenets from critical literacy and critical-mathematical literacy.

In this dissertation I demonstrated the need to not only offer developmental math in postsecondary education but also to apply pedagogical practices that consider race, class, histories, personal experiences, and backgrounds of students while teaching math concepts. Furthermore, I examined the social practices and educational structures that influence a students’ readiness for college-level work such as family income/socioeconomic status, race, and unequal K-12 schooling practices. I presented the influences relevant to college readiness in order to explain the need for developmental math courses in higher education, as well as instruction that is informed and framed with a critical inquiry framework.
CHAPTER 1. INTRODUCTION

Access to postsecondary education, particularly at four-year institutions, has increased within the past decade; however, persistence and retention rates are consistently of great concern to higher education educators, administrators, and policymakers. As a result, many four-year institutions are tightening up admissions requirements since low persistence and retention rates may be due in part to the number of recent graduates who are considered unprepared for postsecondary education. For example:

- Only 25% of high school graduates met all four college readiness benchmarks in English, reading, mathematics, and science.
- Only 30% met the college readiness benchmark in science.
- In only one state did more than half of the graduates meet at least three of the four benchmarks established by the American College Testing Service (ACT). In no state did more than 55% of ACT-tested graduates meet three of four benchmarks.

African American graduates were least likely to meet the benchmarks—4% met all four benchmarks. None of the benchmarks were met by at least 50% of African American, American Indian, or Hispanic students (ACT, n.d.).

Considering the lack of college readiness among recent high school graduates, entering a two-year open-enrollment community college may be a viable and perhaps the only possible next step for students who may not be academically equipped for admission to a four-year institution. Many of these students enter community colleges in need of developmental
education. The open-enrollment status of community colleges offers an opportunity for students who otherwise may not have access to higher education to prepare themselves for four-year institutions. As a result, community college enrollment continues to increase; specifically, enrollment at two-year public institutions increased by 25% between 2000 and 2009 (National Center for Education Statistics, 2011).

The range of academic readiness exhibited by students can be very broad, requiring learning opportunities that are inclusive and courses that offer effective developmental education. Such learning opportunities are most likely to be offered in community colleges, whose mission is to serve students at all levels of readiness. Specifically, learning opportunities that enrich learning include providing student feedback, allowing multiple voices to be heard, and legitimizing diverse backgrounds. In short, community colleges are an ideal “bridge” from high school to the four-year institution. Additionally, community colleges are positioned to address the needs of those who may not be fully prepared based upon their previous educational experiences.

Therefore, to meet the diverse learning needs of the student population, community colleges are often required to offer remedial education courses. Based on the literature, remedial education is often used interchangeably with developmental skills education. Throughout this study, both terms will be used and defined as “a class or activity intended to meet the needs of students who initially do not have the skills, experience or orientation necessary to perform at a level that the institutions or instructors recognize as ‘regular’ for those students” (Grubb et al., 1999, p. 174). However, in this study I will not only discuss the
importance of remedial education but will also address faculty perceptions, beliefs, and attitudes that may positively or negatively influence student engagement.

**Purpose of the Study**

The problem that underlies this study is the alarming percentage of students who are graduating from high school without basic skills and are unprepared for four-year institutions. Therefore, the purpose of the study is to determine how community college teachers, specifically those at a large urban community college located on the east coast, are preparing students to gain basic mathematics skills that will enable them to accomplish their educational goals. To protect the identity of the institution, the school will be called East Coast Community College (ECCC). For the purposes of this study, I assessed the perceptions, beliefs, and attitudes about developmental mathematics education held by the instructors at ECCC who teach developmental mathematics courses, the factors these faculty take into account when designing developmental mathematics courses, the teaching strategies that the instructors use, and the outcomes of developmental education as perceived by the instructors.

The findings from the study are intended to provide ECCC and other higher education institutions with information that could aid in enhancing or modifying existing teaching strategies in developmental mathematics courses. The goal of the study was to identify teaching practices that enhance learning and contribute to increased student engagement within the classroom by exploring the experiences of developmental mathematics instructors. Moreover, I hoped that the findings would support the mission of East Coast Community
College, which has a strong focus on enriching the lives of students through effective education. To retain the anonymity of the institution, the actual mission statement is not included.

To achieve the purpose of the study, I conducted a case study in which I explored the experiences of instructors who teach developmental mathematics; their engagement with students; student to teacher interactions; and faculty perceptions, beliefs, and attitudes about developmental mathematics courses and the students enrolled in developmental mathematics. The study included interviews with instructors, observations of developmental mathematics classes, and a review of documents. Data collected using these varied methods provided a thorough, rich, and detailed account of the teaching of developmental mathematics at ECCC.

**Research Questions**

The following research questions guided the case study:

Research Question 1: What factors do faculty take into consideration when designing instruction to enhance developmental mathematics?

Research Question 2: What does teaching developmental math entail?

Research Question 3: From a developmental math instructor’s perspective, what are the perceived outcomes of developmental mathematics education?

**The Setting**

East Coast Community College (ECCC) was founded in the mid-1900s. It is an urban, public, postsecondary community college located on the East Coast. East Coast Community College is strategically located to meet the needs of recent high school graduates from the area who are considered unprepared for postsecondary education.
Today, East Coast Community College serves more than 50,000 students total, with almost half being full-time degree-seeking students. Enrollment at East Coast Community College by race mirrors the local population, having a significant percentage of Asian, Black, and Latino students. According to an enrollment overview report from Fall, 2011, prepared by ECCC, racial minorities make up more than 50% of the student population. White students currently make up 32%, a significantly lower percentage than the minority student population at East Coast Community College.

East Coast Community College offers a comprehensive selection of courses, and educational learning opportunities. In addition, ECCC offers various campus resources for students, such as counseling and advising, and campus life services. Counseling and advising resources include helping students achieve their educational goals, offering a first year seminar course, and providing support when students need help. Campus life services include opportunities to participate in co-curricular activities such as clubs and organizations, athletic and intramural sports, and service learning. Both the counseling and advising resources and the campus life services help to support student retention and achievement of educational goals.

Due to the purpose of the study, I focused on developmental mathematics courses. I identified developmental mathematics courses by course descriptions and call numbers that appeared in the online course catalog and schedule of classes. In addition, I asked the department chair to identify developmental mathematics courses to ensure that I was interpreting the published descriptions correctly.
Rationale for the Study

A considerable amount of research has been published that has addressed the issues, patterns, and implications relevant to college readiness, which are factors that contribute to the increasing demand for developmental education (Byrd & Macdonald, 2005; Conley, 2008; Reid & Moore III, 2008). The percentage of students who are not ready for college continues to increase annually, (ACT, 2011) with minority populations and students from low-income backgrounds being less likely to be ready (Bragg, Eunyoung, & Barnett, 2006; Green, 2006; Ogbu, 1990). However, minimal literature exists regarding the experiences of instructors who teach developmental courses and even fewer regarding developmental mathematics. Effective teaching practices encourage student engagement and learning necessary for the 21st century (American Association of Community Colleges, 2007). Therefore, in this study I explored the experiences of developmental mathematics instructors and observed their teaching practices to identify factors that encouraged student engagement and were perceived by instructors to be intentional actions designed to motivate students to excel at mathematics.

Upon entry into the community college, students are informed of their readiness for specific courses through the students’ personal reflection and intuition, placement examinations (Boylan, Saxon, & Bonham, 1997; Roueche & Roueche, 1999), and/or advising from a member of the professional staff. However, the factors that instructors consider when designing and teaching developmental mathematics education courses are not reported in the literature.
As a result of unequal secondary education, inadequate teaching practices, and poor scores on standardized tests, the percentage of students who require developmental mathematics education prior to entry into a four-year institution is high and presents a critical issue for educators and policymakers (ACT, 2011). Until secondary schooling problems are addressed, a large number of high school graduates will continue to be unprepared for college and the potential for those numbers to increase will be significant, having a considerable influence on community colleges, preparation of a skilled workforce, and the transfer rate from community colleges to four-year colleges and universities. In this study, I examined this issue student under-preparedness at the postsecondary level by exploring the experiences of instructors who teach developmental mathematics, studying the developmental mathematics education classes, and observing instructors while they were teaching developmental mathematics.

The percentage of students entering postsecondary education unprepared (ACT, 2011), as well as the increased need for community colleges to offer developmental mathematics, added a sense of urgency to the rationale for this study. Although I examined developmental mathematics education classes offered by an urban public community college located on the east coast, the information I gained may be useful for secondary educators as well as those teaching in community colleges. In addition, the information I gathered can be used to implement effective teaching practices at other postsecondary institutions that are responsible for providing developmental mathematics courses. In doing so, my hope is that underrepresented students, who are often insufficiently prepared for college, will not only gain
admission to college, but also persist to completion and achieve or exceed their educational goals.

**Significance of the Study**

In the study, I sought to identify practices demonstrated by East Coast Community College instructors that enhance the effectiveness of developmental mathematics education. Through exploring the experiences of instructors and assessing the effectiveness of the courses they taught in terms of engaging students, my goal for the study was to enhance developmental mathematics education at East Coast Community College.

The case study extends current research on developmental mathematics education courses by uncovering the implications for ECCC in the event that intentional teaching strategies are employed. Furthermore, the information from the case study can be used to inform educators, college administrators, and policymakers who are actively engaged in examining and addressing the needs and demands of students who are characterized as not ready for college. Finally, findings from the study support the argument for developmental mathematics education within the postsecondary curriculum, particularly at community colleges.

**Theoretical Perspective**

The theoretical perspective is the philosophical stance that supports the case study methodology. According to Crotty (1998), the theoretical perspective provides a context, logic, and criteria for research. I used critical inquiry as the theoretical perspective for this study. Critical inquiry calls into question social practices of oppression, exploitation, and injustice.
(Crotty, 1998; Lincoln & Guba, 2000) and establishes an argument against oppressive structures that exist within society but can be changed to forms that are more transformative (Broido & Manning, 2002). For these reasons, I used critical inquiry to examine the experiences of developmental mathematics instructors.

I also used concepts of critical pedagogy in my analysis and discussion of the data. Critical pedagogy offers a framework and language to explore and explain the influence of culture on teaching practices and learning environments (Giroux & McLaren, 1989). The concepts I found most relevant are: (a) resisting a curriculum that promotes dominant cultural practices (Giroux, 1992; McLaren, 2007; Wink, 2000), (b) highlighting the social construction of knowledge (Giroux, 1981; McLaren, 2007), and (c) training instructors to be educational change agents by increasing awareness of the diverse student population (Giroux & McLaren, 1989; Hinchey, 2004).

**Researcher Perspective**

According to Creswell (2007), the researcher is the key instrument in a study, being solely responsible for collecting data. Therefore, the researcher is challenged to constantly test personal biases and preferences. Entering the study, I was keenly aware of four areas of personal preference that I needed to openly acknowledge. First, as a result of my exposure to critical theories such as critical pedagogy and critical race theory (CRT), I naturally examine phenomena through a critical lens. Second, the research topic was provoked by my personal interest in supporting access to four-year institutions for groups with which I personally share two identities: low-income and racial minority groups. Third, I am a first-generation college
student and strongly promote the need for resources, such as developmental education, to support college access and college completion among populations that are not highly represented in postsecondary education. Lastly, I have not served as an instructor of developmental mathematics, although I have taught other higher education courses. Therefore my experience with mathematics is solely as a student. My hope is that the findings of this study help to increase accomplishment of educational goals and access to four-year institutions among groups that are largely underrepresented.

Summary

The purpose of the study was to extend the conversation beyond the need for developmental mathematics education to how we can enhance developmental mathematics education by improving classroom instruction. Additionally, the study provides information regarding effective teaching practices such as providing student feedback, allowing space for multiple voices to be heard, legitimizing diverse backgrounds, and using non-traditional styles of instruction. Effective teaching practices used by developmental mathematics instructors at East Coast Community College were uncovered through interviews, observations of developmental mathematics education courses, and a review of documents.

Overview of the Dissertation

In Chapter 1, I have introduced the three concepts that will inform the study: the issue of college readiness, the role of the community college in preparing students for attainment of their educational goals and completion of college-level coursework, and developmental education with a focus on developmental mathematics. I began by presenting the low
persistence and retention rates among students in higher education, and the alarming percentages of recent high school graduates who are considered unprepared for higher education.

Lastly, I briefly discussed the demand placed upon community colleges to offer developmental mathematics education due to the mission of community colleges to prepare students for the workforce, college-level coursework, and postsecondary education; the open-enrollment status of community colleges; and the perception that community colleges are a “bridge” to four-year institutions. These considerations all support the need for this study, which examines how community college instructors design developmental mathematics education courses, the teaching strategies they use in these courses, and how the perceptions, attitudes, and beliefs that instructors hold pertaining to developmental education may affect their teaching and connection with students.

In Chapter 2, I describe existing research on college readiness and the factors contributing to the ongoing increase of recent high school graduates who are considered unprepared for postsecondary education, particularly four-year institutions. In addition, I examine the literature on community colleges and developmental mathematics education to uncover the relationship of these variables to college readiness. Literature on these three topics—college readiness, community colleges, and developmental mathematics education—provide the foundation for the development of my research questions and inform other aspects of my study.
In Chapter 3, I offer an overview of the epistemology, the theoretical perspective, the methodology, and the data collection methods that I use to frame the study. I include a description of case study methodology and explain the case study design and ethnographic methods used in this study. I offer a detailed explanation of the three forms of data I collected—interviews, observations, and documents—and why the three forms were chosen. Furthermore, I explain how I collected the data: in-depth interviews with faculty, observations of developmental mathematics courses, and review of departmental and institutional documents. In the data analysis section, I outline each step that I took to analyze the data, such as coding and memo writing. I discuss the ethical issues relevant to the study, such as anonymity of the participants, handling data and keeping data secured, and informed consent. I include discussion of my decision to use the professional principles published by the American Educational Research Association (AERA) to ensure that ethical standards were upheld and the study was deemed to be credible. Lastly, to ensure and explain the credibility of the study, I include sections on trustworthiness, limitations, and delimitations.

In Chapter 4, I include an analysis of the data and presentation of the findings and in Chapter 5 I summarize the study, discuss the findings in response to the research questions, include a discussion of the results in light of existing literature and theory, discuss the study’s strengths and weaknesses, and offer conclusions from the study. I also offer a list of recommendations for future practice to be considered by East Coast Community College and implications for future research. I conclude the chapter with my personal reflections.
CHAPTER 2. LITERATURE REVIEW

In the literature review for this study, I first examine college readiness and the factors contributing to the growing number of students who are graduating from high school unprepared for postsecondary education (ACT, 2011). These contributing factors include the process of funding secondary schools, the use of standardized test scores and related practices, and the influence of socioeconomic status (SES) on student learning. I then explore the mission and roles of community colleges, with a focus on current enrollment trends, instructors’ influence on learning, and developmental education, giving particular attention to developmental mathematics. Finally, I review the outcomes of developmental education, as presented in existing literature.

College Readiness

Although a considerable amount of literature has been published on college readiness, many researchers continue to grapple with constructing a concise definition of this term (Byrd & Macdonald, 2005; Conley, 2008). I was unable to find an agreed-upon understanding or consistent definition of college readiness in the literature. Byrd and Macdonald (2005) argued that the complex issues related to the phenomenon of college readiness make it practically impossible to construct a concise definition. For example, college readiness can be understood as an assessment of students’ academic and intellectual skills, emotional aptitude, and/or ability to socially adjust to a college environment with relative ease (ACT, 2011; Byrd & Macdonald, 2005; Conley, 2008). Each interpretation of college readiness includes a unique assessment of student preparation.
For this study, I defined college readiness as an assessment of students’ preparation to succeed at a college or university without developmental education (Conley, 2008). There can be many interpretations of Conley’s use of the term “succeed.” To succeed within an educational environment may imply persistence from one semester to the next, receiving “good” grades, or actual completion of a degree. The ability to persist or complete the degree requires significant emotional balance and social skills to adjust to the new college environment along with the academic and critical thinking skills to manage the intellectual expectations.

Overwhelmingly, a student’s level of readiness is juxtaposed against his or her degree of preparation for college. Conley (2008) presented “a broader, more comprehensive concept of college readiness built on four facets: key cognitive strategies, key content knowledge, academic behaviors, and contextual skills and knowledge” (p. 3). All of these factors can be determined by students’ grades and standardized test scores.

The literature, however, indicated a need to further analyze the complex issue of college readiness, particularly for low-income students and students of color. Considering the large academic disparity among those who are low-income and/or part of a racial minority group (Ogbu, 1990; Steele, 1992; Weissglass, 2001), I argue that college readiness is closely associated with both socio-economic status (SES) and race. The issue of college readiness can be further understood by examining the achievement gap demonstrated throughout secondary education between non-White and White students (Bragg, et al., 2006; Duran, 1994). Thus, students who are members of racial minority groups and/or low-income communities are less likely to be
prepared for the academic, emotional, and social demands presented throughout postsecondary education (Duran, 1994; Ogbu, 1990).

Although emotional and social readiness are both significant aspects of college readiness, in this literature review I focused more on academic readiness. I highlight the different experiences and diverse learning needs of marginalized populations and the related demands placed upon community college instructors (Green, 2006; hooks, 1994; Osborn, 1990). Due to the significant academic disparity between non-White and White students, as well as the influence of socio-economic status on college readiness, I conducted this literature review using a critical perspective to expose systems of inequity within educational structures that contribute to the need for developmental education.

The contributing factors considered in this literature review are those that magnify the lack of college readiness among members of low-income and/or minority populations. These three factors are: 1) the process of funding secondary education, 2) challenges relevant to college entry and placement standardized testing, and 3) the influence of SES and racial identity on student learning.

**Funding Secondary Education**

State practices of funding public schools based on neighborhood taxes serve as a contributing factor to the increase in numbers of recent high school graduates who are unprepared for postsecondary education. The systemic process of using neighborhood taxes to fund schools produces an inequality among secondary schools. Neighborhoods with higher tax rates have schools with greater resources and students with a higher probability of readiness
for college. Students who attend schools in low-income neighborhoods are more likely to need remedial education prior to entering postsecondary education (Ogbu, 1990). According to Ladson-Billings (1998), critical race theory scholars have argued that “school funding is a function of institutional and structural racism” (p. 20) that is intended to reinforce unequal schooling and social reproduction.

Unequal resources among neighborhood schools are prevalent today just as they were during the segregation of schools. This issue warrants greater attention among educators and policymakers in relation to college readiness and the implications for remedial education. African American students are more likely to attend inferior schools, to be taught by less qualified teachers, and to have teachers with lower expectations (Bell, 1980; Gonzalez, Stoner, & Jovel, 2003). Unfortunately, more than 50 years after the integration of schools, students of color are still more likely to attend schools with limited resources due to the racial and economic segregation that exists among neighborhoods.

Although schooling practices and policies differ from state to state, funding that is based on property taxes is a shared practice (Ladson-Billings, 1998). As a result, students from low-income families and racial minority groups who come from poor neighborhoods and the under-resourced schools within those neighborhoods are less likely to complete high school, score well on standardized tests, or be prepared for college (Steel, 1992; Walpole et al., 2005), factors that contribute to the growing need for developmental education at colleges and universities to support academic success among underprepared and underrepresented students.
Standardized Tests

A recent study suggested that many students of color are 2 years behind White students by the end of 4th grade, 3 years behind in reading and math by the end of 8th grade, and 4 years behind if they reach 12th grade (KnowledgeWorks, 2007). As a result, subordinated groups, have a higher probability of not scoring as high on standardized tests as students from dominate groups (Green, 2006; Ogbu, 1990). Jencks (1998) affirmed that students of color, particularly African American and Latino students, historically and currently score lower on standardized tests, including the SATs, than their White peers.

Because of students’ participation in a less than rigorous K-12 curriculum and their low standardized test scores, students of color are less represented in postsecondary education institutions than White students. Increasingly, decisions about college readiness and college access are made by standardized assessments and high school grade point averages (Jencks, 1998; Walpole et al., 2005). Standardized test-based admissions and GPA may overlook the historical and cultural background of students of color that might include strengths related to readiness for college, such as innate survival abilities and community support (Byrd & Macdonald, 2005; Ogbu, 1990; Yosso, 2005).

The lack of congruency between academic performance and test scores among racial groups, particularly non-White versus White students, establishes a legitimate argument that standardized tests are culturally biased and have a negative impact on underserved students (Duran, 1994). Many scholars support the claim that African American and Latino students
have lower scores on standardized tests because of cultural bias inherent in the tests (Hacker, 1992; Jencks, 1998).

Standardized tests are commonly used as a determining factor in gaining admission to college. The demand for high test scores is fueled as competition for admission to selective colleges increases among recent high school graduates (Walpole et al., 2005). However, the literature reveals that a rigorous secondary curriculum and a high grade point average are better predictors of student success than standardized tests (Adelman, 1999). Considering the study presented by Adelman, one must question the purpose of using SAT scores as a standard for admission. Given that admissions standards such as high SAT scores support an institution’s rankings and contribute to the competitive environment among higher education institutions seeking opportunities for greater exposure (Bowman & Bastedo, 2009; Ding, Jalbert, & Landry, 2007), underserved populations are often denied admission due to selfish motives upheld by politics, institutional gain, and bureaucracy.

In addition to the SAT or ACT tests, which are commonly used by four-year institutions, American College Testing’s (ACT) COMPASS and the Educational Testing Service’s ACCUPLACER are standardized computer-adaptive assessment instruments used by community colleges for appropriate course placement. According to Medhanie (2012), “Most colleges use placement tests designed locally or by an outside agency to determine a student’s readiness for college level work” (p. 334). In a study conducted by Gerlaugh, Thompson, Boylan, and Davis (2007), the authors found that among the institutions studied, 97% used the COMPASS.
According to the U.S. Department of Education’s National Center for Education Statistics (2004), 61% of community colleges used some form of placement test to assess students’ readiness for college and appropriate course placement. This use of standardized placement tests has been encouraged by state legislators, who have begun to urge community colleges to effectively assess and place students in the proper courses based on placement tests scores (Gerlaugh et al., 2007; Russell, 1997).

Although varying placement tests are used by community colleges, the ultimate goal of the tests is to determine whether or not a student can be successful in a particular course (McFate & Olmsted, 1999). Moreover, placement tests are used to avoid denying admission to community colleges by assessing students’ skills upon entry and placing the students in courses that are appropriate, which may be developmental education courses (College Board, 2009).

**Socioeconomic Status**

Socioeconomic status also has a significant impact on student learning. Bourdieu and Passeron (1977) postulated that cultural capital, which is an accumulation of cultural knowledge and skills possessed and inherited by privileged groups, has a tremendous impact on student success and parental involvement. Lareau (1987) extended Bourdieu and Passeron’s position by stating that parents’ educational background, their view of schooling, and the available resources in the home, which can be perceived as forms of cultural capital, influence parental involvement, which in turn impacts student learning.

Parental involvement and behavior are directly related to SES. For instance, parents’ responses to requests from middle-class schools are much higher than parents’ responses at
working-class schools (Lareau, 1987). As indicated throughout the review of the literature, students of color traditionally are less likely to gain access to higher education. As a result, people of color are also more likely to be in low-income positions, to be constantly exposed to racial discrimination, and to have limited access to forms of cultural capital that might promote access to higher education, such as precollege preparatory resources that are often absent in low-income communities and schools (Ogbu, 1990; Yosso, 2005).

Along with, and related to, socioeconomic status, quality of schooling and available resources are arguably factors that influence college preparation. Resource differences among schools and neighborhoods are prevalent today just as they were decades ago (Lareau, 2011). There is a significant body of published studies concluding that students of color are more likely to attend urban schools that are resource poor, to be taught by less qualified teachers, to have teachers with lower expectations, and to be tracked away from higher achieving groups (Gonzalez et al., 2003; Lareau, 2011; McLaren, 2007).

**Community Colleges**

Continuing the literature review, I examined the community college and its role in educating students who are poorly prepared for college through the use of developmental courses. I first provide a brief profile of community colleges. The community college is the largest and fastest-growing segment of higher education in the U.S. (AACC, 2010b). The growth of the community college can be partially attributed to the increasing number of students who are graduating from high school unprepared for postsecondary education.
In 2006-2007 there were 1,045 community colleges throughout the U.S. (NCES, 2008). The approximate enrollment among all community colleges is 6,184,229 (NCES, 2008), currently 43% of all U.S. undergraduates (NCES, 2007a). I specifically investigated community colleges in the geographic area surrounding ECCC. Forty of the 1,045 community colleges in the U.S. are located in this east coast metro area. (http://www.eccc.edu [generic website used]).

The role of the community college is defined by its open-door access enrollment standard (Levin, 2001; Rhoads & Vladez, 1996; Shaw, 2001). Additionally, community colleges are characterized by multifaceted missions that help students develop skills, prepare students for college-level work and transfer to four-year colleges, and prepare students for the workforce.

The role and trajectory of the community college was defined by the Truman Commission’s report, which promoted and enforced accessibility to higher education for every citizen, youth, and adult (President’s Commission on Higher Education, 1947). This role continues today. Community college leaders, educators, and policymakers uphold the directive of the Presidential Commission of 1947 by sustaining an ongoing commitment to providing access to marginalized populations. Data regarding the racial diversity represented at community colleges demonstrates that the commitment is a reality: 53% of Hispanic students, 45% of Black students, 52% of Native American students, and 45% of Asian/Pacific Islander students attend community colleges throughout the U.S. (NCES, 2007a).

The expansion of community colleges has continued since the mid-1940s; they now reach millions of students, employ significant numbers of people, and serve as a major
contributor to local and U.S. economies (AACC, 2010b). Arguably, community colleges are within a reasonable driving commute of 90% of the U.S. population (AACC, 2010b). Various studies have revealed that as community colleges become more accessible, research universities have become more selective in their admissions policies (Hoxby, 2000; Turner, 2004) creating negative implications for students, particularly those who are underprepared, to successfully transfer from a community college to a four-year institution.

The open access enrollment policies and ongoing expansion of community colleges has created demands that community college administrators and instructors must address. Specifically, a strong focus on the curriculum is needed. Every public community college that receives state and public funds is required to offer developmental education courses and services (NCES, 2003), a requirement that generates tension among educators and policymakers since funding is tied to it. Subsequently, there are significant implications for institutions, such as the need for more instructors, a diverse population of instructors, and adequate developmental skills courses.

Although every member of the college community is important to the success of students, because of their numbers and roles on campus, faculty members strongly influence the campus culture, policies, and curriculum that in turn have an influential effect on students. Therefore, in this study I explored the experiences and attitudes of developmental mathematics instructors in community colleges and their influence on student engagement and academic success.
Developmental Education

The final topic I explored for this literature review was developmental education with an emphasis on developmental mathematics. In the simplest of terms, developmental education fulfills the purpose of equipping students to be successful in college and prepared to manage college-level courses (Aycaster, 2001; Bailey, Jeong, & Cho, 2010; Boylan & Saxon, 1999). From a broader point of view, developmental education is designed to assist students to develop minimum reading, writing, and math skills (McCabe, 2003), close the achievement gap by reducing disparities between populations (Roueche, Roueche, & Ely, 2001), and increase access to and completion of postsecondary education among underrepresented populations leading to higher economic potential (Brothen & Wambach, 2004). Subsequently, developmental education provides the opportunity for students to improve their own lives and the lives of their families (Boylan & Saxon, 1999; McCabe, 2000). Developmental education has outstanding potential to advance student achievement. However, Bailey, Jaggers, and Scott-Clayton (2013) concluded that the current practice of developmental education does not work well. They advocated the importance of continuing to assess, modify, and offer developmental courses.

Definitions of Remedial and Developmental Education

In addition to understanding the purpose of developmental education, acquiring a working definition of the terms used is important. Throughout the literature the terms “remedial education,” “remedial,” “developmental,” “developmental education,” and
“developmental skills” were used interchangeably and were common keywords throughout the literature search.

Remedial education is defined as “a class or activity intended to meet the needs of students who initially do not have the skills, experience or orientation necessary to perform at a level that the institutions or instructors recognize as ‘regular’ for those students” (Grubb et al., 1999, p. 174). Boylan, Bonham, and White (1999) suggested a slight distinction between remedial and developmental education, stating that remedial education is pre-college level work, somewhat lower-level than the regular college curriculum, while developmental education is college-level work with an emphasis on skills development, such as critical thinking. Moreover, according to the National Center for Education Statistics (2011), remedial education refers to college courses in reading, writing, or mathematics for students in need of skills to perform at the level required by the institution (p. i). Beyond offering a formalized definition of remedial, Rouche and Rouche (1999), suggested that “remediation is a ‘remedy’ intended to restore opportunity to those who otherwise may be relegated to meager wages, poor working conditions, and other consequences of socioeconomic marginalization” (Bahr, 2008, p. 422).

On the other hand, the term developmental shares similarities with remedial but incorporates a broader focus on supporting students holistically. Almost 40 years ago, Cross (1976) defined developmental education as a continuum of services from remedial courses to learning assistance centers.
Boylan and his colleagues (1999) demonstrated agreement with Cross (1976), suggesting that developmental education includes an emphasis on student development relevant to understanding content as well as development of basic skills (Boylan, et al, 1999, p. 87).

More often than not, the terms were used interchangeably throughout the literature, referring exclusively to courses or a curriculum that is considered to be precollege level. However, in reference to mathematics and writing courses, the content is commonly beyond high school level but the course is considered developmental because it is designed to fill the gaps between high school and college with the focus being on the course content alone, absent of other institutional services and interventions (Boylan, et al., 1999, p. 88). Therefore the term *developmental* will be used throughout this study when referring to remedial or developmental mathematics education. Understanding the purpose of developmental education and ways in which terms are used when referring to developmental education are important in order to evaluate the effectiveness of developmental education at colleges and universities.

