DISSERTATION

THE MOTIVATIONS AND EXPERIENCES OF STUDENTS ENROLLED IN ONLINE SCIENCE COURSES AT THE COMMUNITY COLLEGE

Submitted by

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ABSTRACT

THE MOTIVATIONS AND EXPERIENCES OF STUDENTS ENROLLED IN ONLINE SCIENCE COURSES AT THE COMMUNITY COLLEGE

An important question in online learning involves how to effectively motivate and retain students in science online courses. There is a dearth of research and knowledge about the experiences of students enrolled in online science courses in community colleges which has impeded the proper development and implementation of online courses and retention of students in the online environment. This study sought to provide an understanding of the relationships among each of the following variables: self-efficacy, task value, negative-achievement emotions, self-regulation learning strategies (metacognition), learning strategy (elaboration), and course satisfaction to student's performance (course final grade). Bandura's social-cognitive theory was used as a framework to describe the relationships among students' motivational beliefs (perceived task value, self-efficacy, and self-regulation) and emotions (frustration and boredom) with the dependent variables (elaboration and overall course satisfaction).

A mixed-method design was used with a survey instrumentation and student interviews. A variety of science online courses in biology, genetics, astronomy, nutrition, and chemistry were surveyed in two community colleges. Community colleges students (N = 107) completed a questionnaire during enrollment in a variety of online science

online courses. Upon course completion, 12 respondents were randomly selected for follow-up in-depth interviews.

Multiple regression results from the study indicate perceived task value and self-regulatory learning strategies (metacognition) were as important predictors for students' use of elaboration, while self-efficacy and the number of prior online courses was not significant predictors for students' elaboration when all four predictors were included. Frustration was a significant negative predictor of overall course satisfaction, and boredom unexpectedly emerged as a positive predictor when frustration was also in the model. In addition, the correlations indicated that elaboration and overall course satisfaction were not significantly related to participants' course grade (performance). Furthermore, five major themes emerged from the students' experiences: the role of personal dispositions, academic challenge, self-regulated learning, student communication, and the negative emotions that shaped student experiences. In particular, negative emotions most experienced by students were found to be anxiety, stress, frustration and confusion.

In total, results from this study implicate an important role of emotions such as frustration in students' overall course satisfaction and the importance of task value. Students' career aspirations and direct use of the course content were more likely to report greater use of elaboration strategies. Finally, this research also found that students self-regulated their learning in the online environment on a variety of levels.

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For their insight and support through this process, I would like to thank the members of my committee: Dr. Tim Davies and Dr. Joe Cannon. Each member of this committee has given me invaluable insight, mentoring, and feedback that enabled me to grow intellectually and emotionally on several levels. I am very grateful for all the interaction and time each and every one has given me in this process.

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CHAPTER 1: BACKGROUND

Distance Education

Between 2002 and 2011, online distance learning surged in postsecondary education. A report by the Sloan Consortium revealed that an estimated 5.6 million students took at least one online course in the fall of 2009, depicting a 21% growth rate for online enrollments from fall of 2008 (Allen & Seaman, 2010). Among students who took at least one online course per year, there was a compounded 19% annual average growth from 2002 to 2009 (Allen & Seaman, 2010). Estimates indicate that more than 100,000 distance-education courses are now offered in colleges and universities worldwide (Oblinger & Hawkins, 2005). Recent survey data indicate one in four students enrolled in higher education now take at least one course online (Allen & Seaman, 2009). The most recent data on online learning enrollments by Allen and Seaman (2008) demonstrate "no signs of slowing" (p. 1).

The growth of online student enrollment has outpaced that of traditional classrooms (Allen & Seaman, 2009, 2010; Oblinger & Hawkins, 2005). For instance, Allen and Seaman (2010) stated that online enrollments increased 21% in 2009 in contrast to traditional course enrollments, which only increased 2.0%. This growth rate is more pronounced in institutions granting 2-year associate's degrees (Allen & Seaman, 2008). Allen and Seaman (2008) noted, "Associate institutions have consistently been over represented among the online student population compared to their share of higher education student enrollments" (p. 6).

Between 50% and 74% of the leadership of higher-educational institutions believe that online education is critical to their long-term strategy and growth (Allen & Seaman,

2009, 2010). At higher-education institutions, the online environment is a source of new found productivity and increased student access (Allen & Seaman, 2009, 2010; SchWeber, 2005). Distance education has the potential to serve decentralized student populations and campuses. At some universities, online courses are an additional source of revenue. Studies by Oblinger, Barone, and Hawkins (2001) and by A. W. Bates (1997) cited four strategic reasons for institutions to invest in distance education: (a) access for students and businesses, (b) leverage scalability, (c) new revenue, and (d) institutional transformation.

With the expansion of online distance education, institutions are focusing on retaining students and enhancing their success. Carr (2000) indicated that online students are more likely to leave a course or program in greater numbers because of work-related pressures, financial constraints, and family concerns. Although the literature on traditional course retention is extensive, the literature on online retention is still emerging. Persistence and retention can be complicated because of the necessity to understand students, their educational goals, and their circumstances. A review of the literature revealed three psychological, social, and environmental factors that contribute to student success in an online environment: (a) personal characteristics/learning styles, (b) motivation/self-efficacy, and (c) environmental influences (Dutton, Dutton, & Perry, 2002; Haigh, 2007; Wahlstrom, Williams, & Shea, 2003).

However, the literature explains neither the importance of these variables nor their potential interaction. An unclear delineation of motivation and course satisfaction is most likely due to an absence of research about online courses at community colleges. Given the increases in numbers of online courses, research on student retention would be

beneficial to the fields of education and curriculum development, especially to community colleges, because they service the majority of students studying online (Allen & Seaman, 2008, 2009, 2010).

The literature, sparse as it is, suggests that an online learner is more intrinsically motivated than a face-to-face learner (Rovai, Ponton, Wighting, & Baker, 2007). Based on this finding, retention in online education may be more rooted in motivation and learning styles than in academic preparedness. Therefore, the relationships among student motivations, learning strategies, and academic achievement are of great interest.

Contextual Rationale

Carr (2000) indicated that online distance-learning retention rates are much lower than those in comparable on-site courses, although the author noted that the research is supported only by limited data. For example, researchers from the University of Central Florida reported that the withdrawal rate from the fall 1998 online program was 9%, which was higher than the 5% for face-to face courses during that same semester (Carr, 2000). In a review of the literature, Boyd (2004) identified time and scheduling constraints. Complicating students' course completion is the lack of studies on the way distance students prioritize and balance their goals (Boekaerts & Cascallar, 2006).

Despite the low number of studies on this phenomenon and the seemingly low retention rates of distance students, almost all community colleges have an institutional priority to develop and deliver online courses to learners (Allen & Seaman, 2007a, 2007b, 2008, 2009). Because many community-college online courses model face-to-face courses without having evaluated their effectiveness, a study of student perspectives in a domain or specific subject area will add to the literature. What is not known is whether

online science courses can be tailored to students' needs in order to enhance course satisfaction. For this study, I studied science courses for four reasons: (a) the difficulty of the subject content and the ability of students to understand unfamiliar concepts, (b) the dearth of studies (Rowe & Asbell-Clarke, 2008), (c) faculty concerns with low course-passing/completion rates, and (d) faculty concerns of placing science courses online while maintaining the hands on experience of experimentation.

As community colleges develop online courses, it has become important to study online students' characteristics, motivations, and reasons for taking coursework in specific subject areas (Massa, 2003). While some general aspects of the student experience in the online environment have been explored in quantitative studies (Aljarrah, 2000; Artino, 2008; Bangurah, 2004; Crabtree, 2000; Jamison, 2003; Massa, 2003; Reed, 2001; Schultz, 2001; York, 2003; Zimmerman, 2005) and qualitative studies (Harbeck, 2001; Kennedy, 2001; Schilke, 2001), such approaches have been limited in understanding the challenges facing science students. Science courses present a significant degree of difficulty to students in terms of the conceptual frameworks and related content presented in face-to-face classes (Hmelo-Silver & Azevedo, 2006; Hmelo-Silver, Duncan, & Chinn, 2007; Hmelo-Silver, Marathe, & Liu, 2007). Learning the facts and linking them to everyday understanding requires a solid conceptual framework (Hmelo-Silver, 2004; Hmelo-Silver, Duncan, et al., 2007; Hmelo-Silver, Marathe, et al., 2007; Savery & Duffy, 1995). Thus, for online science learning it is important to know which concepts student do and do not understand. In addition, science courses with a laboratory component are difficult to adapt to an online learning environment and have met with faculty resistance. Bangurah (2004) observed the need

for research into the student online experience across disciplines to determine if some disciplines are better suited for online delivery than others.

Statement of the Problem

A serious problem with online distance education, especially science courses, is student course performance and course completion by community-college students (Boyd, 2004; Carr, 2000). In general, institutional data from community colleges show dropout and non-completion rates for online courses that are well over 50% (York, 2003). In addition, community-college faculty who teach online courses tend to claim that their students are more likely to withdraw or drop out (personal communication, B. Dow, January, 29, 2010; E. Kershisnik, May 19, 2009). Although this evidence is anecdotal, in light of course performance and completion rates, this phenomenon warranted examination.

There is a scarcity of research about community-college students in online science courses (Rowe & Asbell-Clarke, 2008). Consequently, it is difficult for community colleges to enhance student performance or raise these completion rates. Therefore, this research attempted to understand the factors in students' performance of online science courses. The study used quantitative and qualitative methodologies to examine the dispositional and motivational determinants and predictors of academic success in online science courses.

Research Purpose

This research study had two aims. The first aim was (a) to understand the influences of different associational variables such as self-efficacy, self-regulated learning (metacognition), and task value on predicted elaboration, (b) to understand how

negative emotions, such as frustration and boredom, predicted student course satisfaction, and (c) to explore how elaboration and course satisfaction predicted students' and course performance. The second aim was to understand the experiences of community-college students in online science courses.

This study explored how predictive factors such as (a) self-efficacy, (b) task value, (c) the number of online courses, and (c) SRL strategies (metacognitive) in the online environment predict variations in students' levels of (a) elaboration, (b) negative emotions, and (c) course satisfaction, both of which are thought to influence course completion. The research also provided an in-depth study of participants with a common experience, an approach Moustakas (1994) suggested might offer valuable insight. Therefore, this approach provided detailed information on the reasons for students' boredom and frustration (emotional components) with course completion.

This study examined factors related to prior knowledge, task value, SRL strategies (metacognition), and self-efficacy as they pertain to the self-regulation of students in the use of learning strategies (elaboration) in online science courses. Several student attributes were examined, and community-college students' motivation for registering in courses was analyzed.

An analysis of student characteristics and motivations is important because electronic learning physically separates faculty from students. An understanding of students' motivation has become even more important to online learning as opposed to on-campus learning. While age, gender, and employment status are important variables, students' motivation and the subject being taught are essential for teaching and learning (Finnegan, Morris, & Lee, 2009). This knowledge can lead an instructor to match

instructional technology to the background and needs of their learners in order to provide differentiated instruction.

Significance of the Study

The rapid development of the Internet has increased the different avenues of learning for students in community colleges. While increasing enrollment is desirable, there is a growing concern about student retention and quality. The significance of this study is two-fold. By understanding the experiences of students enrolled in specific areas, community colleges can (a) begin to design better courses and (b) create better support services to promote student retention. This research may be beneficial to students, instructors, and administrators involved in online science courses.

Implications of Design

With the proliferation of online learning at community colleges, the literature reports concerns for the creation of learning environments in which students remain motivated, integrated, and interested. This study focused on the motivational beliefs of community college students who take online science courses. Knowledge gained from understanding students' self-regulation and motivations in online science courses may lead to better-designed online courses by (a) assessing the dispositional attributes of successful students (such as task value and self-efficacy), (b) understanding the perspective of the students' learning, and (c) understanding the reasons for students' anxiety, boredom, anger, or frustration (e.g., negative achievement emotions). Further understanding of student motivation and self-regulation can assist in better decision making in curriculum design and assessment of online science courses.

Implications in Learning Strategies

For faculty, knowledge gains from this research can lead instructors to adopt a variety of tailored instructional methods in order to match instructional technology to the background and needs of their learners. For students, information gained from this study, such as what different motivations and learning strategies were being used by science instructors, may potentially help students to develop their own learning skills in new ways. By using both quantitative and qualitative data, the different and complementary dimensions of self-regulation and use of learning strategies in the online environment was explored.

Research Questions

The following research questions were addressed in this study:

Research Question 1: Are participants' self-efficacy, self-regulatory strategies [metacognition], perceived task value, and prior knowledge in online courses statistically significant predictors of elaboration? (See diagram for variables in Figure 1.)

Research Question 2: Are students' achievement emotions (boredom and frustration) statistically significant predictors of their overall course satisfaction? (See diagram for variables in Figure 2.)

Research Question 3: Are the participants' elaboration and course satisfaction in online courses statistically significant predictors of final course grades? (See diagram for variables in Figure 3.)

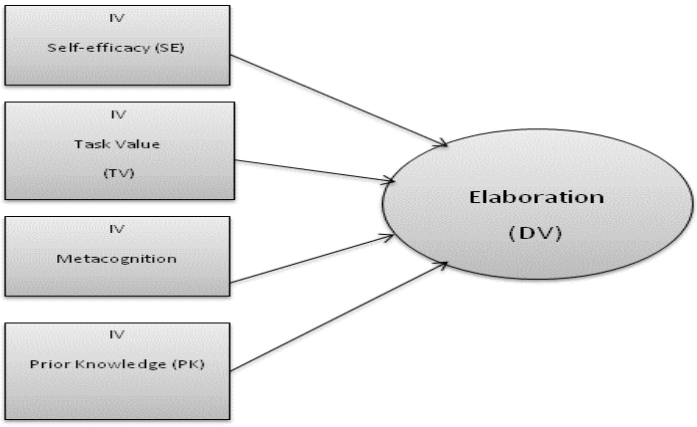

Figure 1. Variables that may predict elaboration.

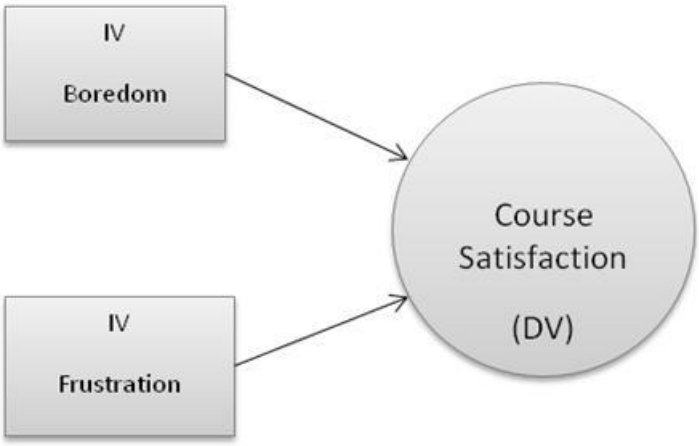

Figure 2. Variables that may predict course satisfaction.

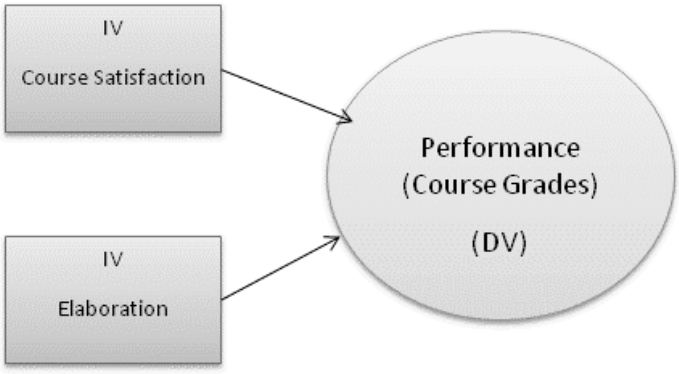

Figure 3. Variables that may predict course performance.

Research Question 4: How do community-college students experience or make meaning of their online science courses? What underlying themes describe students' online experiences in community-college science courses?

Research Question 5: What are the reasons associated with course satisfaction of community-college students enrolled in online science courses? What challenges and successes do they experience?

Research Question 6: What are the reasons underlying the inhibitory dimensions, such as boredom and frustration that influence success in an online science course?

Limitations of This Study

The following limitations may have reduced the ability to generalize the findings from this study:

1. This study was delimited to students enrolled in online science courses. Thus the findings may not represent students in all online courses at community colleges or students taking online courses at 4-year colleges.
2. The study used a convenience sample of students from only two community colleges. Thus, the results may not be generalized (a) to other community

colleges in Illinois and Colorado specifically or in the United States in general or (b) to other types of higher-education institutions.

3. The 12 interview participants self-selected themselves to participate in this study and thus constituted a convenience sample rather than one selected randomly. Therefore, the results may not be reflective of other populations.
4. Only 12 students agreed to participate in the interview process. This small sample size may not represent the perspectives of other populations; and therefore, the results may not be generalized.

Definition of Terms

Achievement emotions. Achievement emotions are tied directly to achievement activities or outcomes (Pekrun, 2006). The enjoyment of learning something new, boredom with classroom instruction, or frustration and anger when performing difficult tasks are but a few examples of achievement emotions (Pekrun, 2006).

Attrition. Attrition refers to a decline in the number of students over the term of a course, program, institution, or system (Berge & Huang, 2004). In this study, attrition was defined at the course level, such that attrition was operationally perceived as the decline of the number of students over the term in a course.

Course completion. Completers were operationally defined as students who completed their course with a passing grade. Non-completers was operationally defined as those students who (a) were nonstarters—that is, they did not commence work on their course or (b) withdrew from their course.

Continuing motivation. Maehr (1976) defined continuing motivation as a "tendency to return to and continue working on tasks away from the instructional context

in which they were initially confronted" (p. 443). Artino (2009) stated that since 1976, continuing motivation "has been employed as a key behavioral indicator of student motivation" (p. 150) because student motivation cannot be observed directly.

Course Satisfaction. Course satisfaction was defined as how much the student is fulfilled or gratified with his or her learning experience in the course. According to Artino (2009), course satisfaction is "important because this type of self-reflective reaction to learning situations may ultimately influence one's subsequent efforts to learn" (p. 151). Past research from Chiu, Sun, Sun, and Ju (2007), Chyung (2001), and Roca, Chiu, and Martínez (2006) have identified student satisfaction as an important outcome in online settings with end-of-course satisfaction predicting course drop-out rates and intentions to enroll in future online courses.

Distance education. Distance education refers to any type of structured education in which students and instructors are physically separated (Wahlstrom et al., 2003). For the purposes of this study, distance education referred to Internet-based courses delivered totally online.

Elaboration. Elaboration refers to study strategies involving paraphrasing, summarizing, creating analogies, explaining the material to someone else, and generative note taking, such that the learner actually reorganizes and connects ideas (Pintrich, 1999).

Emotions. Emotions are multi-component, coordinated processes of psychological subsystems including affective, cognitive, motivational, expressive, and peripheral physiological processes (Pekrun, 2006). For example, anxiety is related to several components, including apprehensiveness and nervousness (affective component), worry

(cognitive), avoidance motivation (motivational), anxious facial expression (expressive), and peripheral physiological activation (physiological; Pekrun, 2006).

Hybrid courses. Hybrid courses are courses that use both types of instruction: face-to-face and online technology. Common technologies used in hybrid courses are e-mail and course-management platforms (such as Blackboard or WebCt) to teach part of the course (Allen & Seaman, 2007a, 2007b, 2008).

Learning. Learning is a permanent change in a knowledge or skill produced by experience (Weiss, 1990).

Learning strategies. Learning strategies are activities that result in learning (Sankaran, 2001). Copying notes, paraphrasing, outlining, comparing, reading aloud, and discussing course content with classmates are among the learning strategies that allow students to process information (Artino, 2008). Active processing of material leads to mastery of material and hence to academic achievement (Sankaran, 2001).

Metacognition. In Bandura's social-cognitive learning theory framework, metacognition is viewed as a component under the umbrella of SRL (Schraw, Crippen, & Hartley, 2006). Artino (2009) defined metacognition as a "strategy where students monitor, control, and regulate their own cognitive activities and behaviors" (p. 150). Previous research has generally indicated that a student's use of metacognitive activities is an extremely beneficial behavior for long-term retrieval of information, transfer of learning, and overall academic performance (Artino, 2009). Students who engage in metacognitive processes improve their academic performance (Lynch, 2010).

Metacognitive learning strategies. Metacognitive learning strategies are the specific types of learning strategies involved in finding resources to meet the demands of

a particular task (Winne & Perry, 2005). Metacognitive strategies help learners make sense of information and extend their knowledge. Examples of such strategies are planning, monitoring of comprehension, orienting oneself before starting an assignment, collecting resource material, integrating theoretical viewpoints, and assessing one's progress (Boekaerts & Cascallar, 2006).

Motivation. Schunk, Pintrich, and Meece (2008) defined motivation in education as "a process whereby goal-directed activity is instigated and sustained" (p. 4). As a process, Schunk et al. examined motivation indirectly from actions and inferred activities, such as choice of tasks, effort, and persistence. The level of motivation is reflected in goals, cognitive views, choice of course action, and an outcome for persistence (Bandura, 1997).

Online learning. In this study, online learning was defined as learning that takes place entirely over the Internet (Means, Toyama, Murphy, Bakia, & Jones, 2009). Online courses are defined as courses that involve the use of communication technologies such as e-mail, a Listserv, website, or course-management platform (Blackboard or WebCt), to teach at least 80% of a course (Allen & Seaman, 2007a, 2007b, 2008). Online learning is used interchangeably with e-learning, Internet learning, distance learning, web-based instruction, distance education, and online learning. This definition excludes purely print-based correspondence education, broadcast television or radio, videoconferencing, videocassettes, and stand-alone educational software programs that do not have a significant Internet-based instructional component.

Prior knowledge. Prior knowledge refers to previous experiences that are both education- and work-related (Artino, 2008). Examples of such experiences are previous

coursework, the number of courses related to the area of science, and work-related experiences.

Retention and course completion. Retention refers to continuous student participation in a form of education, or for the purposes of this study, course completion. In this study, retention referred to student enrollment in a course, that is, the individual course-completion rate. Students are considered to be retained in a course if they complete the course with a final passing grade. Retention was operationally defined as the number of learners who start and finish one science course in an academic semester.

Self-efficacy. Self-efficacy refers to a "judgment of one's ability to organize and execute given types of performance" (Bandura, 1997, p. 21). As a result, self-efficacy refers to learners' beliefs in their own capabilities. If learners believe they are capable, then they are more inclined to organize and take the actions that are necessary to attain a high performance and improve their skills (Zimmerman, 2005). The literature contends that students are motivated to persevere if they both employ effective learning strategies and believe that their actions will produce positive outcomes (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996). Thus, self-efficacy is the belief in one's ability to coordinate and execute given levels of performance required to complete a course (Bandura, 1997).

Self-regulated learning (SRL). Drawing on Bandura's work, Zimmerman (1986) defined SRL as the process of "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (p. 14). SRL depends on the learner's beliefs and motives. According to Zimmerman, SRL is a proactive, self-directed process by which self-generated thoughts, feelings, and behaviors are used to reach self-reflection, self-awareness, self-evaluation, intrinsic motivation, and adaptation.

Task value. Task value refers to the extent to which learners find a task interesting, important, and/or valuable (Eccles & Wigfield, 1995). Eccles and Wigfield (2002) elaborated on four components of task value: attainment value, intrinsic value, utility value, and cost. Attainment value is defined as the personal importance of doing well on a task (Eccles & Wigfield, 2002). Intrinsic value is defined as the enjoyment that a person derives from performing an activity or the subjective interest that the person has for that particular subject (Eccles & Wigfield, 2002). Utility values are beliefs about ability and competency (Eccles & Wigfield, 2002). Eccles and Wigfield (2002) conceptualized cost in terms of the negative aspects of engaging in a task, such as fear of failure or success, as well as the amount of effort needed to succeed, and the lost opportunities resulting from making one choice rather than another.

Traditional students. Traditional students are considered to be students between the ages of 18 and 25 who matriculate immediately after high school Boston, Ice, & Gibson, 2011).

Researcher's Perspective

An essential part of a phenomenological approach to qualitative analysis is the concept of bracketing, that is, when researchers review and set aside their own prior experiences and preconceived biases about the phenomenon under study to understand it better through the experiences of the participants. Thus, it was important for me to complete a description of my own experiences as an online student to acknowledge and bring forth my own assumptions and preconceptions during the research process. Therefore, I first discuss my online experiences and thoughts about such experiences,

which present my own perspective on taking an online science course at the community-college level.