**Enrollment in Developmental Education**

Unfortunately, a shared standard between universities and community colleges to evaluate and manage developmental education issues does not exist. According to Meritosis and Phipps (2000), developmental education is determined by the admission requirements of the particular institution. Thus, each institution has its own individualized methods of admitting students, placing students in developmental courses, and administering developmental instruction.
However, developmental education existed prior to standardized testing and some scholars argue that developmental education services have existed since the early establishment of higher education (Casazza & Silverman, 1996; Maxwell, 1997; Meritosis & Phipps, 1999). Specifically, developmental education is noted as originating at the University of Wisconsin’s college preparatory program in 1849 (Brier, 1984). Although developmental education has existed almost since the establishment of higher education, not until the 1960s did formal organizational structures begin to develop within colleges and universities to support underprepared students (Casazza & Silverman, 1996).

Informal and formal developmental education practices have existed for many years and considering current data, developmental education will continue to be a part of postsecondary education. For example, Adelman (2004) estimated that 41 percent of all students enroll in at least one developmental course. During the same period as Adelman’s study, the authors of the National Postsecondary Student Aid Study concluded that 43 percent of first- and second-year students enrolled in public two-year colleges were enrolled in at least one developmental course (Horn & Nevill, 2006).

According to recent reports, almost 30 percent of traditional age (18-24 years old) students enrolled in a developmental mathematics course (Attewell, Lavina, Domina, & Levey, 2006). Based upon the data presented by Adelman (2004), and Attewell et al. (2006), along with national studies, a greater percentage of students are enrolling in developmental mathematics at some point during their college experience than developmental courses in any other academic discipline.
Current projections offered in various studies have demonstrated the need for colleges and universities to offer developmental education courses: through the year 2018, nearly two-thirds (63%) of all new jobs will require more than a high school diploma; nearly half of all new jobs will require some college level education but less than a bachelor’s degree; and 21 of the 30 fastest-growing occupations require postsecondary education (Carnevale, Smith, & Strohl, 2010; Lacey & Wright, 2009). Considering the stated projections and increased numbers of students graduating from high school unprepared for college, the demand for developmental education and for community colleges to provide this resource is high.

**Controversy Regarding Developmental Education**

Developmental education has become associated with community colleges and is perceived to be an integral educational program used to achieve the community college mission to support students’ successful completion of high school requirements, prepare students for the workforce, and/or equip students to transfer to four-year institutions. Many of the existing perceptions regarding community colleges are due to their open-access enrollment policies. As Armstrong (2000) noted,

> The open-access philosophy of community colleges practically ensures that the students served will differ in their experiences, education levels, and socioeconomic status. Open access combined with the growing national emphasis on improving student outcomes is a major challenge facing community colleges. (p. 681)

To meet the challenge issued by President Barack Obama to increase the number of student completers at community colleges, educators must enhance and expand programs that
support student academic success and goal achievement (AACC, 2010a). As argued by Bailey and Alfonso (2005), developmental education programs are capable of increasing the number of graduates and are crucial to community college students; however, advancing developmental education continues to be met with opposition.

Some educators perceive developmental education courses to be a burden (Parsad & Lewis, 2003) due in part to the cost of maintaining quality services and the desire to achieve high standards, goals that are threatened by the presence of so many students in need of developmental skills education (Perin, 2006). The burdens of developmental education are exacerbated by the arguments of those who oppose developmental education who believe that necessary skills taught in developmental classes should be acquired in high school or prior to postsecondary schooling (Boylan, et al., 1999).

Lastly, negative perceptions of developmental education can be attributed to the stratification of courses based on socioeconomic status and race. One study revealed that a large percentage of students enrolled in developmental education classes are from low socioeconomic status (SES) backgrounds and members of racial minority populations (Boylan & Saxon, 1998; Dowd, 2007). However, a study published during the early 1990s suggested that a greater percentage of students enrolled in developmental education were White (two-thirds) while the remaining one-third were minorities, with the largest groups being African American and Latino (Boylan, Bliss, & Bonham, 1994).

Two social dilemmas that are pertinent to the study are the economic recession, which illuminates the arguments both for and against developmental education among educators and
policy makers, and the increasing number of students who are not prepared for postsecondary education following completion of high school. Supporters of developmental education argue that a skilled workforce is necessary for an immediate economic recovery and future economic competitiveness of the U.S. (AACC, 2010a). In the same study, the Association of American Community Colleges (AACC) posited that community colleges are the “engine driving the nation toward renewed and sustained economic prosperity” (p. 8). Offering access to higher education and creating a skilled workforce are both related to addressing the demands associated with preparing students for postsecondary education.

In light of the current economic crisis, however, the cost of developmental education is under greater scrutiny. Critics argue that the public is paying for developmental education twice: once for secondary education and again for students who enter postsecondary education required to take developmental education courses, which are perceived to be high school level work. Boylan, Bonham, and White (1999) critiqued this argument, stating that only 43 percent of high school students completed a college preparatory curriculum, definitively concluding that the public has not paid for developmental education twice—and really not even once.

However, developmental education does demand significant financial resources from the public. During the late 1990s, the cost of developmental education was reported to exceed one billion dollars a year (Breneman & Harlow, 1998). Within the past five years, the annual cost has been estimated to exceed a billion dollars per year at community colleges alone and an additional 500 million at four-year colleges and universities (Strong American Schools, 2008).
Nevertheless, given its value and influence, developmental education contributes significantly to preparing students to be successful in college. Subsequently, success in college positively influences economic growth through lowering the unemployment rate, need for welfare, and rate of incarceration (Aycaster, 2001, p. 404). In short, Claxton (1994) argued that the cost-benefit ratio for developmental education is about the same.

Despite the existing debate among educators and policymakers regarding the cost of developmental education at colleges and universities, initiatives that promote developmental education are necessary in light of the economic recession, college readiness issues, and other social issues that corroborate its importance, value, and need within U.S. higher education. Initiatives that argue for effective developmental education and therefore support the need for this study include the stated commitment to educational access by the Obama administration (McGuinn, 2011; Obama, 2009), A National Call to Action: College Completion Agenda presented by American Association of Community Colleges along with other national organizations (AACC, 2011), and the Achieving the Dream Initiative (AACC, 2010a).

The Obama administration has explicitly stated a strong commitment to increasing access to higher education for all Americans (Obama, 2009). The commitment is accompanied by an emphasis on community colleges to lead the way, considering their open-access policy and mission to prepare students for the workforce or for postsecondary education at four-year colleges (AACC, 2010a; Obama, 2009). Secondly, the National Call to Action is an initiative headed by AACC, an organization that represents community colleges throughout the U.S. The organization pledged to promote the development of policies and practices that will increase
the number of students with postsecondary degrees by 50% by 2020, while increasing access and quality (AACC, 2010a). Lastly, the purpose of the Achieving the Dream initiative is to help more community college students achieve their educational goals and increase their probability of graduating. This initiative has a special emphasis on students of color and students from low-income backgrounds (AACC, 2010a; http://www.achievingthedream.org).

**Developmental Mathematics**

Due to the multitude of students entering postsecondary education academically unprepared and in need of developmental mathematics education, the aforementioned initiatives must give consideration to improving mathematics education within the community college environment in order to help students achieve their goals. Although multiple variables may have an influence on learning mathematics, the literature highlights enhancing self-efficacy among students (Smittle, 2003), motivating students to apply themselves throughout the learning process (McCusker, 1999), and employing effective teaching practices (AACC, 2007) as major contributing factors to a student’s success in mathematics courses. While a significant body of literature exists relevant to developmental education within the college and university environment reaching as far back as 50 years (Cross, 1976) and significant literature exists regarding mathematics education on the secondary level, far less information is available relevant to developmental mathematics as taught in community colleges, and even less literature examines the experiences of instructors who teach developmental mathematics courses.
Therefore, using applicable literature from resources that focus on postsecondary education, I provide a brief summary of the three factors that promote student success in mathematics: enhancing self-efficacy, motivating students, and employing effective teaching practices. To close this section, I highlight the purpose of this study, which is designed to address a significant gap in the literature: exploring the experiences of instructors who teach developmental mathematics and ways in which instructors influence learning in the classroom.

**Enhancing Self-Efficacy**

Self-efficacy is noted as a primary factor in assessing a student’s potential to excel at learning mathematics. Self-efficacy can be viewed as a “distant relative” to self-esteem. Smittle (2003) concluded that enhancing self-esteem is extremely important for developmental students, who often have low self-esteem (p. 5). A student who has low self-esteem may encounter challenges within an academic environment that they often perceive to be insurmountable. Several education scholars have defined self-efficacy as students’ perceptions of their ability to be successful, accomplish goals, and attain academic success (Hall, 2002; Shunk, 1990). Moreover, self-efficacy is defined as a means of evaluating the self, making choices, and determining effort, factors that may contribute to a student’s decision to stop out or drop out of school (Snow, Corno, & Jackson, 1996, p. 277).

Self-efficacy can be a determining factor regarding students’ completion of academic goals. Students with low self-efficacy are described as being less likely to think critically, persist over an extended period of time, or solicit help when needed (Dembo & Seli, 2004, p. 6). Fortunately, strategies are available to aid students with low self-efficacy. According to
Bandura (1995), emotional arousal, opportunities to learn from others, accomplishing goals, and verbal persuasion are principal factors that can help students develop and maintain a strong sense of self-efficacy. In sum, self-efficacy is a mediating variable between student performance in the classroom and accomplishing the course objectives outlined by the instructor (Chen & Kaplan, 2003).

**Motivating Students**

Motivating students to complete assignments and solicit help when needed is another factor that contributes to success in developmental mathematics. However, teaching strategies and initiatives used to motivate students are often met with student resistance and a lack of engagement throughout the learning process. Student resistance can materialize from feelings of embarrassment resulting from placement in a developmental course (Hall, 2002). In addition, students are often “living with” math anxiety stemming from a low sense of self-efficacy (Tobias & Weissbrod, 1980).

According to Maxwell (1997), students are stigmatized when placed in developmental mathematics, which can lower their perceptions of themselves and lead to embarrassment that negatively influences their academic performance. In addition, recent high school graduates are often surprised when placed in developmental courses, adding frustration to their sense of embarrassment about having to deal with the stigma associated with placement in a developmental education course (Bailey et al., 2010, p. 257). Developmental education students may not have the tools, nor solicit the support from faculty or staff, to manage the
stigma, embarrassment, and discouragement they experience and resort to leaving the institution (Deil-Amen & Rosenbaum, 2002; Rosenbaum, 2001).

Moreover, negative feelings associated with being placed in developmental education courses are heightened by additional cost, added time to completion, and lack of credit for courses taken. Bailey et al. (2010) argued, “While students are enrolled in developmental courses, students accumulate debt, spend time and money, and bear the opportunity cost of lost earnings” (p. 257). Thus, students naturally begin to assess the value of college enrollment while struggling to overcome emotional distress and manage personal responsibilities. Equally important, students are aware that despite their effort, financial loss, and accumulated debt, they will not receive credit for developmental courses. These factors are very discouraging and definitely contribute to students’ lack of motivation (McCusker, 1999).

The ability to overcome math anxiety is central to a students’ academic success in developmental mathematics and subsequently to completion of their educational goals. Although introduced in 1980, the definition of math anxiety presented by Tobias and Weissbrod (1980) captures the impact of math anxiety as experienced by current developmental mathematics students: “the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem” (p. 65). However, I believe that math anxiety begins at the thought of encountering mathematics, prior to the need to solve a mathematical problem. Many students feel a sense of paralysis when even thinking about having to accomplish a mathematics project. Researchers following Tobias and Weissbrod (1980) argued that teachers and their methods of teaching of mathematics
contribute to math anxiety (Williams, 1988). Teachers must use effective teaching strategies, such as teaching the content so that students thoroughly understand the concepts, to successfully overcome math anxiety (Reyes, 1980).

**Employing Effective Teaching Practices**

Effective teaching strategies, such as thoroughly teaching math concepts, were commonly referred to throughout the literature as an important method of supporting students’ academic success while enrolled in developmental mathematics. However, Smittle (2003) argued that teaching concepts and subject matter alone is not enough when students lack basic foundational knowledge (p. 3). Hall (2002) further claimed that instructors should do whatever is necessary to support students in raising their mathematics self-efficacy so that students’ options for selection of academic major and career are broadened (Hall, 2002, p. 10). Increasing mathematics self-efficacy may include supporting students’ developmental needs in addition to addressing the course objectives. Teachers indicated that motivating students to apply themselves and engage in learning activities was the most difficult task in the classroom (Smittle, 2003).

The literature suggests multiple teaching strategies and classroom practices that can be used to help motivate students. However, scholars viewed two traditional strategies--lecturing and creating controlled classroom environments--as barriers for learning among students (Fiore, 1999; hooks, 2003; McLaren, 2007).

Fiore (1999) maintained that instructors must do more than facilitate lectures in order to promote student engagement; rather, they must create a classroom environment that
invokes positive feelings among students (p. 405). Using teaching styles other than lecturing may be uncomfortable for instructors who teach in the manner that they were taught as a student. However, the practice of lecturing leads to creation of an environment where the teacher provides information and the students listen without relating the content to personal experiences (Freire, 1973). Thus, the instructors create a “teacher-controlled” academic environment having a greater focus on who, what, when, and where while limiting development of critical and analytical thinking skills among the students (Dembo & Seli, 2004, p. 6).

On the other hand, existing literature emphasized three effective teaching strategies that have been proven useful to enhance the learning of mathematics: transferring content to real world experiences (Cross, 2000), using conceptual methods to teach mathematics (Desimone, Smith, Baker, & Ueno, 2005), and structuring and leading activities for students in developmental education courses (Smittle, 2003, p. 2).

The practice of making math applicable to students enrolled in developmental math courses has been proven to be successful. Students who are able to transfer the content of the lessons to everyday experiences are more likely to be engaged throughout the learning process and find the course meaningful. Stahl, Simpson, and Hayes (1992) offered ten recommendations to support learning among “high-risk” students. One recommendation applicable to this study is to use a course model that stresses a transfer of content knowledge so that students have a chance to practice newly learned strategies when carrying out tasks that they perceive to be “real” (Stahl, et al., 1992, p. 2). Considering that many students
enrolled in developmental mathematics can be characterized as “high-risk,” the recommendation provided by Stahl and his colleagues should be considered as a way to enhance developmental mathematics education.

Secondly, literature suggests conceptual teaching of mathematics as another effective teaching strategy. As part of a comparative study to uncover effective mathematics teaching practices, Desimone et al. (2005) concluded that conceptual teaching of mathematics is an effective method to better mathematics instruction in the United States. Desimone et al. explained that conceptual teaching of mathematics can be understood as the practice of thoroughly teaching concepts to students while creating applicability to the students’ everyday experience; thereby assisting them in making meaning out of the knowledge acquired.

Thoughtfully structuring learning experiences and activities for students in developmental courses is another teaching method that have been proven to enhance learning. According to Smittle (2003), instructors of developmental education courses must lead classroom activities and provide constant feedback with the intent of helping students to become independent learners (p. 2). Although Smittle’s research focuses on developmental education in general, the method is applicable to developmental mathematics. If Smittle’s suggestion is adopted, instructors will be actively involved in the learning experience, which may improve student engagement and ultimate fulfillment of educational goals.

**Outcomes of Developmental Math**

In the literature I reviewed, I identified several outcomes related to developmental education in general and developmental mathematics in particular. The broad learning
outcome for developmental mathematics is to prepare students for college-level work. The actual outcomes that students who took developmental mathematics demonstrated included: lower grades than students not enrolled in developmental math (Burley, Butner, Anderson, & Siwatu, 2009), lower chances of academic success (Burley et al., 2009), greater time to completion (Melquizo, Bos, & Prather, 2011), and decreased likelihood of transferring to four-year institutions (Bailey, et al., 2005). I identified one positive outcome: higher retention rates when developmental math and a specific course sequence are mandatory (Bailey, et al., 2005; Melquizo et al., 2011).

Burley et al. (2009) presented two interrelated outcomes experienced by students: receiving lower grades and lower chance of academic success. Burley and his colleagues reviewed GPAs reported on transcripts from the National Educational Longitudinal Study: 88/100 (2000) and concluded that students not enrolled in developmental math had GPAs of about 2.8 versus 2.3 for students in developmental math. Considering the GPA of students in developmental math, students are less likely to achieve their educational goals, such as degree completion or certifications. Burley et al. (2009) concluded that “developmental education math students have a lower chance of success due to the additional support needed to be successful” (p. 37).

The additional time required to complete degree or transfer requirements may contribute to the limited chances of success described by Burley et al. (2009). Students in need of developmental mathematics are required to complete these additional courses before entering college-level mathematics. Therefore, more time is required for students to complete
the degree and/or transfer academic requirements. According to Melquizo et al. (2011), students who enrolled in developmental courses spent approximately 5 years at the community college before transferring to a four-year institution.

However, despite the additional time required, mandatory placement in developmental math promotes student retention. Using a study conducted by the National Center for Developmental Education (Boylan, Bliss, & Bonham, 1997), Melguizo et al. (2011) concluded that “retention rates in math were higher for students when remediation placement was mandatory” (pp. 176-177). As a result, mandatory placement and sequence of courses has the potential to support positive outcomes for students in developmental mathematics.

Unfortunately, Bailey et al. (2005) concluded “only 31% of those referred to developmental math complete their sequence. And this accounts for only 44% of those who enroll in any developmental math course” (p. 14).

The probability of students in developmental education achieving their educational goals is low (Bailey, et al., 2005). Using data from the National Education Longitudinal Study (NELS), Bailey concluded that less than one-quarter of community college students who enroll in developmental education complete a degree or certificate within 8 years of enrollment (p. 14). The negative outcomes demonstrated by students who take developmental mathematics suggest that community colleges must strengthen their developmental mathematics program if students are to achieve its stated learning outcome--preparation for college-level work. Since instructors play an important role in creating and teaching developmental courses, I discuss their perceptions of the curriculum and the students they teach in the next section.
Instructors’ Perceptions, Beliefs, and Attitudes about Developmental Mathematics

Developmental education and related trends at community colleges have been of significant interest to educators and experts for several decades (Attewell, et al., 2006; Bailey, 2009; Boylan, et al., 1994; Cross, 1976; Hagedorn & Lester, 2006). Studies demonstrate multiple points of disagreement regarding developmental education, such as which postsecondary institutions should offer developmental education, the cost of developmental education, ways of improving pedagogy and instruction, the experiences of subordinate groups, differences within academic disciplines such as English and math, and influences on degree completion and transfer rates (Bahr, 2008; Bailey, Jeong, & Cho, 2010; Hagedorn & Lester, 2006; McCabe, 2000). However, few studies exist in which the experiences, attitudes, and perceptions of developmental mathematics faculty are examined, particularly from a critical perspective. Therefore the purpose of this study was to fill the “gap” in the literature by investigating the experiences of instructors who teach developmental mathematics within a community college setting.

Grubb et al. (1999), in his book Honored but Invisible: An Inside Look at Teaching in Community Colleges, discussed an early investigation of teaching practices among community college instructors. Grubb and his colleagues, motivated by the absence of active support for teaching innovation, interviewed instructors and observed classroom instruction. However, they did not explore the attitudes or perceptions of instructors that influenced their practice. Also, the study was not limited to developmental mathematics but rather observed courses across disciplines and credit status.
Other studies focused on faculty characteristics as a predictor of student success. In particular, Boylan, Bliss, and Bonham (1994) conducted a study at the National Study of Developmental Education in which they compiled characteristics of over 1000 developmental educators. They reported such statistics as, “69% of developmental mathematics faculty in four-year institutions were part-time and 70% of them had 5 or fewer years of teaching experience” (p. 2). Other experts have explored characteristics of developmental education instructors including: professional experience and background, academic attainment, part-time versus full-time status, pedagogical strategies, and gender influences on classroom learning (Boylan, et al., 1994; Grubb et al., 1999; Mesa, 2012).

Although faculty characteristics are well studied, their attitudes and perceptions have been overlooked. However, a recent study conducted by Mesa (2012) demonstrated some similarities to my study in that he investigated community college mathematics instructors’ perceptions of community college students and their goal orientations. He concluded that instructors had a negative perception of community college mathematics students and their goal orientations. Although Mesa studied instructors’ perceptions, he did not explore how those perceptions influence teaching and learning. My study is designed to address this gap in the literature.

**Conclusion**

Literature on college readiness highlights the need for postsecondary education, with emphasis on community colleges, to provide services that will help to close the achievement gap and to make higher education accessible to everyone (Bragg, et al., 2006; Martinez &
Klopott, 2003). The community college is challenged to maintain an open-access philosophy and manage multiple missions, with an overarching goal of serving the community by helping students to achieve their educational goals. Therefore, the community college setting includes a very diverse population. Often students are in need of developmental skills due to increasing numbers of students graduating from high school without basic academic skills. Subsequently, faculty members, who strongly influence the college culture, are challenged to meet the learning needs of students by striving to provide effective instructional strategies that will promote learning. However, the ways in which teacher effectiveness is measured may be negatively influencing the academic success of students enrolled in developmental skills courses.

Effective developmental mathematics courses are essential for community colleges to meet the needs of a growing majority of students. Recent studies show that at least half of community college students require developmental education (Meritosis & Phipps, 2002). According to Shults (2000), 80% of community college students enroll in at least one developmental education course.

The literature documents the increased numbers of students graduating from high school in need of developmental courses, with reasons to explain the phenomenon. Furthermore, the literature suggests that as the percentage of students graduating from high school unprepared for college increases, the need for remedial education will continue to expand. The information gathered from the literature review is intended to push the conversation beyond needing to improving developmental mathematics education.
CHAPTER 3. METHODOLOGY

In this chapter, I provide a description of the epistemology, theoretical perspectives, and methodological framework that guided the study. Also, I outline the methods I used for studying developmental math education at an urban two-year community college located in the East Coast region of the U.S. Following the outline of the methods, I describe the research site and provide reasons for selecting the site; I then describe the participants and present data collection procedures and data analysis techniques. I provide information pertaining to the study’s trustworthiness, as well as ethical issues and considerations. Finally, I discuss the limitations and delimitations of the study.

Research Design

In this section, I review the epistemology, theoretical perspectives, and methodological framework used in this qualitative study of instructors’ perceptions of developmental math education at a community college.

Epistemology: Critical Inquiry

Critical inquiry was used as the guiding epistemology for this study. Because critical inquiry is strongly connected to research in the field it was very suitable for this study (Crotty, 1998). In addition, critical inquiry calls into question social practices of oppression, exploitation, and injustice (Crotty, 1998; Denzin & Lincoln, 2000). Denzin and Lincoln (2000) argued that critical inquiry calls for a “radical restructuring [of] society toward the ends of reclaiming historic legacies, social justice, the redistribution of power and the achievement of
truly democratic societies” (p. 1056). Critical theorists argue that oppressive structures exist within society but can be changed to a more transformative form (Broido & Manning, 2002).

Considering the notion that oppressive structures can be changed when examined with a critical lens, I used critical inquiry to frame this study. I provide a brief overview of critical inquiry and follow with a descriptive discussion of critical pedagogy, highlighting specific concepts that strongly support the research design. In addition, I discuss critical literacy as a bridge between critical pedagogy and critical mathematical literacy. My hope was that critical pedagogy would provide the perspective needed to examine the current supportive, oppressive, and exploitative practices related to developmental mathematics education at East Coast Community College (ECCC), reinforced by the goals of critical-mathematical literacy. The case study was limited to one college, within the east coast region, but the data collected are applicable to supporting the transformation of developmental mathematics education throughout postsecondary education.

It was my intention to use critical inquiry to examine the college as an environment that has the potential to promote empowerment and self-transformation (McLaren, 2003) through developmental math education. In order to do so adequately, the methodology and methods were guided by an understanding of the influence of society on the developmental mathematics curriculum and the power relationships within society that could help to uncover hegemonic practices and injustices (Crotty, 1998) that might be infused overtly or covertly within the curriculum. I entered this study in agreement with McLaren (2003) who argued, “Any worthwhile theory of schooling must be fundamentally tied to a struggle for a qualitatively
better life for all through the construction of a society based on nonexploitative relations and social justice” (p. 194). McLaren posited that the many sides of a social problem are often linked to class, race, and gender.

Considering the themes that emerged from the literature review, class status and racial identity of students appeared to be significant factors related to developmental mathematics education. Specifically, a theme that emerged from the literature highlighted the disproportionate number of students from low-income backgrounds and/or persons of color who are unprepared for postsecondary education (Steel, 1992; Walpole et al., 2005). Therefore, I considered both factors as I sought to identify practices that enhanced developmental mathematics education at the college. The end goal of the investigation was to create a more just, equitable, and freer society among those who may be marginalized based upon economic status or racial identity (Crotty, 1998).

Critical inquiry provides a broad view and critique of society, unlike critical pedagogy, which focuses more specifically on educational practices and institutional structures. Moreover, critical pedagogy is often referred to as “critical theory of education” in that its proponents examine the historical and current context of schools that characterize the class-driven dominant society (McLaren, 2003). In doing so, the application of critical pedagogy strengthens the focus of the study on education, instruction, and the classroom environment.

**Theoretical Perspective: Critical Pedagogy**

The theoretical perspective is the philosophical stance that supports the case study methodology. According to Crotty (1998), the theoretical perspective provides a context, logic,
and criteria for research. Critical pedagogy is a theoretical perspective that can be used to uncover and examine educational practices that limit the academic achievement of students due to institutional structures that promote dominant cultural practices while eliminating subordinate cultural practices within the educational context. Critical pedagogy practitioners and scholars analyze educational systems and practices that continue to marginalize students based on race, culture, and class (Giroux & McLaren, 1989; Monchinski, 2008). Furthermore, critical pedagogy “asks” questions such as why and how knowledge is constructed and why certain knowledge legitimates some cultures while excluding others (McLaren, 2003). Typical questions include: “Whose culture? Whose knowledge? Whose history? Whose perspective?” (Wink, 2000, p. 54), “Who benefits from this way of things? Why? Who suffers?” (Monchinski, 2008, p. 8). These are important questions for educators as they establish the groundwork for examination of the status quo and challenge instructors to use nontraditional teaching strategies to enhance learning and academic achievement among students. Additionally, use of critical pedagogy concepts may provoke education advocates to challenge policies and practices that fail to promote learning for all students.

McLaren (1998) noted that critical education emerged during the late 1970s, originating from a variety of influences, including the work and writing of Freire (1998, pp. 441-442). To date, multiple definitions for critical pedagogy exist. I have compiled a few of the definitions by some of the leading scholars of critical pedagogy to provide a working definition of critical pedagogy. According to Wink (2000), critical pedagogy is the process of teaching and learning together and the act of integrating new ideas into the real world. Freire (1997) defined critical
pedagogy as the act of reflection on oppression and the related causes, leading to liberation. McLaren (2003) concluded that critical pedagogy is a “way of thinking about and transforming the relationship between classroom teaching, production of knowledge, and institutional structures of the school” (p. 35). On the other hand, Giroux (2006) adopted a political stance by defining critical pedagogy as an “understanding and engagement with social issues and how to educate students to fight for a truly democratic society” (p. 209). Critical pedagogy clearly requires knowledge, reflection, and action to transform teaching and learning in the classroom.

Critical pedagogy is described and defined by scholars of this field based in part on their personal values (Kinetcheloe, 2008). In addition, critical pedagogy is context specific (Monchinski, 2008) and requires educators and students to consider their institutional structure to effectively use critical pedagogy. Therefore, the definitions and interpretations of critical pedagogy are constantly evolving. Critical pedagogy demands an ongoing back-and-forth flow between action and reflection, and theory and practice (Kincheloe, 2008; Monchinski, 2008). Concepts of critical pedagogy change due to the intellectual development of those who use critical pedagogy, the context in which it is used, and the constant movement between action and reflection.

Critical pedagogy was an ideal theoretical perspective for this study because it involves more than learning pedagogical techniques; it also includes an appreciation for multiple bodies of knowledge within the context of the school’s political structure and educational practices (Kincheloe, 2008). Critical pedagogy was used to examine the experiences of instructors who teach developmental mathematics--the “gap” in the literature that this study was designed to
address. My hope was that using critical pedagogy as a basis for examining developmental mathematics instruction would lead to its improvement and use as a means of empowering students.

Of course, concepts of critical pedagogy continue to evolve and expand. For example, Kincheloe (2008) presented 14 concepts that constitute critical pedagogy, drawing on scholarship from multiple authors such as Freire, Giroux, hooks, and McLaren. I introduce three broad concepts of critical pedagogy that I used to critically examine the strengths, issues, and implications of developmental mathematics education at ECCC. Lastly, I explain the value of this study and ways in which it will affirm and advance the existing literature.

Scholarship relevant to and guided by critical pedagogy presents a number of concepts that supported the research questions, interview protocol, and epistemology of this study. The concepts I found most relevant were: (a) resisting a curriculum that promotes dominant cultural practices (Giroux, 1992; McLaren, 2007; Wink, 2000), (b) challenging the social construction of knowledge (Giroux, 1981; McLaren, 2007), and (c) training instructors to be educational change agents by increasing awareness of the student population (Giroux & McLaren, 1989; Hinchey, 2004).

Critical pedagogy and resisting dominant cultural practices in education. From a critical theorist’s perspective, the curriculum goes beyond the program of study or course syllabi, and includes an examination of ways in which a person is prepared for dominant or subordinate positions. Giroux and McLaren (1989) explained the curriculum from a critical perspective as an introduction to a form and position in life that prepares students for
dominant or subordinate positions. McLaren (2007) suggested that a few common characteristics of the curriculum favor certain forms of knowledge and are often discriminatory on the basis of race, class, and gender (p. 212). Critical theorists label a curriculum that benefits dominant groups the “hidden curriculum” (McLaren, 2007). Apple (1982) described schools as a mirror of society, using their social relations and covert teaching to create compliant workers. According to McLaren (2007), the hidden curriculum refers to unintended outcomes practiced by schools to shape students to conform and adopt dominant cultural practices and behaviors. In addition, the unintended outcomes can occur because of the practice of directing students to subordinate or dominant social positions by tracking certain students into certificate programs and skills development courses while others are placed in advanced classes or gifted programs.