I first became interested in distance learning when I started my MBA at Colorado State University. Because I was working full-time, traveling extensively to meetings and conferences, and caring for young children at home, I found the idea of attending school at a convenient and flexible time and place appealing. The format also appealed to my sense of independence and ability to self-pace my learning, which was something I learned to develop as an undergraduate.

My first distance-learning courses were videotaped lecture classes associated with an Embanet communication platform. They were standard videotape recordings of the regular, in-person graduate-level management classes offered by the business school. On a weekly basis, I received the videos to view and use for note taking during times that were most convenient to me. Different instructors taught all the courses, yet my learning experiences in the different courses were remarkably similar. The courses were all videotapes of lectures. I watched the tapes, took notes, and completed textbook assignments on my own.

There were both advantages and disadvantages to distance learning through videotapes. Advantages included the ability to plan my own schedule for class attendance that fit around my work and family life. I was able to pause or rewind the tapes as often as necessary to understand a concept. I could fast forward through sections that I already knew well and spend more time on the sections that I was not familiar with or needed to hear several times in order to gain comprehension. In short, I felt that the videotapes were extensions of the material to be covered in the textbooks. The disadvantage I encountered

in this format was that I never was able to interact with other students on a real-time basis during class. My communication was limited only to weekly online chats and course communication with the instructor. I soon found that not all professors communicated as often and as effectively as I would have liked. The most challenging aspect of these classes was that I felt somewhat isolated in my learning. Therefore, I had to form my own class discussions with my friends and close family members around me in order to gain perspective and find my own method for generating the critical thinking and exchange that goes on in the classroom.

In addition to integration, I believe communication with the instructor and my peers became extremely important to my online experience. Not having the advantage of the in-person class in order to have informal conversations and exchanges with the professors, effective e-mail communication became vital to me. Peer-to-peer communication in an online course made a significant difference in how I engaged in the online class.

Most of the courses involved case studies, short assignments, analysis of short articles, and online threaded discussion boards. All of the discussion forums had several options, so I was able to choose the topics in which I was most interested. I could participate in the discussions at my convenience. The asynchronous nature of the format allowed me time to think about what my peers had to say about the issues and concepts. This allowed me more time to think about and write my responses than I would have had if I was in a face-to-face conversation. The best part of this learning was that I felt I was part of a larger class or community of learners. Of particular importance was the realization that my classmates and I could all read the same material and see the many

different resulting perspectives. I also remember how some of my classmates would bring real-world expertise to definitions and concepts that only active members in my field would know about. This made me realize the wealth and depth of expertise as well as intellectual capital of my classmates.

Writing was the primary form of communication in the online environment. Writing took on many forms such as e-mail, synchronous chats, and discussion postings. The higher level courses entailed group course work on Embanet through instant messaging and discussion boards. Real-time communication with my peers who were in different time zones and states with different schedules and backgrounds was both intellectually stimulating and challenging. It was my responsibility to contact the instructor if I had any questions about the assignments. Feedback and communication was both timely and frequent. I learned much from the feedback on the assigned work. I really appreciated the frequent feedback. It assisted me in self-regulating my learning, self-reflection, and use of learning strategies, as well as adjusting my habits. My habits included such lifestyle habits as sleep patterns, doing assignments sooner rather than later, and researching the material as soon as the material was given as an assignment.

From these experiences, I learned that I could learn on my own, in my own time, anywhere, and on a schedule that was already full. I learned I could constantly adjust, self-monitor, plan ahead, and keep pace with the demands of both work and coursework. Multitasking became its own way of life for me. I thrived on it. I felt empowered and intellectually challenged, which lead to even more motivation and desire to excel. I loved figuring things out on my own; the challenges became something I wanted to do. As a result, the personal themes I found from my online experience in my master's program

were (a) online learning experiences are generally different from in-person learning experiences, (b) communication and feedback is critical to the learning experiences, and (c) self-regulation of learning is critical to continued success.

CHAPTER 2: LITERATURE REVIEW

Distance-education research focuses on the convenience and flexibility of online learning (Allen & Seaman, 2007a; Wahlstrom et al., 2003). Online education is particularly attractive to students who desire more course choices and scheduling flexibility (Wahlstrom et al., 2003). In addition to providing freedom for students, it appeals to adult learners who want professional advancement because of the time constraints faced by this population. Several comparative studies have shown that online learning is as good as traditional classroom instruction (Dutton, Dutton, & Perry, 2001, 2002; Gloster & Doss, 2000; Green & Cifuentes, 2008; Tucker, 2000; Wutoh, Boren, & Balas, 2004). However, because some courses rely more on delivery of content rather than on conceptual understanding, some courses are more effectively designed than others to the online format (Dutton & Dutton, 2005). For this reason, Dutton and Dutton (2005) questioned whether the findings of these studies apply to science courses.

Of concern to distance-learning service providers is student retention. Despite the convenience of online courses, research has indicated distance courses have lower student retention rates, ranging between 10% and 50% (Carr, 2000; Dutton et al., 2002). This has been a significant problem for community colleges with a high proportion of online students because their enrollments determine their federal, state, and local funding. In addition, critics of online learning tend to view such high withdrawal rates as a sign of a course's academic failure (Merisotis & Phipps, 1999).

This literature review examines the attributes of retention and explores the following questions:

1. Which media are used in distance education?

2. Who are the theorists on motivation and retention?
3. What are the models of student retention?
4. What factors constitute success for distance learners?
5. What motivation techniques influence course satisfaction?
6. What is the relationship between self-efficacy and satisfaction in online science courses?
7. What are the relationships among task value, self-efficacy, and emotional states?
8. What external pressures influence degree completion (social systems, time pressures, program costs, and other socioeconomic factors)?

The literature review first presents the forms of distance education then discusses the theories of online retention. The section concludes with a discussion of the importance of motivation and self-efficacy in science instruction in community colleges.

Distance Education

Distance education focuses on the delivery of off-site education, where media can include Internet-based systems and network-based technologies (Allen & Seaman, 2007a). Rather than meeting in a classroom, teachers and students communicate by exchanging print or electronic media. Many universities and community colleges are participating in distance education to better serve students and employees (Allen & Seaman, 2007a, 2007b). According to Bambara (2007) online learning is convenient, economical, flexible, and supportive to time schedules of learners. Online courses offer more flexibility in course times, which often appeal to students with career and family commitments because most online courses can be taken when needed and can be self-

paced (Bambara, 2007). Online courses can move faster for some learners partly because the individualized approach allows learners to skip material they already know and understand or to move onto material they want to learn. Another benefit is a learner can work from any location and at any time, that is, online learners can work through training or coursework sessions from anywhere and in their chosen timeframe. This just-in-time benefit can make learning possible for people who would not have been able to mesh coursework with their schedules prior to online learning (Appana, 2008). Time is very important to students, especially for those students who are nontraditional, returning to further their education to better themselves in their current job or to find a better job Kim, Liu, and Bonk (2005). The college experience is not as critical to such a group; therefore, distance education becomes an effective alternative to the traditional college experience. In many cases, distance education can lessen the time of commuting and the frustration of getting to class on time while searching for parking.

Types of Communication in Online Courses

The practice of online communication can be divided into two temporal groups: synchronous and asynchronous (Wahlstrom et al., 2003). The former consists of real-time interactions, generally delivered through web-conferencing or chat rooms. Students and instructors communicate simultaneously. Other examples are telephone conferencing, computer conferencing, and interactive television, all of which occur in real-time. In contrast, in asynchronous technology, participants do not need to interact simultaneously (Wahlstrom et al., 2003). This feature of distance learning provides temporal flexibility because traditional learning requires students and professors to interact concurrently, on-site, up to 29% of the time (Allen & Seaman, 2007a, 2007b).

Forms of Distance-Education Courses

In distance education, students study on their own schedule so they can concentrate on priorities (home, work, or learning). The learning medium is crucial, as teachers and students must interact regardless of time shifts. In higher education, media (also known as *delivery systems*) are varied, ranging from web-enhanced, hybrid/blended courses to completely online courses (T. Bates, 2008; see Table 1). The Internet is the dominant medium, allowing a number of niche content media to work effectively; these allow teachers and students to interact through e-mail, video, audio, teleconferencing, correspondence courses, hybrid courses, and extension courses (Gilbert, 2000). Course delivery can be viewed along a continuum depending on the amount of technology used to facilitate communications and course activities.

Hybrid courses blend online and face-to-face instructional methods, wherein "30 to 80 percent of the course content is delivered online" (Allen & Seaman, 2007a, p. 5). This type of course harnesses the capabilities of the Internet and other types of media, such as textbooks, CDs, DVDs, face-to-face interaction, and interactive video. At the end of the continuum, fully online courses deliver more than 80% of their content online. According to T. Bates (2008), few teaching systems are completely online, and few students study in complete isolation. For instance, students are required, even in fully online courses, to discuss topics with each other and collaborate on projects; students are sometimes encouraged to meet face-to-face with or without the instructor.

Table 1

A Comparison of Types of Instruction by Content Delivery

Type of instruction	Content delivered online	Typical description of course
Traditional	0%	No online technology used. Contents are delivered in writing and verbally.
Web facilitated	1–29%	Uses web-based technology to facilitate what is essentially a face-to-face course, using a course-management system or web pages to post the syllabus and assignments, for example.
Blended/hybrid	30–79%	Blends online and face-to-face delivery. A substantial proportion of the content is delivered online, typically uses online discussions, and has some face-to-face meetings.
Online	80% +	Most or all of the content is delivered online, typically with no face-to-face meetings.

Note. Adapted from "Making the Grade: Online Education in the United States," 2006, by I. E. Allen and J. Seaman, retrieved from http://sloanconsortium.org/publications/survey/index.asp

Characteristics of Online Students

Many types of students enroll in online courses (Gibson, 1998). As a result, it is more difficult to tailor the courses to this diverse student population. To meet student needs, educators should first identify students' demographic and motivational profiles and use the profiles to determine the best manner in which to educate them. Thus, demographics and student motivations should guide pedagogy (Gibson, 1998). The literature divides online students into three strata or categories based on a) demographic/ socioeconomic characteristics, (b) educational goals, and (c) motivational profiles (Oblinger et al., 2001; Rovai, 2003; Rovai et al., 2007). Figure 4 illustrates this division.

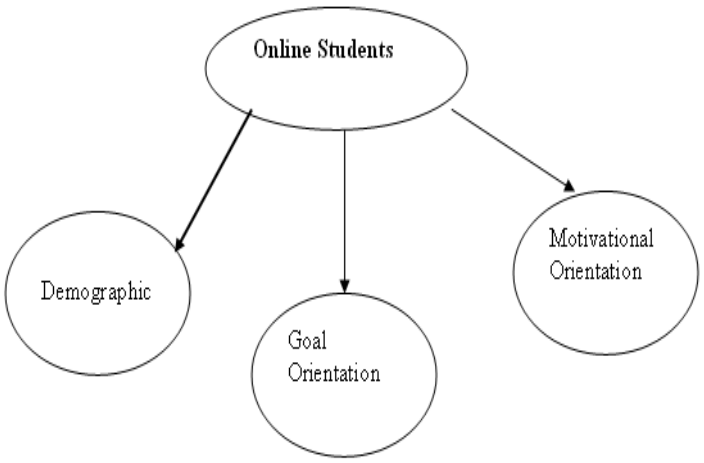

Figure 4. Stratifications of online learners.

Demographic Stratification of Online Learners

From a demographic perspective, distance learners are characterized by age, gender, employment status, family income/socioeconomic status, parental educational level, prior educational experience, and parental expectations. These characteristics allow educators and researchers to classify many students as either traditional or nontraditional (Diaz, 2002; Rovai, 2003).

Traditional online learners. Studies have shown that traditional online learners (between 18 and 24 years of age) prefer online communication. Howell, Williams, and Lindsay (2003) described online students as being comfortable performing several tasks at once (multitasking), being less tolerant of communicative delays, and preferring typing to handwriting. Traditional online students were also more comfortable navigating the Internet for information and assembling knowledge from fragments (Oblinger et al., 2001). Hiltz and Goldman (2005) profiled students conducting online education as motivated and in need of an anytime and anyplace mode of education. Further, students

need to be able to express themselves well in writing and have the willingness and ability to collaborate.

Nontraditional online learners. In contrast, nontraditional adult distance learners (over the age of 25) tend to be practical problem solvers, goal and relevancy oriented, and more self-directed and to know the rationale for their learning (Howell et al., 2003; Ross-Gordon, 2003). According to Howell et al. (2003), nontraditional learners are motivated by "professional advancement, external expectations, the need to serve others better, social relationships, escape or stimulation, or pure interest in the subject" (p. 3). Raven and Jimmerson (as cited in Ross-Gordon, 2003) perceived nontraditional learners as goal oriented, responsible, competitive, and self-directed.

T. Bates (2008) characterized the nontraditional adult learner as a lifelong learner or knowledge worker—one, who works full-time, has a family, and has an established social life. Similarly, Howell et al. (2003) profiled nontraditional online students as those who are more constrained by life demands, including "time, scheduling, money and long-term commitment" (p. 3). These lifelong learners take distance-education courses to improve their professional qualifications (T. Bates, 2008). The literature indicated that nontraditional online students tend to feel insecure about their ability to succeed in distance learning; they seek personal contact with the instructor, support services, and technology training more often than do traditional students (Diaz, 2002; Dubois, 1996).

Educational Goal Stratification of Online Learners

The literature indicated significant goal-orientation differences among distance education students. According to Oblinger et al. (2001), there are six categories of distance students:

1. Corporate learners are those who use education to upgrade or maintain skills in the workplace. Corporate learners fund their education through the corporations that employ them.
2. Professional enhancement learners are largely working adults who make their own educational decisions but need education to advance or switch careers.
3. Degree-completion adult learners are largely those working adults who desire to complete a college degree later in life. Such adult learners need to balance work and family priorities with educational goals.
4. Most precollege learners are high school students who want to learn online to earn advanced-placement credit toward college. Some of these learners are eager to start earning college credits or take courses not available at their schools.
5. Recreational learners are interested in learning for the sake of learning and take personal enjoyment in exploring new topics.
6. Remediation and test-preparation learners are either completing the prerequisites for enrollment in a college-level course or are interested in taking an examination to enter a degree program.

Motivational Stratification of Online Learners

Successful online students tend to be self-directed learners, exhibiting a high level of motivation. These students quickly complete their tasks and are comfortable directing their own learning (Cahoon, 1998). They are also highly self-motivated and self-disciplined; this is important because online learning places a greater responsibility on the learner.

Characterizing online students is important if faculty members are to teach to their strengths and improve their weaknesses. This includes tailoring classes to the motivations of the learners. A few studies have categorized online learners using Houle's classification of adult learning (Harsh & Sohail, 2002). According to Houle (1961), adult learners fall into one of three categories. Goal-oriented learners use learning to reach specific objectives, such as learning to solve family problems, learning better business practices, or following an interest (Houle, 1961). Activity-oriented learners participate primarily for the sake of the activity itself, to join a group, or to escape an unhappy situation (Houle, 1961). Learning-oriented learners pursue learning for its own sake; these are lifelong learners (Houle, 1961).

Online Learning in Community Colleges

The primary mission of community colleges is to provide open-access education to all learners. To meet these goals, 90% of community colleges or 2-year public institutions offer distance-education courses (Oblinger & Hawkins, 2005). Allen and Seaman (2007a) found that more than half of all online students in the Midwest were attending 2-year associate's-degree institutions. Thus, the greatest growth in online enrollments was taking place at institutions granting 2-year associate's degrees (Allen & Seaman, 2007a).

Community colleges serve three types of online students: transfer, vocational, and continuing education (Mays, 1998). While transfer students earn credit hours to gain admission to a 4-year institution, vocational students usually are working toward a certification, and continuing-education students may have an interest in some area or want to take a course at a community college to learn or acquire a skill.

Retention of Students

In today's environment, the understanding of retention has become even more complex, particularly with the changing landscapes in learner demography, roles, responsibilities, learning opportunities, needs and perceptions, and modes of instruction and learning (Gibson, 1996). Procedural differences at the institutional level in measuring retention rates vary at community colleges, complicating the issues and often leading to inconclusive results in empirical studies (Gilbert, 2000; Kember, Lai, Murphy, & Siaw, 1944).

There are many student-demographic variables that students and institutions should consider: parental support, parents' education and income, educational goals (Oncu, 2011), precollege academic success, college-preparatory curriculum, and friends attending college. For minority students, background variables include support from the extended family (Erichsen, 2011), church, and community, and previous positive interracial/intercultural contact; for nontraditional students these include support from a spouse and employer (Githens, 2010).

Theories of Student Retention

Scholars have long held an interest in retention rates, in part because remaining in college is a complex human behavior related to status attainment, self-development, and the development of human capital and because college is a place where theory could affect practice (Tinto, 1987). Retention studies are important to institutions because institutions that can maintain or raise their retention rates survive and prosper (Bandura et al., 1996).

Because student retention occurs over time, theoretical models tend to be multifaceted and contain several categories of variables that reflect both student and institutional characteristics. Theories of departure provide an explanation of why students leave college. In contrast, the models of departure identify factors related to retention without explaining why the factors act the way they do. The terms *theoretical models* and *models* are used interchangeably in the literature.

Student-retention models contain a large number of variables, often set in a causal pattern. A variable could either affect retention directly, or some other variable that, itself, indirectly affects retention. For example, high school grades could directly affect rates of retention (e.g., the higher the high school grades, the higher the rate of retention).

While the study of persistence and retention in distance education is not new, the study of e-learning retention is. Most models of retention were based on retention research of campus-based traditional and nontraditional learners. The major theorists were Tinto (1982, 1987) and Bean and Metzger (1985). Boyles (2000) concentrated on retention in the community colleges. According to Bandura (1997), Bandura and Adams developed models that explained student persistence through motivation.

Tinto's Model of Student Integration

According to Tinto's (1975, 1993) model of student integration, college students persisted and remain enrolled in college courses because of their social and academic attachments. Tinto's model explained that students enter college with family, individual attributes, and prior education. They also enter with commitments to staying at their institution until graduating. They enter an academic system characterized by grade performance and intellectual development, which together lead to academic integration

and a social system in which peer-group interactions and faculty interactions lead to social integration. In effect, academic and social integration work together to influence ongoing goal and institutional commitments, and this leads to the decision to remain in or to leave college.

Tinto (1987) claimed that the development of effective educational communities was the key to retention. These communities give students the ability to forge personal bonds with others. Students forge such bonds when the needs and interests of individuals are compatible with the intellectual atmosphere of the institution or its academic culture. Such academic integration was thought to be the result of sharing academic values; social integration is the result of friendships with other students and faculty members. In Tinto's model, a student who does not achieve academic or social integration is likely to leave school.

Tinto's later model (1993), similar to his earlier ones, offered another explanation of student departure: failure to negotiate the rites of passage. According to this theory, students remain enrolled if they separate from their family and high school friends and identify with and assume the values of other students and faculty. The importance of social and academic integration to student progress in distance education is supported by application to different sets of institutions, courses, and students (Kember et al., 1994).

Most studies about the building of online communities have found that academic communities are important to persistence. Harris and Muirhead (2004) examined online community learning and networks and concluded that most studies supported the importance of engagement, bonding, communications, and therefore persistence. Harris and Muirhead found that frequency of exchanges, a strong sense of trust, and efforts to

listen and respond to communication gave online students a sense of community. Communications did not have to pertain to the course, could be driven by the instructors or students, and thus led to bonding and to a sense of belonging (Harris & Muirhead, 2004).

Bean's Model of Retention for Nontraditional Students

In contrast, Bean and Metzger's (1985) student attrition model suggested that students' commitment to learning is a significant predictor of their persistence. Bean and Metzger's model, based on empirical and theoretical studies published in the 1980s regarding turnover in work organizations, evolved into one where the overall structure was based on a psychological model that linked retention (a behavior) with similar past behavior, values, attitudes, and intentions. Bean and Metzger's model differed from Tinto's (1975, 1993) in two important ways: it included that environmental variables (factors outside of the college that might affect retention) and student intentions were found to be the best predictors of student retention.

Bean and Metzger's (1985) model, originally used to describe traditional-age students, stated that background variables, particularly students' high school experiences, educational goals, and family support, influenced the way they behaved in their courses. After matriculation (as in Tinto's [1975, 1993] model), a student interacted with members of the academic and social arena. According to Bean and Metzger, students also interacted in the organizational area and were simultaneously influenced by environmental factors, such as wanting to be with a significant other at another school or running out of money. Students' interaction with the institution led to the development of a set of attitudes about themselves.

To assess students' academic capabilities (as indicated by grade point average), institutional integration, and loyalty to courses, institutions should develop a model of student retention for nontraditional students. Bean and Metzger's (1985) ideas are appropriate as they reduce the emphasis on social-integration factors and because nontraditional (older, working, commuting) students have less interaction with others on campus than do traditional, residential students.

Boyles's Model of Student Retention in the Community College

Reviewing the research and theoretical literature has revealed the complexity and multidimensional nature of persistence and retention. As an example of a model developed to accommodate e-learning in the community college, the model of Boyles (2000) consisted of three sets of variables: background, environmental, and academic. It contained seven singular variables: academic self-confidence, academic integration, academic outcome (grade point average), institutional size, social integration, psychological outcomes, and utility. This model was based primarily on the Bean and Metzger (1985) path model with additional variables such as institutional size, academic self-confidence (Napoli & Wortman, 1998; Webb, 1989), and academic integration (Pascarella & Chapman, 1983). This model was designed to address retention issues that were most relevant at the institutional (particularly the community-college) level.

Student Retention Model for E-Learning

Berge and Huang (2004) developed a model for student online retention with shared and general themes. The model addressed personal, institutional, and circumstantial variables. In personal variables, one emerging theme from recent research was students' learning characteristics: some students are better suited for distance

education than others. Successful distance learners have a high degree of self-regulation and motivation, enjoy self-pacing, and possess an internal locus of control (Tallent-Runnels et al., 2006). Boyd (2004) described students who are best suited for and most likely to succeed in online education as highly motivated, independent, active learners who have good organizational and time-management skills and who adapt well to new learning environments. In institutional variables, Berge and Huang's model proposed that institutions foster integration through support services and management that enhance academic and social experiences of students. In addition, the model advocated better online-support services, staff development, and academic advising. Berge and Huang advocated for easing the transition of students into the institution. In circumstantial variables, Berge and Huang encouraged institutions to assess the perceived utility and satisfaction of students to make improvements.

Success Factors for Students Online

Increasing retention and course satisfaction of online learners is of significant financial and strategic concern both for institutions of higher education and students. By understanding the motivation of students in the online environment, colleges and universities can increase the retention of students taking online courses and hence maximize their revenue and allocate their funding more wisely (Bandura et al., 1996).

Three areas of literature explained many of the psychological, social, and environmental factors that contributed to a student's success in the online environment. These three areas were personal characteristics, motivation, and environmental influences (see Figure 5). Three bodies of literature support the multidimensional aspects of successful online students.

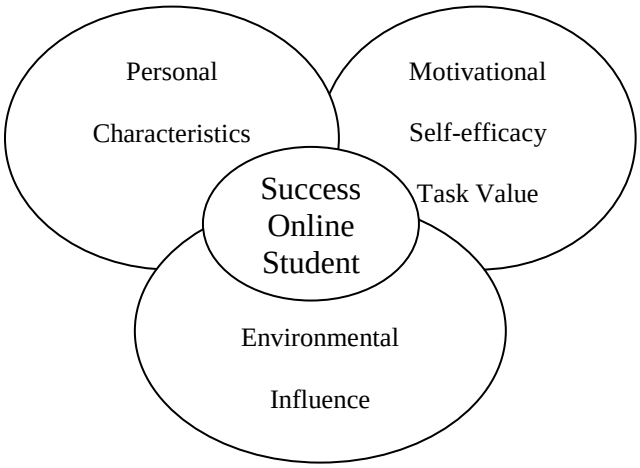

Figure 5. Student-success model of online learning.

Personal Characteristics of Successful Online Students

The first factor that influences online student success is the personal characteristics of the student. The literature indicated that there are many characteristics that influence cognitive activity. For example, Hill, Song, and West (2009) identified epistemological beliefs (views about learning and knowledge), individual learning style, self-efficacy, motivation, and prior knowledge as important personal characteristics.

The first personal factor was individual beliefs. According to Hill, Song, and West (2009) as students' experience the online environment, personal epistemological beliefs about how knowledge is constructed and evaluated changes because the students are reflective thinkers who tend to change and respond to their environment. Tsai and Chuang (2005) found that students with constructivist-oriented beliefs tend to prefer Internet-based learning. Such students want to engage in inquiry learning, work on open-ended tasks, and link prior knowledge. Students with constructivist-oriented beliefs probably prefer to engage in higher-order metacognitive activities such as examining and

monitoring their own ideas (Tsai & Chuang, 2005). In addition, the belief in autonomy and equity found in the online environment seems to be attractive to some learners. For instance, Tait (2000) wrote that some online learners prefer the virtual classroom precisely because they feel more confident and competent to participate in class discussions from a distance, rather than in a conventional classroom, because the conventional classroom could be dominated by the teacher and a few outspoken students.

Personal beliefs influence a wide range of thinking and decision-making processes. For example, Boyd (2004) discussed the importance of students' own initiative, assertiveness, self-discipline and ability to self-regulate as important personal characteristics. Students who are successful have the ability to self-direct their learning and have a "desire for more control over one's learning environment" (Boyd, 2004, p. 35). Successful online students can quickly move through activities; prefer independent, self-paced instruction; and have a high sense of motivation (Boyd, 2004). Successful online students have a good understanding of their ability to manage time, be free of distractions, and plan ahead to distribute their time effectively (Boyd, 2004).

The second factor in success was learners with learning strategies and associated skill levels that make them successful in the online environment (Boyd, 2004). The various techniques used to process information and help make sense of the information include copying notes, paraphrasing, outlining, comparing, reading aloud, and discussing course content with classmates. Associated skill levels include appropriate use of computer technology such as the ability to download and install software, e-mail, navigate well through the Internet, use search engines and databases for library research, and know how to participate in Web-based discussions (Boyd, 2004). Academically,

successful online students have "well-developed writing skills such as spelling, grammar, and a good grasp of basic English" (Boyd, 2004, p. 36).

The third factor was learning styles, such as image or analytic-oriented students (Hill et al, 2009). Grasha (1996) defined learning styles as personal qualities that influence a student's ability to acquire information, interact with peers and the teacher, and otherwise to participate in learning experiences. Different students tend to process information in different ways.

Only a few studies have been conducted on the relationship of learning styles to success in a distance-education environment (Diaz & Cartnal, 1999; Graff, 2003). Saba (1999) concluded that distance courses require students to take greater responsibility for their learning by identifying their own learning style. Dille and Mezack (1991) used Kolb's Learning Style Inventory to measure student learning-style preferences in bipolar dimensions and found students who needed fewer concrete learning experiences and preferred to look for abstract concepts performed better in community-college telecourses than did students exhibiting other tendencies on the Learning Style Inventory.

A fourth factor cited by researchers such as Romainville (1995) and Bessant (1997) was that successful students are more aware of the learning strategies and procedures they use. The researchers found a significant correlation between learning strategy and learning results. Online distance learners needed to manage their learning much more and in this way often were required to be more self-directed and monitor their own thinking and actions as they work toward the objectives of the course.

Zimmerman (2005) suggested that learning motivation, learning strategy, self-efficacy, and attribution of success and failure were all important psychological variables

in this kind of learning. Artino (2008) suggested, through several multiple-regression analyses, that task-value beliefs were the most consistent indicator of online-course satisfaction and metacognition and that students who reported being bored or frustrated with a class were less likely to be motivated.

Self-Determination Theory: Intrinsic and Extrinsic Motivation

Martens, Bastiaens, and Kirschner (2007) stated, "Motivation appears to be the heart of the matter in constructivist learning" (p. 82). Two types of motivation—intrinsic and extrinsic—seem to contribute to successful online learning (Ryan & Deci, 2000). Intrinsic motivation refers to doing something for the inherent satisfaction of the activity itself, whereas extrinsic motivation is the performance of an activity to attain some separable outcome (Martens et al., 2007).

Intrinsic motivation is the tendency to engage in tasks because the learner finds the activity interesting and enjoyable (Martens et al., 2007). Because learners find the activity interesting, they are influenced in a positive way, according to individual preferences. For example, the learner may be more self-regulating, more focused, concentrate more, and use a repertoire of strategies to manage the challenges. Hence, the combination of skills, activity, and perceived challenge of the activity are important for sustaining the motivation (Ryan & Deci, 2000).

Ryan and Deci (2000) proposed the self-determination theory, in which they integrated two perspectives of human motivation: maintaining an optimal level of stimulation and having a basic need for competence. Ryan and Deci argued that a learner would seek challenging activities and find these activities intrinsically motivating because they have a basic need for competence. In addition, learners with more intrinsic

motivation would tend to persist at difficult problems and learn from their mistakes because of their engrossment in the activity (Pajares, 2002). Intrinsic motivation is central for the integration process through which elements of the learner's existing internal knowledge are integrated with new knowledge. Intrinsic motivation is a critical component of a learner's task-value beliefs (Eccles & Wigfield, 2002).

In contrast, extrinsic motivation is the tendency to engage in tasks outside of an individual's own interest level for a reward, such as money or grades (Martens et al., 2007). The rewards provide satisfaction and pleasure, which the task itself may not provide. Extrinsically motivated learners will work on an assignment even when they have little interest in it, or may find it boring because of the anticipated satisfaction of receiving the reward (e.g., passing an examination or getting a good grade). An extrinsically motivated learner may or may not get any pleasure from working on or completing a task. Extrinsic motivation can also be negative, such as avoidance of a bad grade or avoidance of the consequences of getting the bad grade. However, the external reward will keep such a learner on task even when the task holds little or no interest (Martens et al., 2007).

Flow Theory

Csikszentmihalyi (1988) defined intrinsically motivated behavior in terms of the degree of engagement a learner has with that activity. For example, expert chess players, composers, or writers describe their experiences as being in a fully engaged state. In this state, individuals characterize themselves as having an integrated feeling of being immersed in and carried by an activity with all their attention. Flow is only possible when people believe tasks that need to be performed in a given situation match their abilities to

master those challenges (Eccles & Wigfield, 2002). Skills, activity, and perceived challenges of the activity are important to achieve flow. Flow is seen as the ultimate in SLR. Through flow, the ability to concentrate and perform is very much enhanced.

Motivation and Performance of Distance-Education Students

The link between academics and motivation was demonstrated by Visser, Plomp, and Kuiper (1999) after being investigated in a study. Given that learners have a variety of educational needs, they may face a variety of motivators, ranging from formal pressures (e.g., job and family) to personal interests and idiosyncrasies (Krentler & Willis-Flurry, 2005; MacBrayne, 1995). Aviv, Erlich, and Ravid (2004) presented several reasons why distance learners appreciate the online environment, such as connectivity and support from others. The most frequent reasons cited in the study by Aviv et al. were career, family, work, and study.

Among distance learners, motivation was mentioned several times as a factor in student success (Hill et al., 2009; Tyler-Smith, 2006). Motivation has been shown to predict academic success in both face-to-face and distance education (Tyler-Smith, 2006). For instance, Y. Wang, Peng, Huang, Hou, and Wang (2008) suggested that important psychological characteristics of distance learners include learning motivation, self-efficacy, attributions, and learning strategy. Y. Wang et al.'s study of 135 distance learners found that self-efficacy had an indirect positive predictable effect on learning results. Y. Wang et al. further demonstrated that learning motivation was associated with positive and predictable effects on learning results.

A review of distance-education literature revealed that learners tend to be nontraditional and constrained by adult responsibilities but that their motivational style is

not well understood and presents a somewhat contradictory picture. Qureshi, Morton, and Antosz (2002) found that distance-education students were less motivated than their on-campus counterparts. In contrast, Dutton et al. (2002) found online and traditional students were likely to have the same motivation to complete a course. Recently, in a study with 72 online English students, Y. Wang et al. (2008) reported that self-efficacy had a moderating effect and significantly (23%) explained positive performance. However, the picture becomes less clear because moderating variables such as course expectations; professors' empathy, time, skill deficiencies; and the learners' experience online complicate inconclusive findings research on the nature of the online academic self-concept (Gibson, 1996).

Zhang and Nunamaker (2003) suggested that the ability to manage one's own learning is closely connected with having both strong computer skills and motivation. Joo, Bong, and Choi (2000) cited learners' computer self-efficacy as an important factor in network learning results. Jegede, Taplin, Fan, Chan, and Yum (1999) carried out comparative research on attributes of distance learners, dividing students into a high grades/scores group and a low-grades group. They discovered learners with the need for high grades showed more self-reliance and confidence, and this attribute was related to use of learning strategies that improved learning results.

Motivation and Self- Regulation

Students who choose distance education need a high level of self-regulation and motivation (Artino, 2008; Kramarski & Gtuman, 2006). Self-regulation was defined as "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2005, p.14)

The main components or subareas that fall under the umbrella of self-regulation are motivation (self-efficacy), metacognition, and cognition (Schraw et al. 2006; see Figure 6). Motivation involves "beliefs and attitudes that affect the use and development of cognitive and metacognitive skills" (Schraw et al., 2006, p. 112). Metacognition plays an important role in self-regulation and includes skills that enable learners to understand and monitor their cognitive processes (Zimmerman, 2005). Cognition includes skills necessary to encode, memorize, and recall information.

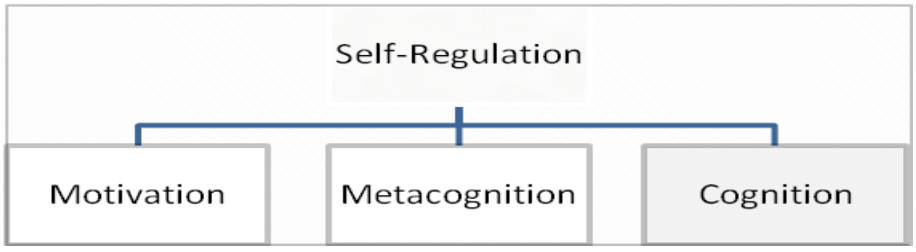

Figure 6. Components of self-regulation. Adapted from "Promoting Self-Regulated in the Science Education: Metacognition as part of a Broader Perspective on Learning," by G. Schraw K. H. Crippen, and K. Hartley, 2006, Research in Science Education, 36, p. 111-1139. Copyright 2006 by Springer.

Motivation and Self-Efficacy

Howell et al. (2003) described online students as learners who work by themselves, with little or no opportunities for peer or face-to-face interaction. These students deal more often with abstract and ambiguous situations than students who take face-to-face courses. To be successful, these students need to be responsible, be in control of their studies, and maintain a sense of self-worth and self-efficacy. Self-efficacy is thought to play a large role in the amount of effort a person gives, the amount of determination a person presents in the face of challenging tasks, and a person's

persistence in coursework (Bandura, 1991, 1997; Bandura & Adams, 1977; Bandura, Adams, & Beyer, 1977). Self-efficacy allows an individual to develop self-perceptions of capability that become extended into the goals they pursue and to the control they are able to exercise over their environments.

Self-efficacy has been defined as a person's confidence in his or her ability to organize and execute a given course of action to accomplish a task (Bandura, 1997). For instance, an individual with high self-efficacy feels capable and believes in his/herself. This belief in self-capabilities allows individuals to set higher goals for themselves and be more firmly committed or motivated to keep to such goals (persist). Hence, self-efficacy contributes to higher levels of motivation and persistence (Bandura, 1997).

Bandura, Reese, and Adams (1982) viewed individual learning in terms of internal beliefs, behaviors, and the environment, influences thought to be reciprocal and interactive in that each would influence the others. Behavior and self-regulation processes are best predicted through the combined influence of one's belief in the ability to perform a task (self-efficacy) and the results anticipated from having performed the tasks (outcomes expectancy; Bandura, 1991, 1997; Bandura & Adams, 1977; Bandura, Adams, et al., 1977; Bandura & Bandura, 1995).

There are four major sources that influence the development or formation of self-efficacy in an individual: (a) past experiences or performances (mastery), (b) observations (vicarious experiences), (c) social or verbal persuasion, and (d) internal judgments individuals make about themselves (Artino, 2006). The most important influential source of self-efficacy is mastery experiences (Bandura, 1997).

According to Bandura (1997), self-efficacy is thought to vary in strength and level depending on the individual learner. Consequently, some learners have a strong sense of self-efficacy and others do not. For example, learners with a strong sense of self-efficacy believe they would be effective even in the most difficult tasks, whereas others believe that they are only efficacious on easier tasks. In addition, Bandura described some self-efficacy beliefs to be broad in range, that is, to encompass many situations, whereas others have a narrow range of such beliefs.

Bandura hypothesized that high self-efficacy beliefs can powerfully influence the level of accomplishment, which is in part due to perceived self-efficacy. Perceived self-efficacy is defined as learners' beliefs about their own capabilities to perform a task (Bandura, 1977). In short, self-efficacy—or the belief that learners have about their capabilities—determines how learners behave. Bandura recognized that what learners believe about their capabilities, rather than what they actually do or could do, was a better predictor of accomplishment (Pajares, 2002). A high sense of self-efficacy would allow a learner to create positive feelings of capability, to want to give greater effort, and to persevere in the face of challenges. The amount of self-efficacy learners have helps determine how much they adjust their knowledge and skills to different situations. As a result, confident learners anticipate successful outcomes. The higher the self-efficacy those learners have, the more likely they are to approach a difficult task as a challenge to be mastered. The perseverance associated with self-efficacy is also likely to lead to greater persistence and accomplishment, which raises self-perception or self-appraisal even further. A learners' self-efficacy influences three major areas: confidence, the amount of effort, and emotional states.

Confidence is tied to performance and accomplishment (Bandura, 1997). In online education, learning confidence seems to exert an indirect effect on accomplishment by affecting the level of learning strategies used by the learner (Y. Wang et al., 2008). Learners are more positive about working on a task if they believe the task can be done successfully and will avoid or reduce their effort and energy on tasks if they believe they will not succeed (Y. Wang et al., 2008). On the other hand, learners who have high self-efficacy and believe they can succeed will put more energy into their efforts and use a repository of skills to achieve what they believe can be done. The degree of self-efficacy can influence the choices a learner can make with respect to the selection of tasks. Learners usually tend to select a task or activity in which there is some feeling of competence and confidence, while avoiding tasks about which they feel unsure (Pajares, 2002). An overestimation of self-efficacy, beyond one's ability, may lead to a tendency to overestimate one's ability to complete tasks, which can lead to failure and reduced self-efficacy. The ideal level of self-efficacy is slightly above one's ability, which encourages learners to tackle challenging tasks and gain valuable experience. Thus, ideal learning is thought to occur when a balance exists between challenge and competence.

The amount of effort a learner attempts on a task relates to self-efficacy. A learner with a strong sense of personal competence will most likely approach a task as challenging and something to be mastered rather than a threat to be avoided (Pajares, 2002). Moreover, according to Pajares (2002), such learners are able to more "quickly recover their sense of efficacy after failures or setbacks, and attribute failure to insufficient effort or deficient knowledge and skills that are acquirable" (p. 5). A learner with high self-efficacy will more likely be able to persevere, with a greater degree of

effort in the process of confronting obstacles, and be more resilient in the face of challenging situations.

A learner's emotional states are also influenced by the level of self-efficacy (Bandura, 1997). A learner with a strong sense of self-efficacy will approach challenging tasks with feelings of calmness and composure (Pajares, 2002). The opposite is thought to occur in a learner with a low sense of self-efficacy; such learners believe things are more difficult than they actually are, thereby producing negative emotional states such as frustration, anxiety, apprehension, stress, and depression. Negative internal feelings could lead to a sense of hopelessness, which would lead to a confined or restricted vision of how to solve a problem. When learners experience negative thoughts and fears about their capabilities, it can lower their perceptions of self-efficacy and trigger feelings of agitation and fear. People live in their own psychological environments that are primarily of their own making (Bandura, 1997).

The concept of self-efficacy also helps explain the discordance between learners' capabilities and accomplishments (Pajares, 2002). For example, many highly capable learners' who suffer from low self-efficacy may not accomplish as much as learners' possessing a modest range of skills but higher self-efficacy because the low self-efficacy makes the learners feel that things are more difficult than they really appear.

Self-Efficacy and Outcome Expectancy

The concept of self-efficacy put forth by Bandura (1997) centers on a learner's expectancies for success. There are two types of expectancy beliefs: outcome expectations and efficacy expectations. Outcome expectations are related to the belief that certain kinds of behaviors will lead to certain types of outcomes (Eccles & Wigfield,

2002). In contrast, efficacy expectations are associated with beliefs about whether one can effectively perform the behaviors necessary to produce the outcome, such as, "I can practice hard enough to do well on a test." According to Eccles and Wigfield (2002), these two types of behavior are different because a learner can suppose a certain behavior will produce a certain outcome (outcome expectancy) but may doubt he or she can perform that behavior (efficacy expectation).

Both self-efficacy and outcome expectancy are part of the cognitive process that precede one's action because self-efficacy is a perception of oneself capably performing a behavior, while outcome expectance is the perception of the purposefulness and meaningfulness of doing that behavior. These two types of cognitive perceptions subsequently influence the person's actual performance of a task. Self-efficacy influences the choices people make, their aspirations, how much effort they put into achieving the task, and how long they persevere in the face of difficulties (Bandura & Adams, 1977; Bandura, Adams, et al., 1977). Bandura, Adams, et al. (1977) demonstrated that adults with high self-efficacy tend to have higher, stronger, and greater expectations of outcomes. Bandura, Adams, et al.'s research also found that self-efficacy could be an accurate predictor of performance on tasks of varying difficulty with different threats or obstacles. Outcome expectancy influences the amount of effort one puts into achieving a task, the amount of satisfaction one derives from completing the task, and one's eagerness to move on to a similar or more difficult task.

Academic retention and success are linked to the ability and willingness of students to use effective learning strategies (Nicholls, 1984), and this is a reflection of their own self-efficacy (Bandura, 1997; Bandura et al., 1982). Self-efficacy and

attribution also have a positive effect on learning results and are connected to motivation and learning strategy. Learners with high self-efficacy are more confident and have more ambitious learning objectives. This often means that learners participate more actively in learning and use certain learning strategies to achieve their objectives. This, in turn, may improve their learning results. Attribution refers to learners' cognition and explanation of their learning behavior, and this explanation is closely correlated with the learner's motivation and self-efficacy (Gibson, 1996). Therefore, it can be hypothesized that if a distance learner attributes the failure or success of learning to internal factors such as effort or competence; it may be possible to use this to modify their learning motivation, confidence, and concept of distance learning. This also can be a vehicle for improving self-efficacy.

Bandura's Social Cognitive Theory of Learning

Social-cognitive theory stresses the idea that human cognition plays a critical role in learners' beliefs and capability to interpret and plan alternative strategies (Pajares, 2002). The ability to plan alternative strategies, choose a course of action, and make a decision to change behaviors comes from the learner's prior experiences, his or her estimations of his or her skills and knowledge, and self-regulation (Bandura, 1991; Pajares, 2002). According to Pajares (2002), self-efficacy beliefs can predict "how much effort people will expend on an activity, how long they will persevere when confronting obstacles, and how resilient they was in the face of adverse situations" (p. 5).

According to Bandura, learning occurs through a reciprocal and dynamic interplay of personal, behavioral, and environmental influences (Foust, 2008; see Figure 7). Personal factors include a learner's beliefs, expectations, attitudes, and prior

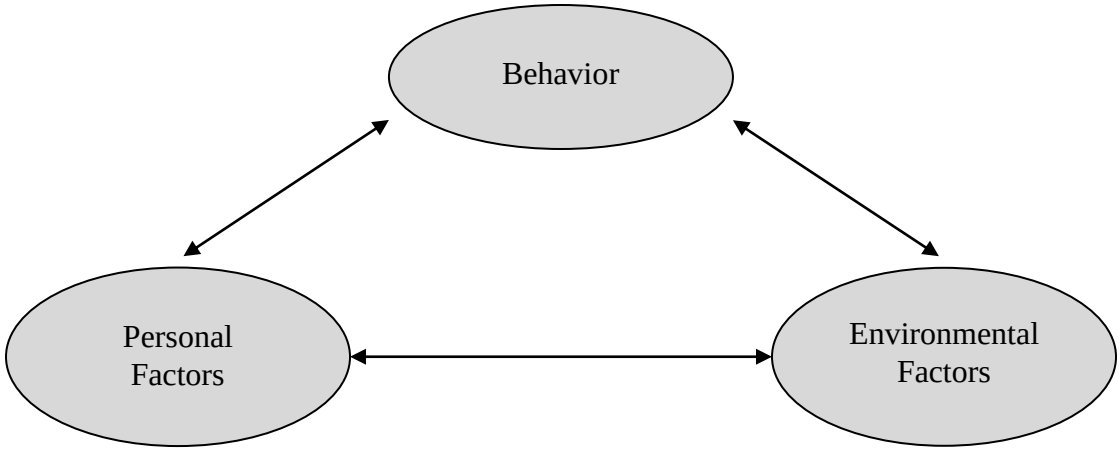

Figure 7. Bandura's social-cognitive theory. Adapted from "Learning Strategies, Motivation, and Self-Reported Academic Outcomes of Students Enrolled in Web-Based Coursework," by R. A. Foust, 2008, unpublished doctoral dissertation, Wayne State University, Detroit, MI.

knowledge; these characteristics influence the choices that was made and the outcomes of learning. Learners are viewed as proactive, self-organizing, self-regulating, and self-reflecting entities rather than just reactive entities (Pajares, 2002).

Behavioral factors include prior performance and aspects of learning, such as the social and physical environment (the types of resources available, interactions, and physical settings). For instance, learners can develop and strengthen a sense of self-efficacy through social persuasions and interactions with peers or mentors (Pajares, 2002); verbal statements from others can come in the form of verbal judgments that empower and encourage a learner's sense of self-efficacy.

Environmental factors are related to the students' actions, choices, and interactions such as quality of instruction, teacher feedback, access to information, and help from peers and parents. For instance, a lack of direct support and one-on-one student

interaction may lead a learner to develop feelings of isolation (Tinto, 1975). Thus, a lack of class support, such as financial aid, may lead students to consider not persisting.

Self-Regulated Learning and Metacognition

Metacognition is a self-regulatory strategy that an individual can use to examine and think about his or her learning process along the lines of how and when to use various resources such as budgeting time, monitoring effort, and planning (Schraw et al., 2006; Zimmerman, 2005). Zimmerman (2005) stated that metacognition is commonly "construed as the awareness individuals have of their personal resources in relation to the demands of particular tasks, along with the knowledge they possess of how to regulate their engagement in tasks to optimize goal-related processes and outcomes" (p.752). Metacognition, for example, may include a student thinking, "What will I need to do well on this exam?" or "I am going to study 10 hours or perhaps I'm going to study a particular area." Those individuals, who typically do well, usually engage their thought processes about how much time it takes to learn. Students with a high degree of metacognition are better able to assess the demands of a specific learning situation and then select strategies that are most appropriate for that situation (Schraw et al., 2006).

There are three components to metacognition: planning, monitoring and evaluation (Schraw et al., 2006). Planning involves selecting effective and appropriate strategies such as goal setting, budgeting time, and including relevant background information (Schraw et al., 2006). Individuals who can plan their actions ahead of task performance generally can progress well. Monitoring comprises self-testing skills necessary to control learning, such as individual test items, as well as the overall test questions, such as how do students approach individual items in the context of the overall

test when students are faced with actual tests. Evaluation involves revising goals and re-evaluating personal goals.

Taken together, metacognition, with its several components, involves how an individual manages him- or herself when learning something (Schraw et al., 2006). Metacognition employs management of resources but more importantly involves the undertaking of a higher order self-management by individuals, such as determining what they need to learn and how they want to learn it and then making a plan in order to learn the material (task; Schraw et al., 2006).

Self-Regulated Learning and Self-Efficacy

An important part of Bandura's theory (1977) is the idea that self-efficacy of learners is able to self-regulate their learning. There are numerous studies indicating that self-efficacy beliefs causally influence learners' regulatory processes in academic-learning strategies (Schunk & Schwartz, 1993), academic time management (Britton & Tessor, 1991), resisting adverse peer pressures (Bandura et al., 1996), and self-monitoring (Bouffard-Bouchard, Parent, & Larivee, 1991).