In order to overcome oppression in the classroom, teachers must recognize the diversity that each student represents and consider the social context (Wink, 1996). For the purposes of this study, diversity extends beyond race, gender, age, and class by including students’ varied and complex life experiences. Instructors who acknowledge diversity can encounter teaching challenges when developing learning opportunities; however, instructors must consider student diversity in order to support academic achievement for students in need of developmental math education. In this manner, when culture is integrated into the classroom environment, students learn within a context that is easily understood and accessible instead of memorizing information that is disconnected from their identity and life experiences.
As students’ lived experiences are included in the learning process, students will come to find their “voice,” which may promote engagement and improve their probability of academic success in college. Giroux’s (1992) “conception of critical pedagogy replaced traditional teacher-centered [instruction] with a student-centered approach that allows students to speak from their own histories, collective memories, and voices while simultaneously challenging the grounds on which knowledge and power are constructed and legitimated” (p. 105). Thus students are more likely to be successful throughout the learning process and equipped to excel in college courses while becoming more socially responsible.

Teachers should be challenged to validate diversity within the classroom environment by adopting practices that promote multiculturalism in order to improve academic success among low-income and racially marginalized students. In short, the link between culture and class cannot be separated from life in schools (McLaren, 2007).

Critical pedagogy and social construction of knowledge. According to McLaren (2007), critical pedagogy seeks to gain an understanding of how and why knowledge gets constructed the way it does, and how and why some constructions of reality are legitimated by dominant culture while others are not (p. 197). An examination of how knowledge is constructed within postsecondary institutions is essential for this study. Equally important for the study is an examination of the social construction of knowledge throughout schooling in general. Critical theorists view knowledge acquired in schools as historically and socially rooted, and interest bound (Kincheloe, 2008). The social construction of knowledge means “the world we live in is constructed symbolically by the mind through social interaction with others and is dependent
on culture, context, and historical specificity” (McLaren, 2007, p. 197). I include a brief discussion of the forms of knowledge, class, and culture that support the research.

McLaren (2007) offered technical knowledge, practical knowledge, and emancipatory knowledge as three forms of knowledge to be examined in the context of classroom teaching. Understanding the forms of knowledge taught in the classroom provides insight into an instructor’s philosophy and attitude regarding developmental mathematics education.

Technical knowledge is based on natural sciences, or empirical methods, and is evaluated by reading scores, intelligence quotients, and SAT scores (McLaren, 2007). Practical knowledge raises individuals’ self-consciousness so that they can shape their daily actions in the world. Practical knowledge is usually acquired through observing and describing social situations. Typically, practical knowledge is not generated numerically like technical knowledge (McLaren, 2007). The third type of knowledge is emancipatory knowledge. Emancipatory knowledge is of greatest interest to the critical educator. Emancipatory knowledge helps to understand and explain the influence of power and privilege on social relationships and ways to overcome oppression and exploitation through collective and deliberative action (McLaren, 2007).

Power and privilege is a shared theme among the forms of knowledge. I hope to apply the information presented to identify the practices related to the social construction of knowledge while observing developmental mathematics classes, reviewing documents, and interviewing instructors. Specifically, I will pay close attention to practices of knowledge construction that are technical, practical, or emancipatory as practiced by instructors.
The influence of class is connected to the power and privilege dynamic that is represented within schools. Class refers to, “the economic, social, and political relationships that govern life in a given social order” (McLaren, 2007, p. 198). The influence of class on college readiness and developmental mathematics education is significant. The literature demonstrated that a large percentage of students enrolled in developmental education are from low-income families (Yosso, 2005). Class is at the core of critical pedagogy and is an important influence on this study. McLaren (2007) explained that class reflects individual limitations and also deals with the social distribution of power.

The concept of culture is the final subheading considered under the social construction of knowledge. McLaren (2007) defined culture as, “a set of practices, ideologies, and values from which different groups draw to make sense of the world” (p. 201). In addition, McLaren stated that we have to be considerate of cultural questions that help us to understand the allocation, reproduction, and manifestation of power.

Critical theorists have explored and offered explanations of how schools perpetuate social relationships that sustain class relations within the larger society (Giroux, 1981; McLaren, 2007; Wink, 2000). Social reproduction refers to the reproduction of social class, such as working-class students becoming working-class adults, or middle-class students becoming middle-class adults (McLaren, 2007). Critical theorists examine the role of schooling in promoting the ongoing social reproduction of class. For example, schools traditionally establish social practices that align with the larger society, such as preferred language, professional behaviors, and acknowledgement of authority figures.
The role of schooling in supporting social reproduction is an ongoing concept explored by critical theorists. Some of the major practices within schooling that encourage social reproduction are private versus public schooling, the SES composition of schools that influence school resources, and the practice of “tracking” students into certain curricula within a school (Colclough & Beck, 1986). Teachers are at the center of the act of social reproduction and are challenged to become intellectual change agents in order to counter dominant cultural practices and the promotion of social reproduction.

The notion of teachers as intellectual change agents, as argued by critical theorists, encourages teachers to be able to identify the influence of class, gender, and race, as well as dominant and subordinate group dynamics to construct alternative teaching strategies that are effective and engaging (Giroux, 1988; Hinchey, 2004). Dialogue can be an alternative teaching strategy used to support learning. The practice of employing dialogue as a teaching strategy involves moving beyond a monological approach, which is often referred to as the banking concept of education where the teacher simply deposits information into the student, to a dialogical approach where students and teachers are regarded as equals with legitimate histories, knowledge, and experiences (Freire, 1972). Dialogue is one of the most significant aspects of critical pedagogy that centers on the development of social consciousness that Freire (1973) termed “conscientization.” Freire argued that educational experiences must include dialogue in order to build both the students, and teacher’s conscientization (i.e., consciousness raising). According to Freire, without dialogue there can be no liberation, conscientisation, or critical thinking.
Critical pedagogy and instructors as educational change agents and critical educators.

In order to adequately transition classroom instruction to a transformative model, educators must be afforded professional development opportunities. My hope is that instructors will be able to critically engage students and less likely to adopt the status quo due to their exposure to critical pedagogical analysis. An educator who is capable of intelligent reflection and able to apply knowledge learned in a classroom setting to daily experiences is designated a transformative intellectual (Kohl, 1998).

Transformative intellectual instructors are assumed to be capable of engaging in thoughtful and critical dialogue relevant to educational practices that continue to marginalize racial minorities and low-income students within the context of an academic discipline such as mathematics. Wink (1996, 2000) asserted that conscientization means that educators have a voice and the courage to question themselves and the role they are playing in maintaining an educational process that they do not value (p. 26). As their consciousness is raised, they develop an understanding and use for critical pedagogy and they are ready to act in a way that takes responsibility for curriculum and instruction that values all races, cultures, and classes of students.

The transmission model directs teachers to deposit information into the students with minimal dialogue, engagement, or questioning. Students easily become containers being filled by teachers with structured lesson plans that are not inclusive and fail to incorporate the students’ cultures and histories (Freire, 1977; Giroux & McLaren, 1986). This style of teaching is an example of the “banking” concept of education, in which the student is viewed as an empty
container to be filled by the instructor (Freire, 1972). Freire argued that application of the banking model “serves the interests of oppression and attempts to control thinking and action, [which] leads men [sic] to adjust to the world, and inhibits their creative power” (p. 62). Thus the creative influence in teaching and instruction is absent from the learning experience and learning becomes a simple act of memorization with minimal application and engagement.

The transformative model of teaching encourages problem-posing and integrates students’ pre-existing knowledge and culture. Critical pedagogy challenges teachers to acknowledge and be guided by a curriculum that legitimates all races, classes, and cultures while emphasizing problem-posing within the educational process (hooks, 2003). As a result, students are encouraged to include personal and professional experiences throughout the learning process.

**Critical Literacy**

The concepts of critical pedagogy share strong ties with critical literacy and critical-mathematical literacy. I discuss critical literacy briefly to provide a theoretical connection between critical pedagogy and critical mathematical literacy. The purposes of literacies are to help us make sense of the world, do something about it, and lead to an emancipated worldview (Freire, 1970; Wink, 2000, p. 55). Critical literacies help teachers and students to “read the world” by accurately interpreting and seeing the relationship between knowledge and power, how it is constructed, and by whom (Freire & Macedo, 1987; Wink, 2000). In doing so, teachers and students are equipped to examine their own knowledge and critique inequalities and
injustices, thereby accomplishing the intent of critical literacy (Aronowitz & Giroux, 1985; Kretovics, 1985).

Lankshear and McLaren (1993), along with Shor (1992), suggested that the objectives of critical literacy are to produce change and to promote the establishment of a socially just society through an ongoing examination of language, literacy, and power. McDaniel (2006) suggested that “the most unique element of critical literacy is social action stemming from readers’ increasing understanding that literacy and who gets to be literate are related to issues of equity and power” (p. 22). In short, critical literacy can be understood as taking action and promoting social justice.

**Critical-Mathematical Literacy**

Critical literacy serves as the conceptual “bridge” between critical pedagogy and critical-mathematical literacy. Critical-mathematical literacy provides a framework for teachers to combine math education with social justice education to promote student engagement and encourage social responsibility. According to Frankenstein (1990), the practice of having students examine their individual ways of comprehending mathematics through discussions and writing provides a starting point to expand mathematical structures understood by the students (p. 341). For example, Monchinski (2008) included in his book a brief section titled “Mathematics Unbound” to describe a method used to bring the “real world” into mathematics education:

I’d ask students if anyone knew what the federal minimum wage was. Usually nobody knew and we’d get guesses that were much higher than the real thing. The federal
minimum wage at the time was $5.15 an hour, whereas the NY State minimum wage was $7.15 an hour. Students were surprised to learn that the federal minimum wage was lower than their state minimum and this led to discussions as to why this was so, discussion that branched off into the feasibility of the minimum wage itself, with me playing devil’s advocate and presenting my views on why a minimum wage works to undermine the labor force and productivity. (p. 143)

Similar practices Monchinski (2008) described expand the teaching of mathematics beyond basic principles to social consciousness and promote personal reflection and action. Specifically, three goals of critical mathematical literacy exist: (1) understand mathematics—students comprehend what is asked of them when they are presented with math in their classroom (Monchinski, 2008); (2) understand the mathematics of political knowledge—students learn how mathematics skills and concepts can be used to understand institutional structures (Guttstein, 2006); and (3) the politics of mathematical knowledge—students understand the correlation between scores on state math tests and district income (Monchinski, 2008). When applying the three goals of critical mathematical literacy, teachers and students are engaged in dialogue that raises consciousness and creates a mental connection between the students’ experiences and mathematical concepts. As a result, students access an additional cultural tool that can support their success in the classroom and active social responsibility within their communities (Monchinski, 2008, p. 143).

The application of critical theory is placed primarily on the teacher. Critical pedagogy promotes the practice of students and teachers learning from one another. However, in order
to use critical perspectives such as critical pedagogy, critical literacy, and critical mathematical-literacy, educators must possess and be guided by what some scholars refer to as “love.” Kincheloe (2008) stated that “love is the basis of an education that seeks justice and equality, otherwise it will operate as a shadow of what it [education] could be” (p. 9). Wink (2000) expressed interest in students and teachers engaging in a dialogue to address fundamental needs of students, such as love. She went on to exclaim that “love trumps methods” (p. 168), referring to educational methods and teaching strategies.

Based upon her experiences as a teacher, hooks (2003) noted that it is politically acceptable to love one’s subject, but to express and demonstrate love for students is often discouraged. She reflected:

When we profess to love what we teach and the process of teaching, that declaration of emotional connection tends to be viewed favorably by administrators and colleagues. When we talk about loving our students, these same voices usually talk about exercising caution. (p. 139)

For critical scholars, expressing love for students guides any and all teaching practices.

Unfortunately, as described by hooks (2003), teachers are cautioned to avoid such behavior. Kincheloe (2008) argued that critical educators believe that all things are possible when we “work in solidarity and love as our guiding lights” (p. 9).

**Methodology**

The study was a single instrumental case study (Stake, 1995) that focused on the effectiveness of developmental math instruction offered at the ECCC. According to Yin (2009),
a case study is a process; a methodological study. However, Stake (2000) argued in opposition to Yin that a case study is less of a methodological study and more of a choice of what to study. In this study, I focused on what to study, in this case the effectiveness of developmental math education, and less on methodological choice. In addition to defining a case study, multiple scholars have offered common characteristics of a case study, such as having boundaries; a finite quality, such as time or space; various components within the case, such as multiple services with a shared mission and participants; an innovative, experimental, or typical program, unit of analysis, and a specific thing or phenomenon to be studied (Merriam, 2002; Smith, 1978; Stake, 1995).

According to Stake (1995), in an instrumental case study the researcher focuses on one issue and then selects one bounded case for illustration. The overarching issue of this case study is the phenomena of recent high school graduates who require developmental mathematics upon entry into postsecondary education, leading to a greater need for effective developmental math instruction. Therefore developmental mathematics taught at a specific community college served as the bounded case (Creswell, 2007). The case study was bounded in terms of location and a specific topic to study. Considering the definition and common characteristics of a case study, applying this approach is ideal. Research questions used for case studies generally begin with ‘why’ or ‘how,’ which is appropriate for this study. The research questions used to organize this study were:

1. What do faculty take into consideration when designing instruction to enhance developmental math courses?
2. What does teaching developmental math entail?

3. What do developmental math instructors perceive to be the outcomes of developmental math education?

Site Selection

While seeking to understand effective developmental mathematics instruction within a community college setting, I selected East Coast Community College as the site for this study. East Coast Community College is a large community college located in the northern region of the east coast.

A large portion of low-income residents within the area seek education at public universities and community colleges due to the cost of local private institutions. As a result, ECCC has experienced a constant increase in enrollment, currently serving approximately 26,000 full-time students per academic year. Enrollment at ECCC by race is in direct alignment with the surrounding community, which has a significant percentage of Asian, Black, and Latino residents.

Another reason for selecting this site is because of the limited percentage of high school students in the area who complete the ACT. The percentage of students throughout the state who choose not to take the ACT illuminates the issue of college readiness and students’ personal perceptions and ambitions for higher education. The limited number of students who complete the ACT raises concerns pertaining to a college ready culture within the state and students’ college going perceptions. In most cases, four-year institutions require that recent high school graduates submit ACT scores for admission. Without ACT scores, students are
required to complete a placement exam and are more likely to be placed in developmental education courses at the community college level. Therefore community colleges within the state are encountering a significant demand for developmental education courses.

Lastly, as discussed in the review of the literature, the economic crisis contributes to the need for developmental mathematics education to help address workforce demands and support an economic recovery. In addition, due to the economic crisis, the current unemployment rate in the U.S. of 8.2% has a significant impact on K-12 schooling. Schools are funded in part by neighborhood taxes; therefore schools that are located near property-wealthy communities have unlimited resources and schools located near property-poor communities have limited resources, creating a major disparity between students from low-income families and those from middle class families (Ladson-Billings, 1998). As a result, states with a high unemployment rate will have a greater probability of low-income students who may not be prepared for postsecondary education due to their K-12 educational experience. Currently, the state in which ECCC is located has an unemployment rate of 6.5% (U.S. Census Bureau of Labor Statistics, 2012). The unemployment rate in the area contributes to the need for effective remedial education within the state.

The factors that I have addressed--a racially diverse population, less than 40% of students in the area completing the ACT, and the unemployment rate--highlight the need for effective developmental mathematics courses at ECCC. Through this study, I intend to determine if the developmental mathematics classes are effective through interviews with instructors, observations of classes, and analysis of documents.
Participants

I was very critical and strategic in identifying participants with the hope of ensuring the probability of capturing “thick” data (Patton, 1990). The process of determining the sample size included an examination of the ECCC web site to identify developmental mathematics classes and the instructors who are responsible for teaching those courses. The instructors identified formed the pool of individuals from which participants were selected to take part in the in-depth interviews. Qualitative research does not have specific rules for establishing the sample size; it is better to seek quality over quantity. More importantly, qualitative researchers are encouraged to consider what they want to know when deciding on sample size. Pinnegar and Daynes (2006) argued that the intent of qualitative research is to be as specific as possible in selecting participants in order to present an organized and rich final product. Consequently, the sample size must be carefully considered in order to achieve the goal of producing a thorough final product.

I interviewed 15 instructors during the summer of 2012. The number of instructors interviewed was dictated by the time available to conduct the study, the instructors’ availability, and point of saturation. The participants provided variety in years of experience and number of developmental mathematics courses taught. Remaining true to the nature of qualitative research, I wanted to be sure that the information was rich in content and interesting to the reader by incorporating differing perspectives. I sought to interview as many instructors as possible, hoping to collect a significant amount of data. However, I remained
flexible, understanding that once the study was underway new information might be uncovered that might require modifications to the study (Creswell, 2007).

The data do not include demographic information about the participants although I am aware that demographic characteristics influence experiences, how experiences are defined, and student to teacher interactions. I chose not to collect demographic data from the instructors in order to keep the focus on their experiences as instructors who teach developmental mathematics. I was able to identify challenges encountered by instructors and subsequently offer solutions that will promote student engagement in the classroom. I did not collect or include any identifiers from the participants, which eliminated the need to transform the data to protect confidentiality (Wolcott, 1990).

Methods

According to Creswell (2007), an ethnography and a case study share common methods of recording information and the types of information typically collected. The ethnographic methods that I employed are observations, interviews, and documents. Each method is discussed in detail in the next section. I recognize the influence that I may have on the data as an “outsider” interviewing participants and observing classes (Hammersley & Atkinson, 1995). Therefore, the three forms of data collection combined will enhance the trustworthiness of the study.

Data Collection

I employed three forms of data collection: observations of developmental mathematics classes, interviews with developmental mathematics instructors, and analysis of documents in
the form of annual reports, institutional data, and course syllabi to name a few. By using three data sources, triangulation was practiced to enhance the trustworthiness of the data collected (Maxwell, 2005; Merriam, 2002; Yin, 2009).

**Interviews**

To select instructors to be interviewed, I used a purposeful sampling method, which is the practice of identifying participants who can address the problem or issue to be investigated (Patton, 2002). Specifically, I identified instructors who could provide an in-depth understanding of the effectiveness of developmental mathematics at the college through review of the college’s web site and preliminary conversations with the department chairs, instructors, and staff. In addition, I conducted a preliminary conversation with the department chairs to identify prospective instructors and to ensure that the participants met the criteria.

The initial list of faculty to be interviewed was developed from information gathered from the college’s web site. Specifically, I identified instructors who are responsible for teaching developmental mathematics and invited them to participate via email. In addition, I asked interview participants to recommend others who met the criteria. Through this use of snowball sampling, which is the solicitation of referrals from key participants, I identified additional potential participants for the study (Patton, 2002). The criteria that I used to select participants were: 1) the participant must have taught a developmental mathematics course, 2) the participants had been employed for at least 2 years (a minimum of 2 years allows time for a person to have an idea of trends and patterns of remedial education), and 3) the instructor had to be able to interpret the campus climate regarding developmental mathematics, which was
ascertained through preliminary conversations with department chairs and review of the interview transcript.

The interview focused on three areas that were guided by the research questions: factors that are considered when designing developmental mathematics courses, teaching strategies used when teaching developmental mathematics courses, and perceived outcomes of developmental mathematics education (see Appendix A for interview protocol).

The interviews allowed instructors to share their experiences, attitudes, challenges, and perceived opportunities for growth related to developmental mathematics courses. Through the use of in-depth interviews, participants had an opportunity to provide details relevant to developmental math education, personal beliefs about developmental mathematics, and trends and patterns among students who are enrolling in developmental mathematics. In addition, instructors had an opportunity to provide information they believe is relevant to developmental mathematics education by responding to an open-ended question as part of the interview.

Observations

The observations included classes that were available during the summer months. I predicted the observations to last from one to two hours, which was accurate. During the observations I focused on the students’ engagement with the topics of discussion as well as the teacher-student interactions. I looked critically for expressions of engagement, resistance, or difficulty connecting with the content. Also, I looked critically at the instructors’ teaching
methods that may or may not enhance learning through the incorporation of culture and social issues. During the observations, I audio recorded the classes as well as took notes.

I observed developmental mathematics courses to assess teacher instruction and student engagement. Teacher effectiveness was assessed through the observation of instruction used to engage students and by the instructors’ ability to address the diverse learning needs in the classroom. Specific pedagogical practices I considered were ways in which the instructor started a discussion, such as with a question, common experience, or controversy, to engage student learning (McKeachie, 2002). In addition, Stronge (2002) offered three applicable characteristics that I considered during observations: classroom management, implementing instruction, and professionalism. Also, critical pedagogy advocates suggest advancing the learning experience beyond simply disseminating knowledge to actual application by acknowledging diverse backgrounds, which leads to transformation for the learner (hooks, 2003).

I assessed student engagement through body language and obvious expressions and behavior that would be associated with engagement or a lack of engagement that may be due to less than effective instruction. Additionally, I observed whether or not the instructors were using community based learning techniques, providing constructive feedback, and providing opportunities to evaluate what students are learning. I used initial and integrative coding to organize the field notes and data collected during the observations (Emerson, Fretz, & Shaw, 1995; Saldana, 2009).
The observations provided a chance for me to note ways in which students were engaged with mathematics concepts as well as the politics of mathematics. More importantly, the observations incorporated student “voices” through the tracking of field notes that captured various statements throughout class dialogue and mannerisms that revealed student engagement. Also, the observations strengthened my assessment of teacher-student interactions.

Documents

The third form of data I collected were documents. The documents examined for the study were end-of-year reports, institutional data such as enrollment, persistence, degree-completion, and transfer data. Lastly, course syllabi and faculty resources were used to inform course development.

End-of-year reports. End-of-year reports provided historical information and institutional goals relevant to developmental mathematics. For example, the end-of-year reports uncovered ways in which developmental mathematics supports the mission of the college.

Institutional data. The transfer rate among students who completed developmental mathematics courses was used to determine the percentage of students who transferred to four-year institutions. I used the data collected from the institution as an indicator of the outcomes of developmental mathematics education on student retention.

Syllabi and faculty resources. I used the syllabi as resources to determine which courses to observe and what class sessions to attend to increase the probability of collecting rich data.
For example, I chose not to attend a class during student presentations or when a guest speaker was scheduled that would limit my time observing the instructor.

Annual reports and institutional data were available on the college’s web site. However, not every report was easily available and accessible online. Therefore, I solicited information from the appropriate instructor or administrator when needed. Finally, I included documents in the data collection as a means of adding credibility to the study by highlighting the effectiveness of developmental mathematics instruction outside of the interviews and observations. In addition, the documents informed the interviews with instructors.

During the interviews and informal conversations with instructors, I determined the specific institutional documents to be analyzed. Data from documents including annual reports, institutional data, and course syllabi highlighted the areas that senior level administrators emphasized as well as trends that influenced developmental mathematics courses. The three forms of data collection helped to establish a trustworthy and credible study that contributed to uncovering insightful themes and categories derived from the data analysis.

**Data Analysis Procedures**

I used three data analysis techniques to uncover themes and categories from the data. I began by coding data collected from interviews, observations, and documents (Saldana, 2009). Following the initial stages of coding, I continued analyzing data to begin developing categories (Merriam, 1998). I used memo writing, which is the practice of noting and reflecting upon
codes used, to organize the data (Saldana, 2009). The following discussion provides more detail about the data analysis procedures.

**Coding**

The practice of employing qualitative research methods allows for an opportunity to capture and collect “thick” and rich data. In order to manage and organize the data, I used an initial open coding method for naming and categorizing data collected from the interviews, observations, and documents (Saldana, 2009; Strauss & Corbin; 1990). I used initial open coding to conduct the “first cycle” of coding that occurred during the beginning stages of data analysis to divide the data into individually coded categories (Creswell, 2009; Saldana, 2009).

Afterwards I applied the practice of axial coding to put the data back together by making connections between categories and subcategories to develop main themes (Strauss & Corbin, 1990). Substantive themes emerged that serve as the primary content for Chapter 4, in which I outline the findings from the data.

**Analysis**

Successful and detailed coding must be paired with a methodical plan of ongoing analysis of the data in order to lead to a final product of quality. Therefore the first step aligned with coding is to read and re-read the data with the intent of identifying patterns and trends, ongoing coding of raw data, and developing categories (Merriam, 1998). The content analysis involved an examination of transcripts, field notes, and various institutional documents.
Memo Writing

I employed the act of memo writing throughout the study. According to Saldana (2009), the purpose of memo writing is to document and reflect on codes and the coding process, the emergent patterns, categories and subcategories, and concepts that are beginning to develop from the data analysis. Memo writing was useful during the process of tracking my thoughts, putting the data back together, and organizing it into themes.

Ethical Issues and Considerations

The study required approval from the Human Subjects Committee at ISU to ensure proper protocol and safety of participants before any participants were contacted or any observations were conducted (see Appendix B for IRB approval form). Receiving approval from the University’s Human Subjects Committee is only the beginning of incorporating ethical standards.

Ethical issues and conducting a study in an ethical manner must be considered throughout all stages of research (Merriam, 1998). Many scholars have noted that ethical issues often emerge during the periods of data collection and dissemination of findings (Creswell, 2007; Merriam, 2002). Ethical standards are often referred to as codes of ethics that can be used to guide a study. Codes of ethics in social sciences ensure personal privacy, data confidentiality, and ownership of data (Krathwohl, 1998). For my research, I used the principles published by the American Educational Research Association to guide ethical courses of action (see Appendix C).
The issues of trustworthiness and credibility are very important to the study. In addition, the instructors who participate must be comfortable and recognize the credibility of the study in order to share confidential information and opinions that may influence their job security. More importantly, the findings can positively influence the number of underrepresented students entering four-year institutions with a greater probability of completion due to adequate developmental mathematics classes, programs, and services.

**Personal Positionality**

According to Creswell (2007), the researcher is the key instrument, being solely responsible for collecting data. As a result, the researcher is challenged to constantly test personal biases and preferences. Entering the study I was aware of aspects of my positionality that must be openly acknowledged. The research topic was selected because of my personal interest in supporting access to four-year institutions for groups with which I personally share two identities: low-income and racial minorities. Secondly, I am a first-generation college student and a majority of my relatives within the same generation did not attend college. My hope is that the findings will increase readiness for and access to four-year institutions among groups that are largely underrepresented.

My beliefs entering the study were transparent. I believe that developmental mathematics education is necessary and will be necessary until equal schooling occurs throughout K-12 education. However, offering developmental mathematics is not enough. I believe that adequate professional development is necessary for faculty who are involved in teaching any developmental education course, but especially mathematics. Professional
development extends beyond topical subjects such as math, science, or English to include cultural competency and social consciousness to address learning needs and legitimize diverse backgrounds by incorporating student voices, including the community, and implementing transformative practices that do not use the banking model by telling instructors what to think. Therefore, the issue extends beyond providing developmental mathematics to enhancing the effectiveness of instruction through the use of cultural inclusion and dialogue.

**Trustworthiness**

According to Guba and Lincoln (1989), trustworthiness is the act of acknowledging how researchers establish confidence in the research findings. Moreover, trustworthiness is an explanation of the practices used throughout the research process to ensure internal and external validity, reliability, and subjectivity of the study and subsequent findings. An element of establishing trustworthiness is to ensure congruence and continuity among all elements of the research process (Jones, Torres, & Arminio, 2006). For the purposes of this study, three practices were used to ensure the trustworthiness of the study: member checks, persistent observations, and progressive subjectivity (Guba & Lincoln, 1989).

**Member Checks**

Multiple scholars defined member checking as the practice of presenting preliminary analysis and interpretations to participants or stakeholders involved in the study for their review and verification (Guba & Lincoln, 1989; Jones et al., 2006; Lincoln & Guba, 1985). Guba and Lincoln argued that conducting member checks is the most crucial technique for establishing credibility.
I interviewed instructors of developmental mathematics courses at the college. To ensure the credibility of the study, each participant was given the opportunity to review the major themes developed from the interview transcripts. In addition, some of the participants were given a copy of the transcript for their review as well. The participants had an opportunity to correct errors of interpretation, and offer additional information to guarantee accuracy and richness (Guba & Lincoln, 1989).

The practice of “member checks” for this study proved to be beneficial for me as well. During the process of member checking I was afforded the opportunity to summarize the data and to share points of preliminary analyses (Guba & Lincoln, 1989). Subsequently, this opportunity to share emerging analyses from interviews with the participants became an integral part of the early stages of data analysis and informed the coding processes for the study to help define major themes and categories.

**Persistent Observations**

Persistent observations served as an additional practice used to ensure trustworthiness and credibility of the study. Lincoln and Guba (1986) argued that sufficient observation can be used to identify elements in the phenomenon that are most relevant to the problem. Considering that one of the guiding questions of the study is how faculty teach developmental math, I attended developmental mathematics classes to observe teaching practices. I looked for strategies used to enhance student engagement such as how instructors began a discussion, managed a classroom, included social issues, and acknowledged diverse backgrounds and experiences (hooks, 2003; McKeachie, 2002; McLaren, 2007; Stronge, 2002).
Progressive Subjectivity

Lastly, I practiced progressive subjectivity to strengthen trustworthiness throughout the study. Guba and Lincoln (1989) defined progressive subjectivity as “the process of monitoring the evaluator’s own developing construction” (p. 238). The process of monitoring my own construction was very valuable throughout this study considering the areas of my personal position that I brought to this study, such as my personal experiences as a first-generation student, my opinions relevant to unequal K-12 schooling, and my belief that developmental mathematics education is necessary. The practice of progressive subjectivity began at the initial stages of the study and continued throughout the in-depth interviews, observations, and document review.

Establishing trustworthiness or confidence in a study is extremely important in order to maximize the credibility of the implications, recommendations, and points for future research and practice. I used the practices of member checking with participants, persistent observations of developmental education courses, and progressive subjectivity to address issues of credibility, transferability, dependability, and confirmability.

Delimitations

The scope of this study was confined to a specific case: developmental mathematics at East Coast Community College. Specifically, the study focused on the teaching experiences of instructors who teach developmental mathematics. Instructors were studied to examine their teaching practices and to explore their interactions with students and challenges in the
classroom. While students were observed during class observations to assess student engagement with teaching practices, they were not interviewed for this study.