Self-regulation is defined as self-directed change influenced by the environment. Self-regulation suggests that learners have the ability to control their learning by being able to modify their own cognitive practices in response to the environment and personal factors (Boekaerts & Cascallar, 2006; Zimmerman, 2005). Learners are thought to want to make sense of their experiences through a combination of their own self-beliefs, self-reflection, and self-evaluation. After self-reflection, the learner is then able to alter their thinking and behavior proactively. Thus, SRL involves a triadic reciprocal exchange involving personal, behavioral, and environmental influences (Pajares, 2002).

SRL suggests that learners are partly intrinsically motivated and strategically practice cognitive processes with a certain goal in mind (Winne & Perry, 2005). Strategic practices are associated with the way learners approach challenging problems, specifically by choosing from a range of techniques they believe are best suited to the situation and applying them properly (Winne & Perry, 2005). According to Pintrich (1995), the important difference between a self-regulated learner and another student is that a self-regulated learner is "aware of her loss of attention and comprehension and go back and repair her deficiency by rereading the material" (p. 6). In short, learners will adjust their responses to stimuli and are moved by reflection, which then triggers the learners to construct their meaning (Zimmerman, 2005).

SRL has been shown to be moderated by varying degrees of the learner's own sense of perceived self-efficacy, prior experiences, metacognition, emotions, task value, elaboration, and interest levels (Boekaerts & Cascallar, 2006; Zimmerman, 2005). What differentiates effective from ineffective self-regulation is both the quality and quantity of the strategies that are implemented by the learner (Zimmerman, 2005). There are three general strategies that are employed by students involved in SRL: cognitive strategies, self-regulatory strategies in cognition control, and resource management strategies (Pintrich, 1999). However, no self-regulatory strategy will work equally well in all circumstances or all individuals. Self-regulation requires continuous adaptation by the learner depending on the context (Zimmerman, 2005).

Self-Regulation and Cognition

In cognitive strategies, SRL learners use primarily three main types of strategies: rehearsal, elaboration, and organization (Pintrich, 1999). Rehearsal strategies refer to

approaches such as saying the words out-loud, or highlighting or underlying text items. Rehearsal strategies help the learner select information from lists or text material and keep information in working memory (Pintrich, 1999). Second, elaboration strategies involve paraphrasing, summarizing, creating analogies, explaining the material to someone else, and generative note-taking, where the learner actually reorganizes and connects ideas (Pintrich, 1999). Third, organizational strategies involve such approaches as outlining the text material, selecting the main idea from the text, and sketching a map of important ideas.

In self-regulatory behavior in SRL, there are three main methods used by learners to control cognition: planning, monitoring, and regulating. Planning seems to help the learner prepare how they are going to approach the material and also seems to activate the use of prior knowledge to more easily organize and comprehend the material. Different approaches to planning include generating questions before reading the text, setting goals for studying, and skimming the text before reading.

Monitoring strategies entail the use of self-corrective approaches that warn the learner of impending cognitive failure against some goal or criteria. For example, monitoring could range from learners tracking their own attention while reading or listening to a lecture, self-testing with use of questions to check understanding, and using test-taking strategies (such as time management and monitoring their speed in answering problems) during an examination (Pintrich, 1999).

Regulating strategies in SRL are methods such as reviewing and rereading material in order to monitor comprehension or slowing down the reading pace in order to

comprehend the material better. Such methods are thought to correct and repair understanding in areas where there is a gap, thereby enhancing learning.

A person's willingness to undertake and persist with their self-regulating efforts depends especially on self-efficacy, which refers to the beliefs about their capability to plan and manage (Zimmerman, 2005). For example, one of the ways learners can self-monitor is by making comparisons—not to other students but to their own performance (Pintrich, 1995). By focusing on their personal performance, learners can focus on the mastery of the material rather than competing with others. If learners can concentrate on their own learning and begin to see how their effort can make a difference in their performance, then their self-efficacy will improve and they may become less anxious about tests (Pintrich, 1995). Thus, the SRL view turns the teacher to facilitation rather than transmission of knowledge by creating an environment that encourages intrinsic motivation and gives learners a sense of belonging in that environment (Boekaerts & Cascallar, 2006).

Self-Regulated Learning in the Online Environment

SRL leads researchers to understand, in part, the how behind the online learner's ability to acquire knowledge and skills in the online class (Artino, 2008; Artino & Stephens, 2009). Some students tend to self-regulate more than others because they are more aware of what is meaningful for them (Boekaerts & Cascallar, 2006). Students, whose goals are consistent with their own values, needs, and interests, are more capable of sustaining themselves and of attaining goals (Boekaerts & Cascallar, 2006). In addition, sometimes learners, in response to task failure, adjust by becoming more aware of other options or paths that would allow them to be successful (Shah & Kruglanski,

2000, p. 104). These newly generated ways of doing assignments allow the learner to see other means of attainment previously not recognized. As a result, despite initial failure, learners may become aware of new ways to make goals more possible.

Artino's (2008) model for online learners' motivation is based on Bandura's (1997) social-cognitive model. Both models see the learner as an active agent who self-regulates in order to fit someone else's expectations (Boekaerts & Cascallar, 2006). The adaptive nature of SRL is partially due to the feedback learners receive from their environment, peers, and instructor (Schunk, 1989). Schunk (1989) found that some learners had an adjustment system that modified their potential achievement and self-efficacy as a result of feedback. Active learning leads to knowledge, which has personal meaning to the learner, and encourages self-monitoring, which results in learners regulating their learning. The two models also agree that meaning and interpretation are both heavily influenced by prior knowledge.

At the same time, the two models differ in their emphasis on the learning environment or context of the learner's ability to self-regulate. In Artino's (2008) model, more emphasis is placed on the influence of the learning environment on the learner's emotions and behaviors. Prior knowledge is used to interpret the information and construct meaning from the online environment, which influences adaptive behavior and emotions (Schunk, 1989).

Second, in contrast to Bandura's (1997) model, Artino's (2008) SRL model suggests that personal beliefs, emotions, academic behaviors, and use of learning strategies are influenced by the learning environment or context (e.g., an online classroom or course environment). The learning environment affects both the student's

learning and specific aspects of self-regulation (Boekaerts & Cascallar, 2006). Moreover, consistent with social-cognitive theory, Artino's (2008) model assumes that students evaluate learning environments differently and perceive them in their own way. As a result, distance learners perceive and experience the same online environment/context differently. The outcome is that distance learners' subjective perceptions of the environment shape their beliefs, emotions, and academic behaviors (Roeser & Gehlbach, 2002). However, this is not to suggest that the students' subjective perceptions of the environment are permanent or static; the formed perceptions—as well as the objective environment itself—can change with students' thoughts, feelings, and actions (Bandura, 1997).

A Model for Self-Regulated Learning Online and Task Value

The model of SRL proposed by Artino (2008) in the online environment has three main components: the influence of personal factors, self-regulation, and the learning environment. Pintrich (2000) and Zimmerman (2005) also suggested these components in their models. Duncan and McKeachie (2005) argued that personal components of self-regulation are not static traits but rather that "motivation is dynamic and contextually bound and . . . learning strategies can be learned and brought under the control of the student" (p. 117). Consequently, students' motivations and emotions can change from course to course and vary depending on their interest and their sense of self-efficacy (Duncan & McKeachie, 2005). For instance, the more value a course has to a student in terms of the student's sense of future use the more that student's motivation would be enhanced. In addition, Duncan and McKeachie suggested that a learner's use of strategy

would vary depending on the nature of the academic problem, such as multiple-choice versus essay questions.

Depending on the nature of the online course and its relevance to individual students, the extent to which students use adaptive self-regulatory behaviors may vary (Boekaerts & Cascallar, 2006). For example, a student majoring in pharmacy or pre-medicine and completing an online course in pharmacology might value the course more than a non-pharmacology or non-science major would because pharmacology students perceive the course to be of practical use and thus pertaining to their future employment. As a result, the pharmacy student might be more inclined to be more adaptive and to take advantage of learning strategies, such as actively linking new information to prior knowledge (elaboration) and using those strategies in metacognition (e.g., planning, goal setting, and monitoring of comprehension). Thus, the student's perception of the future usefulness of the course, or task value, can influence self-regulatory perceptions and behaviors online.

Task value is particularly important to the student's ability to self-regulate learning (Zusho, Pintrich, & Cuppola, 2003). Artino and Stephens (2009) studied 481 undergraduates learning about aviation physiology in an online course and found task value to be important to SRL. Specifically, students who reported that they were planning to become aviators upon graduation from the academy reported higher mean scores on measures of task value and self-efficacy than did their nonaviator counterparts. Effect sizes for the differences were moderate (Cohen's $d = 0.60$ and 0.56 for task value and metacognition, respectively; Cohen, 1988).

In addition, the online-learning environment may have unique features that influence personal perceptions and behaviors. In a descriptive case study of six graduate students in an online technology course, Whipp and Chiarelli (2004) found that some components of the online environment, such as instructor support, peer support, and course design, were influenced by students' SRL strategy use. For instance, students stated that the constant presence of the teacher and peers in the online-discussion forums was an incentive for continued participation in the discussions. Furthermore, the results revealed variations of traditional help seeking and peer-assistance behaviors that seemed to result, in part, from the unique behavior of the student in the online classroom. For example, several students regularly used their peers' online discussion posts to plan and shape their own work (Whipp & Chiarelli, 2004).

Consistent with Whipp and Chiarelli's (2004) findings, Artino's (2008) self-regulated model highlights specific features of the online environment and its relationship to important aspects of academic self-regulation. Indeed, the association between the environment and behaviors are thought to work together to enhance one another. This synergy between the environment and online behaviors means that not only does the environment influence students' behaviors but also that those students' behaviors actually influence aspects of the environment. For example, students can find extra time to study online materials and use online tools such as online discussion boards, chats, and e-mail (Dabbagh & Kitsantas, 2005). In essence, the importance of the online instructional environment and its influence on components of self-regulation are critical for understanding how students learn and perform online (Whipp & Chiarelli, 2004).

The Influences of Emotion on Self-Regulation

Learners' emotions have the ability to influence the amount of self-regulation that occurs (Boekaerts & Cascallar, 2006). Studies show that learner' perceptions of positive or negative environmental cues and their interpretation of the experience can affect their achievement. Boredom, anxiety, hopelessness, and anger have a negative impact on self-regulation, unless such emotions can be somehow mediated by the learner (Boekaerts & Cascallar, 2006). In contrast, positive emotions such as joy, feelings of relaxation, and relief can increase self-regulation and lead to a higher level of achievement.

In situations where the activity is perceived as unfamiliar and challenging and is relevant to the learner, intense emotions can arise and emotions may range from highly positive to highly negative, that is, from high levels of excitement to high levels of anxiety towards the new challenge (Wosnitza & Volet, 2005). Depending on the strength of emotions, subsequent actions generated by the students' thought may range from a determination to invest mental energy in the learning process to the adoption of coping strategies to protect well-being and survive the challenge. In contrast, if the activity is perceived as challenging and unusual but of little relevance to the learner, then the student's emotions may lead the learner to either ignore the challenge or quit the activity altogether. In any case, emotional processes have some impact on the learning process (Wosnitza & Volet, 2005).

Another body of literature on emotions related to learning is the work on types of emotions (Pekrun, Goetz, Titz, & Perry, 2002). This literature is extensive but one gets the impression that test anxiety is the only emotion that can occur in the learning environment. The research by Pekrun et al. (2002) and Linnenbrink and

Pintrich (2002) has revealed a broad range of emotions that fall into at least two broad categories: (a) positive emotions (e.g., relief, hope, pride) and (b) negative emotions (e.g., anger, envy, sadness).

Underlying the research on students' emotions is the notion of two different learning environments: independent and social learning situations. In an independent learning situation, such as the online environment, socially oriented emotions are self-directed rather than directed at other people (Wosnitza & Volet, 2005). Examples of emotions that occur in independent learning environments are enjoyment of the online-learning experience, hopes of success, pride, and shame. In a social learning situation, other-directed emotions, such as gratitude, envy, sympathy, admiration, may also arise in addition to self-directed emotions.

Personal Motivational Beliefs and Perceptions

Online students must be motivated to know how and when to employ learning strategies (Pintrich & De Groot, 1990). Artino's (2008) model identified two motivational beliefs. First, students' self-efficacy for learning is important in both traditional and online learning environments (Bandura, 1997). Second, the extent to which students value learning determines the emphasis they place on their task-value beliefs (Eccles & Wigfield, 2002). The extent to which a student relates task value to a particular subject, that is to say, the meaning and interpretation, is heavily influenced by prior knowledge and future career aspirations.

Self-Efficacy Beliefs

In general, highly self-regulated students tend to have greater self-efficacy for learning than those with less-adaptive self-regulatory skills (Schunk, 2005a, 2005b). With

this in mind, several investigations have studied self-efficacy and how it relates to other important variables in online contexts. Generally speaking, when compared to their counterparts with lower perceived self-efficacy—efficacious students report fewer negative achievement emotions such as anxiety, boredom, and frustration (Artino & Stephens, 2009); a greater use of SRL strategies (Artino & Stephens, 2009; Joo et al., 2000), greater satisfaction with their learning experience (Artino, 2006, 2008; Lim, 2001), increased likelihood of enrolling in future online courses (i.e., improved continuing motivation; Artino, 2006; Lim 2001), and superior learning and performance (Joo et al., 2000; A. Wang & Newlin, 2002). Such empirical findings support the theoretical links between students' self-efficacy beliefs and their achievement emotions, SRL behaviors, and academic outcomes, as suggested in the conceptual model (Bandura, 1997).

Task-Value Beliefs

Eccles and Wigfield (2002) defined task value as the extent to which students find a task interesting, important, and/or useful. Like perceived self-efficacy, task-value beliefs are hypothesized to positively impact students' learning and performance. According to Schunk (2005 a, 2005b), "students with greater personal interest in a topic and those who view the activity as important or useful are more likely to use adaptive self-regulatory strategies" (p. 87) when studying a subject. Over the past decade, a few researchers have used task value as a predictor of adaptive outcomes in online settings. The findings have determined that task value is negatively related to students' negative achievement emotions and positively related to their use of cognitive and metacognitive learning strategies (Artino & Stephens, 2009), overall satisfaction (Artino, 2008;

Miltiadou & Savenye, 2003), and continuing motivation (Artino, 2006). Such findings support the theoretical relations between students' task-value beliefs and their achievement emotions, self-regulatory behaviors, and academic outcomes (Eccles & Wigfield, 2002) as presented in the conceptual model (Bandura, 1997).

It is worth noting that researchers believe the links among students' motivational beliefs (e.g., self-efficacy and task value), achievement emotions, and academic behaviors and outcomes to be complementary (Bandura, 1997; Kitsantas, Zimmerman, & Cleary, 2000; Pekrun, 2006). For example, several studies (Artino & Stephens, 2009; Joo et al., 2000) have found students' self-efficacy to be related to adaptive academic behaviors, such as students' use of cognitive and metacognitive strategies during online learning. In turn, by using adaptive learning strategies that result in "deeper and more elaborated processing of the information" (Schunk et al., 2008, p. 226), students are more likely to experience greater academic success in the form of improved learning and better grades. Such behaviors and the resulting positive outcomes subsequently feed back into the system, conveying to students that they are "capable of learning and performing well," (Schunk et al., 2008, p. 127) which enhances their self-efficacy for further learning.

Personal Achievement Emotions and Perceptions

In recent years, several investigators (Linnenbrink & Pintrich, 2004; Pekrun et al., 2002) have described the importance of emotions and their influence on students' engagement and learning. For instance, Pekrun (2006) designed a control-value theory of emotions and achievement. Pekrun suggested that various interrelationships exist between students' motivational beliefs and their emotions, ultimately influencing their

learning and performance. According to Pekrun's theory, positive achievement emotions (e.g., enjoyment and hope) and negative emotions (e.g., boredom and frustration) are partly determined by students' motivational beliefs, or cognitive appraisals. Furthermore, emotions' effects on learning and performance are thought to be partially mediated by several cognitive and motivational mechanisms, such as students' use of learning strategies and their allocation of effort, such as time spent on task (Pekrun et al., 2002).

Of the many categories of motivational beliefs involving emotions related to achievement, two critical components for achievement have been suggested: the perceived controllability of achievement activities, as indicated by competence perceptions (e.g., self-efficacy) and the subjective value of those activities (e.g., task value; Pekrun, 2006). Moreover, Pekrun (2006) argued that the relationship between motivational beliefs and emotions is interrelated: "control and value appraisals are posited to be antecedents of emotions, but emotions can reciprocally affect these appraisals" (2006, p. 327). For example, not only does self-efficacy for learning affect achievement emotions, but negative feelings (e.g., test anxiety) can also influence future self-efficacy beliefs. In fact, according to Bandura (1997), information conveyed by emotions is cognitively assessed by an individual and can positively or negatively influence self-efficacy beliefs, depending on the level of arousal and the person's cognitive appraisal.

Using control-value theory as a framework, a small number of studies involving university students in traditional classrooms found that achievement emotions were related—as predicted—to students' use of learning strategies and various measures of academic performance (Pekrun et al., 2002). For example, the findings indicated that

negative achievement emotions (e.g., boredom and anger) are negatively related to motivational variables (e.g., interest and effort) and measures of learning-strategies use (e.g., elaboration and metacognition), whereas positive emotions (e.g., enjoyment, hope, and pride) are positively related to these same outcomes.

The findings related to online settings are limited; however, they are similar to the results previously described. For example, in a study of two samples of service-academy undergraduates (N = 783), Artino (2008) found that online learners' emotions were related to several adaptive outcomes. In particular, findings from several multiple regressions revealed that students' boredom and frustration were statistically significant predictors of metacognition, with boredom emerging as a negative predictor and frustration unexpectedly emerging as a positive predictor. Meanwhile, enjoyment emerged as a positive predictor of both elaboration and metacognition.

Although inconsistent with Pekrun et al.'s (2002) empirical work, the finding that frustration is positively related to metacognition corroborates the theoretical suggestion that certain negative emotions "may well facilitate the use of specific kinds of learning strategies, even if such effects do not appear in more consistent ways when self-report measures of learning strategies are used" (p. 99). This novel finding is supported by the multifaceted, dynamic interplay among cognition, affect, and behavior described by Linnenbrink and Pintrich (2004). Nonetheless, the results reported by Artino (2008) support the tenets of control-value theory (Pekrun, 2006), indicating that students' achievement emotions are related—in significant ways—to their use of SRL strategies and their online success.

Learning Strategies in the Online Environment

Learning strategies help students make sense of the material they need to master in a classroom. When students review related topics, learning strategies help students relate material and make recalling material more meaningful. Two basic strategies are commonly used. The first type of strategy is organizational, which includes outlining, chunking, and assembling time lines. These strategies are useful for placing different pieces of information into a structured context. The second type of learning strategy is elaboration: prior knowledge and new knowledge are linked and incorporated. Some examples of elaboration strategies are paraphrasing, summarizing, and comparing and contrasting. In summarizing, for example, students share what they know and what they have learned. Some students also will make connections by paraphrasing material that they have learned and what they know. Because every student learns in a different way, there is no single way to teach a topic. Several learning strategies were successful for some students, but not for others. Thus, it is important to incorporate and introduce new methods that will prove helpful to students.

Course Satisfaction

An important area of investigation has been course satisfaction in the online environment. A few variables appear important in students' course satisfaction toward online courses, such as student–faculty interaction (El Mansour & Mupinga, 2007) and computer self-efficacy. Lim (2001) studied 235 online students at five American Universities and found that computer self-efficacy explained 15% of the variance in students' overall satisfaction and 12% of the variance in their intentions to enroll in future online courses. The effect sizes discovered by Lim were moderate; however, Artino

(2008) found much larger effect sizes when attempting to predict course satisfaction (model R^2 = .65) and continuing motivation (model R^2 = .40) using a combination of students' prior experience, task value, and self-efficacy in a self-paced military course.

In an online classroom, instructors must build a method of communication with and among students and then develop computer-mediated communications that students can use to participate in the social exchange of information in a virtual environment. The pedagogical importance of creating and maintaining a method of social interaction in an online classroom is driven by two assumptions. First, the social construction of knowledge through discourse, such as the understanding of concepts and social implications of issues through social dialogue, is thought to enhance student satisfaction. Second, a sense of community or social presence, that is, a feeling of belonging to a group, seems to increase student satisfaction and may aid in student retention (Tinto, 1987).

Environmental Factors

Research has pointed to the importance of strong social systems in the success of online learners (Boyd, 2004; Slagter van Tryon & Bishop, 2009). Support from family members, friends, employers, and others for a learner's studies emerged as a key variable in persistence studies by Kember et al. (1994), Ross and Powell (1990), Woo and Reeves (2008), and Boston et al. (2009) and in studies of academic outcomes (Gibson, 1998; Gillis, Jackson, Braid, MacDonald, & MacQuarrie, 2000).

Similarly, research indicates a lack of direct support and one-on-one student interaction as factors in low-retention rates. According to White and Weight (2000), the online learner is isolated from many of the social activities of learning. A typical online

student lacks the immediate support of peers and instructors, which is important in academic success (Tinto, 1975). At the same time, many online learners balance full-time work and family responsibilities. According to Tullock (as cited in Carr, 2000), the Executive Dean of Distance Education at Dallas Community College, "distance-education students tend to leave us because they are very busy, their lives are crammed full of things, and suddenly they find themselves in a situation of having to rethink their priorities" (p. 40). Professors teaching online say they lost students to marriages, job changes, pregnancies, and other personal or professional transitions (Carr, 2000). External pressures come in many forms but often appear as organizational variables, such as financial aid, registration, and staff attitudes. For minority students, organizational factors include role models of staff and faculty and a supportive environment. For nontraditional students, parking, childcare, campus safety, availability of services after hours, evening/weekend scheduling, and cost per credit hour are factors (Bandura et al., 1996). Due to the higher exposure to external pressures, many students easily lose sight of the reasons for completing a course and course retention falls below that in an on-campus course.

A recent study by Davies and Graff (2005) indicated that students who interacted and participated more in online discussions did not necessarily achieve higher grades. Therefore, simply encouraging students to get more involved in online discussions is unlikely to automatically improve their performance. Indeed, Swan (2002) has argued that the mere provision of a discussion forum does not aid in learning. It is possible, therefore, that for students who are close to failing the course, online participation may not provide support or a sense of community (Rovai, 2002).

Online Science Education at the College

There is a lack of studies that have examined academic self-regulation and student experiences of science online distance courses in the community college. Of the few studies, retention rates of science students in distance learning have been found to be poor in comparison to those in traditional science classes (Fozdar & Kumar, 2007; Rowe & Asbell-Clarke, 2008). Fozdar and Kumar (2007) stated that even when intervention is undertaken to improve student retention, such methods fall short. Finnegan et al. (2009), in a study of 22 online courses that included science courses, observed that science students viewed fewer content pages than did successful students in the social sciences. The level of engagement for science, technology, engineering, and mathematics students was less overall in online science courses in comparison to social sciences.

Retention factors for online science students are not a well-researched or understood; more often, factors affecting retention in traditional classrooms were examined (Fozdar & Kumar, 2007). Research of science students indicated that important factors that assist in the retention of students include engagement, inquiry-based activities, and integration of knowledge through scaffold pedagogy (Linn, Davis, & Bell, 2003). Such activities involve modeling, designing projects, discussing, interactive activities, and debating through various approaches (Linn et al., 2003). For example, Harlen and Altobello (2003) found that online discussions promote reflection and articulation about the process of learning and inquiry and resulted in greater science understanding.

Because online science courses are primarily asynchronous and text based, and involve archival learning material, Rowe and Asbell-Clarke (2008) wrote that “students

who reported receiving more instructor support got higher grades than other students in the course" (p. 93). Thus, the literature supports the idea that instructor support contributes to positive learning outcomes in online science courses. However, such conclusions from previous studies have been conducted at university or 4-year college institutions and remains to be investigated at the community-college level.

Summary

Factors affecting student motivation, performance, and retention are multifaceted and evolving. As community colleges expand their distance-learning offerings to attract new students, especially in the sciences, retention has become a critical issue. In today's environment, understanding of retention is becoming even more complex, particularly with the changing landscapes in learner demography, roles, and responsibilities; learning opportunities, needs, and perceptions; and modes of instruction and learning.

The dearth of literature provides a significant basis for seeking a viable solution to the problems of student retention. By gaining more insight and understanding into the relationships between variables such as negative emotions (boredom and frustration), self-efficacy, self-regulation, learning strategies (elaboration), and student performance (see Figure 8), faculty and administrators can strategically shape classes and institutional support systems to facilitate student retention. Such insight could be of vital importance to faculty and institutions.

Further, by understanding students' motivations, colleges might better channel resources and design strategies to optimize student success in online courses. In addition, understanding why students select a particular course, their expectations for that course, and retention in that course can help colleges design, implement, and adapt teaching

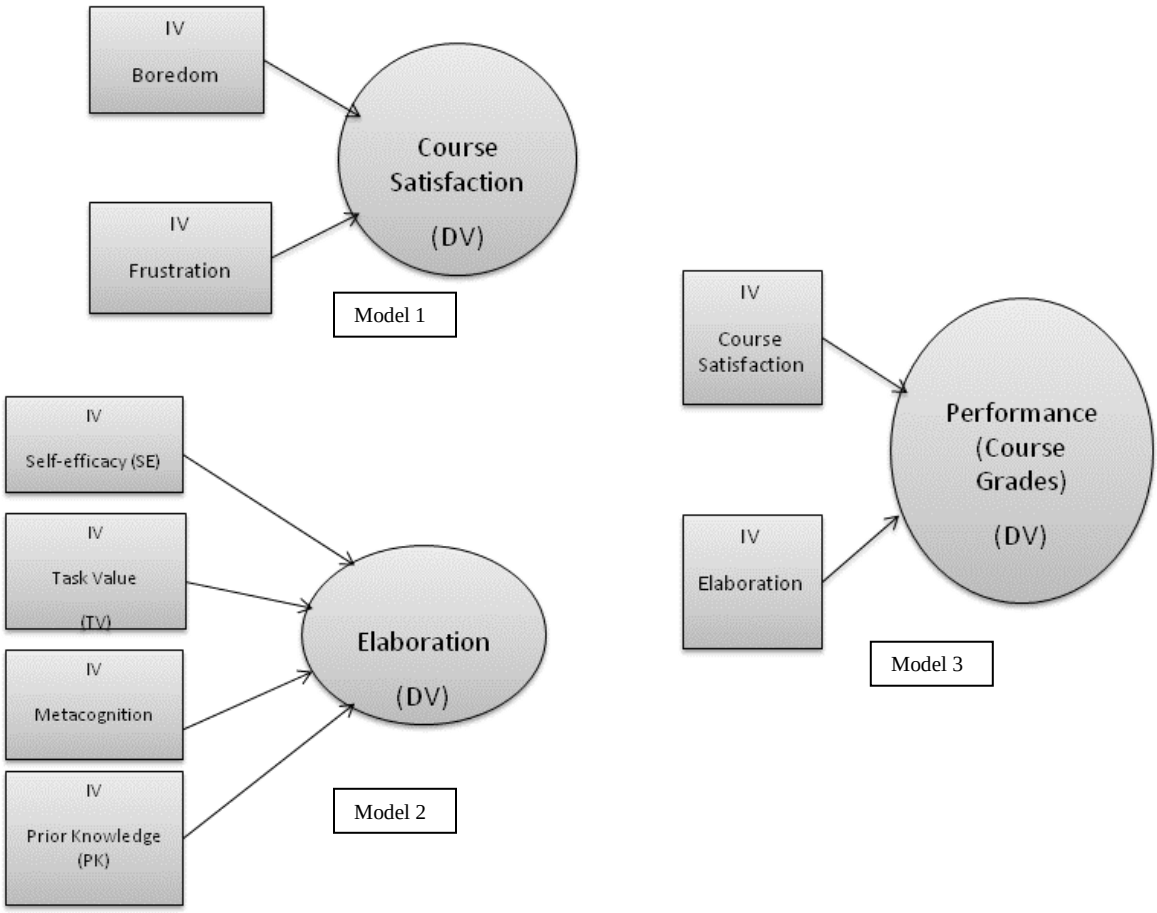

Figure 8. Putative student performance models for online leaning.

methods to suit this rapidly evolving area of education. The community college can also design supportive services to enhance students' motivation and persistence.

In Figure 8, Model 1 describes the variability of negative emotions, such as boredom and frustration, on a students' course satisfaction. Model 2 depicts possible variables such as self-efficacy, task value, metacognition, and prior knowledge which may possibly explain for differences in students' elaboration levels. Model 3 depicts possible variability of a students' course performance in terms of course satisfaction and elaboration.

CHAPTER 3: RESEARCH DESIGN

The purpose of this study was to further the understanding of the motivations and experiences of students who completed online science courses in the community college. The study was composed of two main sections—a quantitative section (survey) and a qualitative section (interviewing of students). The quantitative section facilitated an examination of the relationship among students' motivational beliefs, negative achievement motivations, prior knowledge, and SRL strategies (elaboration). Such variables were measured with a modified version of the Online Learning Beliefs, Emotions, and Behaviors Survey (OLBEBS) by Artino and McCoach (2008). The data were collected using a cross-sectional design. In order to examine students' subjective perceptions of their experiences in the online-learning environment, a qualitative approach was used. Individual perspectives of academic success in online science courses were examined by interviewing community-college students.

The first section of this chapter discusses the research rationale, research questions, and design. Next, the study explains the participant sampling used in this mixed-methods study. The third section details the instrumentation scales, collection, and analysis of the data. Lastly, the chapter concludes with a discussion of the assumptions and limitations of the study.

Rationale of the Study Design

Online learning has experienced rapid growth since 2002 (Allen & Seaman, 2009). Studies have compared online courses to face-to face courses and the quantitative outcome measures of online courses. Almost all of the prior studies have been based at 4-year college or university settings; relatively few have been conducted at 2-year

institutions. Most of the studies have provided little information on how students experience online courses, whether those experiences were instructionally anticipated, or why students withdraw from the course (Bambara, 2007). Information on the perspective of the students and the exploration of reasons for student behaviors and responses are essential to the design of online environments so that institutions may remain responsive to student needs. The behavioral and emotional aspects of an experience are problematic, if not impossible, to quantify. In addition, the lack of pertinent literature reflects a need for studies from the perspective of community-college students. Hence, this study design used a mixed-methods approach to understand students' characteristics and experiences.

The research study used both quantitative and qualitative methodologies to examine the motivational aspects of academic success in online science courses because both approaches provided a synergistic understanding of students. Several studies (Garland, 1993; Schilke, 2001) have noted that survey questions and brief interviews gathered data supporting only a superficial account of student experiences. Garland (1993) and Schilke (2001) have supported the use of in-depth interviews in order to gain more in-depth understanding of reasons behind certain responses. Morgan and Tam (1999) found distance-education literature to be fragmented and sparse. Studies have focused on demographics, personality characteristics, learning styles, and some motivational aspects of student persistence in face-to-face classroom settings and other non-science online classes. However, there is a dearth of studies of community-college students in online science courses. In the online context, Morgan and Tam advocated investigations into the student experience as a holistic means of understanding students' perspective.

Creswell (1998) advocated for qualitative research in the inquiry process as a means of understanding the complexity of the human experience. The researcher should build a "complex, holistic picture [by exploring] multiple dimensions of a problem or issue" (p. 15). Qualitative inquiry allows the researcher to construct the meaning behind the data and understand the interrelated dimensions of a phenomenon in the human experience. By using a qualitative research design, a researcher can describe the shared experiences of students. In addition, this study examined quantitative variables (e.g., self-efficacy, task value, and emotional components of learning) to understand the aggregate experiences of community-college students in online science courses.

In searching for a research design that can provide the best insights, a mixed-methods approach with a phenomenological component seemed appropriate to answer the research questions. The phenomenological component of this study design was influenced by Merriam (1993) and Moustakas (1994) for data collection and structuring.

The first part of this study adopted a quantitative approach to examine the dispositional variables that lead to student performance. The quantitative analysis (e.g., multiple regressions) yielded specific data on variables based on the theoretical frameworks of self-regulation, learning strategies, and self-efficacy. The predictive variables examined were self-efficacy, task value, negative emotions (such as boredom and frustration), self-regulation learning strategies (metacognition), prior knowledge, the number of courses taken in relation to course completion, and the use of learning strategies (elaboration) that may influence course completion. These variables were related to students' characteristics that have been linked to course satisfaction and the use of learning strategies.

The second part of this study adopted a qualitative approach to examine the motivations of students enrolled in online science courses at several community colleges. The literature indicated that motivation and self-efficacy are important factors in students' success in the online environment; participants in the study were asked to discuss their reasons for course selection, their expectations for the course, and their experiences. With this information, researchers can possibly help faculty design, implement, and adapt teaching methods for this rapidly emerging population. Also, by understanding the students' perspective, administrators and faculty members can better inform students about what to expect before registering for an online science class.

A qualitative approach provided information about students' experiences with instructor interaction, communication, motivational influences, and the support that students find helpful in the online environment. In addition, interviews elicited detailed information about students' experiences in online science courses. Given this focus, participants provided a detailed explanation of the different influences on their behavior in their own words.

An advantage of the mixed-method design is that researchers can verify and generate data by using both qualitative and quantitative strands. Results from both strands were synthesized to make inferences about the inquiry problem, and then the data were triangulated as suggested by Jang, McDougall, Pollon, Herbert, and Russell (2008). For instance, the qualitative data could lend either supporting or negating evidence to the quantitative data.

Research Design

This mixed-methods study combined non-experimental quantitative and qualitative methodologies. The quantitative portion of the study used a descriptive and associational research design with cross-sectional survey data. The qualitative portion of the study was purely descriptive in nature and used cross-sectional interview data.

Participants were surveyed in order to identify common motivations, attributes, strategies, and processes relating to the online science-course experience. A select group of participants were interviewed as part of the qualitative component of the study.

The qualitative data garnered from open-ended interviews were analyzed using content analysis. Content analysis yielded key structures and themes that were used in descriptive statements, which were grouped into categories related to the research questions. The research described common structures and themes in order to depict the essence of the phenomenon.

Advantages and Disadvantages of Quantitative Design

Quantitative survey data are often employed to characterize a population, to explore relationships among variables, and to test hypotheses. Surveys are an efficient and cost-effective way to gather data (Whitley, 2002). The design is particularly useful when building theory and testing theoretical assumptions. Survey data provides researchers the opportunity to investigate processes that would be impossible or unethical to investigate with more sophisticated experimental or quasi-experimental designs.

Advantages and Disadvantages of Qualitative Design

The qualitative portion of the study supplemented the survey data with in-depth discussion; it was useful because it allowed the researcher to approach the research topic from the several unique perspectives of the interviewed students. A qualitative design

was particularly useful in this mixed-methods study because the data can shed light on issues such as instructor communication, emotional experiences of the students, and psychological characteristics that may not be understood from survey data. In addition, the qualitative process was not limited by mathematical theory. Sample-size issues and the validation of statistical assumptions are limiting factors that can make the quantitative process less practical.

Setting

A convenience sample of students who attended community colleges that offer a diverse group of science online courses were approached in order to gain maximum variation within science courses. In order to survey diverse institutions and science courses, with consent of the institutions, I enrolled two community colleges, one in Illinois and one in Colorado. Consequently, data were gathered from the respective institutional research offices at the two community colleges with students who were enrolled in at least one for-credit online community-college course in 2010. At the time of this study, the community-college board did not track enrollments for specific online science courses; therefore, data were gathered for online courses to illustrate general online demographics at the community college. This study assumed that online science courses have similar representation to that of other online courses offered at the community-college level.

Sample

Assuming a medium effect size from power analysis (Faul, Erdfelder, Lang, & Buchner, 2007), an estimated 109 students with valid completed surveys were needed to reach a minimum sample size. In order to ensure significance, the researcher required

sufficient numbers of valid surveys; I attempted to recruit a minimum of 450 students in order to get an estimated sample of approximately 200 (more than 200% over the requisite 109). I contacted several community colleges in Illinois and Colorado in order to determine which colleges offered programs aligned with the goals of this study and to achieve a diverse sample of science courses and enrolled students. Depending on accessibility and course availability, 12 community colleges in Illinois and Colorado were invited to participate in this study. The online science courses included in this research were primarily from introductory science courses, including coursed in general biology, genetics, chemistry, astronomy, and nutrition. Two community colleges agreed to participate in this study.

The first community college sampled was located in Illinois. The total online enrollment for the 2010 fall semester was 1,848 students. The average age of online students was 28.4 years. Students who were enrolled in online courses in the 2010 fall semester were predominantly female (57%). The data obtained from the college's department of institutional research indicated that the predominant ethnic group enrolled in the courses was White (55%), followed by Asian or Pacific Islander (21%). The author of this study was employed as a science instructor at this community college.

The second community college sampled was located in Colorado. The total online enrollment for the 2010 fall semester was approximately 1,100 students. The average age of the student was approximately 30 years. Similar to the Illinois community college, the community college in Colorado had predominately female enrollment (70%). From the data obtained from the college's department of institutional research, the predominant

ethnic group enrolled in online courses was White (78.5%), followed by Hispanics (11%).

To obtain sufficient numbers for statistical analysis, I used convenience sampling. A selected sample of approximately 450 community-college students who were enrolled in online science courses in 2010 were invited to participate in this study. Of those participants who were selected to participate, 127 students returned surveys, resulting in a 28% response rate. In the final count, there were 107 completed surveys from the participants.

Quantitative Section

A convenience sample of 107 community college students enrolled in online science courses in 2010 completed surveys. I analyzed data from these surveys. A limitation of this sampling method is that the sample may pose an external threat to validity in that it may not be fully representative of all students in online courses. The survey was administered between weeks 10 and 12 of a 16-week semester or between Weeks 5 and 6 of an 8-week summer semester.

Qualitative Section

A number of students who participated in the quantitative survey were asked to participate in qualitative interviews. Student interviews were conducted for 12 participants from the initial quantitative portion of this study to ensure saturation had been reached. As such, interviews ceased once saturation was reached or no new themes emerged. Inclusion criteria for the students were that they were enrolled in a community college in Illinois or Colorado and had taken at least one online science classes at that

community college in the 2010-2011 years. Interviewees consented to be interviewed for the study.

Exclusion and Inclusion

The inclusion criteria for participants were that they were enrollment in at least one online science course taught at the community college in 2010. Included online science courses were primarily introductory science courses offered by the community colleges, such as biology, astronomy, genetics, chemistry, and plant biology.

The sampling frame excluded participants who were enrolled in hybrid science courses. Courses identified by administrators as inactive were excluded; any courses without students currently enrolled also were excluded. Students who dropped the course in the first few weeks were excluded. After survey administration, upwards of 25 participants were interviewed about their online science classes around mid-semester (approximately Weeks 10-12 of a 16-week semester). Students were asked to participate in the interviews if they expressed interest and had consented to be part of the interviewing part of the study.

Instrumentation

The OLBEBS assessed students' motivational attitudes. It was composed of seven subscales, all of which were used. The subscales used in this study assessed self-efficacy, task value, SRL (metacognition), boredom, frustration and use of elaboration. OLBEBS also assessed course satisfaction and prior course knowledge. The subscale pertaining to course-specific information was excluded because course-specific prior knowledge was beyond the scope of this study.

All 40 Likert-type items across the seven subscales were scored on a 7-point scale, from 1 (*completely disagree*) to 7 (*completely agree*). This instrument also examined several background factors such as demographics, prior online course experience, and overall satisfaction with the course.

In the first section, items were divided into seven subscales that assessed students' characteristics. The first attributes were motivational beliefs such as self-efficacy and task value. The second set of items examined SRL strategies, followed by subscales that examined overall satisfaction with the course, self-efficacy, and achievement emotions. The second part of the instrument examined demographics, prior online course experience, and satisfaction with the course.

Motivational Beliefs: Self-Efficacy and Task-Value Subscales

Self-efficacy and task value were measured using two subscales developed by Artino and McCoach (2008). Their instrument used a sample of 204 U.S. Navy personnel (74% men and 26% women). The participants ranged in age from 22 to 69 years. The participants' educational backgrounds ranged from high school to the doctorate level. Artino and McCoach reported the OLBEBS had good internal reliability estimates for self-efficacy and task-value subscales (α = 0.87 and 0.85 respectively). Validity studies showed the scales correlated positively with academic outcomes such as course satisfaction and perceived learning (Artino, 2008).

These two subscales consisted of 11 items rated on a 7-point scale, from 1 (*completely disagree*) to 7 (*completely agree*). Self-efficacy was measured using a five-item subscale in order to assess students' confidence in their ability to learn the material presented in the science online courses (see Table 2). The other seven items made up the

Table 2

Items Contained in the Self-Efficacy Subscale

Self-efficacy item	Item descriptions
1	Even in the face of technical difficulties, I am certain I can learn the material presented in an online course.
2	I am confident I can learn without the presence of an instructor to assist me.
3	I am confident I can do an outstanding job on the activities in an online course.
4	I am certain I can understand the most difficult material presented in an online course.
5	Even with distractions, I am confident I can learn material presented online.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

task-value subscales. Task value was measured using a six-item subscale to assess students' judgments of how interesting, useful, and important the online course was to them (see Table 3).

Cognitive Learning Strategies: Elaboration and Metacognition Strategies Subscales

These two subscales consisted of 13 items rated on a 7-point Likert scale, with two subscales that measured elaboration or SRL (metacognition) strategies. Elaboration was measured using a four-item subscale to access students' elaboration strategies such as paraphrasing and summarizing in the courses (see Table 4).

Table 3

Items Contained in the Task Value Subscale

Task value item	Item description
1	It is personally important for me to perform well in this course.
2	This course provides a great deal of practical information.
3	I am very interested in the content of this course.
4	Completing this course will move me closer to attaining my career goals.
5	It is important for me to learn the material in this course.
6	The knowledge I gain by taking this course can be applied in many different situations.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

Table 4

Items Contained in the Elaboration Subscales

Elaboration learning strategies item	Item description (While working on the online course…)
1	I try to relate it to the learning I already know.
2	I try to make all the different ideas fit together
3	I make up my own examples to help me understand the important concepts.
4	I try to connect what I was learning with my own experiences.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

Self-regulatory learning strategies (metacognition) was measured using a nine-item subscale designed to assess students' ability to use metacognitive strategies such as planning, goal setting, monitoring reading comprehension, and regulating performance (see Table 5). Artino (2008) modified these two subscales from the Motivated Strategies for Learning Questionnaire through some minor rewording to reflect the online nature of the course. Artino and Stephens (2009) reported high reliability estimates of $\alpha = 0.87$ and 0.89 for elaboration and metacognition subscales, respectively.

Negative Achievement Beliefs: Boredom and Frustration Subscales

The negative achievement beliefs of students enrolled in science courses were evaluated using two subscales adapted from Artino (2008) and the Achievement Emotions Questionnaire (Pekrun, Goetz, & Perry, 2005). The two negative achievement beliefs are boredom and frustration and have a total of nine items rated on a 7-point scale. The boredom subscale consisted of five items that are designed to measure course-related boredom (see Table 6).

The frustration subscale (see Table 7) consisted of four items designed to assess students' course-related frustration, annoyance, and irritation (Artino, 2008). The subscales were shown to have good internal reliability in a study by Pekrun (2006). Pekrun et al. (2002) obtained a Cronbach's $\alpha = 0.93$ for the boredom subscale and $\alpha = 0.86$ for the anger [frustration] subscale among a sample of 222 university students. In a recent study of 389 students, Pekrun, Goetz, Frenzel, Barchfeld, and Perry (2011) found similar results. Pekrun et al. (2011) obtained a Cronbach's α for the boredom subscale of 0.93 and a Cronbach's α of 0.86 for the anger [frustration] subscale.

Table 5

Items Contained in the Self-regulatory Learning Strategies (Metacognition) Subscales

Self-regulatory learning strategies (metacognition)	Item description (While working on the online course…)
1	If I became confused about something I read, I went back and try to figure it out.
2	If course material was difficult to understand, I changed the way I studied it.
3	I asked myself questions to make sure I understood the material I was studying.
4	I tried to think through each topic and decide what I was supposed to learn from it, rather than just reading it over.
5	I tried to determine which concepts I didn't understand well.
6	I set goals for myself in order to direct my activities.
7	If I got confused during online activities, I made sure I sorted it out before proceeding on to the next section of the course.
8	I kept track of how much I understood, not just if I was getting through the material.
9	I stopped once in a while and went over what I had learned.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

Table 6

Items Contained in the Boredom Subscale

Boredom item	Item description (While completing this online course…)
1	I have been bored.
2	I felt the course was fairly dull.
3	My mind wandered.
4	I was uninterested in the course material.
5	I thought about what else I would rather be doing.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

Table 7

Items Contained in the Frustration Subscale

Frustration item	Item description
1	I feel frustrated.
2	I am angry.
3	I feel that I was wasting my time.
4	I am irritated.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

The course satisfaction subscale (see Table 8) consisted of three items that were designed to assess students' course-related satisfaction (Artino, 2008). Since the previous study by Artino focused on a different population, this subscale was completely changed in order to fit the community college student population.

Table 8

Items Contained in the Course Satisfaction Subscale

Course satisfaction item	Item description (While completing this online course…)
1	Overall, I was satisfied with my online course
2	This online course met my needs as a learner
3	I would recommend this online course to a friend who needed to learn the material.

Note. Adapted from "Learning Online: Understanding Academic Success From a Self-Regulated Learning Perspective," by A. Artino, 2008, unpublished doctoral dissertation, University of Connecticut, Storrs.

The prior knowledge subscale (see Table 9) consisted of three items designed to assess students' prior knowledge (Artino, 2008). Since the previous study by Artino focused on a different population, this subscale was completely changed in order to fit the previous expected knowledge of community college student population.

Table 9

Items Contained in the Prior Knowledge Subscale

Prior knowledge item	Item description (While completing this online course…)
1	I felt my formal educational background has given me adequate preparation for this course.
2	My work experience and other prior experiences from outside formal school have prepared me for this course.
3	I have had four courses in science and or math previously.

Procedures for Quantitative Survey

After receiving approval from the Colorado State University committee for Human Subjects, the researcher e-mailed the respective administrators and online science instructors who agreed to participate in this study. An initial e-mail was used to contact either a faculty member or senior administrator's staff at the selected community colleges, notifying them of the purpose of the study and soliciting their cooperation as well as offering to answer any questions they might have had (see Appendixes A and B). To protect the anonymity of the study participants who responded only to the quantitative portion of the study, the faculty member or administrator maintained possession of student e-mail addresses and did not share them with me.

The community-college faculty member was sent an e-mail invitation stating that they were being asked to forward the invitation to all students who were enrolled in their online science courses in the summer and fall of 2010. The invitation contained a unique URL for the Web-based survey (Survey Monkey). The student e-mail invitation explained to the students the purpose of the study, their rights in regard to participation, safeguards that were taken to ensure confidentiality, and information about the incentives offered for participation (see Appendix C). The underlying purpose of the first e-mail was to alert the students to the second e-mail that would follow. The voluntary participation of the respondent served as their consent. The online survey was administered at two community colleges between June 2010 and December 2010.

A second e-mail was sent to the students within 1 week of the initial e-mail. The second e-mail included web links to the instrument and guidelines for participation in the incentive prize drawing. After receiving the URL link to the survey, students were asked a series of survey questions and if they wished to take part in the second part of the study, the interviews. Data collection for this study began around Weeks 10-12 of the 16-week semester or in Weeks 5-6 of the 8-week summer course.

The online survey was built using Survey Monkey, which was configured to return responses confidentially (see Appendix D). All respondents were given a small incentive ($5 gift card) for their participation. At the end of the data collection, the $5 gift card was emailed from a well-known online retailer, such as Amazon.com.

Quantitative Measures of Reliability

Measures for reliability and validity are fundamental aspects to any quantitative study. For the survey portion of the study, internal consistency and reliability were

evaluated using Cronbach's alpha. The study independently measured and calculated alphas for each subscale. These values were compared with previously reported alphas from Artino and McCoach (2008).

Confidentiality

To maintain confidentiality, students were contacted through an e-mail from their online instructors. Instructors were sent the web link to the Survey Monkey instrument, and the link was forwarded to the students enrolled in their online science courses. Students were asked for their student numbers in order to serve as a linking identifier between their survey and personal address information. Participants were asked their home addresses in order to mail out the gift cards. All personal data were erased from computer hard drive storage 1 year after completion of the study. Participants' address information was kept separate from student data and was housed in a locked file cabinet to which only I had access. Responses were downloaded to a separate database as an Excel file. Data were analyzed using SPSS software.