**Summary**

The purpose of this study was to examine the experiences of instructors who teach developmental mathematics at an urban community college and identify strategies to enhance learning in the classroom and promote student academic achievement through use of critical theories. Information included in this chapter provided a description of the epistemology including a rationale for the use of critical inquiry, theoretical perspectives, and the methodological framework for the study. I also provided an overview of the setting, described the process for selecting participants, and explained the data collection and data analysis procedures. I then addressed ethical issues and considerations, discussed my positionality in relation to the study and steps I took to ensure the study’s trustworthiness. Finally, I presented the delimitations of the study. In this chapter I have explained the strategies that I used to sustain rigor and remain methodologically sound and congruent throughout the research process. In the next chapter I present the data and findings from the study.
CHAPTER 4. FINDINGS OF THE STUDY

The purpose of this study was to examine the experiences of instructors who teach developmental mathematics with the hope of improving instruction and enhancing student engagement. East Coast Community College, an urban community college located on the east coast, served as the site for the study. East Coast Community College offers developmental mathematics courses for a significant percentage of the student population. According to the instructors, more than half of the mathematics courses offered are listed as developmental. In this chapter I outline the findings of the study. In Chapter 5, I provide a discussion of the findings within the context of the literature, epistemology, and concepts of critical pedagogy.

I examined the experiences of community college instructors who teach developmental mathematics by analyzing the three forms of data I collected for this study. The data collection process included gathering documents, observing developmental mathematics classes, and interviewing instructors. I identified six major themes as a result of the data analysis: defining the purpose of community colleges and developmental education, identifying external influences, teaching beyond the content, overcoming student challenges and resistance, enhancing learning, and recognizing intended and unintended outcomes. The themes, with supporting data, are discussed below. The names used in this discussion are pseudonyms.

The Purpose of Community Colleges and Developmental Mathematics

A major theme identified through the data analysis, the purpose of the community college, demonstrated that community college instructors were interested in the mission of the type of institution in which they worked. Two subthemes were apparent in the data as well:
the role of the community college, and defining developmental mathematics as an important
program to carry out that role. Instructors noted that the associated goals and objectives of
the community college, such as providing access to postsecondary education through an “open
enrollment” standard, create an ideal opportunity for community colleges to offer
developmental education. Some of the instructors expressed concern about the “open
enrollment” policy but remain in support of it in order to provide an opportunity for
underrepresented students to access higher education. For example, Mr. Hall articulated
concerns for those students who are passive and not engaged by enacting a typical instructor to
student conversation:

There is still that huge chunk [of students] that is just passive in the background, and
now I’m saying, “You’ve got to do something,” and they’re saying, “Well, I won’t come
at all.” That is the nature of being an open enrollment institution. That is okay with me.
I really want to make sure that we stay open enrollment. We provide a very valuable
service with that.

Role of the Community College

The community college as a form of postsecondary education is a major social entity
within the United States. The value and importance of community colleges has been
emphasized due to recent implementation of the completion agenda by President Obama,
along with additional funding to support the mission of community colleges. In addition to the
completion agenda, community colleges offer programs and services designed to strengthen
the local community, provide support for the local industry and employment demands, and equip students for four-year institutions.

The role of the community college is very diverse depending upon location and needs of the community. Most of the participants explained the role of the community college as providing an opportunity for students. Mr. Branham described the role of the college while sharing his philosophy of community colleges:

It gives people an opportunity, those who really need an opportunity. Because of it, you would be amazed how many gifted, how many bright and intelligent students there are out there, but for some reason they were not given that opportunity.

Several instructors described characteristics of ECCC. The characteristics included the open-enrollment policy, emphasis on providing opportunities for students to access higher education, the tradition of offering job training options, the need to offer developmental math, and a focus on offering certifications unlike traditional four-year institutions, which are more focused on offering degrees.

The study focused primarily on instructors’ experiences while teaching at a community college. Most of the information gathered was underscored by the instructors’ desire and motivation to teach and help students to achieve their educational goals. Ms. Pearson described the motives of her colleagues:

Most of them [the instructors] pretty much understand why the students are here, and what we need to do to help them. I think most people who teach in a community college wouldn’t be here if they wanted to just teach upper level classes.
This statement indicated a true motivation to support students.

Instructor’s attitudes appeared to be influenced by the open-enrollment policy. Understanding that students enter the college and subsequently the classroom with varying skills requires that instructors be willing to teach both developmental and credit classes. The participants frequently discussed the open-enrollment policy. Instructors who commented on the open-enrollment policy expressed support for it and acknowledged ways in which the policy reinforced the underlying mission of the College. Mr. Erwin reflected:

We kind of take that as our mission because we are a two-year college so by definition and with the open enrollment that we have we just welcome everyone and we make sure they understand what they have to do to bridge the gap that they missed from high school and almost every time the student says, “Yes, I know I wasn’t ready, but I feel I’m ready,” and it is a very win-win attitude.

Providing an opportunity for students to access higher education is another characteristic often associated with community colleges that participants emphasized throughout the study. Specifically, the College’s admissions policy affords students access to higher education, which leads to an opportunity to learn, obtain job training, develop skills, and subsequently to obtain a job of choice if that is the student’s academic and professional goal.

Several participants indicated the need for instructors to talk with students about educational options such as certificates and other pathways to get something from college. Instructors noted the need to advise students on the various options and tracks offered by the college in order to minimize the number of students who leave the college empty handed. By
taking their instructors’ advice, students leave the college with some sort of credential that may increase their access to higher level positions of employment and possibly contribute to a successful transition to another community college or four-year institution. Mr. Hall passionately expressed the need to expand such conversations with students:

What I wish that we did better, and what we don’t currently do, is we don’t talk to students about options if they start and then realize [they] don’t want to do this anymore—to have an option for them. And we have them at the college. There are all sorts of certificates and other pathways for students to get something from us, but we don’t do a good job with capturing those students and having that conversation. We just keep saying, “Oh you just have to get through this one more math class.” I think talking to them about something other than the next course would be valuable.

Several participants noted that developmental education has to be a focus at the community college level because so many students are in need of developmental education. Ms. Young described the need for community colleges to offer developmental mathematics:

We have to make sure we are meeting the needs of the students we’re getting whether they’re traditionally aged right out of high school or people returning to school. I think the developmental series really has to be a focus, especially in the community college, because a lot of our students are facing that.

Specific to mathematics, the percentage of students in need of developmental education is well over 50 percent of the student population, according to participants. In addition, according to
the Mathematics Department Chair, the number of students in need of developmental mathematics education at the College is a little over 5000 students per academic year.

Due to the demand for developmental mathematics courses, there is a great need for instructors. It is important to note that teaching developmental mathematics is not always accepted with enthusiasm among the instructors. Ms. Young stated, “I think most people who teach at a community college understand that this is what we have to deal with and everybody generally teaches some level of developmental math.” Based upon the language used by Ms. Young, teaching developmental mathematics is something to “deal with,” which suggests a sense of resistance exhibited by instructors.

**Defining Developmental Mathematics**

Participants explained that according to state guidelines, developmental mathematics is defined as a mathematics course that has a prerequisite at the level of Intermediate Algebra. Specifically, Ms. Anderson defined developmental mathematics as, “ Anything Intermediate Algebra and below and we define Intermediate Algebra as getting through exponential and log functions, and usually elementary is through the quadratic.” Students’ placement into developmental mathematics is based upon their Accuplacer or SAT scores. The Accuplacer is a placement exam required by the state and administered by the College.

Beyond the state’s definition of developmental mathematics as anything below Intermediate Algebra, the participants elaborated on their meaning of “developmental mathematics” as used throughout the college and based on their personal experiences as instructors of developmental math. Mr. Nazier offered a very thoughtful definition of
developmental mathematics based upon state guidelines and his experiences as a developmental mathematics instructor:

Maybe the best way to define developmental mathematics I guess is two-fold. Firstly, it is defined in terms of what we perceive it is not, so we perceive that developmental mathematics is not the same as college mathematics and typically we think of college mathematics as beginning maybe with Pre-Calculus. It depends on where you are [referring to the institution]. In some places its Calculus I and in other places we think of college mathematics as beginning with Pre-Calculus. And so when we say developmental mathematics, we are typically referring to basic mathematics. This is material that you commonly think of being taught in elementary school up to grades about sixth or seventh and maybe some high school mathematics. So there are two things developmental mathematics is defined by: the fact that it is not college mathematics and by the fact that it has a lot in common with what’s taught on the primary and secondary level.

Several participants defined developmental math using similar concepts to explain why students enter in need of developmental mathematics. For example, some instructors implied that developmental mathematics is needed due to a lack of engagement during primary and secondary schooling. Ms. Houston shared an experience with students that provided an example of limited engagement while in secondary school,

They come from the high school and so many of them are passed along, and passed up. I’ve had students in Pre-Algebra who went all the way through Algebra I, II, and
Geometry, in high school, and I asked them how they got into Pre-Algebra and they say, “Well, I was an athlete and my coach was my teacher.” There you have it.

Regardless of the ways that participants defined developmental mathematics, an official explanation of developmental math is warranted. Therefore, according to the state where the study was conducted, developmental mathematics is anything below Intermediate Algebra, which aligns with the definitions provided by the instructors. In addition, as expressed by the instructors, developmental mathematics requires teaching study skills, teaching basic math skills that were never learned, and providing a refresher for students who completed college level coursework some years earlier. Ms. Hernandez commented,

I guess developmental education is pretty broad, because the students come to us not just needing math that they should have learned before college math, but also needing to learn how to do study skills, and becoming familiar with expectations with college level work.

The educational goals associated with developmental math courses at the College are two-fold. Developmental math, according to the course syllabus, includes the following content goals: (a) review of the fundamentals of arithmetic, (b) a thorough introduction to signed numbers, and (c) a presentation of the basic concepts of algebra. Topics listed on the course syllabus included proportion and percent, polynomials, factoring, linear equations and inequalities in one variable including systems, graphing, integer exponents, and quadratic equations. Application exercises were outlined throughout the course schedule.

Beyond the goals developed by the Mathematics Department faculty and imposed by
the state, several informal goals were compiled from the interviews with instructors. The goals articulated by the participants included:

- guiding students into college level math while allowing time to improve skills,
- giving students a second chance to perform tasks for which as they might not have been ready in high school,
- helping students understand the material to avoid repeating courses and thoroughly preparing them to excel at higher level math,
- helping students to develop a level of independence as a student and in less need of hand holding, and
- providing an opportunity for students to get adjusted to college level work.

**Identifying External Influences**

Participants explained that external entities influenced the curriculum and goals for developmental mathematics at the College. Participants defined external influences as those entities outside of the Mathematics Department that are given thoughtful consideration when implementing or modifying policies and practices related to the developmental math curriculum at the College. The external influences identified by several participants were (a) frustration with secondary schools, (b) meeting requirements for transferring to four-year institutions, (c) involvement of local business, (d) state policies, and (e) need for institutional changes in policies and guidelines.
Frustration with Secondary Schools

Throughout the interviews participants addressed the need to strengthen the forms of communication between secondary and postsecondary schools throughout the state. The data were saturated with phrases that reiterated the need to connect secondary and postsecondary education such as: “a disconnect somewhere,” “needs to be a stronger link,” “two groups need to coordinate better,” “dialogue between the decision makers,” and “needs more coordination.” The need to strengthen communication between secondary and postsecondary school reinforces the definition of developmental math as mathematical concepts that should have been learned in high school. Instructors suggested that if the communication were strengthened, interventions could be implemented to prepare students for college level work prior to completion of high school. In addition, Mr. Hall expressed a desire for less demand for developmental math courses as such, “I would really like to see it (developmental math) have smaller and smaller numbers. I don’t want it to be undervalued, but I wish that more students wouldn’t need to be placed there. Either coming out of high school with this knowledge, or if they came to us we could get them out quickly.”

Ms. Knight stated, “K-12 schools do not influence what we teach here, except that we teach a lot of stuff they had, but that’s everywhere.” Although practices and policies relevant to K-12 schools have minimal influence on the College’s curriculum, as explained by several instructors, underlying practices within K-12 schools were discussed with moderate to high frustration based upon comments and non-verbal cues. Ms. Young commented on K-12
practices that are disconcerting and often referred to as a disconnection between secondary and postsecondary schools:

I think having a stronger link between the high schools and community college would be in the students’ best interest. It would better prepare them for life at the College. Because I think many students are expecting a pretty similar experience and it’s not at all. We don’t talk to parents; the school system has a 50 percent rule that as long as you make a significant effort on a test, the minimum score you can make is a 50 percent. So I have students who are right out of high school who have gotten a 24 percent on a test and they’ll ask me, “Can I at least get a 50?”

While participants stated that K-12 schools did not influence the developmental math curriculum, upon closer examination of their comments, several factors emerged that do influence practices and policies at the College as well as teaching demands within the classroom. Four factors related to secondary school practices emerged: (a) operating under a political system and being forced to manage the demands that stress the importance of getting more students to pass state standards, (b) limiting the students’ critical thinking and basic understanding of math concepts through use of calculators, (c) giving students 50 percent credit in K-12 schools for simply writing their name on the paper, and (d) providing excessive partial credit on assignments, which generates expectations for similar treatment in college.

According to the College’s 2011 end-of-year report, nine out of ten students (90 percent) are from within the county. In addition, the college’s draw rate among public high school graduates has reached approximately 25 percent over the past two years. Moreover,
according to the same report, the draw rate is expected to increase slightly over the projection period of 5 years, 2011-2015.

Meeting Requirements for Transferring to Four-Year Institutions

Several participants stated that designing a curriculum that prepares students to transfer and be successful at a four-year institution is important. Ms. Knight explained, “We have to look at where our students transfers [sic], so we do need to look at what courses will transfer, which of our courses will transfer for credit. And we need to offer those.” Many of the instructors highlighted a leading institution in the state more than any other four-year institution in the area. It was evident throughout review of the transcripts that this institution is a guide for the curriculum and has an influence on the College and more importantly the developmental mathematics curriculum. For example, Ms. Lacey stated, “We take a lot of our guidelines from what they [referring to the leading institution] do; what our transfer students are expected to know.” Ms. Lacey went on to say that many of the students transfer to this leading institution, which demands that East Coast Community College provide the best course offerings and course content to enable students to transfer with ease and to be successful in a university environment. Overall, many of the participants expressed the importance of knowing what four-year institutions expect in order to create a curriculum that is effective and prepares the student for success after they leave the College.

Mr. Hall mentioned an internal policy requiring that the College be cognizant of four-year guidelines and requirements in order to design the right courses. Ms. Knight stated, “We need to make sure, before any courses are approved in the curriculum, that five
transfer institutions will accept those courses or else our curriculum committee will not approve them.” Ms. Knight did not describe the process of identifying the five institutions or the subsequent process to gain the institution’s approval, however.

While participants indicated that four-year institutions have an influence on the developmental math curriculum, participants also noted that they had minimal conversations with students at the developmental level about transferring to a four-year institution. Ms. Lacey stated,

I think that the transfer issue is less on the radar screens of our instructors in the developmental classrooms; it’s more getting them to that college level course. And then we start to ask the question, and we probably should focus more, earlier, but then what do you want us to do? And for us that ends come after … this math prep course. Instructors appear to be more concerned with getting students to credit courses and at that stage will begin to engage in advising and having conversations about transferring to a four-year school.

Involvement of Local Business

While many of the instructors were unfamiliar with the influence of local businesses on the developmental math curriculum, a greater percentage of participants were able to identify the involvement of local business owners and leaders. They articulated interest in gaining greater involvement from business leaders to inform the curriculum. For example, several instructors, including Ms. Ladner, mentioned involving members of the business community in the redesign of Math 094—the math preparatory course.
In terms of the business community, when we set up a task force to do this redesign of our developmental courses, one of the groups that we wanted to bring in were [sic] local businesses. You know, what do you need students to know when they walk out our door? What do you want them to be able to do quantitatively? We had one big, sort of, advisory meeting with a couple of people from the industry.

Mr. Hall noted the involvement of business and industry: “They definitely had an input for what a student knew when they left here [The College].” Mr. Hall further explained their involvement in this way:

Local businessmen don’t really understand the distinction between college level and pre-college level and probably a lot of businessmen have never taken those developmental math courses, and so they didn’t have anything specifically to say about developmental math education, but had very useful things to say about education in general.

In spite of the limited insight from business leaders in the community, many instructors commented on and expressed a strong desire to continue engaging with the “right” business leaders to ascertain information that will inform the developmental math curriculum. Ms. Lacey expressed the sentiments of herself and others as:

I would love to bring in some sort of front line people from the industries in the area and say: “What are your workers doing quantitatively? Are they pulling up excel and having to do stuff and what kind of stuff? And what are the shortcomings; what do you find they can’t do?” Discovery Channel, we have a partnership with them, and they did a
fabulous panel discussion here this spring directed at students who wanted to get into media, communications, and that sort of thing.

Ms. Lacey continued to elaborate on the subject of business influences on the curriculum:

Where are the gaps? What can we fill? So that you are not having to spend your money, because that’s supposed to be our [developmental math instructors] job. That’s how this is supposed to work. We host a science bowl each winter and somebody from the business community spoke. He gave a wonderful address, again talking about what people, employees, needed to know on different levels. I would love to sit down with him or somebody he might direct me to. And then really go after our curriculum and let that guide the kinds of problems that we might infuse [into the mathematics curriculum].

State Policies

Based on the participants’ comments, it seems apparent that the curriculum and the related guidelines are influenced by four-year institutions and local businesses. The college faculty and staff have the option of infusing information garnered from four-year institutions as well as local businesses. However, participants noted that the state imposes policies that are non-negotiable and applicable to all postsecondary institutions. For instance, Mr. Erwin explained,

Yeah, the state requires that in order to get an academic degree you must have a math foundation course, which is a college course above Intermediate Algebra, so by that definition anything below the foundation math course we’ll consider developmental.
Moreover, participants commented on three state policies: (1) to get an academic degree you must have a math foundation course that is a college-level course above Intermediate Algebra, (2) community colleges must use the Accuplacer or Comer placement exams or SAT scores to determine placement into appropriate courses and, (3) postsecondary institutions must require pre-requisite materials before students enter college courses. It was evident that most of the instructors were familiar with and adopted the state guidelines.

The College uses the Accuplacer placement exam to determine the appropriate math sequence for students. Ms. Lacey explained the use of the Accuplacer test, “So, we basically, the state allows us to use either the Accuplacer placement test or Comer. The college before my time chose Accuplacer. Based on the score students gets on Accuplacer, they are placed into an appropriate course.”

However, the College does use SAT scores to determine appropriate placement. Scholastic Aptitude Test scores are used in place of the Accuplacer if available. Ms. Anderson noted that SAT scores are used similarly to Accuplacer scores, “Well, I mean, the whole state uses the same cut off scores for Accuplacer and so that particular score tells you where you are going to start and we use the same SAT scores if, you know, if the kid happened to have taken SAT.”

Completion of placement exams upon entry into the institution is widely upheld. However, the associated prerequisites toward degree completion after assigned placement are met with some disagreement. Mr. Hall expressed dissatisfaction with the prerequisite requirement: “We have to say, ‘Here is all the prerequisite material. Why you care about this, I
can’t tell you. Just learn this and then later on we will show you where it all comes back in.’ That is backwards to me. These current state regulations really change our curriculum.”

**Need for Changes in Institutional Policies and Guidelines**

Changes in institutional policies and guidelines may be more of an internal influence than external. However, the institutional policy changes are outside of the Mathematics Department. Also, some of the policy changes suggested by the participants are indirectly connected to external influences that need to be enforced by the state.

Instructors highlighted the need for changes in institutional policies and discussed why making changes can be difficult at the College. In explaining the need for policy changes relevant to developmental math, participants stressed the large number of students who are not persisting on to college level courses. Ms. Pearson stated the urgency to implement changes:

Can we effect change on that? Doing what we still have been doing, for 50 years? No, it’s going to stay; we had to do something radical; we have to shake up the entire system to change the outcome. Our outcome that we’re really hoping to see down the road is that students will persist.

Fortunately, the math department was able to implement a modified self-paced version of developmental math in order to address the low persistence and retention rates among students.

Moving beyond validating why policies and guidelines should be changed and acknowledging the difficulty in making changes, the recommendations from participants that
were salient to the study included: (a) requiring that students take developmental math courses early, (b) incorporating a process to weed-out students who are not serious, (c) modifying the curriculum or curriculum design to strengthen learning and the students’ foundation, and (d) providing early and ongoing academic advising.

**Take developmental mathematics early.** The suggestion that students take developmental math courses early was a resounding recommendation from several participants. The instructors interviewed strongly advocated a policy requiring completion of developmental math early be implemented immediately. The participants indicated that they have observed students who wait until the end of their programs to complete their math requirements. Participants stressed that such students, if they experience difficulties with comprehending math concepts, are likely to dropout when they are close to completion. Mr. Hall expressed disappointment upon observation of students who were struggling with math concepts at the end of their program, “It’s hard for me to see people who have spent two years here and then finally decide to take their math and science courses” and have trouble passing them.

Also, participants pointed out that students’ potentially did not make the highest grade possible in earlier courses while in college because they had not developed the necessary critical thinking skills associated with math education. The participants strongly recommended taking math courses early in their course sequence in order to develop critical thinking skills that will support academic success in other courses. As a result, students may receive a higher
grade resulting in a higher Grade Point Average that would positively influence acceptance to a four-year institution of choice.

**Incorporating a process to “weed-out” students who are not serious.** A second suggestion recommended by Ms. Hernandez was to incorporate a weeding-out process for those students who are not serious about learning. While it is somewhat disconcerting that an instructor would be in favor of intentionally “weeding-out” students when the vision of the institution is to increase retention and support students in becoming engaged learners, the instructor’s frustration with some students’ behavior is evident in her statement:

I think that students in some situations are given too many chances and students sort of sign up cavalierly, not having any idea or not having any intention [of making an effort to pass]; those are the students I don’t want in class, the ones who don’t have any intention on doing the work.

**Modifying the developmental mathematics curriculum.** Another suggested policy modification was related to the developmental math curriculum. Several instructors expressed the need to modify the curriculum in order to strengthen basic math skills development and support academic success in higher level math credit courses. Two instructors strongly suggested the need to teach mathematics concepts at a slower rate on a “need to know” basis. For example, Mr. Hall stated,

If I had my choice, I would say here is the college level math we are interested in. Oh we can’t do all that? Well, here’s what we need to learn. Kind of backtrack out and say
here’s a little math, we need to teach them that, then go on to the next topic, we need to teach them that, and it’s a need to know.

Although interviewed separately, two instructors shared similar sentiments about the need to decrease excessive coverage of concepts and to focus on what the students need to know to excel in the current course and to be prepared for the next course. Their recommendations were couched in the importance of instructors consistently assessing learning to ensure that a large number of students are learning mathematical concepts that are relevant. Lastly, the suggestions alluded to creating courses with a focus on specific topics such as math basics or advanced math.

In addition, other participants indicated the need to be more intentional about course content that is applicable to the students’ everyday lives, such as the construction and context of word problems. This suggestion regarding modification of the curriculum included the need for word problems that make sense to the students. Ms. Lacey stated that word problems are sort of standard contrived kind of word problems: a farmer needs to fence a pasture, classic sort of the train leaves the station, the things that everybody hates. My favorite was the compass that falls out of the weather balloon; I mean, they call this the real world. There is a little bit of a stretch unless you do a lot of farming.

According to several instructors, word problems commonly create obstacles for students in developmental mathematics due to the reading and critical thinking skills that are needed. The data suggested that developing word problems that resonate with students would be helpful to support engagement, learning, and overall academic success. For instance, Mr. Hall stated:
Yeah, and I can tell you right now, the word problems are the ones that take the longest and are the most missed. It doesn’t necessarily mean these are the ones we have to get rid of or change them, but it does mean that we have to think, “Is that the perfect place for them? Are we noticing that when students get to those, are they dropping out?” That data is [sic] really important for us.

In addition to changing course content to be more applicable to the students’ daily life experiences, some instructors suggested two major modifications to the curriculum design. The suggestions were (a) to not require students who were not interested in the sciences to take upper-level mathematics, and (b) to offer courses that are more focused and provide time for students to fully understand the concepts. Mr. Zales proclaimed, “I think it would be okay if somebody is not going into science and engineering. Maybe you should not require them to take these classes,” referring to higher level math courses. Mr. Zales further explained what he would do to support learning: “I would design courses in such a way there would be one class which [sic] teach[es] the basics, one class which could be more advanced, and maybe a third class where we can put the whole picture together.” Both suggestions imply a strong critique of the current curriculum and a desired major overhaul of the current curriculum to support learning among students in developmental math courses.

The various suggested changes to institutional policies and guidelines related to developmental mathematics included instituting a requirement to take developmental math courses early, incorporating a process to weed-out uninterested students, and modifying the curriculum. If implemented, each modification would require clear communication among the
campus community with greater attention to students. Unfortunately, Ms. Lacey indicated that communication with students needed to be enhanced, “We tend to be a little sloppy [with] language, in terms of credits, credit hours, or content hours, and other things,” which leads to an additional institutional change to improve communication with students regarding the curriculum.

**Teaching beyond Mathematics Content**

Many of the participants commented on the need to provide advising to students beyond math content. Students sought personal advice along with academic and career advising. Ms. Young described her observation of students in developmental math courses as “in need of a lot more hand holding,” implying that the need for hand holding is not as common among students in credit courses. Other instructors described the advice they gave as “non-mathematical support.” Participants suggested that the need for extensive hand holding and non-mathematical support be addressed by adopting advising remedies such as additional academic advising, career advising, and promotion of certificate programs as a viable option to the Associate of Arts degree. If such strategies were adopted, students would be less likely to self-advice, a practice that may lead to academic obstacles.

Another recommendation was to prevent self-advising by making academic advising a requirement. Moreover, based upon the comments, there are many concerns associated with academic advising. The depth and maturity of the concerns are captured in the following comment from Mr. Hall,
There’s enough people saying, “This is not okay to have students self-advising their whole careers; we have to do something.” But it will be hard to implement something that works on a small campus as well as a big campus.

The concerns are not only well developed, but the instructors are also engaging in critical thinking that presents one of the challenges of implementation: the diversity of the institution due to organizational structure and uniqueness.

**Advising**

As stated previously, participants stressed the importance of students receiving ongoing advising starting early in their college experience. According to the developmental math curriculum, after completing the Math Prep (094) course students have to make a decision to take Intermediate Algebra (097) for humanities and arts, or Intermediate Algebra (099) for business and STEM majors, which are two versions of intermediate algebra, depending upon their major. One instructor described Math (099) as the “high road for those planning to take calculus” while Math (097) is designed for “liberal arts majors and at least 95% of the homework assignments are word problems.” As implied by the instructors, in order for students to make an informed decision, speaking with an advisor regarding career goals and to gain an understanding of the differences between Math (097) and Math (099) is crucial to their academic success. During class observations, I did notice a math sequence document posted throughout the math lab for students to review and for instructors to access in order to advise students on courses to take for the next semester.
However, to offer ongoing advising to students, the institution will need to consider increasing the academic advising staff in order to adequately provide additional counseling services. Acknowledging the challenges and obstacles, the need for additional counselors to be able to accommodate so many students and effectively advise them was noticeably important to the participants. Specifically, Mr. Hall stated that there are over 5000 math students who would require advising; this figure does not include students in other departments. According to the institutional fact sheet, the college-wide population for AY 2012 exceeded 27,000 students, which presents a major concern when trying to provide adequate advising for all of the students. Mr. Hall expressed both distress and frustration: “It would be hard because we have so many students and it’s hard to justify the need for counselors like that, so if we were to go with this policy, we would need to double or triple the amount of counselors we [entire college] have.” Evidently the instructors are clear about the need but they recognize the limitations. The emotions and distress expressed by the instructors were valid and understood; they were aware that due to limited resources students were not receiving adequate support, which may be a contributor to failing courses or choosing to withdraw from the institution.

**Skill development.** The need to support students’ skill development was a reoccurring theme throughout the interviews. Several instructors commented on the need for students to develop basic skills and patterns of responsibility that would contribute to their learning and overall academic success. For example, Mr. Zales described his reactions to student behaviors: “I was kind of shocked in the way they attend the classes [referring to excessive absences], and their study habits were not what you would expect.” The patterns demonstrated by the
students were surprising to Mr. Zales but he was not alone; several other instructors shared the opinion that students do not have the basic skills needed to be successful. Ms. Knight described students’ skills in this way: “They just don’t know how to be a good student.”

The students’ behaviors associated with not being a “good student” were mentioned throughout several interviews. Mr. White noted that some of the patterns: “Students need help with structuring a notebook, numbering their work, helping with basic organizational skills or needs, and navigating a system in terms of not being held responsible for missed assignments in the event of an absence.” In addition, during class observations it was evident that some of the students required assistance with basic computer skills, such as adjusting the volume. It became apparent throughout each interview that students needed extensive advising related to skill development.

**Requiring early and ongoing advising.** The need for required academic advising was noted by many of the participants. Participants indicated that requiring academic advising early might have a positive influence on retention rates among all students, but especially those enrolled in developmental math courses. The instructors expressed comments such as that of Ms. Lacey: “They’re supposed to meet with their advisor but they don’t have to and they can register all online.” Failing to meet with an advisor before course registration was an area of concern for instructors. Such concern is fueled by other patterns among students described by instructors: “They find that they’re taking [the] wrong courses,” or “They can just put math off” until the end of their course requirements. Actions such as taking the wrong courses and putting math off create obstacles for students and can negatively influence completion of
educational goals. Therefore instructors suggested that advising be required “as students come in,” stressing that what is needed is “advising that makes it clear as they are thinking about their schedules.” Each comment reinforced the need for ongoing academic advising to address the instructors’ frustrations due to students enrolling in courses without foundational and critical thinking skills that can be learned while enrolled in developmental mathematics.

Instructors often mentioned the need for early academic advising when discussing the Accuplacer exam. Many instructors suggested encouraging students to study before taking the placement exam. Students entering the College are required to take the Accuplacer in order to determine current math skills and gain advising on appropriate courses for which to register. Ms. Hernandez explained that studying for the placement test has an impact on the student being placed in the most appropriate course and having positive feelings and agreement about the placement. She went on to note challenges encountered in the classroom when students believed they had been inaccurately placed in developmental math:

Some of what happens, some are angry that they got placed into there [developmental mathematics] and that is another thing you have to deal with in the classroom. So if they didn’t really need it, I would rather them not do it for their sake and mine too.