Procedures for Qualitative Interviews

For interviews, I sampled 12 participants (those who indicated from the survey pool both interest and consent). The participants, in order to qualify for this portion of the study, needed to have completed the online survey and indicated at the end of the survey that they would agree to an interview. An attempt was made to sample participants from different online science courses for the qualitative portion. Participants were asked to participate in one individual semi-structured interview over the telephone. According to Patton (2002), I ended up with 12 student interviews because that number was realized based on the number of students needed to reach saturation. Each interview lasted

approximately 60 minutes. Participants who completed the interview received a $25 gift card in addition to the $5 gift card they received for their participation in the quantitative survey. Interviews were digitally recorded, transcribed, and analyzed for general themes by the content-analysis method proposed by Moustakas (1994). Pseudonyms were be used to protect participants' anonymity.

Interview Rationale

The researcher tried to interview at least one student from each of the different online science courses. I anticipated needing at least three to four different courses to be included in the study in order to gain maximum variation. In order to gain a diversity of perspectives, the study tried to identify students enrolled not only in different courses, but in different community colleges. The interview protocol was developed in consultation with the researcher's faculty advisors. The purpose of the interviews was to gain a basic understanding of learning experiences, strategies used to do well in the course, and reasons behind the emotions about the online experience. To accomplish this, the interview questions contained open-ended general questions with accompanying probes intended to generate information specific to a particular area. At the end of the interview, the last question paraphrased the main points from the interview to verify my interpretations of the students' responses and after the transcript had been analyzed, I went back and content checked the data. Questions for the interview were adapted and developed from similar questions used by Bambara (2007). Sample interview questions are found in Appendix E.

Trustworthiness of the Qualitative Interviews

To allow the participant to establish the content and direction of the interviews, the first few minutes of the interview were used to establish trust and elicit background information from the participant. The open-ended questions were designed to gain insights into the early learning experiences that a student had of a class. During the interview, I asked the student for confirmation or clarification of certain points. The last question validated the interviewer's understanding of the student's responses to previous questions. After the interviews were completed and transcribed, participants were contacted a second time in order to get clarification or further data. Participant data were also content checked with a copy of the interview transcript.

Data Analysis

I investigated students' various disposition characteristics and experiences in a convenience sample of two community colleges. Data were gathered through two approaches: quantitative (survey) and qualitative (interviews of participants). The key variables and the operational definitions or measurements along with the subscales were found in the Instrumentation section.

The quantitative data from the OLBEBS were entered into SPSS. Then data analyses occurred in two stages. First, descriptive statistics were calculated on all research variables, including means and standard deviations for variables on a ratio or interval scale. Frequencies and percentages were provided for nominal variables. The second stage of the analyses was the presentation of the inferential statistics used to test the research hypotheses. All statistical tests were conducted at $\alpha = .05$. Statistical

analyses were used to test each research hypothesis for the quantitative research questions.

Quantitative Analysis: Sample-Size Justification

One way of choosing an appropriate sample size for a quantitative study is to assess the number of respondents needed to achieve a particular level of statistical power. The a priori power analysis was used to this end. The power analysis was conducted using the statistical software G*Power 3.1.0 on the most conservative (e.g., analysis yielding the largest sample size) statistical approach. An a priori power analysis determines the number of participants required to detect a medium effect size ($f^2 = .15$) with power = .80 for a multiple regression with eight predictors tested at $\alpha = .05$. The power analysis suggested that 109 respondents were needed to achieve a power of .80 given these parameters. The individual data were collected from returned questionnaires, which needed to be higher than a sample size of 109 due to participant attrition or missing/incomplete data. Also, because the study assumed a medium effect size, this study needed (approx.) more than 109 students to fill out the questionnaires. Based on this, the study attempted to over sample and attempted to recruit 450 participants in order to take into consideration a possible low response rate (estimated at approximately 20%, i.e., 200 participants). The response rate was 28% in this study (127 surveys were returned). However, only 107 of the returned surveys were complete.

Research Questions

The following research questions were used to guide this research methodology:

Research Question 1. Are participants' self-efficacy, SRL strategies (metacognition), perceived task value, and prior knowledge in online courses statistically

significant predictors of learning strategies (elaboration)?

Research Question 2. Are students' achievement emotions (boredom and frustration) statistically significant predictors of their overall course satisfaction?

Research Question 3. Are the participants' elaboration and course satisfaction in online courses statistically significant predictors of performance (final course grades)?

Research Question 4. How do community-college students experience or make meaning of their online science courses? What underlying themes describe students' online experiences in community-college science courses?

Research Question 5. What are the reasons associated with course satisfaction of community-college students enrolled in online science courses? What challenges and successes do they experience?

Research Question 6. What are the reasons underlying the inhibitory dimensions, such as boredom and frustration, that influence success in an online science course?

Quantitative Analysis of Data

The data were collected and entered into SPSS. The data were analyzed in two stages. First, descriptive statistics were calculated for all research variables. Descriptive statistics were determined for the subscales and each individual item in the subscales had its own statistics calculated (such as mean, maximum, standard deviation, variance, and skewness). Means and standard deviation were calculated for variables on a ratio or interval scale. Frequencies and percentages were provided for nominal or ordinal-scaled variables. After data were collected, the Cronbach's alpha values from this study sample were compared with published scales from Artino's (2008) study.

The second stage of the analyses presented the inferential statistics used to test the research hypotheses. All statistical tests were conducted at $\alpha = .05$. The following is a review of the statistical analyses that were used to test each research hypothesis.

Research Questions 1-3. Several multiple regressions (one for each research question) were conducted to address Research Questions 1–3. The following testing procedures were used for each regression. First, the data were screened for outliers. Participants with a standardized residual greater than three were considered outliers. A plot of standardized residuals was reviewed to assess the assumptions of linearity and model homoscedasticity. Variance inflation factors were used to assess model multi-collinearity. A table of descriptive statistics and a table of regression coefficients were displayed for each analysis.

Research Questions 4-6. The preliminary analysis of survey data was complemented by interviews using open-ended questions to generate key themes. The data were analyzed using the phenomenological approach described by Moustakas (1994) and Creswell (1998). Moustakas modified two methods of phenomenological data analysis: the Van Kaam method and the Stevick–Colaizzi–Keen method. This study adopted the Stevick–Colaizzi–Keen method because of its ability to derive a structure from participants' experiences and to interpret participants' experiences by structuring and reflecting on the data. In this method, the phenomenological analysis proceeds through the reduction, fragmentation, and analysis of specific themes and statements (Creswell, 1998). In reduction, the transcripts of each participant underwent horizonalization, which results in a complete listing of all descriptive statements (Creswell, 1998).

In this process, an inductive code was assigned to every statement about its online class experience with equal weight. All statements were treated as equally important even though there might have been some repetition among the interviews. The statements were then sorted into non-repetitive, non-overlapping units of meaning from each participant. These statements were organized into a list of statements that was considered to have equal value. These statements were grouped into categories according to emerging themes or meaning units. The statements from all the interviews were grouped into more generalized meaning units. This method allowed the participants, rather than me, to define their learning experiences.

In applying this method, I looked for any statements in the student interviews that described their learning strategies and experiences in the online course. The interviews gathered detailed information on students' learning strategies and experiences. For example, information about course communication, attitudes, motivation, and learning strategies was explored with open-ended questions. Students were asked to describe how they learned, who or what helped them learn, and how satisfied they were with their online experiences. Using imaginative variation, I examined and reflected upon the composite themes to form the structural qualities that framed the phenomenon under consideration in this study.

Confidentiality. Pseudonyms were used to protect the confidentiality of the students who were quoted in the descriptions. Such use of pseudonyms allowed participants to discuss the phenomenon candidly with me. Permission for the interview was asked for once in the survey. In addition, the exact wording of the student's responses was used from the interview transcripts whenever possible, with exceptions

being the replacement of vague pronouns or references and the removal of any specific references that would compromise confidentiality.

The interview data. Trustworthiness depends on the credibility and dependability of the study. In this study, I attempted to conduct member content checks by obtaining participant feedback, reviews, and commentary on the transcript. Within 4 to 6 weeks of interview, participants received a copy of the transcript to review for accuracy. I then performed a content check with participants to ensure accuracy of interpretations. Moustakas (1994) described participant feedback as a method of data verification. Thus, data were obtained from the interview, and participants were asked to provide feedback as to the accuracy of the data. Dependability of the data was established through peer review and a detailed audit trail, consisting of a notebook with field notes, coded transcripts, data displays, coding process, and details of thematic development.

Assumptions and Limitations

This study made the assumptions that participants in the present study were somewhat characteristic of students who were enrolled in online distance-education programs in the community college and that the instructors sampled in this study were representative of instructors of community college online science courses. However, these assumptions may not have been completely valid. Consequently, the ability to generalize findings beyond the present study was limited because only a few community colleges were sampled and the learner characteristics, course content, and pedagogy used by the online instructors in the present study may not have been fully representative of other instructors and other settings. The study results may not be generalized to other distance-education formats, such as television-based systems or hybrid programs. The

measurement of variables for the quantitative portion of the study (survey instrument) is limited to self-report measures. The survey instrument assumed that the participants responded honestly and had taken their time in responding to the survey. Study limitations were linked to the selected sample (convenience sampling) and the sample size of the participants. The survey considered two community colleges with two or more different science courses in order to maximize course variation, which may have limited the external validity of the study.

The main limitation associated with the use of the non-experimental survey design and qualitative data was that I cannot infer causality. That is, statistical significance in this design does not imply cause-and-effect relationships. This limitation was a result of my inability to control extraneous confounding variables that could affect data analysis and interpretation.

A second limitation of this study was that students were selected from a limited convenience sample of community colleges in two states. In addition, only 12 students agreed to be interviewed. Consequently, the community colleges and the interviewed participants were not representative of all community colleges or science courses. Thus, the results from this study may have limited generalizability beyond the present sample and for traditional students nationwide in community colleges (external validity).

Summary

Factors affecting students' motivation, performance, and persistence are multifaceted and evolving. As community colleges expand their distance-learning offerings to attract new students, especially in the sciences, persistence has become a critical issue. In today's environment, understanding retention is becoming even more

complicated, particularly with the changes in learner demography, roles, and responsibilities; learning opportunity, needs, and perceptions; and modes of instruction and learning.

The dearth of literature provides a significant basis for seeking a viable solution to the problems of student retention. By gaining more insight and understanding of variables such as self-efficacy, SRL strategies (metacognition), and motivation, faculty and administrators can design classes and institutional support systems to facilitate student retention. Such insight could be of vital importance to faculty and institutions.

Further, by understanding students' motivations and factors that influence performance, colleges might better channel resources and design strategies to optimize student success in online courses. The community college can also design services to support students' motivation and persistence.

CHAPTER 4: RESULTS

Chapter 4 presents the findings of this research examining the motivations and experiences of students taking a science online course at community colleges. The study was composed of two main sources of data gathering, a survey of students and a subset of 12 student interviews from students who completed the survey. Five online courses were included in the study at two community colleges. The courses included astronomy, biology, human genetics, nutrition, and chemistry.

The student survey portion of the study explored the relationship between students' SRL strategies, motivation beliefs, achievement emotions, and several measures of academic success in the online science courses at the community college. The interviews examined the motivations for enrollment and the importance of students' subjective perceptions of the online learning through 12 in-depth interviews of students.

Descriptive Statistics

Participant Demographics

Two community colleges participated in the study with 107 students returning the student survey from both institutions. The details about student demographics are shown on Tables 10 and 11 respectively. Of the participants, 93 (88.6%) were female, and 12 (11.4%) were male. The participants included in the study reflected a wide age range from 18 to 70 years old. The average participant age was 29.35 (*SD* = 11.29) years. Approximately half (57, 54.3%) of the participants indicated that their intended major was nursing. Other popular majors were education (9, 8.6%), business (5, 4.8%), fine arts

Table 10

Descriptive Statistics for Student Gender, Major or Intended Major, and Reason for Course

Variable	*n*	%
Gender		
Female	93	88.6
Male	12	11.4
Major or intended major		
Nursing	57	54.3
Education	9	8.6
Business	5	4.8
Fine arts	4	3.8
History/global studies	4	3.8
Psychology	3	2.9
Nutrition/exercise science	3	2.9
Graduated	2	1.9
Pharmacy	2	1.9
Undecided	2	1.9
Other	14	13.3
Reason for course		
Required for major	59	56.2
Required for graduation	27	25.7
Other	19	18.1

Table 11

Descriptive Statistics for Student Age and Numbers of Prior Courses

Variable	*n*	*Min.*	*Max.*	*M*	*SD*
Age	103	18.00	70.00	29.35	11.29
Number of Prior Online Courses	105	0.00	5.00	1.63	1.88
Number of Prior College Math Courses	102	0.00	22.00	2.49	2.93
Number of Prior College English Courses	101	0.00	20.00	2.57	2.55

(4, 3.8%) and history/global studies (4, 3.8%). There was a wide dispersion (range = 6) in the participants' experience with online courses. The average participant reported taking 1.63 (*SD* = 1.88) online courses. There was also a wide range in the participants' experience in math (range = 23) and English (range = 21) courses. The average participant had completed 2.49 (*SD* = 2.93) math courses and 2.57 (*SD* = 2.55) English courses. Of the participants, 59 (56.2%) were taking the course for a major requirement, 27 (25.7%) for a graduation requirement, and 19 (18.1%) for other reasons.

Participant Perceptions of Online Courses

The participants responded to several items pertaining to their experiences with online courses. The descriptive statistics for these responses are listed in Table 12. Given the Likert-type scale for each item (1 to 7), these data indicated that participants were relatively likely to enroll in another online science course and that they felt that they learned by taking their online course.

Participants' Self-Efficacy Construct

The five subscale items from the motivational beliefs construct of self-efficacy were analyzed. The descriptive statistics for these responses are listed in Table 13. Given

Table 12

Descriptive Statistics for Participants' Perceptions of Online Courses

Variable	*n*	*Min.*	*Max.*	*M*	*SD*
Given your experience with this online course, how likely are you to enroll in another science course?	105	1.00	7.00	5.10	1.98
How much did you learn by taking this online course?	103	1.00	7.00	5.51	1.64
How experienced are you with computer technology?	105	2.00	7.00	5.72	1.18

Table 13

Descriptive Statistics for Self-Efficacy Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
Even in the face of technical difficulties, I am certain I can learn the material presented in an online course.	107	1.00	7.00	6.17	1.28
I am confident I can learn without the presence of an instructor to assist me.	107	1.00	7.00	5.78	1.58
I am confident I can do an outstanding job on the activities in an online course.	106	1.00	7.00	6.03	1.40
I am certain I can understand the most difficult material presented in an online course.	107	1.00	7.00	5.42	1.78
Even with distractions, I am confident I can learn material presented online.	107	1.00	7.00	5.87	1.61

the Likert-type scale for each item (1 to 7), the data indicated that the participants who took online science courses demonstrated a relatively high degree of self-efficacy, since the means of each line item were between 5 and 6 out of a 7-point scale. The subscale for self-efficacy showed good internal reliability estimates for self-efficacy ($\alpha = 0.929$). This was in agreement with previous studies by Artino and McCoach (2008), who reported the OLBEBS had good internal reliability estimates for self-efficacy also ($\alpha = 0.87$).

Participants' Self-Regulatory Learning Subscale

The nine subscale items from the SRL subscales for the metacognition construct of set were analyzed. The descriptive statistics for these responses are listed in Table 14. Given the Likert-type scale for each item (1 to 7), the data indicated that the participants who took online science courses demonstrated a relatively high degree of SRL [metacognition], since overall the means of each line item were in the range of 5.67 to 6.2 out of a 7-point scale. The subscale for self-regulatory learning showed good internal reliability estimates ($\alpha = 0.91$). Previously, Artino and Stephens (2009) reported high reliability estimates of $\alpha = 0.89$ for SRL (metacognition).

Participants' Task-Value Subscale

The six subscale items from the task value construct set were analyzed. The descriptive statistics for these responses are listed in Table 15. Given the Likert-type scale for each item (1 to 7), the data indicated that the participants who took online science courses embraced a relatively high degree of task value, since the means of each line item were between 6.03 and 6.79 out of a 7-point scale. The subscale for task value showed good internal reliability estimates ($\alpha = 0.89$). This is in agreement with previous studies by Artino and McCoach (2008), who reported the OLBEBS had good internal reliability estimates for task value also ($\alpha = 0.85$).

Participants' Elaboration Subscale

The four subscale items from the task value construct set were analyzed. The descriptive statistics for these responses are listed in Table 16. Given the Likert-type scale for each item (1 to 7), the data indicated that the participants who took online science courses answered with a high degree of elaboration, since the means of each line

Table 14

Descriptive Statistics for Self-Regulatory Learning Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
If I became confused about something I read, I went back and try to figure it out.	107	3.00	7.00	6.55	0.73
If course material was difficult to understand, I changed the way I studied it.	106	3.00	7.00	5.79	1.26
I asked myself questions to make sure I understood the material I was studying.	107	2.00	7.00	5.74	1.36
I tried to think through each topic and decide what I was supposed to learn from it, rather than just reading it over.	107	1.00	7.00	5.72	1.38
I tried to determine which concepts I didn't understand well.	107	2.00	7.00	6.08	1.13
I set goals for myself in order to direct my activities.	106	2.00	7.00	6.20	1.10
If I got confused during online activities, I made sure I sorted it out before proceeding on to the next section of the course.	107	1.00	7.00	5.94	1.29
I kept track of how much I understood, not just if I was getting through the material.	107	1.00	7.00	5.79	1.36
I stopped once in a while and went over what I had learned.	107	1.00	7.00	5.67	1.39

Table 15

Descriptive Statistics for Perceived Task Value Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
It is personally important for me to perform well in this course.	107	1.00	7.00	6.79	0.78
This course provides a great deal of practical information.	107	1.00	7.00	6.11	1.28
I am very interested in the content of this course.	107	1.00	7.00	6.12	1.34
Completing this course will move me closer to attaining my career goals.	107	1.00	7.00	6.15	1.57
It is important for me to learn the material in this course.	107	1.00	7.00	6.37	1.26
The knowledge I gain by taking this course can be applied in many different situations.	107	1.00	7.00	6.03	1.46

Table 16

Descriptive Statistics for Elaboration Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
I try to relate it to the learning I already know.	107	3.00	7.00	6.29	0.99
I try to make all the different ideas fit together and make sense to me.	107	3.00	7.00	6.43	0.80
I make up my own examples to help me understand the important concepts.	107	2.00	7.00	5.56	1.36
I try to connect what I was learning with my own experiences.	107	2.00	7.00	6.16	1.12

item were in the range of 5.56 to 6.43 out of a 7-point scale. From previous research, Artino and Stephens (2009) reported high reliability estimates of $\alpha = 0.87$ for elaboration scales. This study also found a high reliability estimate of $\alpha = 0.84$ for the elaboration subscale.

Participants' Negative Emotions

Participants' boredom subscale. The five subscale items from the negative emotion, boredom, construct set were analyzed. The descriptive statistics for these responses are listed in Table 17. Given the Likert-type scale for each item (1 to 7), the responses revealed that the participants who took online science courses experienced a relatively low degree of boredom, as indicated by the relative means of each line item were in a range of 1.75 to 2.38 out of a 7-point scale. Previous research by Pekrun (2006) and colleagues obtained a Cronbach's $\alpha = 0.93$ for the boredom subscale among a sample of 225 university students. This research found a Cronbach's $\alpha = 0.9$ for the boredom subscale.

Table 17

Descriptive Statistics for Boredom Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
I have been bored.	105	1.00	7.00	1.89	1.40
I felt the course was fairly dull.	105	1.00	7.00	1.85	1.31
My mind wandered.	105	1.00	7.00	2.38	1.60
I was uninterested in the course material.	105	1.00	7.00	1.75	1.34
I thought about what else I would rather be doing.	105	1.00	7.00	2.13	1.52

Participants' frustration subscale. The 4 subscale items from the negative emotion, frustration, construct set were analyzed. The descriptive statistics for these responses are listed in Table 18. Given the Likert-type scale for each item (1 to 7), the responses indicated that the participants who took online science courses experienced a relatively low degree of frustration, since the means of each line item were between 1.86 and 2.80 out of a 7-point scale. Previous research from Pekrun (2006) obtained a Cronbach's $\alpha = 0.93$ for the corresponding frustration scale. The frustration subscale in this research was a Cronbach's $\alpha = 0.9$.

Descriptive Statistics for Participants' Overall Course Satisfaction

The three subscale items from overall course satisfaction construct set were analyzed. The descriptive statistics for these responses are listed in Table 19. Given the Likert-type scale for each item (1 to 7), the data indicated that the participants who took online science courses indicated a high level of overall course satisfaction, since the means of each line item were between 5 and 6 out of a 7-point scale. The course satisfaction subscale had a Cronbach's $\alpha = 0.97$ in this study.

Table 18

Descriptive Statistics for Frustration Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
I feel frustrated.	105	1.00	7.00	2.80	1.90
I am angry.	103	1.00	7.00	2.04	1.69
I feel that I was wasting my time.	103	1.00	7.00	1.86	1.53
I am irritated.	105	1.00	7.00	2.03	1.70

Table 19

Descriptive Statistics for Overall Course Satisfaction Subscale Items

Item	*n*	*Min.*	*Max.*	*M*	*SD*
Overall, I was satisfied with my online course	107	1.00	7.00	5.94	1.52
This online course met my needs as a learner	107	1.00	7.00	5.82	1.67
I would recommend this online course to a friend who needed to learn the material.	107	1.00	7.00	5.74	1.76

Summary of Descriptive Statistics

Taken together, the data suggested that participants were likely to enroll in another online science course and that they felt that they learned what they expected to learn by taking their online course. For the most part, the data indicated that the participants who took online science courses indicated a high level of overall course satisfaction. Generally, the participants who enrolled in the online science courses had a high sense of self-efficacy, task value, and self-regulation. Respondents were relatively high on the elaboration subscale. In terms of overall emotions experienced, participants reported experiencing a relatively low degree of boredom and frustration in the courses.

Research Questions 1-3 and Hypothesis Testing

Research Question 1

Research Question 1. Are the participants' self-efficacy, self-regulatory learning, perceived task value and prior knowledge in online courses statistically significant predictors of learning strategies (elaboration)?

H_0: The participants' self-efficacy, self-regulatory learning, perceived task value and prior knowledge in online courses are not statistically significant predictors of learning strategies (elaboration).

H_A: The participants' self-efficacy, self-regulatory learning, perceived task value and prior knowledge in online courses are statistically significant predictors of learning strategies (elaboration).

A multiple regression was conducted to determine if self-efficacy, SRL, perceived task value and prior knowledge in online courses were combined statistically significant predictors of learning strategies (elaboration). The descriptive statistics for the individual items of the self-efficacy, SLR, perceived task value and elaboration subscales are listed in the previous Tables 16-19, respectively.

The data were screened for outliers prior to analysis. The participants' standardized residuals were utilized to identify outliers in the data. A participant was considered an outlier when the absolute value of the standardized residual is greater than 3. This process did not reveal any outliers in the data.

The descriptive statistics for the predictors, the intercorrelations, and criterion are listed in Table 20. The variance inflation factors and tolerance levels did not seem to indicate a problem with multicollinearity. However, a plot of standardized residuals

Table 20

*Means, Standard Deviations, and Intercorrelations for Variables Predicting Elaboration in RQ1 (*n = *102)*

Variable	*M*	*SD*	2	3	4	5
Self-Efficacy (1)	5.82	1.38	.44**	.44**	.11	.38**
Self-Regulatory Learning (2)	5.93	0.95	---	.47**	-.01	.65**
Task Value (3)	6.25	1.06		---	.11	.54**
Number of Previous Online Courses (4)	1.65	1.89			---	.08
Elaboration (5)	6.10	0.90				---

*$p < .05$. **$p < .01$.

(Figure 9) did reveal evidence of model heteroscedasticity. The model was a significant predictor of the participants' elaboration, F (4, 97) = 23.41, $p < .01$, $R^2 = .49$. This indicated that together the predictors accounted for a significant amount (49%) of variation in the criterion. The regression coefficients are listed in Table 21. The coefficients indicated that SRL and task value were significant positive predictors of elaboration within this model, $\beta = 0.50$, $p < .01$ and $\beta = 0.28$, $p < .01$, respectively. This indicated that elaboration increased with increasing levels of SRL and task value within this model. The participants' self-efficacy and prior experience in online courses were not significant predictors of elaboration within this model, $\beta = 0.03$, $p > .05$ and $\beta = 0.05$, $p > .05$, respectively when SRL and task value were also in the model.

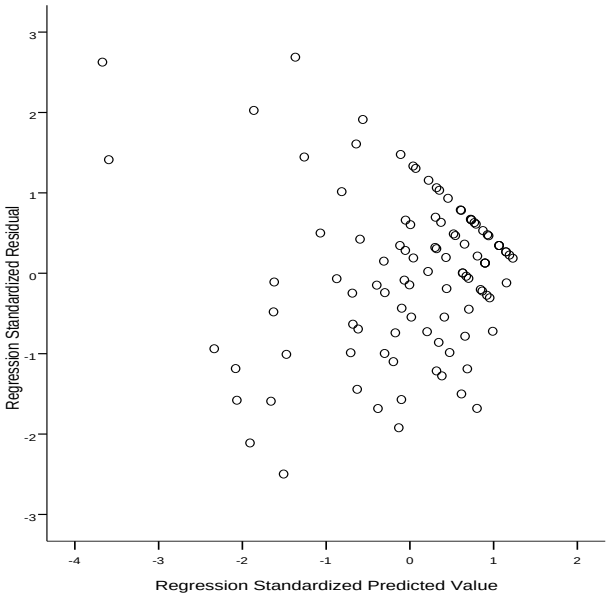

Figure 9. Residual plot for Research Question 1.

Table 21

Regression Coefficients for Research Question 1

Predictor	*B*	*SE*	*β*	*t*	*Sig.*
Self-efficacy	0.02	0.06	0.03	0.38	.706
Self-regulatory learning	0.48	0.08	0.50	5.83	<.00
Task value	0.24	0.07	0.28	3.25	.002
Number of previous online courses	0.03	0.04	0.05	0.74	.459

Research Question 2

Research Question 2. Are the participants' achievement emotions (boredom and frustration) statistically significant predictors of overall course satisfaction?

H_0: The participants' achievement emotions (boredom and frustration) will not be statistically significant predictors of overall course satisfaction.

H_A: The participants' achievement emotions (boredom and frustration) will be statistically significant predictors of overall course satisfaction.

A multiple regression was conducted to determine if boredom and frustration combined were significant predictors of the participants' overall course satisfaction. The descriptive statistics and the intercorrelations for the individual items of the boredom, frustration and overall satisfaction subscales are listed in Table 22. The data were screened for outliers prior to analysis in the same manner described in Research Question 1. This process revealed one outlier in the data.

The descriptive statistics for the predictors and criterion along with the intercorrelations are listed in Table 22. The intercorrelations revealed that boredom and frustration were correlated with each other (r = .65). As seen from Table 22, boredom was negatively correlated with overall course satisfaction (r_{bore} = -.481) and frustration was highly negatively correlated with overall course satisfaction (r_f = .-861). Even though the two predictors were highly correlated (.65), the variance inflation factors and tolerance levels did not seem to indicate problems with of multicollinearity. A plot of standardized residuals (Figure 10) did reveal some evidence of model heteroscedasticity. The omnibus model was a significant predictor of the participants' overall course satisfaction, F (2, 97) = 168.13, p < .01, R^2 = .78. This indicated that together the predictors accounted for a large amount (78%) of variation in the criterion.

The regression coefficients are listed in Table 23. The coefficients indicated that frustration was a significant negative predictor of overall course satisfaction, β = -0.98, p < .01. This indicated that course satisfaction increased with decreasing levels of frustration within this model. Surprisingly, the coefficients also indicated that boredom

Table 22

*Means, Standard Deviations, and Intercorrelations for Boredom and Frustration as Predictors of Course Satisfaction in RQ 2 (*n *= 100)*

Variable	*M*	*SD*	1	2	*3*
Boredom (1)	1.95	1.21	---	.65**	.48**
Frustration (2)	2.16	1.56		---	.86**
Overall Course Satisfaction (3)	5.91	1.62			---

***p* < .01

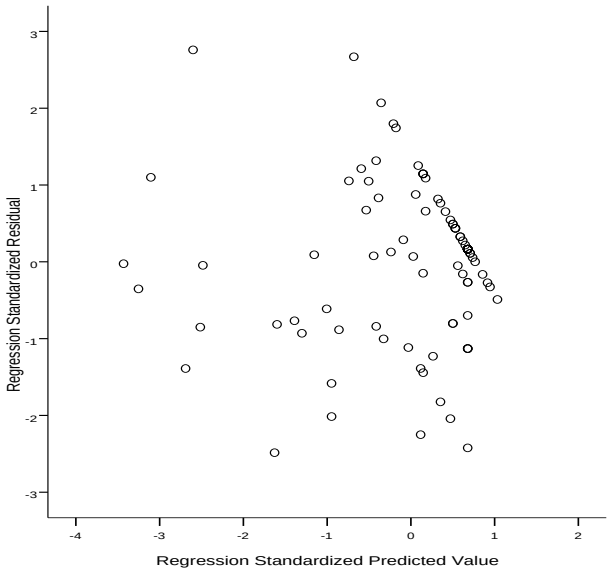

Figure 10. Residual plot for Research Question 2.

Table 23

Regression Coefficients for Research Question 2

Predictor	*B*	*SE*	β	*t*	*Sig.*
Boredom	0.21	0.08	0.16	2.50	.014
Frustration	-1.01	0.07	-0.98	-15.40	<.001

was a significant positive predictor of overall course satisfaction, $\beta = 0.16$, $p < .05$, when frustration was also in the model. This indicated that course satisfaction increased with increasing levels of boredom when considered in combination with frustration within this model. This unexpected result is discussed in Chapter 5.

Research Question 3

Research Question 3. Are students' elaboration and overall course satisfaction statistically significant predictors of their overall course completion?

H_0: Students' elaboration and overall course satisfaction are not statistically significant predictors of their overall course completion.

H_A: Students' elaboration and overall course satisfaction are statistically significant predictors of their overall course completion.

A binary logistic regression was conducted to address Research Question 3. The binary logistic regression is appropriate when predicting a dichotomous criterion. The following criterion dummy coding scheme was utilized for entry into the regression model: class grade (0 = B or C, 1 = A). The data were screened for outliers prior to analysis. A participant was considered an outlier when the absolute value of the standardized z-score was greater than 3. This process did not reveal any outliers in the

data. The variance inflation factors (1.083) and tolerance levels (.923) did not seem to reveal a problem with multicollinearity.

The classification table is presented in Table 24. Of the students, 52 received an A for their final course grade, and 23 of the students received a B or C. Thus, if one guessed that every student would receive an A, one would classify 69.3% of the participants correctly by chance. The omnibus model was not a significant predictor of course grade, $\chi^2(2) = 2.58$, $R^2 = .05$, $p > .05$. The model correctly predicted 94.2% of the students who received an A in the course. However, the model was able to correctly classify only two (8.7%) among the students who received a course grade of B or C. The coefficients are listed in Table 25. The coefficients indicated that elaboration and course satisfaction were not significant predictors of course grade within this model.

Table 24

Classification Table for Research Question 3

Observed	Predicted		
	Course Grade		% Correct
	A	B or C	
Course Grade			
A	49	3	94.2
B or C	21	2	8.7
Overall			68.0

Table 25

Regression Coefficients for Research Question 3

							95.0% C.I.for EXP(B)	
Predictor	*B*	*S.E.*	*Wald*	*df*	*Sig.*	*Exp(B)*	*Lower*	*Upper*
Elaboration	-0.04	0.29	0.02	1	.894	0.96	0.55	1.69
Course Satisfaction	0.25	0.16	2.46	1	.117	1.28	0.94	1.75

Research Question 3b

Research Question 3b. Is there a statistically significant relationship between students' elaboration, overall course satisfaction and overall course performance (final grade)?

H_0: Students' elaboration and overall course satisfaction do not have statistically significant relationships to their overall course performance (final grade).

H_A: Students' elaboration and overall course satisfaction have statistically significant relationship to their overall course performance (final grade).

I intended to use a binary logistic regression to address Research Question 3. The binary logistic regression is appropriate when predicting a dichotomous dependent variable. For this research question, overall course completion was to be coded pass/fail for entry into the regression equation. However, only one participant failed the course. Therefore, the lack of variability in the dependent variable precluded the use of the binary logistic regression. The traditional multiple linear multiple regressions also were not possible because the remaining course grade data were ordinal scaled rather that ratio scaled.

Therefore, I continued with the Spearman correlation because of the scale limitations and the lack of variability in the criterion. The Spearman correlation is a non-parametric equivalent of the Pearson correlation. It is appropriate when assessing the relationships among ordinal scaled variables. The descriptive statistics for the dependent and independent variables are listed in Tables 26 and 27, respectively. Most of the students (68, 89.5%) received an A or B in the course. The correlations (Table 28) indicated that elaboration and overall course satisfaction were not significantly related to the participants' course grade, $r_{sp} = .02$, $p > .05$ and $r_{sp} = .12$, $p > .05$, respectively.

Table 26

Descriptive Statistics for Course Grades

Course grade	*n*	%
A	52	68.4
B	16	21.1
C	7	9.2
D	0	0.0
F	1	1.3

Table 27

Descriptive Statistics for Regression Predictors

Variable	*n*	*M*	*SD*
Elaboration	108	6.10	0.90
Overall course satisfaction	107	5.83	1.60

Table 28

Bi-variate Spearman Correlations for Research Question 3

	1	2	3
Course Grade (1)	---	.02	.12
Elaboration (2)		---	.40**
Overall Course Satisfaction (3)			---

*$p < .05$. **$p < .01$.

Summary of Research Questions 1-3

The research findings indicated that for Research Question 1, SRL and task value were significant positive predictors of elaboration within this model. This suggested that elaboration increased with increasing levels of SRL and task value within this model. The participants' self-efficacy and prior experience in online courses were not significant predictors of elaboration within this model.

For Research Question 2, the coefficients indicated that frustration was a significant negative predictor of overall course satisfaction. This implied that course satisfaction increased with decreasing levels of frustration within this model. Surprisingly, the coefficients also indicated that boredom was a significant positive predictor of overall course satisfaction, $\beta = 0.16$, $p < .05$, even though the bivariate correlation of boredom and satisfaction was negative (-.48). This indicated that course satisfaction increased with increasing levels of boredom within this model when both boredom and frustration were used as predictors.

In Research Question 3, the dependent variable, course completion, could not be used for the logistic regression since there was only one respondent who failed the course

(lack of variability in this group). I went back and tried to use course grades by grouping students into two categories: A and B/C for the logistic regression. The model was not significant however. Next, a nonparametric Spearman correlation was done. The correlations suggested elaboration and overall course satisfaction were not significantly related to the participants' course grade.

The Qualitative Participant Profiles

The lived experiences of community college students enrolled in an online science course were found in their rich descriptions. The study profiled 12 students from various online courses at two community colleges with each respondent's permission. The profile of each respondent explains how I came to know him or her in the course of the interview. The respondents offered details about their family life, education, career goals, and the purpose of enrolling in the online science course.

1. Allison

Allison was 24 years old when we talked. She was married with no children. She was an only child. Her husband was self-employed and worked in the computer field. Immediately after high school, Allison had enrolled at a nearby state university to study business, majoring in finance. After 2 years, Allison found she did not like business and "didn't want to continue doing it." While volunteering at a hospital, she decided to shift to a career in the medical field. She currently works 20-30 hours a week as a CNA and as an EKG technician. While taking the science online course in the fall semester, she said that she also had worked part-time for 10-15 hours per week, but "closer to 15 hours per week."

Because a local community college was nearby, Allison enrolled there to earn an associate's degree with the goal of transferring to another 4-year college or university. Before enrolling in the college, Allison had taken two online courses in English and psychology at another community college. She said she prefers online classes over face-to-face classes in subject areas with which she was familiar because online classes could accommodate her work schedule. Allison indicated that she was comfortable taking science courses since she had already taken face-to-face courses in chemistry, anatomy, and physiology. The human genetics course she took at the college was her first online science course. Allison took the online genetics course because of her interest in the subject and because the course fulfilled a graduation requirement.

Allison characterized herself as an independent learner with a strong predilection for visual learning. She said she also learns by listening but more by looking at pictures and graphics. She described herself as someone who tends not to ask for help but who prefers to figure things out for herself.

2. Emily

Emily was a 22-year-old student who worked part-time to help pay for her education. She explained that she usually held multiple part-time jobs while attending college part-time. Her most steady part-time job over the past 5 years involved working at a nearby school district.

She referenced that she was currently living with her boyfriend who she had been with for about 2 years. She said she had a normal childhood but did not mention any other personal or family relationships. Immediately following high school, Emily entered a community college to earn an associate's degree in art. Initially, since she lived about

70 miles away from the community college and most of her classes were taken online. Emily liked the flexibility of time and place and she thought being able to take classes regardless of distance was an advantage of online learning. She explained, "the first time, when I first enrolled, it was all online for me." Emily said that she had enrolled in about five online courses during her previous semesters at the college. These online courses were mainly in "reading and language arts," such as film art, literature, and world geography. Because of this experience, Emily was very comfortable with the online learning format as well as the Web-based Blackboard course management platform the college used to deliver the courses.

Emily described herself as someone who learns well independently. She particularly likes hands on learning and is comfortable figuring things out on her own. She added, "I think that is why I do well in online courses because I try to learn from my mistakes and go from there." The anywhere, anytime nature of online learning appealed to her way of studying.

Prior to taking the online astronomy class at the college, Emily described herself as a strong, self-reliant student, "I have never gotten lower than a B+ in any class. Mainly all I get is A's." She was also a member of the honor society on campus. Emily described herself as someone who was organized and kept "on top of things." She commented on the fact that she enjoyed independent study and liked "working alone more." Further, she commented on working on her own: "I guess it is just less distractions for me. I can think about what I am doing a lot easier than having to do what everybody else is doing." Emily also noted that work was easier for her because she believed that "by yourself, you can get a lot more done. You can ask more questions, and you can understand it better

because you know where your weaknesses are." She also believed that in the safety of the Internet she could more easily relate to others, keep on topic, and "get the point across rather than being in a class and having somebody take a conversation way out there." She added that she knew she had been doing really well in school up until the science online course.

Emily enrolled in the online astronomy class during the summer semester. She stated that her favorite part of the course was the astronomy night sky drawings. Additionally, she thought the course was four credit hours and indicated that she worked a lot during while taking the online course, with two part-time jobs, one at a record store and another at a school. Additionally, while she also sporadically worked three jobs, she found time to study at night and on the weekends.

During that summer, Emily found the astronomy course to be very frustrating: "it was a tough class to take." She added, "I think it was the hardest class I have taken online." During the course, she experienced a high level of anxiety: "I felt a lot more stressed out than with any other course online that I have taken." Emily cited multiple sources of frustration and anxiety with the online science course. The first area of frustration was the extensive math involved with the coursework. She said that she became "lost" in the course because the math was "really hard to even understand, that was really the worst part for me." She also described the subject as conceptual, which "was really complicated."

A second area was the instructor feedback, which she described in the following comment: "He gave us feedback, but it did not always make sense." She noted that her initial confusion, if it was not cleared up, only compounded when the feedback came: "I

mean, if you are not understanding something and you get feedback it is hard. I think a lot of students, especially me, were discouraged from asking about it again." Therefore, when something was unclear initially, she fell into a vicious cycle of not understanding the material in the later chapters or the feedback from the later content areas of the course. She felt this type of confusion made the class "tough."

The third area was the textbook reading and homework assignments. The chapters in the textbook were long and full of material. She elaborated, "It took a long time to read and understand a science book. I felt like the reading was very hard. It took up the most time in the class" and the content was hard to relate to. As Emily stated, there was an "endless amount of theories you didn't know . . . endless amounts of stuff that you had to figure out." Emily also felt that the homework was confusing because it was on a different Web-based platform than Blackboard. Further, there was a test every week that consisted of about 60 to 70 questions. In addition, there was a video every week that Emily described as, "really long and really hard to understand." She also felt overwhelmed by the amount of material and the presentation of the material, as she stated, "No matter how hard I tried, I felt like I was swamped" and "It was really hard to grasp the subject matter in a lot of ways because there was so much to take in at once. It was really overwhelming."

The level and constraints of communication (e.g., via email exchanges), were also frustrating for Emily. She considered the communication rather limited with her online instructor: "I just didn't feel like the communication was open enough for me. I just didn't feel comfortable calling."

She described her situation: “I asked a few questions, but it is kind of hard and frustrating to just talk back and forth in email.” She complained, “It was really hard to keep up that communication.” Emily described a communication gap between herself and the instructor: “If I would have asked more questions, I doubt it would have helped me much in that class. I felt so confused by it. It was just really hard.”

Emily completed her online astronomy course with the support of her family and her boyfriend. She thought her boyfriend was very supportive and comforting to her as she struggled with the course material. In the end, Emily indicated that she earned a grade of a D in the online science course. “I am just glad that I just passed it,” was her final thought for the online science course.

3. Jim

Jim was a 20-year-old full-time college student at the time I interviewed him. He had recently transferred from a local community college to a large private 4-year university in Chicago. He had attended the community college for 2 years. Although he was still undecided about his major, Jim did express an interest in studying the sciences. Jim specified familiarity with the science content from prior coursework. He had a chemistry class and an earth science class at the community college. He also reported having taken physics, chemistry and biology in high school.

Jim had completed an online class in computer arts and two online English classes before enrolling in his online genetics class. He valued the flexibility of the online course. “What I liked about the course was just the flexibility and not having to go to another class.” While enrolled in the science online course, he also registered for three other classes that met on campus 20 days a week.

Jim believed that the online courses were a great way for people with busy schedules and multiple commitments to learn. “I think that the online course is just a good way to go if you are really busy,” he said. “If you don’t have time to fit in another class and are good at staying on task, it is a good way to go.”

Jim described himself as an independent learner with a good memory. He claimed to be comfortable with computer technology and learning online. He did not experience any anxiety or boredom while taking the course. He viewed the online class as an opportunity for self-paced learning. For Jim, the anytime, anyplace, anywhere nature of learning was nice “because you go at your own pace. You can work on your homework whenever.”

4. Charles

Charles was a 70-year-old lifelong learner who had a graduate degree in biochemistry and a medical degree. He was married and a father of six grown children (three biological, three adopted) when we talked. He now was a semi-retired physician who only worked only 10 hours a week.

Charles had an impressive educational background. He had completed 4 quarters at a very prestigious university in California, gone on to complete an undergraduate degree in chemistry and a master’s degree in biochemistry, and then attended medical school at University of Nebraska. After medical school and residency in pathology, Charles had enrolled in the Air Force, where he taught for 2 years. He had returned to the community college to complete an online course in astronomy for personal education and pleasure. He had been “an amateur astronomer for at least 10 years” and thought that taking a course would give him the structure to learn the science behind the subject. He

admitted to having a lifelong interest in astronomy and of owning two telescopes. In short, Charles loved to learn and take on many new subjects that interested him.

The science course was Charles's first online course. The flexibility and convenience of the online course appealed to him because he did a fair amount of travelling and still worked part-time out-of-state. For Charles, the anywhere nature of online learning was the most attractive feature. He noted, "I was out of town for nearly half of the course." During the semester that he took the science online course, he said he was able to attend his oldest granddaughter's graduation and had spent nearly 6 weeks in Washington State. He described the online science course as "fantastic." After he completed his online s astronomy course, Charles said he would like take a more advanced course in astronomy.

Charles described himself as "a pretty compulsive person" and as a "compulsive studier." From his days in the military, he claimed that he was well organized, disciplined, and comfortable working independently and "figuring things out on his own." In addition, he indicated that he was comfortable taking science courses since he already had a strong background in math and science. He said that prior to taking the course online, he had "tons of material on astronomy," so that part of him just wanted to "fill in the gap." While taking the online science course, Charles was very enthusiastic and stated the only drawback was the technology, which he was unfamiliar with and sometimes had to figure out on his own. He said that he did not earn a grade in the class because he was simply auditing it.

Charles was a life-long learner who was teaching himself French by using the Rosetta stone software. By the time of interview, he had already mastered three out of the five levels in the program within just a few weeks.

5. Hillary

Hillary was an older adult learner who enjoyed taking courses in subjects that interested her. Hillary said she loves to learn and try out different subjects. The format of distance education afforded her the ability to do her work from her computer. She explained her joy of learning: "I just like doing it. It is also a good example I think, for my daughter." Hillary felt that by her taking a class every semester it would help motivate her 14-year-old daughter to do well in school. Hillary also explained "that I am not just barking out orders, but that I can understand how it is to do some homework too." In the process of setting an example for her daughter, Hillary has taken a number of courses online. She described herself as a "pretty experienced student" because she has taken at least one distance "course a semester."

Hillary earned an undergraduate degree in French in the 1970s from a large state university on the east coast. However, she decided that this degree would not get her a job in a career she was interested in. Hillary stated that for a while she "drifted into different accounting and bookkeeping jobs." While working, she began taking correspondence courses in business and accounting from a large Midwestern state university. After taking these courses, she decided to pursue another bachelor's degree in general studies with an emphasis in accounting.

She had returned to the community college to complete an online course in astronomy for personal education and pleasure. Concerning this class, she thought that she "wanted to learn a bit more about it" and said she "enjoyed looking at the stars."

Concerning her experiences with online courses, Hillary could be described as a returning life-long distance learner. Hillary had taken numerous correspondence and online courses prior to enrolling in the online astronomy course. She revealed, "I would say I have probably have taken 15 or so" distance correspondence courses prior to the science online course at the community college. As far as online course, she also claimed to have "taken probably eight or so online courses in various areas" including economics, psychology, sociology, and math.

The independence, flexibility, and convenience of the online courses appealed to Hillary and she felt that she was "an experienced distance student" and confident that she could manage her time effectively. Hillary also described herself as a learner who needs both visual material, such as audio-visual lead instruction, and textbook-based instruction. She claimed to prefer a regular textbook over an e-book because "I have to highlight and underline." By highlighting, underlying, and rereading material, Hillary described a system where she not only constantly monitored her own learning but also utilized different resources, people, and activities to help her learning. She utilized generative note taking in the course of her studying. As she indicated, "I made notes on them [wrong answers] . . . and used those notes and labs pretty extensively." She went on to describe how she generated her own "little system of notebooks."

Hillary further described herself as “pretty excited” and “thought that I would do well” before taking the astronomy course online. She also stated, “I would have an easier time understanding the material.”

After completing the course, Hillary described the online course as “challenging,” “stressful,” “frustrating,” and more work than she had anticipated. For Hillary, the abstract concepts were especially challenging to understand, as she stated, “I was busy just trying to grasp some the concepts.” She also struggled to gasp not only the main concepts but also the math that was associated with the course, and she found herself emailing the instructor about questions and assignments. The instructor was very prompt in returning the students’ emails and indicated that she thought the terminology and not having enough examples to help guide her learning was a big obstacle.

Despite her struggles, Hillary believed in being a continuing student and enjoyed taking online classes on her own time, as she was also enrolled in a geology course. At the time of interview, she indicated that she found the geology course much more user friendly because the instructor had taken the time to incorporate instructional lecture and internet streaming components into the course.

6. Jeannie

Jeannie was 54-year-old lifelong learner who had a previous career as a chiropractor. Jeannie loved to learn, experiment with, and take courses in subjects that interested her. Originally from New York, she worked and had moved to Colorado to shift her career focus. She worked full-time as a development coordinator and managed different construction projects for the ski resorts in Colorado. She lived within 6 miles of a community college and liked taking continuing education courses the college. She

acknowledged that she had taken numerous courses for her "own education" on-campus at the community college prior to enrolling in her online astronomy course.

The astronomy course was Jeannie's first online course, and she had enrolled in the course for the fall semester due to a long-time interest in the subject. For Jeannie, the subject of astronomy "was something that I was interested in." She further discussed her long-standing interest: "I always liked the stars," and she noted that she could only take the astronomy class online since it was only offered online. Jeannie recognized, upon reflection, that her learning preference would have been to take the class on-campus.

Jeannie described herself as having a strong science background. In general, she depicted herself as comfortable with both independent learning and working with others. However, she noted, "I generally work independently, if I were doing homework or a project." At the same time, Jeannie noted that she enjoyed the interaction, stimulation, and back and forth connections made in the classroom from the exchange of others' questions of the concepts and theories discussed in class. For example, she felt that to "have other students around in the class asking questions sort of broadened the experience of being in class." Jeannie expressed her compatibility with the face-to-face classroom setting as well as online environment: "I do like the class experience as well."

In contrast to her face-to-face classroom experiences, concerning her online learning experience, she felt that she missed the "benefit of other people asking questions." She also explained that, in the online environment, she had to "figure out everything on my own," which was something that took more effort than she originally anticipated.