The instructor implied in this statement that negative emotions could be avoided if students were encouraged to study prior to taking the exam. Because students are only allowed to take the Accuplacer test once unless they submit an appeal and receive approval, the need to encourage preparation and studying prior to the test is critical. As Ms. Anderson reflected,
“You know, we don’t let them retake it, so if they didn’t take it seriously they are pretty much stuck.”

Career Advising

The need to provide students with both academic and career advising was mentioned by several participants. Ms. Lacey described the importance of advising: “The advising component becomes huge, even just in terms of exposing students to the kinds of things that they might do, and what of those skills you need to have.” Although career advising was identified as something that is important, instructors noted two obstacles that they need to overcome in order to provide effective advising: “It [career advising] is not on our radar,” and a personal bias that “freshmen graduate” rather than pursue job skills or certificates.

Not being on the instructors’ “radar” implied that instructors focus more on getting the students to credit classes and ultimately to graduation than on advising students regarding careers. Secondly, instructors’ personal bias that “freshmen graduate” stems from their personal experiences as “successful completers”; they assume that everyone is successful. Therefore giving consideration to career options becomes secondary. However, instructors do see the value of encouraging students to consider career options. Ms. Young explained, “Being a successful car mechanic, one could argue, might be better than having a philosophy degree.”

Thinking outside of the box, Ms. Lacey stated, “There are jobs today that didn’t exist yesterday and there is going to be some job tomorrow that doesn’t exist today,” indicating the need for instructors to be aware of changes in workforce demands in order to provide advising to
students that is thoughtful, with full consideration of both current trends and the students’ interests.

Ms. Lacey mentioned,

Everybody’s trying to be a little bit better about getting students to be thinking about this [referring to career preparation], and not what a course does for them, but truly the whole spectrum of courses. To get them to be thoughtful about what happens is not just about getting that college degree, but the skills that you present to your employer. Her statement suggests that instructors must become cognizant of the need for career advising and overcome their personal biases in order to challenge traditional advising promoting degree completion. They must also promote skill development for a career and encourage pursuit of certifications as an option to the Associate of Arts degree.

**Promoting Certificate Programs as an Option to the AA degree**

Promoting certificate programs is another recommendation participants mentioned as a part of effective academic and career advising. The importance of encouraging certificate programs, as indicated throughout a number of interviews, is providing students an option in the event that they are not passing developmental math courses, helping students to develop skills that will prepare them for a specific career, and limiting the amount of time required in school and away from the workforce.

Participants mentioned the completion rate as one of the biggest issues related to developmental math. Ms. Lacey explained,
I think that we could have an impact there [completion rate]. And whether it’s to complete a degree, or getting to a certificate program, we have networking, we have cyber security, we have a biotech program here where students can get degrees, but they can also get a certificate that is a credential to go out into the workforce.

It became evident that the instructors support the option of pursuing a certificate instead of a degree; however, they struggled with providing adequate advising without discouraging the student. Ms. Young suggested that it is the role of the counselor to provide options:

I think that's probably more for counseling, too, to say because I would never want to, as a math teacher say, “I don't think math was for you” because that's why a lot of them are there. But I think counselors can say “You’ve tried to pass this class four times and you haven’t been successful. Have you considered such and such?”

The recommendation implies that students may be more receptive to such a suggestion from a counselor instead of their instructor.

**Overcoming Student Challenges**

In addition to providing adequate advising for students in developmental math, participants listed multiple challenges instructors needed to overcome. Teaching challenges not associated with teaching mathematics were:

- helping students to overcome low self-confidence,
- challenging high-school mentality exhibited by students,
- helping students to find their “voice” in the classroom,
- addressing performance and behavior issues that prohibit learning,
• managing students’ personal and emotional distress,
• understanding and advising students on their unique life experiences, and
• managing diversity in the classroom.

Low Self-Confidence

Several instructors addressed the issue of students who exhibit low self-confidence in their ability to do mathematics. Ms. Houston noted that low self-confidence often is limited to mathematics “but somehow they can be very successful in other areas of academe.”

Ms. Young referenced students’ experiences in elementary school where they might have been discouraged by a teacher regarding their math skills. Ms. Young stated, “I think something that happens when you’re 10, 11, 12 years old; it’s hard on you and it’s hard to make yourself feel good in math.” She continued by elaborating upon an experience shared by a student, “I had one student... who said in seventh grade one of her math teachers said ‘Whatever degree you go for, make sure it has nothing to do with math.’ She was 40 and she was still carrying that with her.” It became evident that for some students the lack of self-confidence began at an early age and continued to influence the students’ perception of themselves and their ability to do math.

Participants provided multiple comments and assumptions about the way that students thought about themselves in relation to mathematics. The participants offered reflections such as, “They don’t think they’re smart,” “They think they’re dumb,” and “They don’t like math,” based upon their experiences teaching developmental math and interacting with the students. Ms. Hernandez summed up these assumptions with the following statement, “A lot of the
students are convinced that they can't do it. So that is just one more reason they can't do it.” Hernandez’s statement implied that it is not about the students’ ability but more about what students think about themselves and their abilities that either prohibit or ensure their success in mathematics courses. Subsequently, as the participants described, the students are likely to “give up,” dropout of the class, and possibly leave school altogether.

Unfortunately, few developmental students are likely to pursue additional resources outside of class, as observed by the participants and shared during the interviews. Specifically, Ms. Knight stated, “The developmental students do not seek out help that they need.” Curiously, the statement implies a unique behavior difference, in that “non-developmental” students do seek help. Ms. Knight, based on observations and conversations with students, had concluded that the developmental students, as a group, do not solicit help when needed, which contributed to a noticeable pattern of students who leave the class or school without communicating with the instructor or a counselor.

However, some instructors suggested that students do not always dropout or choose not to solicit help when needed. Ms. Houston commented, “I think basically the students [who seek help] have more self-respect. I kind of see them standing up a little straighter, and they have a ‘can-do’ attitude now [that they have experienced success in the course].” Although the instructor observed a change of confidence, the students were described as still being less motivated than their peers. They did, however, possess an enhanced awareness of their capability to do the work.
Fortunately, instructors observed an improved level of self-confidence among some students. However, fear of math and the related anxiety that may have stemmed from secondary education experiences seemed to overwhelm many students, as participants described. For example, Ms. Lacey commented that students expressed their disdain for math in the following manner, “I hate math, I have never been good at math, but I really need to pass this course.” Lacey further explained that “there is just extensive anxiety and lament about mathematics.” The statement from Lacey was supported by Mr. Nazier’s comment:

A lot of students have developed math phobia as a real thing. There are people who have an actual fear, an actual trepidation towards mathematics and their relationship to this subject as some type of reflection on their own personal intelligence.

He went on to say,

And no kid walks into a class, at age 5 or 15 or 25, and says, “I’m going to make this hard, I’m going to be outside, and I’m not going to get this.” This has happened over time, and we’re trying to do something with this. Developmental math is often not on the radar screen of people we hire, and they’re often shocked.

**Students’ Fear; Instructors’ Comfort**

Another factor contributing to students’ negative feelings and lack of self-efficacy is the belief that they are not “math people.” While instructors did not provide solid reasons for such beliefs, they did suggest that the social acceptance of not being good at math was a viable factor. Ms. Knight explicitly stated, “Looking at it broadly, it’s okay to say you’re not good at
math.” She went on to explain the social factor with a little more detail, stating, “There is a whole social acceptance of not being good at math. And then it requires hard work.”

Several instructors noted the social acceptance of “not being good at math” as a significant factor among students’ challenges and negative feelings regarding math. In addition, some of the instructors compared the social perceptions relevant to reading versus mathematics skills. Several instructors commented, “Not being able to read isn't socially acceptable. Not liking math is.” Society allowing individuals to admit that they have not developed math skills was described as influencing students’ acceptance of not being a math person and potentially was a means of escape to avoid learning basic skills. The data included a passionate statement from Ms. Lacey regarding the mental damage that occurs once students see themselves as not being math people,

Once a kid has labeled himself as not a good math student I think those things get hard to shed. I am talking psychology, but I am not a psychologist, but it seems like children pick up most things very early and it affects how they do; it affects their placement. As a result, a majority of students in developmental math see themselves as being different from instructors who would describe themselves as being good at math or as being “a math person.”

The disconnection between students and instructors created by their individual perceptions of themselves may contribute to the instructors’ stated challenges of engaging students and understanding their difficulties related to learning math. In particular, Mr. Nazier described his frustration and experiences in the following words, “I don't remember not
understanding this stuff and so one thing that I've had to become sensitive to and actually I've tried actually meditating and trying to recall what that felt like trying to learn this stuff.” Closer examination of the quote uncovers the instructor’s hope to understand the students’ experiences of learning math. Mr. Nazier continued to explain the practice of trying to “look at it from their point of view....Well if you’ve never seen this before then it may be confusing.” Instructors’ different personality types may influence the classroom environment and subsequently the students’ success in the classroom.

Other instructors explained the simplicity of mathematics and suggested that math is less complex than other areas of a student’s life, which supports the assumption that some instructors hold that the ability to learn math is innate. Mr. Nazier explained,

Compared to all the other situations in your life that you run into, I mean one plus one is two and it always will be. And maybe even on a logical level, it makes sense that it should be that way. On that level I can't understand these students.

Feelings of Discouragement

Outside of the perceived simplicity of mathematics from the instructors’ point of view, students may develop feelings of discouragement due to placement in a developmental mathematics course. According to the information gathered from the interviews, these feelings of discouragement may develop from resistance to taking developmental courses due to feelings of embarrassment, a longer time requirement to complete their educational goals, and the requirement to pay for a course without receiving course credit.
Participants commented that students may feel embarrassed after being placed in a developmental course if they feel as if they learned the material in high school. In addition, students may become frustrated and embarrassed if their peers are not required to take developmental mathematics. Ms. Lacey explained,

A lot of these students come pretty fed up; they know they shouldn’t be in developmental math. They know that they graduated high school and other classmates go on to college level stuff, and they’re doing stuff that they know they probably saw for the first time in 8th grade, 10th grade.

Lacey explained the impact of being placed in a developmental course this way: “Being placed in developmental from the get-go is discouraging. Very few people come here and want to do developmental anything.” Ms. Lacey added, “We have students who get frustrated at their placement, especially when it’s the developmental placement, and they’ll say: ‘But I took such and such course in high school.’” Based upon these comments, students seem to enter the College with ideas of their skill level that may not align with their scores on the Accuplacer Placement test.

In the event that students are placed in developmental mathematics, they are required to take additional courses, which leads to the second factor contributing to feelings of discouragement. Several participants expressed their concern about the additional time required for students who are placed in developmental mathematics courses to complete college programs and mentioned that this issue contributed to lack of retention and the overall
drop-out rate among students in developmental courses. For example, Mr. Hall summed up comments from several participants:

So when they look at the time they spent, even if they believe they need it, it is a turnoff. [They think:] “It’s a 2-year degree; if it is going to take me 4 years or more to get it, then maybe this is not the place for me.” It's a huge turnoff.

The additional years lead students to question the possibility of managing life responsibilities and school for an extended period of time and, according to the instructors, students may opt not to pursue the degree. Moreover, without adequate advising, students may not consider pursuing other options such as developing skills for a specific job or getting a certificate, both of which could lead to additional benefits such as upward mobility, higher paying careers, and job security.

**Not getting credit but required to pay.** The need for additional time to complete the degree forces students to incur additional expenses. Several participants indicated the negative feelings generated when students discover that they will not receive credit for the developmental mathematics courses but they will have to pay the cost for tuition and fees. Developmental mathematics courses cost the same as college level mathematics courses. Therefore county residents pay over $440.00, state residents pay over $860, and out-of-state residents pay more than $1100 per 3 credit hours for tuition and fees.

Instructors shared the negative feelings, particularly anger, that students expressed about this policy. Ms. Young reflected, “First of all they’re mad that they’re in this class.” She further indicated that some students may ask, “What do you mean I have to take three of these
classes before you’ll let me [take the course or courses I need to graduate]?” Comments made by Ms. Young were reinforced by Ms. Houston who noted that “they (the students) resent it.”

However, many instructors expressed optimistic comments despite the students’ anger and resistance due to their placement in developmental mathematics. The comments demonstrated an eagerness to help the students overcome their feelings and to learn. Demonstrating compassion, Ms. Young commented: “Nobody's happy to be there but if you can convince them that it helps them in the long run, usually once you get them moving and getting through that first test then you've got hope usually.”

High School Mentality

Participants witnessed students who displayed a high school mentality and behavior that was not congruent with college level maturity. Ms. Young described it as students who perceive college to be “13th grade, which leads to high school behaviors.” She further explained, “The expectations of the college don’t always match what the student thinks” college will be like. The students’ perception of college being 13th grade was reinforced by several other participants. Moreover, they identified student behaviors such as demonstrating impatience throughout the learning process, not being responsible for missed information, assuming that being polite will lead to good grades, and believing that they should get credit for trying even if they do not learn the material. These behaviors affirmed the instructors’ idea that students enter community college with a high school mentality. Students who possessed a high school mentality, as described by the instructors, were often recent high school graduates.
The instructors mentioned several times that students demonstrated impatience during the learning process. It was evident to the instructors that the students were not interested in actually learning and garnering skills but rather that they were more interested in advancing to the next course. The instructors were unaware of the origin of such behavior or how to address it appropriately without discouraging the students. Mr. White provided an example of students’ behavior,

You have to be ready with seven different approaches. That one approach doesn’t work and some of them just get so frustrated. In fact I’ve had a situation where a [student] said to me, ‘Listen, I really don’t want to understand this. Just give me the answer because I don’t have time for this.’

Other instructors expressed very similar concerns. Mr. Branham implied that “they would rather try to get you or someone else to work the problem for them, just so that they could move ahead.” The instructors’ concerns were voiced clearly, reinforcing the need to teach beyond the content and to help the students learn to apply themselves and become patient with the learning process.

A second behavioral pattern that demonstrated a high school mentality, as described by Mr. Hall, is not taking responsibility for missed information. Secondary school teachers are responsible for making sure that students who have missed class learn the material despite their absence. Hall further explained, “When you think back, the way the public schools work is if you are gone, it’s the teacher’s responsibility to tell you what you missed, to give you a highlight, and if schools were to stop doing that, I would have issues with that.” Students’
failure to take responsibility for missed information becomes a challenge for instructors who are required to cover course objectives within a certain amount of time and to manage students who are in need of past material due to absences. Encouraging students to take ownership of their learning becomes an additional requirement for instructors beyond teaching the content.

In addition to students not using their “voices,” I observed basic personal management and organizational skills during class observations that reinforced the high school mentality that instructors described. For instance, students did not come prepared for class with necessary tools such as calculators and notebooks. One student asked for a calculator from the instructor. The instructor then borrowed a calculator from another student.

**Be polite and pleasant to make good grades.** Four of the instructors noted a third behavioral pattern: the idea possessed by students that being polite will lead to passing grades. Mr. Erwin summed up this pattern of behavior very succinctly, “We get a lot of students who are thinking that they can just show off to people as polite and not do much work and they expect to pass.” Mr. Erwin went on to explain, “I find that students straight out of high school are still in the high school mode where if they are polite and pleasant they tend to expect to pass.” Based on the instructors’ observations, students seem to have been given good grades in secondary school and passed to the next grade regardless of learning. The College, however, challenges students to master the material before they are allowed to advance to the next course. Ms. Young described a regular conversation that occurs with students,
So they’d come to say to me, “But I tried so hard.” And I said, “You know what, I don’t care how hard you tried at all. I only care if you could perform.” And they look at you like, “What are you talking about?”

Credit should be given for trying. A final behavioral pattern instructors noted was students’ request to gain credit for trying even if they do not actually learn the material. Several of the instructors stated that students often requested that the grades be curved or that they get a higher grade for simply signing their name, which is a common practice in secondary education. More importantly, instructors addressed the ongoing practice of challenging the students to work harder and their refusal to award credit for simply trying rather than demonstrating comprehension. Mr. White described his response to students:

I don’t really care how long you work, you have to succeed. And that’s another thing—the problem with high school. I don’t care how hard you’re trying. I’m sorry. Welcome to the real world. I care how you’re succeeding. And if you’re not, then you need to try harder.

The instructors described the practice of not allowing students to simply get credit; rather, they insisted that students demonstrate math competency. Forcing students to demonstrate their competency challenges the secondary school practice of allowing students to pass. Ms. Knight explained,

Maybe they have gotten by in high school with a ‘C’ or even a ‘D’ and they come here and they think, “Oh, I can just go to college.” They don’t know what it means to be a college student.
Instead students do not apply themselves, hoping they will receive credit and be allowed to move on to the next course. Mr. Erwin noted that students think “that just being in class is enough to pass.” Erwin went on to explain, “For those who aren’t in the learning mode, they are just hoping the time will hurry up and go by and they can pass the way they did in high school.”

As mentioned previously, students’ high school mentality is often demonstrated through lack of engagement. Specifically, instructors described students as not being used to speaking out, asking questions, or having a “voice” in the class. Mr. Nazier explained that constantly engaging students can be challenging “if they are not used to being engaged or used to having a voice in the class.” Behaviors associated with lack of engagement may actually be a pattern developed during secondary education when students were not encouraged to use their “voices” throughout the learning process.

**Unique Life Experiences and Responsibilities**

The need to teach beyond the content included addressing students’ unique and extreme life experiences and non-college responsibilities. More than half of the participants commented on the unique experiences of students that influenced their success in the classroom. Participants described the experiences as unique because students who attend four-year institutions do not generally experience such situations. Participants shared the following examples of the extreme situations their students experienced: “separated from husband or boyfriend,” “living in their car or homelessness,” “sick parents or children,” “lack of support from family members,” “murder of loved one,” and “lack of resources and money.”
Learning about such aspects of their students’ lives while getting to know and advising them is a challenge that most college instructors do not face.

Several of the instructors commented on the large number of commitments and responsibilities that students had outside of class. Ms. Knight stated,

They have so many other things going on in their lives. That’s really a lot of our students. No matter how motivated they are to learn, if they have these horrible things happening in their everyday lives or they, you know, parent getting sick, someone dying, children being sick, they just have--They are being pulled in so many different directions that they just [participant pauses and shrugs shoulders].

The instructors expressed concern for the students who were entering with basic skills and had so many personal issues to manage. Ms. Houston reflected,

But time constraints and again being a non-residential [college], where they've got so many commitments. Some of them were part-time, some of them were full-time. They're taking classes. They've got people they're taking care for. You know, I just have so much admiration for them. I know what it is to go to school and have a family and have a life.

Many of the participants described some students as motivated and aware of the importance of education but overwhelmed due to outside responsibilities. Ms. Young explained,
We've got students who they might be the first ones in their family to be going to
college. We have students who have families, are holding one or two jobs. They know
that college is the key to getting a better job, but they're stuck in the realities of today.
The participants noted an important variable: many of the students are first generation, which
indicates that they may not have resources at home or in their community to help with
navigating school, work, and personal responsibilities.

Instructors repeatedly mentioned that the multiple responsibilities that students had to
navigate was a point of concern and an area that required support beyond teaching math
content. For example, many of the instructors discussed outside influences and responsibilities
that influenced students’ academic success. Ms. Hernandez reflected, “Some of these students
have jobs, they are taking a full load of classes, they have families. And so they have all these
other things pulling for their time and there are only so many hours in the day.”

Participants also commented on other issues that women may encounter based on
cultural norms. For example, Ms. Anderson stated, “Are you foreign and your husband doesn’t
want you in school and kidnaps the kids to try to get you back or whatever. I mean we have
those kinds of things.” While instructors are empathetic, they are challenged regarding how to
adequately advise students struggling to navigate cultural challenges and multiple
responsibilities. The need for involved counselors and academic advisors is evident.

A small number of participants discussed the need to partner with counselors in order
to advise students appropriately. More importantly, having counselors actively involved in the
classroom was seen as an opportunity to support students by holistically addressing their
academic needs as well as personal challenges. The instructors speculated that students may not want to talk with an instructor about personal issues, which validates the need to partner with counselors. Ms. Lacey noted,

And they may, or may not, be comfortable talking to their math teacher about that [personal problems]. And that’s one of the reasons we try to partner more with a counselor by bringing them into the classroom, give students a name, [and a] face, and then say: “It’s okay to go talk with somebody about these things.”

Lacey expanded on experiences with students who demonstrated discomfort when discussing personal issues, “If I’m your math teacher, you may not want me to know that you’ve just separated from your husband or broken up with your boyfriend.”

In the event that a student’s resistance to talking with a counselor about personal issues is overcome, instructors need to offer appropriate advising that is supportive. Ms. Lacey honestly stated, “And part of the solution may be drop your math class this semester, come back when you’ve got less on the plate.” The challenge of advising students to “take a break” was reiterated by Ms. Knight who commented,

And, you know, you want to say to them: “You know what, maybe this is not the semester for you to be at the school. Why don’t you do something else and, you know, when you can get everything ironed out [come back].”

In addition, instructors highlighted the current philosophy and approach of the math department to incorporate counselors earlier in the developmental math sections in order to
help students and enhance engagement with the hope of building a strong math foundation that will help the students in credit courses. Ms. Young explained,

Yeah, and not all the time. They have to be able to know the content. But it helps to know if there are particular things that are causing them to either not be in class regularly or just overall misunderstandings and those kinds of things. A lot of times it doesn't have to do with content; it has to do with their day-to-day life.

**Diversity in the Classroom**

Gaining knowledge about how diversity was represented within the classroom was difficult. When asked how diversity influences classroom instruction and the overall classroom environment, almost all of the participants indicated that diversity in terms of race does not influence the instruction. Ms. Knight stated, “Math is math; race or income doesn’t make a difference.” The dismissal of race as a factor in the classroom environment came as a surprise considering that Black, Asian, Hispanic, American Indian, and “Multi-Race” students make up over 65% of the student body at ECCC, according to the Enrollment Overview and Table of Contents 2011 report.

However, other instructors offered three forms of diversity that do influence instruction and the classroom environment: (a) differences among students with regard to math competency, (b) English as a second language, and (c) diagnosed or undiagnosed learning disabilities. More importantly, several of the instructors noted techniques used to address the diversity in the classroom to enhance learning, such as asking questions to engage students and
requiring students to demonstrate what they know by working through math problems on the board.

**Level of math competency.** The diversity among students with regard to math competency was consistently mentioned by more than half of the participants. Instructors noted that many students entered the college without knowing basic math skills while others were more advanced. Ms. Lacey explained,

We would have students in the classroom who literally didn’t know their addition and subtraction facts. And then you have students who just missed next course placement by a point. And you’ve tried to move them on forward, and that’s tough.

As indicated, the diversity in the classroom creates challenges for the instructor to provide classroom instruction that meets each student’s needs. As a result, the self-paced model for developmental courses was highly advantageous for both students and the instructor since students were working at their own pace with individual support from the instructor.

Although the self-paced classroom structure is seen to be beneficial to students, some instructors described the classroom experience as demanding. Mr. Branham stated,

Students are at all different levels, so consequently you are helping students on an individual basis. Usually when you talk to students you’re talking to them one-on-one; that's not the same as talking to a class of 30 students instead of one. You’re finding yourself doing quite of bit of work during each class time. You’ve got to have the time to talk to each individual student, to help him [sic] understand the process.
English as a second language. English as a second language was noted as a form of diversity among the participants. Those students who were not native English speakers often experienced challenges in the classroom articulating their problems as well as understanding the instructor. For example, Mr. Nazier explained, “A lot of our students are not even comfortable with English as their first language so that they can actually articulate what it is that they had in their minds.” Mr. Anderson further noted, “Students who do not speak English have difficulty understanding the instructor.” According to the Fall 2011 enrollment report, almost 8000 non-U.S. citizens were enrolled, representing 174 individual countries of origin; 931 students were on foreign student (F-1) visas. Therefore the probability of having a significant percentage of non-U.S. citizens who may not speak English as their primary language enrolled in developmental math courses is relatively high.

Learning disabilities. Lastly, learning disabilities were listed among the areas of diversity that instructors need to consider. Some instructors quietly suggested that having a learning disability may explain why students are not engaged and are unable to comprehend the content. With a sense of hopelessness, Mr. Nazier passionately explained, “I don't want to say they are unreachable. I just I haven't found a way.... Some of them have--maybe a small number--have serious learning disabilities.”

Techniques to overcome diversity-related challenges. The diversity of math competency, English as a second language, and potential learning disabilities challenges instructors to engage and motivate students. The act of engaging students was described as having to ask questions in order to know what the students were missing or to ask students to
demonstrate what they knew on the board to identify areas that needed attention. One instructor explained, “They [referring to instructors] have to ask students, such as, ‘You probably should explain to me, what’s the confusion?’” In the evident that inquiry does not identify the problem areas, asking a student to “go to the board” and write out the math steps may be a second approach. Mr. Zales described with a pleasant countenance, “We have those students who would actually do the problem on the board, and then explain how they do it, and then we understand what the difference is.” The two techniques are useful tools to help students who may be experiencing problems due to a lack of understanding or those students who are experiencing problems due to a language barrier.

**Overcoming Student Resistance**

Strategies used to overcome student resistance was a significant theme. Mr. Erwin emphatically explained, “Overcoming student resistance will help to counter the dropout rate. Oh yeah, the dropout rate is pretty high.” Participants suggested that if the forms of resistance are not remedied, students will essentially give up and/or become “stuck” in the course, subsequently becoming “repeaters” and possibly never achieving their academic goals. In addition to discussing factors that may explain why students are resistant, participants also identified potential strategies to address resistance, which included the importance of building positive relationships with students and helping to enhance student confidence.

**Building Relationships**

More than half of the participants commented on the importance of building positive relationships with the students in order to enhance students’ engagement and motivation.
Specifically, Mr. Zales addressed the need to connect with students and the reasons why it is important:

I think that it has to be kind of a connection between the student and the instructor. Sometimes you feel like the student is not under full learning. Many of them, they [students] believe they're in a dumb class. They’re not engaged, and you try hard connecting to make them engaged. It’s all a bit difficult.

Zales’s comment illustrated the importance of connecting with students, why students may not be connected, as well as the challenges presented to instructors when students resist.

However, Mr. White mentioned the difficulty or impossibility of connecting with every student in the context of the self-paced model.

If you were lecturing to 24 people, that's kind of buffered or a distance. But it's not the case if you have to teach 24 people 24 separate times. One of those 24 times you're going to be meeting with somebody that you're just not--. You ever just meet somebody and go “I don't like him.” Something chemical about that and I've seen it happen. Maybe it's because I'm nasty or something. No, I don't see it that often though.

Ms. Knight stated,

Well, first of all, I think the students need to know that the instructor cares about them, that the instructor knows who they are, and the instructor is on top of what they are doing. Not to nag them, but to just keep reminding them that if they want to be successful this is what they need to do. So to provide, you know, the path to success.
But of course you can’t force, you know, you can’t force--. You can lead a horse to water, but you can’t force him to drink.

Ms. Hernandez noted that allowing students to work together was a way of not only building positive relationships but also creating a team environment.

One way that I try to help with the anxiety piece is that I let them work together, even on some graded things. I think that helps. For some of them, it helps their self-esteem because they’re the one explaining it, and they’re like “Wow, I really do understand this.” They actually did, they just didn’t realize it. Then for others, it helps them realize that they’re not alone, and that helps also.

Regardless of the technique used to build positive relationships with students, participants stressed that it is vital that instructors demonstrate a willingness to help. Mr. Branham noted, “I sit there and talk to them, and it doesn’t matter who it is, if they are willing to learn, then I am willing to help. I am willing to teach, if they are willing to learn.” Therefore communicating with students allows an instructor to determine if a student is motivated and ready to work. It is important to acknowledge that making such a determination begins with building a relationship with the student. Ms. Young reflected,

But I think it’s a lot a matter of respect. My students hopefully know from the get-go that I don’t think any of them are stupid and they might not like math but they’re all capable of it. It’s more of a team effort kind of thing. And I think by breaking up the lecture into little bits of lecture and then more group interactive work, it’s less of a me and them and more of a let’s work together kind of thing. But it takes a while to get
that going. You couldn't the first day of class, the first week of class; the student would never say something like that. Hopefully by the time you're at the halfway point, and it's a matter of trust. If they trust you enough to tell you something.

Supporting Student Self-Confidence

The ability to remedy or overcome student resistance can be achieved through helping students to strengthen their self-confidence. Almost half of the participants provided examples and stated the importance of helping students to build their self-confidence and overcome their fear of failing math. Participants recommended helping to build students’ self-confidence through encouragement as a method of overcoming resistance. Ms. Lacey stated,

And again, I don’t think I’m alone in trying to get students to sort of be at ease, you can figure this stuff out, and get them again to appreciate why, as well as give them that confidence that they can do it.

Providing encouragement verbally and non-verbally offers students the support needed to think differently about their abilities to learn and succeed at math.

The act of offering encouragement to students can be an extension of providing validation. Participants described providing validation to students as going beyond encouragement and affirming abilities that students were aware of but were in the process of questioning. Mr. Nazier explained,

It's a challenge, however, if it's in terms of engaging the student. I think when you validate that the student's question is actually a good question from a certain point of view, then I think that validates. That's a validation—when you can acknowledge that
the question is a good one--and so I tend to say that a lot in my classes: “Well, that's actually a good question.”

Explaining the Value of Having a Strong Math Foundation

Participants noted that one strategy for helping to strengthen self-confidence among students was helping them to understand the value of having a strong math foundation. Ms. Lacey reflected,

I think sometimes these students--they come sometimes without goals. They’re not motivated; they don’t see the purpose. You are sometimes as much a cheerleader as a math teacher, and trying to help them. But to help them understand that laying the foundation now, on which they can build, will stand them in good stead, for whatever they end up doing.

Enhancing Learning through Instruction

The importance of overcoming resistance demonstrated by students is closely related to the ways to enhance learning among students. Enhancing learning among students was a significant emergent theme from the findings. All of the instructors commented on the need to enhance learning among students and offered strategies that have proven to be successful. I discuss the specific strategies they mentioned under two subheadings: student engagement and teaching strategies. The two subheadings provide an umbrella for various practices that the participants shared. Some strategies were mentioned more than once and others were suggested by only one instructor. However, each of the practices seemed to be noteworthy and have the potential to have a positive impact upon students.
Engaging Students

The value of student engagement was a resounding comment from multiple participants. It became clear that in order for students to be successful in developmental math they must be engaged, motivated, and willing to work. It was encouraging to hear from a little less than half of the participants that some of the students enter the course engaged and willing to work. Mr. Zales proclaimed,

I think sometime we have students that are very ambitious. They take their studies very seriously, they come to class, they want to sit in class, they try to [come to class] always. Sometimes some of them ask what is it that you want to cover next, because they want to get prepared for the next time, to know the material.

However, because of the points of resistance stated previously, a larger majority of students are not engaged, which prompted comments and expressions of frustration from the participants.

Participants were optimistic that in the event that a student is ready to work she or he will be successful. Specifically, Mr. Erwin confidently stated,

When students are ready to undertake the challenge of performing a series of steps that have been shown to them, and that they practice, if they are ready to do all of this for a whole semester they will succeed.

Despite their background or lack of skills upon entry into the course, Erwin felt certain that students are capable of doing the work if they demonstrate a positive attitude and try.

A students’ willingness to work leads to demonstrated engagement in the classroom.
Almost half of the participants offered a list of characteristics that students are likely to demonstrate when they are ready to work and apply the necessary effort, such as completing assignments, asking questions, and possessing a serious attitude. Mr. Erwin went on to explain that engaged students “perform all of the assignments. They ask questions about their problems that gave them trouble and they express their apprehension with exams.” My classroom observations supported the participants’ statements. Throughout a majority of the observations, particularly observations of the self-paced courses, most of the instructors were constantly moving from one student to another to answer questions, help with homework, and to prepare students for the test. It was noticeable that instructors with creative and engaging teaching strategies were more active throughout the class and worked with students.

**Teaching Strategies**

Each participant referenced the importance of using teaching strategies to engage students and enhance learning. Participants suggested three substantive strategies: incorporating team-based learning, demonstrating high expectations, and making math applicable. In addition, participants stressed the importance of raising instructor awareness through examining instructor attitudes and providing professional development to enhance teaching strategies.

**Motivating students.** One of the most significant obstacles for the instructors was the need to motivate students to apply themselves. Considering that the instructors are “math people,” teaching the content is not a challenge but getting the students to work and apply effort was often described as “overwhelming.” Ms. Anderson explained, “And like you said, you
know the math so your effort goes into motivation and finding things that I guess bring success.” Ms. Lacey clearly stated, “They’re [students are] not motivated; they don’t see the purpose.” Successfully addressing the lack of motivation seemed to be hopeless to many participants who noted that they had tried multiple strategies and the numbers of students who passed remained the same year after year. Although the pass rate remained stagnant, Mr. Hall believed that the practice of applying “tough love” in order to motivate the students could work. He stressed,

Well, challenging them, getting them to work in a non-credit course. And they can have an attitude and hate it, but [I tell them], “You’re here; take advantage of what you have and do your homework.” It can be done.

**Team-based learning approach.** The practice of incorporating team-based learning in the classroom can contribute to student motivation. Team-based learning involves teachers working with students and students working together to create a collaborative learning environment. Although a small group of participants emphasized the value of encouraging teamwork in the classroom and partnering with students, during classroom observations I did not notice many of the students working together. Mr. Zales observed that the students seem to be in “isolation” and not working with each other in class or outside of class. He went on to explain the potential benefits of the team-based approach:

When they leave class, there’s no connection between the students. I don’t think they even meet, for example, to discuss, ‘Hey we have a test next week, can we get together to do the tests?’ I think that would help the students tremendously because when the
students get together to try to solve the problem, one has to explain to the other. In that sense, they’re becoming the teacher, and they have to convince the other one of the argument.

More than three-fourths of the classes I observed were using the self-paced format, which I am certain was a factor in the type of data gathered. A few of the classes I observed did include students who were naturally working together without being prompted by the instructor. Perhaps they had been in a previous course together or in some way knew each other and were willing to help one another get through the assignments.

Some of the instructors expressed the value of partnering with students to create a positive learning environment. Ms. Hernandez reflected,

I think I kind of learned over the years how to get that core group of ones that are focused or how to enable them to make a classroom atmosphere that focuses on learning. And so if you can get those as your colleagues in the classroom then we can have an environment, because there is a tendency for some behavioral issues in these classrooms.

Her comment was a powerful acknowledgement of the influence that students can have on one another as well as in helping the instructors to achieve their learning objectives. More importantly, pairing the students together increases the probability of successful mastery of the course content. Mr. Hall shared a specific incident with an individual student in which they became partners throughout the learning process and the subsequent positive outcomes. He noted,
Suddenly I was making it so we can be working together instead of against each other. I don’t think he will say that I was [an] influence for him or anything, but he eventually sat down and passed the course. That's what really matters to me. That's a huge success for me, even though he will not show up on any of our numbers, or I changed his life or anything.

In addition, moving away from lectures and encouraging students to work together has proven to be successful for some participants. Ms. Young described the value of team-based learning in the classroom,

In a face-to-face class I find active learning--having students working together, working independently in the classroom, not just listening to me talk--has been very successful. So rather than being passively just watching me just do math, because I can do math really well and I can do it all day, but it's them doing it that's going to really make them learn it. So I think having them do more active learning in the class has been a huge difference.

**Making math applicable.** Almost half of the participants noted the importance of making math applicable so that students recognized the value of what they were being charged to learn. Many of the instructors expressed concern that word problems taken from the state adopted textbook were not very applicable to the students. In addition, a majority of the participants mentioned that the students resist the classroom instruction due to a disconnection between classroom content and their everyday lives. For instance, Mr. Hall stated, “I don't think many students realize that they need this. It's a common high school
question, ‘When am I going to use this?’ And the response is that you need it to get into college level courses.” Getting into college level courses may not be an adequate response for students who do not have clearly stated academic goals and are simply hoping to get from one semester to another. Some instructors expressed agreement with students’ concerns regarding the disconnection and lack of applicability. Challenging the current curriculum, Mr. Zales surprisingly explained,

I don’t think if we teach someone how to solve a linear equation, how to solve a quadratic equation, how that would help them in their life and job. And that’s how they also look at that: “Why do I need to learn this, when do I need that?”

Some of the instructors seemed to express some empathy regarding the students’ concern and may be likely to suggest a modification to the curriculum with the hope of supporting students. As I observed several classes, I wondered if the students were aware of the practical side of mathematics or if they were simply going through the motions with the hope of advancing to credit courses.

Several participants sought to address the need to make math more applicable by infusing certain practices that link math to everyday lives as well as students’ professional interests. For example, Ms. Lacey applied mathematics to shopping,

And when you say, something is 40 percent off, what you’re going to pay for it? They got the answer like that, and I say: “You just solved a math problem.” And it’s meaningful, that was important to you, you need to do that, and you figure out what the others think. I had one time, many, many years ago; these were students in there taking
developmental reading, English, and math. And I brought in banana bread or pumpkin bread, or something, with a copy of the recipe, and they had to earn their piece of it, and I’ve asked them things like: “If you doubled recipe, how much flour?” and all this. We had some fun with it that I hope that help students relax. The recipe called for 2 eggs or something, and I said, “You open your refrigerator and you’ve only got one egg, you’re going to hurt the recipe.” And then I called on one student, and I say, “How much sugar?” whatever, he says, “I’d go to the store and by a dozen eggs.” And I said, “It’s midnight,” and he said, “7/11.”

She continued to offer strategies to connect mathematics to students’ current professional places of employment or their professional goals. For example, she reflected upon a “school in Colorado where [there is a] nursing program and the developmental math is infused into the nursing courses,” suggesting a potential practice for ECCC to consider. Mr. Nazier stated,

One thing that I try to do with my developmental students is at least to give them an appreciation for how this stuff is actually useful in terms of what they do want to do. And certainly I hope that kind of appreciation in dealing with the kinds of skills that come with that are transferrable to whatever jobs they have.

**Instructor Perceptions and Attitudes**

Analysis of the data captured 11 different attitudes that participants exhibited. Two of the 11 attitudes were labeled as positive and the remaining 9 were labeled as negative. Unfortunately, few studies investigate and define the attitudes and perceptions of instructors
who teach developmental math. However, one study conducted by Mesa (2012) concluded that instructors have a negative perception of community college math students and their goal orientation. Due to the lack of current literature, I label the attitudes as positive or negative based upon my own interpretations. I discuss the demonstrated attitudes beginning with the two positive comments.

The positive comments were couched in a teaching philosophy that demonstrated a sense of purpose among instructors. Their philosophy incorporated teaching at a community college as a “calling” and/or professional mission. Ms. Young explained her perception of instructors at the community college as such, “I think that when you get instructors that this is where they want to be, it’s not a stepping stone to a four-year [institution]. They’re here because they know they’re making a difference in student lives.” The statement shared by Young challenged the perception that community college instructors are driven by ulterior motives, such as professional advancement or personal gain. Ms. Anderson went on to support Young’s opinion by stating, “It’s our job to bring them up so they’re ready for college.”

Mr. Branham extended the philosophy of professional purpose by framing it with his perception of the role of the community college. He explained,

I think it’s [developmental mathematics] very worthwhile, very useful, gives a lot of people opportunity who would not have had the opportunity, and they’re sort of people who are very gifted. There are some people who work really hard, but for any reason they come in without those skills; a lot of times that may not be so much the student. Sometimes it may take a student a while to get his [sic] life in order.
Mr. Branham expressed an appreciation for community colleges that offer developmental education and provide an opportunity for students. Particularly, he described a positive attitude toward students, describing them as “very gifted” but possibly having external challenges that impede their academic success.

Mr. White agreed with Mr. Branham, describing the student with optimism as the “common guy.” Furthermore he indicated that the community college has a responsibility to meet the needs of students regardless of academic readiness. He explained,

We have to serve the common guy. We're a community college. Someone has to serve these people and that's why I'm proud to work here because we are the statue of liberty. Bring us your [as he pauses and gestures by opening his arm]. I mean we have people who have just got off a boat. I just love [that] and also love that anybody can come here but if you don't want to work, sorry, hit the road jack. But it's the land of opportunity. That's what I love.

Mr. White’s explanation suggests a unique characteristic about community colleges; they provide accessibility to higher education for the common local residents. Although the phrases used such as “we are the statue of liberty” or “just got off a boat” may raise concerns, he shared his philosophy with a positive attitude and strong desire to support students who are willing to work.

Although some of the instructors expressed positive thoughts and demonstrated a positive attitude, others were not as encouraging. For example, some participants described students as “stupid” or “dumb” based on their experiences teaching developmental
mathematics or statements expressed by other participants. Specifically, Ms. Ladner described an incident with a colleague who was disappointed in student test scores on a recent test. The unknown colleague, out of frustration stated, “They’re just so stupid.” Ms. Ladner described her response to the statement as such, “You just cringe, you just die a little bit. I think it’s all over the place, huge frustration, and some of that’s compassioned frustration.”

On the other hand, Mr. Nash spoke from his personal perception. His experiences were in line with the experiences reported by Ms. Ladner. He stated,

Sometimes they are breathtakingly dumb and they take even me by surprise. And sometimes, to be honest, it just indicates that they haven’t really been paying attention. What I mean by “breathtakingly dumb” is like you haven't been here the last two months to have a question.

Mr. Nash’s statement implied a sense of frustration and surprise with students. He used the phrase “breathtakingly dumb” but went on to clarify the statement by explaining that some students are not in class enough to ask questions. The statement of clarification presents an attitude that students with excessive absences relinquish their “voice” and should sit silently.

Mr. Nash’s statement and expectations introduces another negative attitude demonstrated by instructors. Some of the instructors implied that students are responsible for their learning or failure to learn. For instance, Mr. Hall expressed his opinion based on observation of students in the classroom,

Some of them want to do it. But they don't. And it's human. We all do that. I want to not do things. But I guess the very basic thing, and I don't know if this is even in my
vocabulary, it scares me, but I had a colleague that I really respected and he used to say **they have the right to fail.**

Ms. Anderson provided a statement suggesting that the student has full responsibility to determine their learning or not. She stated,

> It's not that I had a bad day teaching; it's that they didn't do any work to learn. The whole job of learning is theirs. I'm there to assist, but I'm not there to teach. They have to learn.

Both the statements offered by Mr. Hall and Ms. Anderson suggested an attitude that places responsibility on the student. Thus, the instructor relinquishes all responsibility for student success in the classroom and ultimate achievement of educational goals.

Although instructors demonstrated negative attitudes regarding teaching in general, they did not express resistance to teaching developmental mathematics specifically. However, Ms. Anderson described resistance exhibited by some instructors to teaching developmental mathematics. She explained,

> We have some rednecks we think shouldn’t be here, but of course if they weren’t here, “Mr. Redneck” probably wouldn’t have a job. **We have people who won’t teach developmental.** And sometimes you can get away with it, and sometimes you can’t.

Mr. Hall supported Ms. Anderson’s comment by describing statements that he has heard while talking with colleagues. “This is my sense. Some is that some would rather be teaching college level math than developmental math. I do know that one of the instructors has been known to say, “I’m so sick of teaching high school math.”
Despite the diverse attitudes demonstrated by the instructors, Mr. White shared his observation of instructors and their attitudes, including his own.

I think people’s attitudes, even any individual attitude, I think varies, and we’re all frustrated that we see so many students who get to a college classroom and are still at this [developmental] level. I think the attitude is probably largely one of frustration.

The instructors’ attitudes are an important factor in motivating students. Entering a classroom with a negative attitude and resistance to teaching developmental mathematics can impede student learning. Therefore the need to provide professional development for all instructors is significant.

**Professional Development**

Participants stressed the need to offer training and professional development to enhance learning by challenging negative attitudes and raising awareness. The need became obvious as participants commented on the absence of training to enhance the educational environment. Specifically, more than 30 percent of the participants “knew very little” about professional development and training opportunities offered by the college. Ms. Hernandez admitted, “That’s something we need to work on,” referring to training and professional development. Another instructor, Mr. Erwin, did not know how instructors were trained and implied that the college may assume “that every new faculty member is prepared to instruct developmental students.”

Moreover, upon closer examination of the professional development theme, three important supporting concepts were generated: identification of professional development
opportunities that are offered, challenges related to organizing training and professional
development, and the value of professional development to support learning among students.
The subthemes highlighted the need to offer, and for instructors to access, various forms of
training to help students enrolled in developmental math courses.

Several participants identified optional professional development opportunities with
which they were familiar. Four specific professional development classes were listed: Cultural
Differences, Math Anxiety, Understanding How to Interact with Millennial Students, and How
Students Learn. Ms. Young stated:

There are classes that are offered on cultural differences of our students. I have taken
one or two classes on how to handle students with math anxiety so I do think that the
college tries to offer classes to professors. You could argue the people taking the classes
are probably those that are already more sensitive to the issues than not but there are
classes that I've taken and I know there's others that are offered that do try to talk
about like--I forget what this generation is called. There's a name for it. We move from
generation X to the millennial. So they have tried to have classes in that and being able
to understand how to interact with students and what not.

Instructors are required to participate in training and professional development
opportunities in order to fulfill employment requirements. The participants indicated that
instructors participate for “the purpose of completing their position requirements,” or
“institutional credit to advance in pay rank for our faculty.” Also, instructors are required to
participate in training for the newest developmental math courses. Mr. Hall explained,
“Training is largely focused on the software issues, because there are a lot of those issues that have to be learned and dealt with.” Considering the comments, it appears that instructors are often motivated by selfish gains or departmental demands to complete training and professional development courses instead of to develop new skills that may help with student learning.

In addition to noting the varying motives instructors possessed for engaging in professional development, those somewhat familiar with training and professional development opportunities stated that organizing training classes and finding a convenient time to offer them is challenging due to availability of instructors. Mr. Hall explained, “We have some people who just come in and teach just on Wednesday nights, or on Friday mornings, and it's almost impossible to have a good professional development opportunity that will meet everyone's needs.” To address the limited availability, Mr. White noted, “We’ll typically have an evening meeting because the adjuncts, they work too, 9-5 kind of a thing.”

A majority of the participants agreed with the importance and value of offering training and professional development for instructors and implied that the department should do more to require applicable courses. Most of them noted that training is most needed to help with supporting students and not so much with how to teach math. As mentioned earlier, the instructors are “math people” and fully understand math. It is “reaching” the student that becomes the challenge. Ms. Lacey explained,

Okay, okay, to help instructors understand what students are bringing to the classroom, they need to hold standards high, but to deal with this problem and help them become
problem solvers so that they know how to approach it. They don’t approach math as I think many of them have through high school: as when I see this type of problem, I do these steps, if I see a different type of problem, I do these steps. But rather how do I know what to do? What’s the thought process to solving the problem? To help the instructors sort of think in those terms. One of the issues with developmental is we hired people with degrees in math.

Instructor Emotional Distress

Another theme identified in the analysis was raising awareness among instructors to enhance student learning and improve the overall classroom environment. Throughout the interviews with faculty, many of them connected awareness to help with their emotional distress as an instructor of developmental math. A majority of the instructors described feelings of paralysis and hopelessness. Mr. Zales explained,

So I am not sure what…. I know certainly something needs to be changed and I am not sure how exactly. How I make, how do I force, a student to actually try at least. I try to reach out to the student and ask them to try. I try to ask other instructors; I thought maybe it’s just me. I just thought teaching for the first time and maybe I’m just not communicating with the students correctly and many instructors told me it’s the same experience where the students don’t try.

Occasionally students were described as unreachable, indicating that instructors had tried various options but without success regarding the students’ motivation and comprehension. Evidently the participants were eagerly seeking teaching alternatives to reach
students, which may support the need for additional forms of professional development. Mr. Nazier’s statement underscored this need: “I don’t want to say they are unreachable. I just, I haven’t found—, maybe it’s possible and we try to do different things, but if you know how to reach them then you let me know, okay.”

**Student Outcomes Related to Developmental Math Education**

Participants identified varied outcomes of developmental math. However, many of the participants shared similar thoughts and an undergirding philosophy of the outcomes of developmental math. Many of the outcomes were directly associated with how participants defined developmental math, which was addressed in an earlier portion of the chapter.

Participants mentioned both positive and negative student outcomes.

**Positive Outcomes for Students**

Several participants noted that the positive outcomes were “obvious”--that students move on to college courses. As Ms. Knight stated, “The positive outcomes are those students that gain confidence, and are able to be successful and move on, and get to a college level math course.” Most of the participants focused heavily on getting students to college credit as the major outcome. In addition, instructors were less likely to identify specific positive outcomes than negative outcomes. The limited acknowledgement of positive outcomes may be related to instructor attitudes, lack of awareness, and/or the emotional distress of teaching developmental math.

Fortunately, in response to the question, “What are the positive outcomes for students enrolled in developmental math?” most of the instructors listed two major points: (a) students
will leave the course with a stronger sense of self-confidence, and (b) enrolling in a
developmental math course provides students with a second chance to access higher
education. Participants constantly mentioned with excitement and enthusiasm the notion that
students will have a greater sense of self-confidence. It was evident that the participants
genuinely hoped that the students would begin to feel better about themselves and their ability
to do math. Ms. Knight stated:

Positive outcomes would be that, like these students that have these A-ha moments:

“Oh, my god, I really can do math.” And then that leads them into their next course, and
hopefully they don’t hit a wall in their next course. Because I believe everyone hits a
wall at some point in math. For me it was in graduate school, but for some kids it’s when
they learn how to multiply.

Ms. Anderson reinforced this point:

Well, positive is, they finally learn they can do this stuff, you know? And I think once
they get over that hump, I think a lot of it’s attitude changing, you know? And if we can
change their attitude towards it---.

Moreover, Mr. Branham mentioned that simply having the choice of enrolling in a
developmental course provides students with an option. As open-admission institutions,
community colleges are required to offer developmental education in order to meet the
learning needs of students who enter with varying skill levels. When asked about positive
outcomes, Mr. Erwin quickly responded, “The positive outcome is that it gives them a second
chance” if students did not apply themselves throughout high school. Offering developmental
math serves as a bridge for the recent graduate or mature adult to develop the skills and knowledge required to be successful in college math courses.

**Negative Outcomes for Students**

Participants also noted negative outcomes for students enrolled in developmental mathematics. Although participants listed multiple outcomes, the outcome most often mentioned was that students may become discouraged. Participants mentioned many factors that were related to students’ feelings of discouragement, including embarrassment, “extended time to degree completion,” and “leaving the course less engaged than [they were at] point of entry.”

For example, Mr. Hall described the immediate feelings upon developmental mathematics placement. He stated, “Being placed in developmental from the get-go is discouraging. Very few people come here and want to do developmental anything.” Based upon the statement Mr. Hall provided, resistance to developmental mathematics begins before entry into the college. As a result, it is evident that students are entering ECCC with a misconception of readiness for college and negative perceptions about developmental mathematics.

Once placed in developmental mathematics, feelings of discouragement and embarrassment are magnified when students realize the additional time required for degree completion. Due to the non-credit status of developmental courses, years may be added to achieving one’s educational goals. Mr. Hall explained, “It’s a 2 year degree. If it is going to take me 4 years or more to get it, then maybe this is not the place for me.”
The discouragement experienced by students can have an ultimate negative effect on students’ outcomes. Mr. Nazier explained,

A potentially negative outcome is that a student comes out less engaged than they were coming in, which happens. And the negative outcome is that students need these courses so that they can actually get a certificate or something showing that they had an educational accomplishment.

Leaving a developmental mathematics course less engaged may lead to failure of the course. Therefore students who leave less engaged are less likely to achieve their educational goals.

Although students are aware of the developmental mathematics requirement, the feelings of discouragement may cause paralysis and heightened fear leading to behaviors prompted by disengagement.

**Outcomes if Student Resistance Persists**

Despite the outcome, participants noted that if resistance and poor behaviors persist, students will often demonstrate patterns of giving up and often become “stuck” in the same course over many semesters. Participants saw the pattern of giving up exhibited through poor attendance. Therefore many of the instructors did not actually witness the resistance or have an opportunity to offer support to the student on a face-to-face basis. Mr. Hall stated,

It's hard to capture the students. The students who don't want this pathway are often the ones who just stop showing up, and so they are not coming in to say “developmental math [is] not for me, what should I do instead?” What they do is they just disappear. “College is not for me, forget this.”
Mr. Zales expanded on this pattern:

They did their first test and did it not too well; for them this is a reason to give up. They say: “Okay, this is not for me” and they give up. But they’re still in class. And I try to, I try sometimes, I try to email them, try to find out, that one test is not the end of it.

“Let’s try to find out why you did poor on the test. Rather than you just quit, maybe it’s not your ability to learn, maybe it’s just that thing that you were doing does not work. Maybe you need to change certain things, maybe you were not doing homework sometimes, or maybe you didn’t spend time under the learning. What can you do to actually improve?” But you don’t get this one from the students, I’m not sure exactly like why the student doesn’t want to get help. We’re trying to offer the help, but the student doesn’t want to get the help.

Mr. Zales went to say,

I see students that come to classes, regularly, and then the test comes in, they take the test, and didn’t do too well. Then that’s when I see that student does stop coming regularly, or they just stop completely. I’m not sure what could be the correct things to do here. How do you retain students? It seems like developmental mathematics might actually make students just move away from academia.

Throughout several of the interviews participants used phrases such as, “they give up,” “they just disappear,” and “they stop showing up” to describe common patterns among students who stop attending class. Throughout the conversations, participants seemed to be at a loss in regards to students who register, stop attending, and choose not to withdraw from the
The participants expressed both concern and hopelessness, lacking understanding of the students’ behavior or how to support the students who “just disappear.”

The students’ failure to withdraw from the course and potential decision not to return the following semester generate points of concern for the college. According to the 2011 Fall to Fall Retention report,

Almost a third (31 percent) of the students enrolled in one fall semester did not return in the following fall term and were perceived to have dropped from the academic pipeline – meaning that although these students did not return to the College, they also did not graduate or transfer.

The report addressed the attrition rates for the entire College indicating the Math Departments are not alone in losing students. The same report included data addressing the retention rates per race.

The differences in the student return rates by race and by full-time/part-time status suggest that some attention should be devoted to developing strategies (e.g., via counseling and advising) that target those groups of students who return at lower rates from fall-to-fall and fall-to-spring. Increased student retention helps students be more successful and helps the College in its pursuit of fulfilling the Completion Agenda objectives.
The data gathered from the participants did not uncover any unique retention issues pertinent to race. Moreover, most of the participants indicated that race was not a factor when developing course content and teaching mathematics.

The participants identified students who disappeared within a semester, but they also noted students who became stuck in the same course, returning semester after semester. Large numbers of students may disappear within a semester but some were likely to return. Ms. Hernandez provided an example of a student who had repeated the same course several times:

I occasionally look up because I had a student that I’m sure that I had before, but I can’t remember when, and so I looked up his record in 2012, and I had him in 2008, 2009, and I think that this is like his fourth class at this level and he's not out of it yet, but he should be. I don’t know how often that happens, but I think it happens more often than it should. That they don’t pass and for whatever reason aren't reaching out to get the guidance that they need in terms of what class, because he was taking several different classes that were kind of equivalent.

Hernandez provided an excellent example that was reinforced by several others who witnessed students who were in a cycle of repeating the same course. The misfortune as explained by the participants is that students are continually being unsuccessful. Mr. Nazier explained,

And so if they take this course and then they don't do well and then they take it again and don't do well and you have this revolving door of students not ready to pass the
course but certainly a negative outcome is a student never achieving their particular
goals. That's not a good thing. And maybe they become discouraged they will never
achieve that goal.

**Conclusion**

The purpose and value of developmental mathematics is to prepare students for
college-level mathematics. Fortunately, the instructors expressed a shared understanding of
developmental mathematics. In addition, developmental mathematics courses were described
as offering an opportunity to some students who would not otherwise have access to higher
education. Therefore, implementing effective developmental mathematics courses and
supportive services promotes access to higher education among low-income students and racial
minorities.

A significant portion of the findings support information found throughout the existing
literature related to developmental mathematics. However, the emotional distress
experienced by instructors of development mathematics, and the disconnection between
students and instructors in developmental mathematics classes was new information. The
findings presented are addressed in greater detail in the following chapter within the context of
existing literature, critical inquiry, and concepts of critical pedagogy.
Chapter 5: Summary, Discussion, Conclusions, and Recommendations

The analysis of the data collected for this study affirmed many points highlighted in the preexisting literature while also revealing new information to add to our understanding of the experiences of instructors who teach developmental mathematics. More importantly, the findings inform the recommendations offered to enhance developmental mathematics instruction. In this chapter I return to the research questions by weaving together data, inquiry, and my interpretation of the findings to offer concise responses to the research questions. I then provide a discussion section that includes my thoughts about the findings that add to the literature. The discussion section is followed by my assessment of the strengths and limitations of the study. Next I offer a list of recommendations for future practice and research. Finally, I share my personal reflections on what I learned from conducting the study.

Summary of the Study

The purpose of this study was to examine the experiences of instructors who teach developmental mathematics at an urban community college and, in doing so, identify strategies to enhance learning in the classroom and promote student academic achievement. With this purpose in mind, three research questions guided the study:

Research Question 1: What factors do faculty take into consideration when designing instruction to enhance developmental math courses?

Research Question 2: What does teaching developmental math entail?

Research Question 3: From a developmental math instructor’s perspective, what are the perceived outcomes of developmental math education?
For this study, I examined the experiences of community college developmental mathematics instructors at an urban community college located on the East Coast. Once the research study was approved by the Institutional Review Board (IRB) at Iowa State University, I contacted the research office at the selected site for approval to conduct the study and permission to contact instructors who teach developmental mathematics. I was granted approval and contacted the mathematics department chairs to discuss the study and to obtain their support before contacting individual instructors. The instructors were identified by the department chairs and through examination of the summer schedule of classes that listed developmental and intermediate mathematics course offerings and instructors. One-hour interviews were scheduled with 15 instructors who were willing to participate and available to meet during the summer. In addition, I observed multiple class sessions throughout the data collection period, which was May-August, 2012, and gathered relevant documents.

Each participant shared his or her experiences teaching developmental mathematics. I analyzed the interview transcript of each participant, generating major themes from each interview. Each participant was given a list of major themes compiled from his or her individual interview transcript in order to verify the accuracy of the data or to modify the information if needed. In addition, I examined fieldnotes from class observations, and institutional documents relevant to developmental mathematics. Through the use of NVivo, a qualitative data software program, the in-depth interviews, class observations, and documents were coded to identify rich details, uncover themes, and construct meaning from the participants’ experiences.
The analysis uncovered ways in which the instructors “make meaning” out of their experiences teaching developmental mathematics and their interactions with students enrolled in the course. As I analyzed the transcripts, several categories, sub-categories, and concepts emerged that were directly applicable to the study, based on the research questions. I organized the findings based on “umbrella-like” themes to comprehensively and concisely present the data.

Response to Research Questions and Additional Learnings/New Knowledge

I identified six themes from the data analysis: the purpose of community colleges and developmental mathematics; teaching beyond mathematics content, overcoming student challenges; overcoming student resistance; enhancing learning through instruction; and students’ outcomes of developmental math education. In this chapter I discuss the themes, framed by supporting data and literature. The discussion is contextualized using information from the literature review in Chapter 2, and critical inquiry and the selected concepts of critical pedagogy with additional information on critical literacy and critical-mathematical literacy described in Chapter 3. I address the themes in relation to the research questions.

Research Question 1: What factors do faculty take into consideration when designing instruction to enhance developmental math courses?

Based upon the data analysis, two themes emerged that offer points of consideration for faculty when designing instruction to enhance developmental mathematics: (1) defining the purpose of community colleges and developmental mathematics, and (2) providing students with advising that incorporates academic and career advising. I discussed the roles of
community colleges and developmental mathematics in the literature review and data analysis. The purpose of education is a controversial topic of discussion among the general public as well as education advocates and policymakers. One argument suggests that the purpose of education is to reinforce class differences and social inequalities among populations. According to McClaren (2007), social reproduction refers to the reproduction of social class such as working-class students becoming working-class adults, or middle-class students becoming middle-class adults.

However, the role of the community college is perceived as, and was described by instructors in the study as, a place of opportunity for students to accomplish their educational goals. Mr. Branham stated, “It [the community college] gives people an opportunity, those who really need an opportunity.” This statement supports the open-access admissions policy of community colleges to admit all students despite their educational preparation. In many instances, the open-access standard defines the role of the community college (Levin, 2001; Shaw, 2001). In addition, research studies show that at least half of community college students require some form of developmental education, reinforcing the practice of open-access admission (Meritosis & Phipps, 2002).

Subsequently, the lack of college preparation for low-income and racial minorities (Ogbu, 1990; Weissglass, 2001) supports the need for developmental mathematics education. All of the instructors defined developmental education as pre-college level work and instruction that equips a student to be successful at college-level work. The guidelines imposed by the
state where the study was conducted defined developmental mathematics as any mathematics course that has a prerequisite at the level of intermediate algebra.

The instructors expressed a common understanding of developmental mathematics and emphasized the importance of preparing students for college-level mathematics. In addition, the instructors mentioned the need to consider the mathematics requirements outlined by local four-year colleges and universities. Unfortunately, the data analysis uncovered minimal practices of advising students on career options or ways to successfully transfer to a four-year institution. Thus, the instructors are practicing social reproduction by focusing only on preparing students to complete the course at hand with limited career advising that might advance class status.

The second theme that addressed what faculty took into consideration when designing instruction to enhance developmental mathematics was the need to offer academic and career advising to students. Specifically, the instructors identified the need to “teach beyond the content” to include early and ongoing required academic advising and to incorporate career advising services. Multiple instructors described these forms of advising as “non-mathematical support.” Ms. Young explained that the students in developmental mathematics are “in need of a lot more hand holding,” which indicated a difference between students enrolled in developmental mathematics and college level mathematics courses. The need for ongoing advising and “hand holding” can be attributed to the students’ low self-efficacy and feelings of inadequacy regarding mathematics (Hall, 2002; Shunk, 1990), a point supported by instructors
in the study who noted that lack of self-confidence was a major issue for students in developmental math classes.

The need to offer advising to students emerged as a major theme throughout the study. Statements from instructors suggested that students are in need of additional out of class advising services due to students’ low perceptions of self-efficacy that interfere with their academic success in developmental mathematics. The academic advising suggestions participants provided included requiring students to undergo early and ongoing academic advising to ensure the proper sequence of courses and avoid self-advising, encouraging students to study for the ACCUPLACER, and increasing the number of counselors available to manage advising services for students.

Instructors mentioned incorporating career advising services for students but with less emphasis than academic advising. However, career advising has significant importance when examined using a critical lens. Career advising is understood as helping students to define their career path as well as raising their awareness of professional possibilities. Ms. Lacey stated that “the advising component becomes huge, even just in terms of exposing students to the kinds of things that they might do, and what of those skills you need to have.” Ms. Lacey described motivational interests among instructors to “get them [students] to be thoughtful about what happens. [It] is not just getting that college degree, but the skills that you present to your employer.”

Instructors noted that promoting certificate programs was a form of career advising. Some instructors indicated that promoting certificate programs challenges instructors to
overcome their personal biases that students are supposed to graduate. Review of the data indicated that many instructors did possess this traditional bias. They overlook other options, such as certificate programs or basic skills development, favoring personal enrichment. However, the interview data also revealed that some instructors believe that certificate programs can be a credible option for skills development and for students who are not successful at completing the associate of arts degree. Their advocacy of certificate programs, though, may be a method of avoiding students who present challenges in the classroom.

Recommendations and comments expressed by the participants about career advising exposed an underlying motive to prepare students for employment. None of the instructors mentioned career advising designed to encourage entry into management positions or business ownership. Instead the statements suggested the value of developing skills for employment in subordinate types of positions. By making such statements, the instructors are supporting the practice of social reproduction by failing to encourage students to consider positions that may exceed their current economic status.

I acknowledge that academic and career advising is often a service provided by an office outside of developmental mathematics classrooms; however, instructors can play a significant role in advising students during classroom instruction and individual conversations with students. According to theorists who use critical pedagogical tenants, instructors should operate as intellectual change agents by challenging social reproductive practices that are upheld within educational environments (Giroux, 1988). Instructors who choose to expose students to opportunities that will advance their upward mobility are acting as change agents.
Therefore, the instructors are no longer promoting social reproduction but challenging students to exceed their current class status.

*Research Question 2: What does teaching developmental math entail?*

The data indicated that teaching developmental mathematics entails significant instructional skills and points of consideration for instructors. The subthemes include considering external influences, overcoming teaching challenges, considering diversity in the classroom, and making math applicable to daily life experiences. The listed subthemes offer insight into what teaching developmental mathematics entails based upon information shared by developmental mathematics instructors.

Instructors stressed the importance of considering external influences when explaining what is entailed in teaching developmental mathematics. The external influences were organized using the following categories; connecting secondary and postsecondary education, considering requirements to transfer to four-year institutions, defining local businesses expectations for employees, and abiding by state policies that govern developmental mathematics education.

Participants explained how each external influence contributed to the developmental mathematics curriculum. For example, the instructors often defined developmental mathematics as concepts that should have been learned in high school. Also, the instructors indicated that the mathematics department strongly considers transfer requirements dictated by four-year institutions in order to design a curriculum that will prepare students once they get to college-level work. For example, Ms. Knight stated, “We have to look at where our
students transfers, so we do need to offer those.” In addition, several instructors supported the notion of engaging with local businesses to define and infuse employer expectations throughout the mathematics curriculum. One instructor, Ms. Ladner, explained, “When we set up a task force one of the groups we wanted to bring in were local businesses. What do you need students to know?”

The data suggested that connecting secondary and postsecondary schools (both two-year and four-year), along with state guidelines, is important to adequately support student learning in developmental mathematics. For instance, the instructors expressed frustration with secondary education and governing state guidelines through the use of phrases such as, “needs to be a stronger link,” and “dialogue between the decision makers.” The instructors at ECCC offered points of disconnection between K-12 schools and community colleges. Fortunately, studies conducted by the American Association of Community Colleges (AACC) suggest that schools such as Inver Hills Community College and Central New Mexico Community College are creating partnerships with K-12 schools to improve the educational pipeline (www.aacc.nche.edu).

The influence of local businesses did not appear to be as favorable when examined using critical theory. Local business owners and leaders were involved on the college’s taskforce committee to revamp the mathematics curriculum and a few instructors suggested increasing engagement with local businesses to continuously solicit feedback on employer-related demands.
Critical inquiry focuses on ways in which a curriculum prepares a student for dominant or subordinate positions within society. McClaren (2007) argued that a curriculum commonly favors certain forms of knowledge that benefit dominant groups creating what is referred to as the “hidden curriculum.” McClaren described the hidden curriculum as unintended practices by schools to direct students to dominant or subordinate positions. The involvement of business owners and leaders in the development of the mathematics curriculum serves as an example of a curriculum that favors the dominant group, which includes business owners and leaders. Although the motivation of the instructors for involving business owners and leaders appeared to be positive, the outcomes potentially lead students to subordinate career positions.

Information gathered from business owners and leaders was intended to be used to strengthen the application of mathematics to everyday experiences. Many of the instructors stressed the importance of making mathematics applicable to the students’ daily life. Teaching experience as well as explicit statements from students who constantly asked, “When am I going to use this [referring to mathematics concepts]” led to a noticeable need to improve mathematics application and use concepts of critical-mathematical literacy.

Instructors themselves expressed disagreement with the current developmental mathematics curriculum. Two instructors argued that the curriculum limits applicability due to poorly developed word problems and useless mathematics concepts. Specifically, Mr. Nazier expressed concerns that word problems taken from state adopted textbooks were not very applicable to the students’ daily experiences. Also, Mr. Zales stated, “I don’t think if we teach
someone how to solve a linear equation, how to solve a quadratic equation, how that would help them in their life and job.”

In spite of disagreement among some of the instructors with the current curriculum, they shared teaching strategies used to overcome student resistance. For example, Ms. Lacey applied mathematics to shopping and career interests such as nursing or business. She concluded that using strategic practices guided by dialogue and problem posing enhanced engagement among students. In doing so, the instructors are moving beyond a model of transmission to instead implement a transformative model of teaching (Friere, 1972; McLaren, 2007). However, the instructors fail to reach a status of emancipatory teaching as described by McLaren (2007) that helps to understand the influence of power and privilege on social relationships.

Fortunately it is a helpful strategy to attempt to apply mathematics concepts to student’s experiences. For example, students are more engaged as word problems and mathematics concepts are integrated with their preexisting knowledge and culture, creating a learning experience that is more applicable (McLaren, 2007; Wink, 2000). By increasing engagement, the students have a greater probability of exceeding their educational goals. By using transformative teaching practices, instructors do risk veering away from the standard curriculum and are required to spend more time developing tailored lesson plans. Nevertheless, the students are more engaged and the instructors are operating as educational change agents (Giroux, 1988; Giroux & McLaren, 1989; McLaren, 2007).
Research Question 3: From a developmental math instructor’s perspective, what are the outcomes of developmental math education?

The third research question was constructed to identify the outcomes of developmental mathematics education at East Coast Community College (ECCC). Upon review of course syllabi, learning outcomes were identified that listed basic mathematics concepts that students would learn. However, the question was intended to identify outcomes perceived by the developmental mathematics instructors. The outcomes as described by the instructors were organized into positive and negative categories based upon my interpretations due to limited literature on the topic.

In terms of positive outcomes, instructors listed developmental mathematics as providing a second chance, helping to build a stronger mathematics foundation, and promoting self-confidence when the students master the concepts. Although listed separately, the positive outcomes are intertwined. For example, students who take advantage of developmental mathematics are more likely to build a stronger mathematics foundation, which will strengthen their self-confidence. Ms. Knight stated, “The positive outcomes are those students that gain confidence and are able to be successful and move on and get to a college level math course.”

The positive outcomes suggested by the instructors undergird the goal of mastering developmental mathematics skills and preparing for college-level mathematics. Based upon the data analysis, the instructors appeared to possess great interest in getting students to college-level math. Ms. Knight stated, “These students have these a-ha moments: ‘Oh my god I
can do math.’ And then that leads them into their next course” with more confidence in their ability to master mathematics.

The negative outcomes the instructors described were developmental mathematics discouraging students by negatively impacting their self-esteem, requiring additional time in school, and creating barriers that cause the students to become less engaged. The overarching theme is that students are likely to become discouraged due to lowered self-esteem, additional time to completion, and becoming less engaged. Mr. Hall shared a comment that captured the negative outcomes:

“So when they look at the time they spent, even if they believe they need it, it is a turnoff. It’s a two year degree. ‘If it is going to take me four years or more to get it, then maybe this is not the place for me.’”

Although the negative outcomes weighed heavier than the positive outcomes, negative outcomes can be countered. The negative outcomes can appear to be insurmountable but when instructors act as change agents by integrating students’ life experiences, social identities, and social issues into the mathematics education, students are more likely to be engaged and less discouraged (hooks, 2003). Operating as intellectual change agents or critical educators, instructors are encouraged to move away from a transmission model to a transformative model of learning (Giroux & McLaren, 1989; hooks, 2003). Thus, the implementation of transformative education minimizes negative outcomes and promotes positive outcomes.
New Knowledge/Additional Learnings

Significant themes emerged that addressed the three research questions and supported the existing literature. In addition, two themes emerged that build upon the existing literature by exposing the experience of instructors who teach developmental mathematics. First, the emotional distress instructors encountered was not discussed in the existing literature. The need to manage emotional distress and continue to be an effective instructor emerged as a major theme. The emotional distress described by the instructors stemmed from their awareness of the students’ personal and academic challenges. Moreover, being aware of the students’ challenges generated emotional distress due to instructors’ inability to find an adequate means of supporting students. Mr. Zales explained, “I try to reach out to the student and ask them to try. I try to ask other instructors, I thought maybe it’s just me, and many instructors told me it’s the same experience where the students don’t try.” The comment provides insight into the instructors’ challenges in attempting to engage students as well as pointing out that there are instructors who no longer accept responsibility for student learning.

The students were described as unmotivated, fueling the instructors’ feelings of paralysis and emotional distress. Mr. Nazier stated, “I don’t want to say they are unreachable. I just have found [pauses and shrugs shoulders], maybe it’s possible, and we try to do different things, but if you know how to reach them then you let me know.” Mr. Nazier’s statement exposed a plea for help from instructors who are at a loss and unsure of ways to assist the students. Although the instructors appreciated the opportunity to learn more about the students, they struggled to define ways to use the information to help students. More
importantly, the instructors desired additional training to equip them to manage their emotional distress and continue to support student learning.

The emotional distress experienced by instructors is connected to the ongoing lack of connection between students and instructors, which serves as the second theme. The disconnection is partly attributed to the coexistence of students who fear mathematics and instructors who confidently mastered mathematics. Thus the students and instructors exercised thinking skills and levels of comfort with mathematics that were different. The students demonstrated learning challenges and anxiety that were difficult for the instructors to comprehend. For example, Mr. Nazier commented, “I don’t remember not understanding this stuff and so one thing that I’ve had to become sensitive to and actually I’ve tried actually meditating and trying to recall what that felt like trying to learn this stuff.” The instructors were noticeably aware of the need to understand the fear and anxiety students demonstrated. They were in distress and in need of support in order to adequately help students. The additional work required of instructors to overcome their emotional distress and attempt to reach students revealed teachers as active participants within the labor market who do more work for the same amount of pay while others profit while doing less. Moreover, the institution does not offer resources to aid instructors and to equip them with the skills needed to overcome their paralysis. In addition, the instructors may not recognize the need to pursue support from colleagues or a professional to discuss their experiences with the hope of gaining helpful insight and clarity.
Professional Development

The effective application of responses to the research question is couched in professional development activities as an underlying theme. Providing professional development activities for instructors to aid with effective teaching of developmental mathematics provides a frame for the themes presented in response to the research questions. Also, Giroux’s (1992) conception of critical pedagogy encourages instructors to adopt a student centered approach to learning that allows students to speak from their own histories, collective memories, and voices. However, in order to create spaces for students to find and use their voices demands professional development. Although professional development does not answer the guiding research questions, it serves as a theme that reinforces the effectiveness of each of the themes discussed and supports the use of critical pedagogy to promote learning between teachers and students.

Instructors who teach developmental mathematics described professional development as an area of need they experienced. The literature I reviewed suggested teaching strategies that can be taught to instructors through training and professional development. However, within the context of critical inquiry, teaching strategies must be interlinked with the cultural and ethnic diversity students present in the classroom.

The three major teaching strategies suggested in the literature to enhance the learning of mathematics were transferring content knowledge to real world experiences (Cross, 2000), using conceptual mathematics teaching methods (Desimone, et al., 2005), and structuring and leading activities for students in developmental education courses (Smittle, 2003, p. 2).
However, in order to use the teaching strategies within the context of critical inquiry and critical pedagogy instructors will need to participate in active and ongoing professional development.

Access to structured professional development opportunities may require resources from the institution such as funding or designing an inter-institutional model to enhance developmental mathematics instruction. Instructors who are adequately trained and equipped using concepts of critical pedagogy advance their abilities to engage in intensive dialogue with students and to operate as an intellectual agent of change (Giroux & McLaren, 1989; hooks, 2003). The notion of “change” refers to the ability to challenge students to think “outside the box,” explore diverse career goals that advance class status, and more importantly, to adopt a sense of personal and social responsibility.

In addition to teaching strategies, the ability to consider diversity throughout the learning experience as recommended by critical pedagogy experts, is a needed opportunity for professional development (Giroux, 1992; McLaren, 2007; Wink, 2000). Combining effective teaching practices with a raised awareness of student diversity will positively contribute to student success. For the purposes of this study, diversity includes race, class, gender, age, language, life experiences, and depth of mathematics competency among students. Since the focus of the study was to examine the experiences of instructors with the intent of enhancing developmental mathematics I did not collect demographic data or note student demographics during class observations.

However, using a critical theorist lens I chose to explore ways in which instructors consider classroom demographics when teaching developmental mathematics. Considering the
diverse student population enrolled at the college, I assumed the instructors developed learning opportunities with race, class, age, and language in mind. To my surprise many of the instructors indicated that they recognize the diversity in the classroom but believe it does not influence instruction. Specifically, Ms. Knight stated, “Math is math; race or income doesn’t make a difference.” I find this attitude to be problematic since the classrooms appeared to be racially and age diverse. With that in mind, it becomes imperative to give strong consideration to all aspects of diversity in the classroom. In light of arguments presented by Freire (1973) that mathematics is innately political, it becomes important to move away from the banking model of instruction and begin to ask students how math concepts apply to their daily lives and/or how to strengthen the math application from a student’s point-of-view rather than making assumptions that math is not related to students’ social identities.

On the other hand, the instructors were keenly aware of the life experiences and the varied depth of mathematics competency among students in developmental mathematics. Student life experiences and mathematics competency were noted points of diversity that influenced lesson plans and interaction with students. For example, several instructors mentioned that students are managing life responsibilities such as “limited financial resources, homelessness, and loss of loved ones.” Ms. Knight explained, “They have so many other things going on in their lives. No matter how motivated they are to learn, if they have these horrible things happening” [instructor stops mid-sentence]. Instructors made such comments when comparing community college students to traditionally aged students who are enrolled at four-year institutions.
Moreover, the varied mathematics competency demonstrated by students is a given point of diversity that the developmental mathematics instructors considered. Instructors mentioned the varied mathematics competency among students several times throughout the interviews. Ms. Lacey stated, “We would have students in the classroom who literally didn’t know their addition and subtraction facts. And then you have students who just missed next course placement by a point.” The instructors described the difficulty of facilitating a lesson when students’ mathematics skills were very basic as challenging. To address the challenges presented by students, instructors should be equipped to use transformative teaching practices that involve more interactive and engaging teaching strategies.

When presented with transformative teaching strategies, students move beyond the act of memorization and begin to apply mathematics concepts in a way that is more engaging. Therefore in the event that instructors operate as transformative educators, students may be more engaged and experience greater success at learning mathematics concepts and successfully transitioning to college-level courses.

Discussion

Critical inquiry and concepts of critical pedagogy and critical-mathematical literacy outlined in this study are intended to challenge teachers to acknowledge and incorporate a curriculum that legitimates all races, classes, and cultures while emphasizing the relationship of question-posing within the educational process (Kincheloe, 2008; McLaren, 2007). In addition, combining critical pedagogy and critical-mathematical theory challenges instructors to teach mathematics within the context of politics that will raise social awareness, encourage
reflection, and potentially lead to action (Monchinski, 2008). Posing questions throughout instruction and integrating social issues are examples of transformative learning that creates spaces for students to incorporate their voices and integrate personal and professional experiences that makes learning engaging. Instructors of developmental mathematics can use concepts of critical pedagogy and critical-mathematical literacy as a theoretical perspective to engage students, support student confidence, and overcome student resistance. Thus, I offer recommendations for future practice and research based on critical approaches to enhance developmental mathematics instruction and subsequently help students to achieve their educational goals.

Based on the data, understanding the experiences of instructors can provide insight into enhancing developmental mathematics. As a result, educational achievement among students and retention rates may increase. However, to recommend the application of critical pedagogical concepts is not a simple task. Applying such concepts requires a shift in thinking among policymakers, institutional leaders, and instructors that challenges dominant cultural practices. However, the instructors are governed by an organizational structure and an overarching curriculum that may prohibit the implementation of concepts that can be used to balance subordinate and dominant cultural influences while challenging positions of power.

The experiences shared by the participants are valuable and affirm the current literature while extending the conversation. More importantly, upon examination of their experiences contextualized by critical theories and current literature, thoughtful opinions about the results were presented. Three opinions that frame my discussion are: developmental mathematics
requires educating beyond math concepts, instructors are forced to consider external influences while addressing teaching challenges, and the attitudes of instructors expose perceived outcomes of developmental mathematics.

Upon completion of the data analysis, I conclude that teaching developmental mathematics requires the inclusion of content that exceeds mathematics concepts. Teaching experiences discussed in this study were framed by instructors who shared an understanding of developmental mathematics as content that prepares students for college-level work. For example, Mr. Hall defined developmental mathematics as, “any pre-college math,” Ms. Houston described it as, “guiding students into their college math credits,” and Ms. Anderson described it as “anything intermediate algebra and below.” The instructors’ understanding of developmental education aligns with definitions included in the literature as instruction used to equip students to be successful in college and prepared to manage college-level courses (Aycaster, 2001; Bailey et al., 2010), in this case college-level mathematics. I argue that having a shared understanding of developmental mathematics has strengthened mathematics initiatives at the college and will support ongoing advancement. Moreover, the mathematics instructors are poised to consider and implement recommendations offered as a result of this study.

Before implementing new practices, the instructors will need to expand their current definition of developmental mathematics to include preparing students to transfer to four-year institutions. Acting as critical educator, instructors should first determine the students’ personal educational goals, offer support, and help the student to become an active and
thoughtful citizen (Hinchey, 2004). Equally important, in order to adequately implement new practices, the instructors will have to acknowledge intentional or unintentional practices of social reproduction that direct students to positions of subordination and to implement an alternative agenda that promotes democracy through education.

In addition, the instructors described the purpose of the community college as a place of opportunity for students to achieve their educational goals. Participants stated that instructors who teach developmental mathematics have mixed emotions about doing so. Some of the instructors are motivated to teach developmental math while others demonstrate resistance. In spite of the mixed emotions, the instructors described the purpose of community college education within the context of the open-access admissions policy, suggesting that access to community colleges provides access to opportunities. Mr. Branham stated, “It [the community college] gives people an opportunity, those who really need an opportunity.” The passion expressed by Mr. Branham along with others, for a commonly shared meaning of developmental education, and the described purpose of community colleges, demonstrates optimism and potential regarding the possibilities to advance developmental mathematics instruction. In doing so, the classroom environment and mathematics curriculum becomes emancipatory by leading students to educational achievement while validating who they are and what they can accomplish while sustaining their race, culture, and ethnicity. Emancipatory knowledge helps to explain the influence of power and privilege on social relationship and ways to overcome oppression and exploitation through collective and deliberative action (McLaren, 2007). Therefore the act of overcoming oppression and exploitation within educational
systems can be a partnership between instructors and students that begins with dialogue that combines mathematics and politics with reflection.

Validating students’ backgrounds and encouraging self-confidence can occur in the classroom. Instructors can offer effective advising in the classroom that outlines educational opportunities after ascertaining the students’ educational goals. Likewise, providing support to students can happen during the process of academic and career advising from instructors and staff that exceeds the act of teaching mathematics concepts and encourages self-confidence. As Ms. Hernandez stated, “A lot of the students are convinced that they can't do it. So that is just one more reason they can't do it.” Demonstrations of students' low self-confidence observed by the instructors highlight the need for a critical approach that infuses life experiences with mathematics concepts and extra support outside of class, such as academic and career advising.

Providing academic and career advising supports the broader need to change institutional policies and guidelines. Advising practices that require institutional change include requiring students to take developmental mathematics early, incorporating a process to weed-out students, and providing early and ongoing advising.

The recommendation to provide academic and career advising appeared to be presented with positive motives when evaluated on the surface. However, upon closer examination, the instructors reinforced the practice of social reproduction by directing students to subordinate career opportunities. In addition, the recommendation to “weed-out” students
who demonstrated a lack of interested presented a significant concern. Specifically, Ms. Hernandez stated,

I don’t exactly know how this could work but is to try to weed-out people that are not serious at all out of school. To make there be some requirement, I don't know, I think that students in some situations are given too many chances and students sort of sign up cavalierly, not having any idea or not having any intention, those are the students I don’t want in class.

The act of weeding-out students and directing students to subordinate positions contradicts the instructors’ philosophy of the college being a “place of opportunity” for students (Bahr, 2008). As Mr. Branham stated, “It gives people an opportunity, those who really need an opportunity.” Therefore, I conclude based upon similar contradictions as expressed by Ms. Hernandez and Mr. Branham, that some of the instructors may not be fully aware of their behaviors that reinforce social reproduction. On the other hand, some instructors may be keenly aware of the influence of their actions on student outcomes.

I agree with the instructors’ promotion of incorporating early and ongoing academic advising. The recommendation to enhance advising appeared to be motivated by the need to avoid self-advising and to ensure an accurate sequence of course enrollment. Ms. Lacey emphasized the need for advising as, “The advising component becomes huge, even just in terms of exposing students to the kinds of things that they might do, and what of those skills you need to have.” Although the comment promotes advising that will help students to explore options, the comment also emphasizes the need to develop skills for employment and
less interest on the students’ educational goals. In most cases, the instructors mentioned career advising to help students identify and develop skills to present to an employer. Unfortunately, the instructors did not mention career advising that included leadership involvement or entrepreneurial opportunities. If advising is instituted thoughtfully and with the intent of supporting student achievement and personal growth based on concepts of critical pedagogy and critical-mathematical literacy, I agree with this suggestion and recommend its implementation.

However, to effectively integrate advising into the mathematics curriculum, the environment has to be both equitable and transformative. Creating an environment within the mathematics department that promotes empowerment and self-transformation (McLaren, 2003) requires the application of a transformative teaching model that is inclusive, engaging, and supportive of the academic development of the whole student.

Secondly, the constant demand for instructors to navigate external influences resonated with me as researcher. The external entities that influence developmental math education are secondary schools, four-year institutions, local businesses, and the state. Participants often mentioned the need to “connect” secondary and postsecondary schools to increase continuity across curricula from high school to college. The instructors expressed frustration with the apparent disconnection with secondary education. Their frustration was exposed through the use of phrases such as, “needs more coordination,” “needs to be a stronger link,” and “a disconnect somewhere.”
The participants implied that if secondary and postsecondary education were interconnected, students would be prepared for college-level work. Therefore the underlying tone suggested that if the connection was stronger between secondary schools and the college, fewer students would be in need of developmental mathematics. Mr. Hall stated, “I don’t want it [developmental math] to be undervalued, but I wish that more students wouldn’t need to be placed there. Either coming out of high school with this knowledge, or if they came to us we could get them out quickly.” Ms. Knight explained, “K-12 schools do not influence what we teach here, except that we teach a lot of stuff they had [referring to high school content].” Multiple instructors expressed their concerns and frustration about secondary education but no one mentioned taking action to partner with secondary school educators.

On the other hand, the participants are diligent about equipping students to successfully transfer to four-year institutions once they move beyond developmental mathematics. They design a curriculum with strong consideration of mathematics concepts that students will encounter at the four-year institution. Ms. Knight explained, “We have to look at where our students transfer, so we do need to look at what courses will transfer, which of our courses will transfer for credit. And we need to offer those.” The comment expressed by Ms. Knight demonstrates intentional acts of using information from four-year institutions to guide the college’s mathematics curriculum.

Despite the instructors’ acceptance of the influence of four-year institutions, they often chose not to discuss transfer possibilities with students in developmental mathematics courses. For example, Ms. Lacey stated, “I think that the transfer issue is less on the radar screens of our
instructors in the developmental classrooms; it’s more getting them to that college level course.” I find this approach to be limiting; it appears to expose attitudes about the capabilities of students in developmental mathematics and low expectations of these students. Mesa (2012) concluded that instructors had a negative perspective of community college mathematics students and their goal orientations.

A third opinion that strongly resonated with me and provided a direct response to one of the research questions are the outcomes of developmental mathematics that instructors reported. The literature review revealed concrete outcomes of developmental mathematics, such as lower grades than students not in developmental math (Burley, et al., 2009), lower chance of academic success (Burley, et al., 2009), more time to completion (Melquizo, et al., 2011), higher retention rates when developmental math and course sequence are mandatory (Bailey, et al., 2005; Melquizo et al., 2011), and less likelihood of transfer to four-year institutions (Bailey, et al., 2005).

The instructors offered perceived outcomes based upon their experiences. The outcomes were organized into two categories: positive outcomes and negative outcomes. The instructors offered fewer positive outcomes than negative. From a broader perspective, several of the instructors mentioned as a positive outcome getting the students to college-level courses. For instance, Ms. Knight stated, “The positive outcomes are those students that gain confidence, and are able to be successful and move on, and get to a college level math course.” In addition, the participants offered only two specific positive outcomes: (a) leaving the course
with a stronger sense of self-confidence, and (b) offering a second chance to access postsecondary education.

The positive outcomes expressed by the participants suggest possibilities of oppression and exploitation of students, which is challenged by critical theory. Critical theory establishes an argument against oppressive structures [such as education and schooling] that exist within society (Broido & Manning, 2002). Considering that a positive outcome is that students may depart with a stronger sense of self-confidence indicates a lack of self-confidence upon entry into the course. With that in mind, it is probable that students entering developmental math courses may have a history of oppressive educational experiences that contributed to their lack of confidence in mathematics, and hence their placement in developmental math. It is important that instructors be cognizant of the acts of oppression that students may have experienced prior to entering the classroom in order to provide adequate support. If they do possess this awareness, the instructor will have the insight to design lesson plans that are insightful and reflective for both the student and the instructor. Thus, a better outcome can be established if instructors partner with students to overcome oppression and exploitation, to become socially active, and in the process, to achieve their educational goals.

Participants identified as an overarching negative outcome that students may grow discouraged while enrolled in developmental mathematics. The negative outcome was attributed to several factors such as embarrassment due to placement in developmental math, extended time to completion, and leaving the course less engaged. Mr. Hall summed it up this
way, “Being placed in developmental from the get-go is discouraging. Very few people come here and want to do developmental anything.”

The negative outcome is significant and presents an opportunity for instructors to serve as educational change agents and critical educators. Educators who are capable of intelligent reflection and able to apply knowledge taught in a classroom setting to daily experiences are designated as educational change agents (Kohl, 1998). Operating as a critical educator and change agent minimizes negative outcomes.

Instructors who are able to apply math concepts to daily life experiences and social issues will encourage engagement. Hence, students who are placed in developmental mathematics may overcome the embarrassment and overlook the extended time when they enjoy learning. As a result, the student has a greater chance of not only advancing to college-level math but to achieving her or his educational goals. All of these positive outcomes can be produced by instructors who are intentional about engaging culture as a tool for educational change.

**New Knowledge/Advancing the Literature**

The majority of the instructors desired skills to teach developmental mathematics that were applicable to the students’ daily experiences and professional goals. The instructors understood that the challenge is not just teaching mathematics concepts but the need to also incorporate cultural sensitivity and social issues. Such teaching practices may oppose social norms because they are based on critical pedagogy. More importantly, the instructors strongly supported the use of professional development activities to equip themselves to consider
diversity, address their personal challenges, and engage students who fear mathematics. Professional development that addresses these issues will enable instructors to build upon their mathematics knowledge by learning more about their students and framing their work with concepts from critical pedagogy.

Understanding the experiences of instructors who teach developmental mathematics is very challenging as each instructor brings to the classroom a different lens for teaching mathematics. Moreover, their lenses are informed by their background, culture, and ways of knowing. However, the instructors described shared experiences that were used to identify patterns and themes. The most noteworthy new discoveries were the emotional distress encountered by instructors, the disconnection between students and instructors in the classroom based on different levels of comfort with mathematics, and the notion that instructors do not consider race as part of mathematics instruction. Also, due to the use of critical inquiry and concepts of critical pedagogy, the existing literature was advanced by offering ideas and suggestions to enhance developmental mathematics instruction through incorporating multiculturalism and the politics of mathematics.

Past research in the field of developmental mathematics education focuses on issues such as: a) the role of community colleges and developmental mathematics education, b) defining effectiveness based upon grades and advancement to college-level courses, c) examining effective teaching strategies to enhance learning of mathematics skills, and d) secondary schooling practices and policies that negatively impact learning, which leads to low self-confidence, which in turn increases the need for developmental mathematics. However,
through the use of critical inquiry, the findings offered new insight into the experiences of developmental mathematics instructors.

**Strengths and Limitations of the Study**

Every study, no matter how well designed, has weaknesses as well as strengths. Here I discuss the strengths of my study as well as way in which it could have been improved.

**Strengths**

The strengths of the study are grounded in the passion that drives the research. My personal experiences as a college student were riddled with academic challenges due to my lack of readiness and limited family support as a first-generation student. I can also recall several peers who entered the university with me but dropped-out or stopped-out within the first two years. As I began to study urban education as a graduate student in sociology, I continued to ponder the issues that prohibit low-income students and students of color from entering and completing college. Years later, I entered the doctoral program knowing that I wanted to study college readiness but with the intent to ensure that the outcomes of the study would offer practical insight into helping students who are unprepared to excel academically. This goal informed my decision to use a case study approach that would lead to development of practical knowledge.

Upon reflection, I identified strengths of the study related to the research design. For example, the data collection and analysis methods were layered to ensure that the research questions were answered thoroughly. The data collection involved interviews, documents, and observations, which created opportunities to reinforce and confirm data through different
methods. In addition, the research design included several stages of coding to create organized and meaningful categories. Overall, the research design helped to frame and organize the information in a thoughtful manner.

Secondly, the depth of the literature review is another strength of the study. The literature review included issues that contribute to the lack of college readiness based on secondary educational structures such as standardized testing, unequal funding of schools, and class status. Including literature on college readiness further validated the need for this study. In addition, I included a thorough literature on developmental mathematics in the study. In doing so, I offered a broad perspective on developmental mathematics, including reasons why developmental mathematics education is needed as well as the students’ challenges when entering postsecondary education.

The data I collected supported the literature reviewed in multiple areas. Based upon the reviewed literature, I concluded that experts saw the need for (a) students to be more confident in their math skills, (b) instructors to motivate students, and (c) effective teaching practices to enhance developmental mathematics education. Data from the study confirmed these conclusions. Moreover, the study advanced the current literature by presenting new information, such as the disconnection between instructors who are comfortable with math and students who fear math, the emotional distress that instructors experience when they are unable to engage students, and the need for professional development that is guided by critical theory.
Lastly, the study adds to the literature by highlighting the experiences of community college instructors who teach developmental math. Previous to this study, few studies existed that went beyond describing characteristics of instructors to actually providing insight into the experiences of instructors who teach developmental math. The study offered a space for the instructors’ voices to be heard during the process of gathering information to enhance developmental math education. Furthermore, in the study I explored the attitudes, perceptions, and beliefs of instructors, which may positively or negatively impact learning.

Limitations

There were also limitations to this research project. First, the study was limited by the time of the academic year in which I collected data. The data collection process occurred during the summer months when there were fewer courses offered and fewer instructors available than during the regular academic year. Therefore, developmental mathematics courses to choose from for observations were limited. Access to faculty was also limited, considering teaching schedules, personal responsibilities, and extended time away from the college during the summer. In addition, I failed to collect demographic data once faculty were identified so I had no record of the background of the faculty I interviewed. Such information would have been helpful in interpreting remarks that faculty made during the interviews.

The second limitation of the study was my decision not to collect data from diverse members of the ECCC community, such as students and staff. For the purposes of this study, the only participants interviewed and observed were faculty teaching developmental
mathematics courses. Nor did I collect descriptive data from the students, this background information also might have aided in data interpretation.

While I did not include the student “voice” in the study, institutional data did provide insight into the student experience since documents that speak to student experiences and persistence/retention rates were included in the analysis. In addition, observations of developmental mathematics courses included actions and behaviors demonstrated by the students in the classes.

Another limitation of the study was use of snowball sampling. A critique of snowball sampling suggests that participants typically refer others who share similar beliefs and members of the same social group, limiting the potential diversity within the sample (Nardi, 2003). Therefore the data collected from interviews may be similar from participant to participant, limiting the “richness” of the findings.

Lastly, the fourth major limitation of the study was my lack of knowledge pertaining to developmental mathematics at the college at which I conducted my study. The topic of developmental mathematics evolved after a review of the literature relevant to college readiness. I completed the review and wanted to conduct a study that would provide practical information regarding how to address lack of college readiness rather than merely describing factors that contribute to students being unprepared for college. Upon reflection of my own undergraduate experience, I recognized that I was unprepared as a first-generation student who graduated from a large public high school with average academic rigor. More importantly, I began reflecting and attempting to understand why very few of my relatives within my
generation did not enroll in higher education. Thus, I really wanted to conduct a study that might address the issue of unprepared students entering college while offering recommendations regarding how to support them.

With that goal in mind, I chose a site that had the potential to offer rich data. The site was selected because of the environmental characteristics of the area, such as the racial diversity (U.S. Census Bureau, 2010), the unemployment rate in the state (U.S. Bureau of Labor Statistics, 2012), and the percentage of students in the area who chose not to take the ACT test (ACT, 2011). Thus, the environmental characteristics dictated the choice of the site, which was quite a distance from my doctoral institution. As such, I was unable to spend a great deal of time learning about the institution’s programs, particularly its program in developmental mathematics, which data suggested was a specific need for students at the college.

As the study was underway two additional limitations were revealed: (1) instructors did not consider race when developing lesson plans which limited insight into the influence of racial diversity and learning, and (2) critical theory should have been directly integrated and used to structure the interview questions.

I entered the study with an assumption that the instructors naturally considered racial diversity in the classroom when developing lessons and designing the curriculum. To my surprise, many of the instructors saw math concepts disconnected from race, stating that “math is math” and implying that race has no influence. As a result, I was unable to examine their beliefs regarding racial diversity in the classroom beyond this stated attitude.
Potentially, the use of critical inquiry to frame the interview questions would have indirectly revealed ways in which the instructors subconsciously consider race. Regardless, I am aware that using critical inquiry to frame the interview questions would have supported the epistemology and theoretical perspectives more directly.

**Recommendations for Future Practice**

I drew four important recommendations for future practice from this study. Because the recommendations were based upon conversations with participants, I acknowledge that some of them may not come as a surprise to the instructors at the college. However, the recommendations confirm what we know and support the advancement of services to promote students’ completion of developmental mathematics and overall accomplishment of educational goals.

First, I recommend offering mathematics preparatory interventions and implementing curriculum modifications that will support students’ transition from developmental mathematics to college-level mathematics. Specifically, implementing a summer transition/bridge program would provide an opportunity for students to adjust to the college environment by being on the campus and engaging with instructors prior to the start of the Fall semester. Students who participate would have an opportunity to alleviate their high school mentality and adopt appropriate college level thinking and behaviors, such as communicating with instructors, using the library, learning how to organize work and assignments, and developing basic management skills; essentially such a program would teach students how to be a “good student.” More importantly, students would have the opportunity to develop basic
math skills and form relationships with instructors who could help them to overcome their math anxiety and strengthen their mathematics self-efficacy. Hence the students’ probability of accomplishing their educational goals would increase.

In addition, the summer transition program could be used to familiarize students with departmental and institutional practices. For example, instructors could incorporate technology-based activities into the summer program so that students become comfortable with computerized assignments, especially given recent implementation of the self-paced developmental mathematics course. Also, given the use of the ACCUPLACER college-level placement assessment, perhaps students could take the placement tests after completion of the summer program, which would potentially increase tests scores and therefore minimize enrollment in non-credit developmental courses. Consequently, students would be less frustrated and discouraged, knowing that they will advance to college level credit courses at a faster pace and minimize tuition expenses.

This recommendation must not be implemented in isolation. The summer transition/bridge program should be implemented in partnership with campus services such as the counseling center, learning and academic support centers, student services, and academic departments and offices that offer resources. The summer transition programs should also collaborate with local public high schools to identify students’ needs relevant to mathematics as well as what the high school curriculum includes. According to Boylan et al. (1999), there is little connection between high school and college curriculums (p. 97), which reinforces the
need for community colleges to collaborate with high schools in order to develop a summer curriculum that is effective and builds upon what students learn in high school.

Offering a summer transition program would equip students for the college curriculum, help students to become more comfortable with technology to complete assignments, and promote mathematics self-efficacy. Therefore, the classroom experience would be more rewarding for instructors and students due to an increased comfort with mathematics among students, as well as a greater sense of motivation and willingness to work. As a result, teaching would be much more enjoyable and less frustrating than struggling with teaching content while encountering student resistance and personal out of class challenges.

In partnership with, and to strengthen the positive outcomes of, the summer transition program, I recommend modifying the developmental mathematics curriculum to address basic skills development, math anxiety, and math applicability along with math content knowledge. Incorporating basic skills as part of the curriculum will teach students how to be “good students” and support student retention and ultimate success. Dembo and Jakubowski (1999) suggested offering “Learning to Learn” courses that teach students strategies on how to self-regulate themselves, which would support their completion of academic goals directly connected to the developmental mathematics curriculum. In addition, a course of this nature could serve as an extension of the summer transition program by offering ongoing support to students throughout the fall semester. As with the summer transition program, I recommend that the “Learning to Learn” course be developed and facilitated in partnership with other student and academic services such as academic advising, supplemental instruction, tutoring,
learning communities, and learning assistance centers (Boylan, et al., 1999, p. 90). Programs with this type of format have demonstrated success and positively impacted student retention and success (Boylan, et al., 1999).

Partnering across disciplines can generate opportunities for academic areas to combine resources and implement strategies that can better serve students who are underprepared for college-level work. Therefore I recommend infusing developmental mathematics content into certain majors in order to strengthen the applicability of mathematics concepts in students’ professional careers. For example, if a student is interested in becoming a personal trainer, the instructor can highlight the importance of knowing mathematics in order to help the student determine a client’s body mass index. Instructors of biology courses can discuss the importance of nurses knowing mathematics in order to prepare medications for patients in their care. In certain professions, emphasizing the importance of calculating measurements and dosages can be a matter of life and death.

Recommendations to offer additional courses and to partner across academic disciplines are important. However, students will not be influenced by the course content if they are consistently absent or choose not to take advantage of various opportunities. With that point in mind, I recommend enforcing strict attendance policies for developmental mathematics courses (Boylan & Bonham, 1999). I use the term “strict” with the understanding that students encounter challenges outside of learning mathematics. Therefore I encourage the use of an attendance policy that highlights the value of attending along with supporting students who
may experience challenges outside of their control or who are paralyzed by mathematics anxiety.

In sum, the instructor must present the attendance policy while demonstrating both challenge and support. Instructors can demonstrate support through follow-up emails and phone calls in the event of excessive absences, or advising the student on alternative courses that might be more appropriate than the one in which he or she is enrolled. Thus, if possible, I recommend allowing instructors to practice discretion as a way of encouraging students to persist without issuing failing grades. For example, students could be removed from a class in the event of excessive absences, or issued an incomplete grade and allowed to fulfill the requirements of the class during the next semester. Such policies could be opportunities for changes in practice to empower instructors and to minimize the number of students who are failing. Perhaps the student could receive a grade of “incomplete” and be required to see the instructor or an advisor before registering for another semester (i.e., a hold on registration would be placed on the student’s record), which would infuse accountability and provide an opportunity for the instructor to have a conversation with the student to help develop an academic plan and gain closure on the situation.

I do recognize the implications for campus offices such as financial aid, the registrar’s office, and enrollment management if existing policies were modified or new practices or policies were implemented and for instructors who would have to develop a method to efficiently track students. Such a plan requires a comprehensive approach that is much more than instituting an attendance policy and necessitates institutional support.
In addition to building working relationships across academic disciplines, divisions, and campus offices to enhance developmental mathematics programs, it would be advantageous for developmental mathematics instructors to be able to easily identify students who are enrolled in two or more developmental courses. With that goal in mind, I recommend that students be coded after registering for two or more developmental courses per semester so that they could be easily identified by instructors, academic advisors, and student services staff. Faculty and administrators, when provided with additional information about the students’ academic profiles, need to be equipped to offer them intentional advising.

Lastly, based on information I gathered from course observations, documents I reviewed such as syllabi, and statements I compiled from interviews with instructors, I suggest that modifications to the curriculum be made. Several instructors indicated that students are unlikely to discuss course assignments outside of class or work together to prepare for an exam. In addition, course syllabi did not include out of class group assignments, nor did courses I observed incorporate many in-class group assignments. Because group assignments provide an opportunity for students to learn from one another, I recommend that out-of-class and in-class group assignments be included in the classroom curriculum. I do acknowledge that the college’s structure does not include residential living, which may create challenges for students to find convenient times and opportunities to meet with peers.

Secondly, I recommend that academic advising services and practices be expanded to incorporate a stronger focus on students enrolled in developmental education. Unfortunately, this study did not include an assessment of academic services; however, several instructors
indicated that the students enrolled in developmental mathematics are in need of mandatory and ongoing academic advising. Moreover, the literature revealed that the majority of students who attend a community college enroll in developmental courses (Meritosis & Phipps, 2000), which highlights the need for academic advising services to pay additional attention to students in need of developmental education to prepare for college-level work.

As mentioned, a tracking and monitoring system would allow advisors to guide students as well as share information with faculty. The monitoring system would also help advisors, faculty, and administrators determine if students were officially enrolled in the correct courses, particularly if they were placed in developmental mathematics. Members of the campus community would be able to easily determine if students were in the appropriate course that aligns with their ACCUPLACER test scores. Specifically, I recommend an online system to share information about the student such as placement test scores, current GPA, and courses taken that would allow faculty and administrators to include notes based upon conversations with and observations of students. Such a system would be particularly helpful for departments that offer developmental courses.

I also recommend expanding the ACCUPLACER placement test that is administered by advisors to include an assessment of noncognitive skills, such as the student’s disposition, which may indicate probability to succeed in college. Boylan et al. (1999) argued that if colleges and universities do a better job of assessing students’ noncognitive characteristics, they might be able to identify those who need extensive support, such as a summer intensive transition program, and those who need basic tutoring and study skills development (p. 98).
Another major recommendation that I propose is offering mandatory professional development and training for instructors who teach developmental mathematics. “Successful developmental education efforts are delivered by those who are well aware of the nature and needs of developmental students and the techniques that contribute to their learning” (Boylan, et al., 1999, p. 91). The number of developmental mathematics courses offered at the college exceeds more than half of the courses offered per academic year within the mathematics department. Thus, the need for instructors to teach developmental mathematics is demanding. As a result, instructors may be assigned to developmental mathematics courses who are resistant to such an assignment and may be a less than qualified candidate. The ultimate recommendation is to avoid hiring and assigning instructors to a developmental mathematics course who do not want to be there or fail to meet the basic qualifications. I strongly recommend providing training and professional development for developmental mathematics instructors to learn teaching strategies that promote student engagement as well as teaching strategies designed to motivate students to learn and overcome their resistance to math (Casazza & Silverman, 1996). Also, professional development should be provided to teach instructors how to become transformative educators rather than strictly lecturers.

Several instructors mentioned that offering professional development for a group of instructors can be difficult due to the conflicting schedules of instructors who teach part-time. To adequately address this challenge, I suggest providing online training and resources to meet the needs of adjunct and part-time instructors who may have limited time on the campus or limited availability for extensive scheduled face-to-face training.
Another option may be pairing exceptional instructors with instructors who are beginners at teaching developmental mathematics. Unfortunately, the review of the literature revealed that developmental courses are often taught by adjunct or part-time faculty with little training to prepare them to teach in developmental classrooms (Boylan & Saxon, 1998; Roueche & Roueche, 1999). To encourage participation, professional development can be used as part of an instructor’s employment evaluation and as part of an ongoing conversation with the department chair as a form of accountability. This recommendation is designed to support students who are enrolled in developmental mathematics and increase their probability of reaching college-level courses in order to achieve their educational goals (Boylan, et al., 1999, p. 98).

The last major recommendation that I offer is to incorporate evaluation and assessment of developmental education programs. Unfortunately, the documents that I accessed did not include information on evaluating and assessing the developmental mathematics courses. However, documents included information about the implementation of a taskforce to assess the challenges, research promising practices, and implement improvements to the developmental mathematics courses. Leading scholars studying developmental education identified program evaluation as a key element to successful developmental programs (Boylan & Bonham, 1998; Roueche & Roueche, 1993).

**Recommendations for Future Research**

The findings from this study suggest the need for future research that will enhance developmental mathematics instruction. I offer three recommendations for future research.
First, I recommend a research study that will assess and determine the value of providing support services in the form of professional development to instructors who teach developmental mathematics. Multiple instructors I interviewed expressed feelings of paralysis when teaching developmental mathematics and an inability to “reach” students. Uncovering the teaching challenges instructors experience could suggest the type of resources and information that professional development for instructors should incorporate. For example, the possibility of discovering ways to support instructors who experience feelings of failure could lead to energized instructors who are equipped to teach successfully and enthusiastic about motivating students to learn mathematics. Instructors expressed an ongoing cycle of beginning the semester with high hopes for the students but witnessing throughout the semester students who were struggling academically, experiencing personal issues, and dropping out, despite instructors’ best efforts.

Secondly, I highly recommend investigating the effective teaching practices that enable students to successfully advance from developmental to college-level mathematics. I suggest approaching such a study from a strengths-based perspective that will inform teaching practices of instructors with the intent of increasing the number of students who advance to college-level mathematics and ultimately college completion.

In addition, I highly recommend a study that investigates effective teaching practices by using concepts of critical pedagogy. The outcomes of such a study could produce insight into the positive outcomes produced when students are part of the learning experience.
I also recommend a study that includes students as participants. By doing so, the students’ “voices” will be actively heard and included in the study to inform recommendations for practice. I recommend this study to be focused on developmental mathematics considering that mathematics is often the gatekeeper course that prohibits educational achievement. Furthermore, it may be advantageous to focus on specific populations of students based on race, gender, or class to identify different experiences and to provide a more focused data.

Lastly, I recommend additional research that will include interviewing developmental mathematics instructors to identify effective professional development activities. In addition, learning more about the needs of instructors to support students will inform the design of professional development events and resources.

The recommendations for future practice and research are credible. In addition, I argue that the discussion regarding developmental mathematics should begin on the secondary level. If implemented, many of the issues such as standardized testing and unequal schooling would be addressed and have a positive influence on learning. Consequently, students would master mathematics on the secondary level, which would minimize the need for developmental mathematics on the postsecondary level, particularly at community colleges. Boylan et al. (1999) argued that developmental education in general will be reduced when college preparation is improved within public schools or by downsizing of postsecondary education (p. 95).

I see the discussion on developmental mathematics to be positive and in need of additional research and investigation. As a result of such investigation, a comprehensive
understanding of developmental mathematics would be available for education leaders who wish to implement new, or modify current, policy and practices. In addition, it is helpful to understand the experiences of instructors who teach developmental mathematics. I also suggest examining the students’ experiences beyond quantitative standards. As our understanding of developmental mathematics is expanded, students will have a greater probability of success and institutions will experience an increase in student retention and completion rates. Therefore an examination developmental mathematics from a critical lens is imperative if we want to experience significant change among students enrolled in developmental mathematics and improve the experiences of developmental mathematics instructors.

What I Learned from Conducting the Study

As I reflected upon what I have learned while conducting the study, several points come to mind. I present these areas of growth using two categories: professional growth and personal growth. Professionally, I reflected upon past career positions and areas of responsibility. For most of my time in higher education administration I have worked in multicultural affairs at both large public and small private universities. Although the context of the three positions was different, the roles and responsibilities were similar since they were guided by a generic mission of creating a welcoming environment for students of color. Depending on the year, trends of the day, and institution, the students were labeled as minority students or multicultural students.
Throughout the early years of my career, I accepted the programming component of the work but as I became aware of the needs of students of color, particularly at Predominantly White Institutions, I wanted to do more. Specifically, I sought out opportunities for conversation to learn about diversity on the campus and what it meant for the community. Also, I sought to meet with faculty to discuss the issues and needs of students of color to inform the practice of instructors in the classroom. Although they were implemented with positive motives, the initiatives were absent of theoretical frameworks such as critical theory to guide the practice. As a result, the positive outcomes were minimal, leaving participants with a “now what” mentality. Critical theory does not outline specific practices but the framework could have been useful for me as the responsible administrator seeking to help students and peers to become critical educators with intentional ideas to advance student engagement.

I also taught sociology courses for two years as an adjunct instructor. Now that I have been exposed to critical theory, I am so disappointed in my work. However, I am reminded that I was doing the best with what I knew at the time. I was considered a knowledgeable staff member on campus but I was ignorant. Not to make excuses, but I was teaching the way that I was taught, using a basic lecture style based on the textbook and ready-made lesson plans without considering opportunities to learn from the students. The opportunities to operate as a critical educator are endless, especially in a sociology course. I can only imagine the potential impact if I knew then what I know now.

A third area of responsibility that I have reflected upon is supervision. Throughout my career I have had the opportunity to supervise undergraduate students, graduate students, and
full-time professionals. I can visualize opportunities to connect concepts of critical pedagogy and supervision, such as making space for multiple voices to be heard, considering cultural diversity when supervising individuals or a group of people, and inviting staff members to examine social issues within the context of their daily work responsibilities. All of these possibilities are very applicable to the work of those who provide co-curricular learning opportunities for students.

Regarding my personal growth, I have developed in many areas. These areas of personal development are couched in emotional discontent and a raised awareness regarding education in general. Emotionally, I am both discouraged and encouraged, creating a sense of uncertainty of what I am to do with the information generated from the study. My feelings of discouragement stem from the insight that I have gained as a result of learning more about the challenges of both instructors and students in developmental mathematics courses. More importantly, I am concerned about the challenges that prohibit learning. The professional development required for instructors is significant and will demand time, energy, and resources. However, I am encouraged that some of the instructors are truly invested in the process and want to see students achieve their educational goals. Unfortunately, it appears that many of the instructors have adopted a dominant culture approach to prepare students for vocational skills or job training.

As I reflect and reread the study, I acknowledge that I am implicated due to the thinking and language used that is framed with a deficit approach. Despite the diversity trainings, courses in sociology and social justice, and professional experiences I have experienced, I am
not a critical educator. With that in mind, I join the instructors as one who is in need of professional development that is framed in critical theory, incorporates student’s voices, and is designed to be transformative. I entered the study with a sense of arrogance that I knew how to do this, that I was better than the instructors I would be interviewing, but as I learned more about critical theory, critical pedagogy, and critical-mathematical literacy I found my own behaviors to be unacceptable. As a low-income African-American I am disturbed and realize that I too have been “brainwashed” by dominant cultural practices that have emerged through my teaching practices, mentorship of students, and work with colleagues.

Considering my raised awareness and acknowledgement of “brainwashing” due to my exposure to public education, I now question the value of integrated schools. As I talk with my parents and others who experienced school segregation, they often share experiences of support and a sense of belonging prior to integration. Now that I have learned about critical education, I am wondering if integration had a positive impact on students of color or if we positioned ourselves to be influenced by dominant culture while hiding our own culture. Potentially, integration would have been more influential and positive for everyone involved if instructors were trained appropriately to integrate diversity in the classroom and value all cultures equally.
Appendix A: Interview Guide

Part I.

1. How do you define remedial/developmental education? What informs your definition?

2. What is your opinion of remedial education?

3. If applicable, what are state restrictions on remedial education in [this state]? What are the statewide standards to distinguish between remedial and college-level courses?

4. How would you describe your experiences with remedial education courses at East Coast Community College?

5. What’s the process for developing developmental courses at East Coast Community College? What informs course design and content?

6. How are students selected to participate in developmental education? What are the developmental education placement policies? Does ECCC use a formula based on high school GPA and ACT/SAT scores to determine placement in developmental education courses? If so, what is that formula?

7. What policies might you change or implement to determine who is placed in developmental education?

8. How are developmental courses and policies influenced by external partnerships such as feeder schools and local four-year transfer institutions?

9. What do you see as societal factors that influence the need for developmental courses at East Coast Community College?
10. What are some of the perceptions that colleagues might possess about developmental education?

11. How might you interpret the leadership’s philosophy on developmental education at East Coast Community College?

12. What support systems are essential in order to adequately provide developmental education at East Coast Community College?

Part II.

1. In your class, what standards of cultural integrity or critical pedagogy are employed to support learning among students?

2. What are potential negative or positive outcomes for learners enrolled in remedial courses? Please describe a time when a learner demonstrated resistance while participating in a remedial course? Describe a time when a learner demonstrated engagement.

3. In general, what are potential challenges that an instructor might encounter in the classroom?

4. What are potential disadvantages for learners who participate in developmental education? (consider self-esteem issues)

5. How are instructors trained to efficiently address the learning needs of learners enrolled in developmental courses? Is the training required or self-directed professional development?
6. What teaching strategies do you employ to identify talent among learners? What teaching strategies do you employ to address challenges among learners in the classroom?

7. How do you demonstrate high expectations for your students? How do you demonstrate challenge and support in the classroom?

**Part III. Open-Ended Question:**

1. What information would you like to add to the information that I have not asked?

2. How do you perceive developmental education at East Coast College?
Appendix B: IRB Approval Form

DATE: March 30, 2012

TO: Cheri Kee

CC: Dr. Nancy Evans

FROM: Office for Responsible Research

TITLE: A Case Study: The Role of Montgomery College in Preparing Students for Four-Year Institutions through Remedial Education

IRB ID: 12-139

Submission Type: New

Exemption Date: March 29, 2012

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

Research conducted in established or commonly accepted education settings involving normal education practices, such as
- Research on regular and special education instructional strategies; or
- Research on the effectiveness of, or the comparison among, instructional techniques, curricula, or classroom management methods.

Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
- Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
- Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- You do not need to submit an application for annual continuing review.
- You must carry out the research as described in the IRB application. Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

ORR 09/2011
Appendix C: Ethical Principles

**Principle A: Professional Competence:** Education researchers strive to maintain the highest levels of competence in their work; they recognize the limitations of their expertise; and they undertake only those tasks for which they are qualified by education, training, or experience. They recognize the need for ongoing education in order to remain professionally competent; and they utilize the appropriate scientific, scholarly, professional, technical, and administrative resources needed to ensure competence in their professional activities. They consult with other professionals when necessary for the benefit of their students, research participants, and clients.

**Principle B: Integrity:** Education researchers are honest, fair, and respectful of others in their professional activities—in research, teaching, practice, and service. Education researchers do not knowingly act in ways that jeopardize the welfare of others. Education researchers conduct their professional activities in ways that are worthy of trust and confidence.

**Principle C: Professional, Scientific, and Scholarly Responsible:** Education researchers adhere to the highest scientific and professional standards and accept responsibility for their work. Education researchers value the public trust in research and are concerned about their ethical behavior and the behavior of other education researchers that might compromise that trust. Education researchers understand that they form a community and show respect for other education researchers even when they disagree on theoretical, methodological, or personal approaches to professional activities. While endeavoring always to be collegial, education researchers must never let the desire to be collegial outweigh their shared responsibility for ethical behavior. When appropriate, they consult with colleagues in order to prevent or avoid unethical conduct.

**Principle D: Respect for People’s Rights, Dignity, and Diversity:** Education researchers respect the rights, dignity, and worth of all people and take care to do no harm in the conduct of their work. In their research, they have a special obligation to protect the rights, welfare, and dignity of research participants. They are sensitive to cultural, individual, and role differences in teaching, studying, and providing service to groups of people with distinctive characteristics. They strive to eliminate bias in their professional activities, and they do not tolerate any forms of discrimination based on race; ethnicity; culture; national origin; gender; sexual orientation; gender identity; age; religion; language; disability; health conditions; socioeconomic status; or marital, domestic, or parental status. In all of their work-related activities, education researchers acknowledge the rights of others to hold values, attitudes, and opinions that differ from their own, and they treat others with dignity and respect.
**Principle E: Social Responsibility:** Education researchers are aware of their professional and scientific responsibility to the communities and societies in which they live and work. They apply and make public their knowledge in order to contribute to the public good. When undertaking research, they strive to advance scientific and scholarly knowledge and to serve the public good. (http://www.aera.net)
References


East Coast Community College. (2011, Fall). Fall 2011 enrollment for credit students. Office of Institutional Research and Analysis. Retrieved from [college’s website]