Further, Jeannie remembered having spent approximately 20 hours per week on the course and she thought the course demanded more time and effort than she had initially anticipated. The reasons she stated for having to spend so much time with the material revolved around the unusual nature of the subject and the complexity of the math involved in the course. As she explained, "There were huge equations, trying to figure out the gravitational pull of the Earth on the moon and the moon on the Earth. They were more complicated than I thought." Jeannie went on to describe how this made her feel like she was going to school all the time, which resulted in her feeling "aggravated and annoyed" by the experience. She was able to email the instructor for further clarification and help; however, she noted, "I felt like a pain in the butt because I had to ask a lot of questions. I would write my questions when I was annoyed."

During the semester when she was enrolled in the online astronomy course, she did not enroll any other courses, online or face-to face. Jeannie indicated that she received a B as her final grade; however, she was disappointed with her experience and she indicated that she would not take another online course in the future.

7. Tom

Tom was 24 years old, married, and a father of an 18-month old when we first spoke. He worked as an international sales development specialist for a large biotechnology company located in a town near the community college. He had been with the company for approximately 5 years.

Before employment, Tom completed a bachelor's degree in science and marketing at a 4-year university. Upon graduation and while working full-time at the biotechnology company, Tom began taking online courses offered at the college, where

he successfully completed two online courses: one in math and one in management. He had never taken an online science course prior to this experience; however, he had taken several face-to-face science courses as an undergraduate student. Through his prior science coursework, he felt he had a solid foundation in the sciences, which helped him successfully complete the online course in genetics.

Tom's position with his company required him to travel extensively and kept him constantly moving internationally and domestically. He felt the science online course afforded him access to education that otherwise would have been difficult to schedule into his busy life. The online science course also afforded him the convenience and flexibility of completing his work anytime and anywhere. While enrolled in the online genetics course at the college, he spent approximately 10-15 hours per week reading and studying.

Tom described himself as someone who makes sure to give his education equal priority as other areas of his life, including his personal and professional development. As such, he saw the online science course as a way to juggle his busy work demands while continuing to expand his knowledge base. Specifically, Tom wanted to take the science course to "increase my knowledge of genetics." Further, he felt that an expanded knowledge base would help him gain more confidence and understanding the biotechnology products he was involved with through his job.

Tom characterized himself as an independent learner who works well in both groups and independently, depending on the setting and type of work. For example, if a project involved a lot of thought and attention to specific details, he said he would like to work alone. However, he does enjoy learning from others in a group as well as getting the

stimulation of several ideas coming together to make a working product. His described his work habits: “depends on what I am doing” and the type of people he interacts with. In short, depending the situation, Tom loves to learn and continue to use online learning as an avenue to learn new subjects.

Tom was generally pleased with the online classes at the college and stated that he would be very likely to take more courses in the future if necessary for his work.

8. Bernadette

Bernadette was a 27-year-old nontraditional student who was married and the mother of 2-year old child. She was also a stay-at-home mom. She mentioned that she was going through a divorce at the time we talked.

Bernadette grew up in Pennsylvania. Upon graduation from high school, she attended a 4-year university in Pennsylvania as a marine biology major. However, she dropped out of school after her first semester because she was doing poorly and had a low GPA. She explained, “I was not ready to dedicate myself to learning and getting an education.” After Bernadette dropped out of school, she enrolled in a vocational/technical school and became a certified phlebotomist. She was working at a blood center and as a waitress when she enrolled in courses at her local community college. She said she took about 20 credit hours during this time. After 3 years, she decided to move to Colorado for her husband. Following her marriage, Bernadette became a mother and stayed at home to take care of her child for about a year. However, after being a stay-at-home mom, she decided that she wanted to continue her education.

At this point, she had been out of school for approximately 10 years. Upon beginning school this time, she stated that her goal was to transfer to a 4-year institution.

Her immediate educational aspirations comprised completing an associate's degree in English or history. After completing her degree, she planned to move and transfer to a 4-year university where she hoped to pursue a pre-med curriculum.

Bernadette mentioned that she had taken two online classes (world geography and cultural anthropology) before enrolling in an online biology course at the community college. In the geography course, Bernadette explained that the course incorporated interesting technology such as Google Earth. Additionally, the instructor incorporated many fascinating aspects of discussion, politics, and controversial topics related to world geography that made the course interesting. Similarly, she stated that the online anthropology class was a "really good class." She also said there was a lot of debate and discussion incorporated into the online anthropology class that made it very interactive. Bernadette also indicated that she felt "comfortable about it because I already had a background with . . . that kind of information."

Her reasoning for enrolling in the online biology class was because she did not have a car [limited transportation] and experienced limited childcare options. The online science course gave her the flexibility of studying on her own time and the access that she otherwise would not have had.

Bernadette further described herself as an independent learner and someone who "loves going to school." She loved to learn on her own time. For Bernadette, the online class offered the ability to "do it on my own time; I got to go at my own pace." She indicated that she took the online science course because she enjoyed all the sciences and "never felt anxiety about taking a course." She also expressed a familiarity and comfort level with the content and stated she had good prior knowledge of the information: "I was

already familiar with information." Bernadette was pretty comfortable with technology, although, since she had been out of school for a number of years, she did mention that she had trouble learning some programs, such as PowerPoint, during the class.

Bernadette portrayed the online biology course as having, "a lot of reading." She stated that the course was "more or less cut and dry" with some, but not a lot, of incorporation of discussion, debate, and interactivity. Additionally, the discussion required students to choose an article from a scientific journal article and write a short synopsis; then other students would comment on the summaries. She also noted that the class involved watching videos and participating in a series of labs. Bernadette reported a wide variation on the amount of time she spent on each lab. Finally, she summarized the course: "for the most part, it's a self-driven course."

9. Michael

Michael was 39-year-old adult learner who wanted to further his education in order to change careers. He was employed full-time and he lived approximately 10 miles from the community college he attended. He was married with two children who were 17 and 19 years old. Michael worked in the medical billing field for 10 years and wanted a career change with more opportunity.

Michael was pursuing an associate's degree in criminal justice. His immediate short-term educational goal was to transfer to a 4-year university. His long-term goal was to switch careers. While taking classes at the community college, he worked mainly Monday through Friday and he used the weekends and nights to study and take his online courses.

The online courses offered at the college provided him the access he needed to complete his educational goals. Further, Michael viewed the online science course as a way to continue working while fulfilling the requirements for his associate's degree. Specifically, he wanted to fulfill his general education science education credits by taking the online science course. Michael also mentioned that he had taken two other classes in addition to the online genetics class while enrolled at the college. Although he thought online courses were a good idea, he readily admitted that there were many distractions, such as "work, traffic coming home, trying to get dinner ready, and family" that hampered his academic online learning experience. He also found the course very frustrating and expressed a great amount of anxiety about the level of support the college provided in terms of tutoring and answering his questions while enrolled in the course. His final grade in the course was an F.

10. Sandy

Sandy was a 42-year-old adult learner who was self-employed. She worked full-time as a visual artist with a focus in painting. She considered herself an "alternative student" because she had previously completed a non-accredited art school many years ago. Sandy had decided about 1 1/2 years ago to go back to school so she "could get a degree that would actually mean something." In the short-term, she planned to complete her associate's degree in art with an emphasis in visual art from her local community college. In the long-term, she planned to transfer to a 4-year college to obtain a bachelor's in fine arts.

Sandy returned to the community college to complete an online course in astronomy for two main reasons, (a) to fulfill a graduation requirement and (b) because of

her interest for the subject. Concerning her reasons for enrolling in the online science course, she stated, “I need to have science credits for my degree” and “the idea of astronomy really interested me.” She expressed a genuine interest in knowing more about “what the universe is made of and what space is all about.”

The online science course in astronomy was Sandy’s first experience taking an online course. She described the course: “everything that we did was online with the exception of our astronomy journal.” She also noted that she could only take the astronomy class online since it was only offered online and the class did not offer a face-to-face element. She also recognized that her learning preference would have been, at first, to take the class on-campus.

Sandy claimed that, from the onset, she preferred to learn from others by participating in class discussions and the group synergy that occurred from instructor-driven exchanges was hard to duplicate in the online science course. Sandy noted that she enjoyed the interaction, stimulation, and connections made in the classroom from the exchange of others’ ideas. She also thought such connections were not possible in the online environment when “left to your own devices.”

Sandy further described herself as a “perfectionist” who had found many of the sciences “intriguing and interesting” prior to taking the astronomy course online. However, she claimed not to be personally drawn to the quantitative aspect or math side of science and she felt that she was more of a “history, art, and writing person.”

Before taking her online science course, she described her course expectations along the lines of the philosophy and visual elements of astronomy, such as looking at and drawing pictures of the night sky. For Sandy, astronomy was more about the visual

aspect of the science with drawings, philosophy, and history associated with the night sky. During the semester, she claimed that in the online environment, it was hard for her to ask questions about the math problems and feedback from the instructor was minimal.

After completing the course, she associated the online course with high levels of frustration and anger because the requirements and content covered placed too much emphasis on mathematical measuring and "a lot of figuring out." Specifically, she felt the course placed too much emphasis on the "mathematical movements of the universe." For Sandy, the frustration she felt for the course varied: "I was really frustrated not just with the instructor. I was also really frustrated with the college for not having tighter parameters for the definition of the class." With this comment, she was referring to the need for the course description to be more descriptive concerning the required prerequisites. Her final course grade was a D.

11. Jackie

Jackie was a 36-year-old nontraditional student with a reading comprehension disability. She was also recently divorced and the mother of three young boys; 5, 6, and 15 years old. She said, "Because I am a single mom, I am trying to do all my classes online."

Jackie graduated from high school in 1992 and took some courses at the community college, sporadically, while working full-time. She spent a number of years married, taking care of her family, and working various jobs. She was laid off from her full-time position about 2 years ago. Upon losing her job, Jackie decided to enroll full-time at the community college in August 2009. In the short-term, she planned to complete her associate's degree in art with a major in early childhood development from her local

community college. In the long-term, she planned to use her associate's degree to become a child play therapist. Jackie returned to the community college to complete an online course in biology for a variety of reasons including flexibility, interest, and the need to fulfill a graduation requirement. Concerning her reasons for enrolling in the online science course, she stated, "I need to have science credits for my degree."

Access, flexibility, and convenience of the online course allowed Jackie to juggle both priorities of her family and education. She noted, "It was more of convenience. To tell the truth, I didn't want to go to class. I am going to school, but I didn't want to take time away from my children." In terms of access, Jackie was grateful for the opportunity to have the flexibility to study on her own time: "If it wasn't for these online courses, I don't think for a single parent, or any parent trying to further themselves in education it would not be possible." Usually, Jackie would begin studying around 8 p.m. after her children went to bed. She noted that she would usually go to bed around midnight and she discussed how difficult it was for to keep up with completing her assignments on time. She stated that she probably spent, on average, 40 hours a week working on the online biology course.

Jackie had completed several semesters of online courses prior to enrolling in her first online science course. For example, she had taken three other online courses in various areas. The semester Jackie enrolled in her online biology course, she also took another two online courses, concurrently. She claimed that she was pretty computer savvy and would most likely enroll in another online course in the future.

Jackie also claimed that, from the onset, she was apprehensive about taking a science course online since she had not had a science course in a long time. She also

described her initial anxiety toward science as she thought she was not good at the subject. Prior to enrollment in the online biology course, she had taken one course in math and one course in English at the community college.

Jackie also described that her reading disability was a source of anxiety and possible obstacle for her learning and doing well in the course. Because of this comprehension disability, she said that she had difficulty reading and understanding the textbooks. Further, it would take several readings to understand and, even then, she might not be able to comprehend the material. In the past, Jackie had used tutors to help her with the college level material; however, this semester was the only time she did not have one. To compensate, Jackie reached out to two other women in the course and formed her own study group. By listening to the other students and asking questions when she was with them, she began to understand the material. She also described how she asked "a lot of questions" and "reread a lot of things."

Jackie enrolled in the online biology course over an 8-week summer semester. During that semester, she felt that there "was a lot of information and not a lot of time." For example, the class required the completion of 11 labs and 11 assignments. In addition to this work, students were also required to watch videos and participate in field trips to the zoo.

After completing the course, she described it as the most difficult course she took online. The main reasons that she thought the course was so difficult were because of the many time-consuming assignments the fact that the textbook was difficult for her to get through. Personally, during this time, she was going through a divorce, which, she noted,

"got really bad a month into the semester." The divorce made the summer especially emotionally taxing and the semester even more difficult.

Jackie completed her online biology course with the support of her instructor. She thought her instructor was very supportive and comforting to her as she struggled with the course material as well as her personal obstacles. She noted that her instructor provided the supportive empathy which helped her persevere and "stick to it."

12. Anne

Anne was a single, 30-year-old nontraditional student when we spoke. She was the oldest of six children with four brothers and one sister. She described herself as a person who took on the responsibility and care of her other siblings as she helped them with a variety of work-life issues such as filling out financial aid forms for college to helping her brothers find employment. As she explained, "I am just the kind of person who takes care of things at home." Anne also dabbled in photography, a long-time hobby. She also had a side-business taking graduation, engagement, and wedding photos for family and friends.

Anne earned an undergraduate degree in business with a math minor from a 4-year college in Nebraska. Following graduation, Anne worked for a nonprofit organization in Denver, CO. After working there for 6 years, Anne felt "burned out" and wanted to try something different. After some self-reflection, she decided that she would try teaching math at middle school level.

For the past 3 years, she has worked as a middle school substitute teacher full-time, while she pursued her math endorsement. She indicated that she was comfortable with math; however, found science courses rather complex. Annie stated, "I avoided it

[science] like the plague" in college. As a result, she had limited experience taking science courses at the college level. However, while in college, she had taken one course in biology. Anne enrolled in an island biology course during an interim break between semesters. In her class, she was able to participate in virtual travel to New Zealand, Fuji, and Australia and wrote a paper on the Great Barrier Reef. She described the biology course as "difficult" and "hard" but "fun" at the same time. She did not mind taking classes that were challenging as long as they interested her. Anne revealed, during the interview, an adventurous quality about herself and a desire to try new things.

As a substitute teacher, she was called on to teach "everything in the building" and gained valuable experience teaching. While teaching many areas at the school, she learned that math was really the subject area that she would like to teach. Last year, Anne was offered a long-term teaching position in math at the middle school after a teacher had left for maternity leave. She stated that she was currently on track for an alternative license teaching program. Anne wanted to use the credits earned in the online science course in astronomy to secure an endorsement certificate in math.

Anne described herself as an independent learner who was highly self-motivated and liked to achieve good grades. She stated, "I just love to learn." She also took great pride in her education as she stated, "I take education seriously . . . I wanted to put my best effort forward." Online learning appealed to her sense of flexibility and her busy lifestyle. Additionally, distance education was perfect for her complex schedule, family commitments, and busy life. As she pointed out, "it really worked out for me," since she preferred to learn alone.

Anne took the online astronomy course over the summer and she described that, initially, she was not apprehensive about taking the course. However, looking back on the experience, she depicted the course as "really difficult, but I liked it." She was not afraid of the challenge and she wanted to do well so she worked hard in the course. She put in approximately 16 hours per week on the astronomy course. She also said she would study between 4 and 5 hours for the tests. Concerning the time spent on the course, she stated, "I was not expecting it to be that kind of a load." Further, she mostly studied, read, and prepared her the assignments at night and on the weekends.

In terms of learning, Anne felt that there were some aspects of the online astronomy course that were easier than a face-to-face course. For instance, the online format was "easier" because she did not have to feel intimidated or self-conscious asking questions around other people in class. The online class format enabled her to ask questions directly to the instructor. She described the instructor as "pretty readily available" to answer questions. She also noted that she learned best visually but liked the quantitative math as well.

In other respects, Anne explained that online astronomy course was more difficult than a face-to-face course, specifically in the way it was taught because it was "super, super math heavy" with a significant amount of technical "science lingo" about different theories and principles. The incorporation of different theories and principles also required higher level thinking to answer the assignment questions. She expressed that there was "a lot of terminology that was thrown at you rather quickly."

The complexity of the material, along with her busy time-crunched schedule, made Anne worried and stressed about the course. She admitted that she had put some of

the pressure on herself because of her own expectations for wanting to do well. In order to combat these issues, Anne noted she "would try to start doing thing earlier in the week" and read the homework "as soon as it was posted."

During the summer semester, Anne also enrolled in another one credit hour course that was only 4 weeks long. For the most part, her time was dedicated solely to the online astronomy course over the summer term. Anne stated that she received a final grade of a B, and she was excited to take the additional online courses for her certification. She expressed, "I feel I learned more than I expected to learn."

Summary of Profiles

The participants were introduced to add faces to the voices that tell the story of the lived experiences of community college students enrolled in science online courses. Respondents came from various backgrounds with varying degrees of prior interest levels and experiences. Their reasons for enrolling in the science online course are presented next.

Motivations for Enrollment

Several online courses in biology, genetics, astronomy, nutrition and chemistry offered by a community college were sampled in this study. A number of the participants chose an online course because of its flexibility, convenience and access. Many participants expressed a personal preference to learn independently, and to try something new. Additionally, several participants indicated familiarity with the sciences and computer technology. Moreover, participants chose the online course because of personal interest in the subject.

Flexibility and Convenience

The nature of online learning allowed for individual variation in the physical environment. As a result, every student who took an online class was able to work at different times, in different locations, and under different conditions. The students were able to work from a variety of locations such as their homes, hotels, or remote locations.

The distance format allowed participants to determine when and where to complete the course. The flexibility of time and place took on different meanings for the participants. The opportunity to take an online class without going to the campus was particularly attractive feature for people with busy, unpredictable schedules and allowed participants to travel while still taking the course (geographic mobility). Other students appreciated the ability to take classes from their own homes, without worrying about transportation and child care. The online format allowed some of the participants to avoid problems of transportation, traffic, parking, and having to be at a set location at a set time. As a result, some participants stated that the online format made it possible for them to take more courses per semester. In addition, by restructuring their time, participants could fulfill their degree requirements while still working full-time. In this way, several participants were able to pursue their dreams and goals without significant personal or professional sacrifices.

Many of the participants enrolled in the science online classes because of the convenient schedule. Several could have taken on-campus science courses, but they chose the online format to ease the demands of childcare, work, and class schedules. The flexibility of time and place allowed Anne, Jim and Michael to work full-time while taking courses.

Geographic mobility was a key attraction for students in the online science course. Charles indicated that he spent over half of his time out of state while taking his online science course. For Tom, the online environment allowed him to keep an intensive travel schedule while being able to continue his education and self-improvement.

Access

The science online courses provided the access to higher education that Bernadette, Jackie, Emily, Tom, and Anne needed. They shared that online courses were their only access to higher education. Without this option, these participants would not have been able to continue their education.

As a result of geographic mobility, participants claimed that the science online course enabled them to overcome schedule problems associated with childcare or work. Allison, Bernadette, and Jackie explained how online courses allowed them to take classes while being able to take care of their young children. As a mother of a 2-year old, Bernadette, who had no car, believed that online course was her best option for access to higher education. She did not want her education to take time away from her child. The online science course allowed her to spend quality time with her child and still complete her course work. Jackie, a young single mother of three young children, could fulfill her degree requirements on her own schedule. Jackie stated that the online courses allowed her to finish her degree despite time and scheduling constraints.

Busy work schedules made many participants gravitate to the online format. The opportunity for higher education hinged on the availability of online courses for Allison, Emily, Michael, and Anne. Allison was able to juggle multiple part-time positions while enrolled in the science online course. The science online course created access for Emily

while working two part-time jobs. Michael claimed that online courses allowed him to hold his full-time position while pursuing a career change. Anne described how online courses allowed her to complete the certificate requirements for teaching at middle school.

Similarly, Tom had extensive job-related travel, which made his schedule very hectic. His travel schedule and busy family life made coming to campus virtually impossible. The science online course helped him to strengthen his background knowledge. The online format allowed him to engage in self-improvement and gain the specialized knowledge that he needed for his job.

Self-Enrichment in a Self-Paced Environment

Online science courses offered some participants the chance for self-enrichment and continuing education. Several participants expressed a longstanding fascination with science. Charles, Hillary and Jeannie were motivated by the self-enrichment aspect of online science courses. Many of the participants were already accustomed to learning independently. These participants described themselves as self-motivated and self-driven.

Many participants such as Jim, Jeannie, Hillary, Anne, and Tom said that they were already able to "figure things out" and were not afraid of trying new things. This comfort level with new experiences overflowed into many of the participants learning experiences as well. Anne, Charles, Hillary, Jeannie, and Tom indicated that they were comfortable with new subjects. Charles, Jim, Tom, Anne, and Jeannie also expressed a familiarity with the content because they had taken several science courses in the past. Both Charles and Jeannie already had graduate degrees in medicine and the sciences.

A few of the participants, like Anne, expressed a sense of pleasure for accomplishing "something very difficult." Hillary also stated, "I think I have a personal pride in being able to do a difficult course" which she attributed to her upbringing. As a child, Hillary's mother would encourage her by stating, "I always expect you to be the very best you possibly can." As a result, Hillary had good time management skills and was able to efficiently control her own learning.

Comfort Level

Participants, in general, had a genuine comfort level with online courses. Prior to enrollment in the science online course, Charles, Jeannie, Jim, Bernadette, and Tom had extensive background in the sciences and experience with other online courses. Michael, Emily, Hillary, Allison, and Jackie stated that they all had taken online classes in other areas and were comfortable with the community college's course management platforms. For instance, Hillary stated, "the last 5 years I have taken probably eight or so online courses."

An Interest in the Subject

Several participants enrolled in their science online because of an interest in the subject area. Some of them, who had a longstanding interest in the subject, wanted to learn more about it so that they could add to their knowledge base or apply the knowledge to their jobs. Charles, Hillary, Jeannie, Sandy, Anne and Sandy all expressed such a desire. Tom reported that he hoped to apply what he learned in his online genetics class to his current position as an international sales development specialist. Anne explained that the science online course enabled her to take courses toward certification as a math teacher while teaching full-time in a middle school.

Summary of Motivations for Enrollment

The motivations of students to enroll in science online courses varied. Many of the students were attracted to the flexibility and convenience an online course provided them. Several students viewed online courses as an avenue for access to higher education that otherwise they could not have. Some cited an interest in the material and subject area. Their interest in the material enabled them to pursue a personal self-enrichment goal in a self-paced learning environment. In addition, several respondents expressed a natural degree of comfort with learning independently with a technology platform. This subgroup preferred to learn online rather than face-to-face course due to the self-driven, independent nature of online learning.

Structural Themes from Students Enrolled in Science Online Courses (Experiences): Research Questions 4-6

Research Question 4. How do community-college students experience or make meaning of their online science courses? What underlying themes describe students' online experiences in community-college science courses?

Overall, the students surveyed in this study were satisfied with their course experience and indicated that they would be inclined to enroll in another online course. Most of the interviewed participants also stated overall they were satisfied with science online, even when they experienced challenges and obstacles. Such challenges led students to experience a variety of emotions.

The science online course structures describe how the phenomenon was experienced. Four structures emerged from the interviews. As the participants shared their experiences, their voices told of how SLR, student communication and interaction,

academic challenge, and their negative emotions shaped their lived experiences. This section of the dissertation describes a detailed examination of each structure.

Self-Regulated Learning Experience

Many participants reported during their course experience how they self-regulated their own learning strategies while enrolled in the science online course. Allison, Jeannie, Emily, Jim, Hillary, and Jackie were quick to identify the necessary adjustments they would have to make to complete their courses. The self-regulated adjustments came in a variety of forms: use of active learning strategies, self-monitoring of learning, and self-management of resources.

Active learning strategies. Many of the participants described their learning as an active, constructive process whereby they set priorities and used various tools to organize on a daily, weekly or monthly basis. As Jim explained, "I would just make sure that I stayed on track" by setting aside time every week to read a chapter. Jim would just make sure "I got that done" every week. In addition, Charles liked having the "structure of having to do things on a timeline." Hillary reviewed how she would "have little tabs in my book for each chapter number" and how she had her own "little system of notebooks."

Several respondents took the time to work proactively on long-term assignments when they were done with the regular coursework. For example, Anne described how she would try to do assignments earlier and "maybe even read the homework as soon as it was posted." Jim said he would "read all four chapters, and then three days before the test, I would start to go over the parts that where tricky." Participants described prioritizing and re-prioritizing assignments, assessments with their family schedules, and

work. As Hillary stated, “I use my outlook calendar. I keep everything organized here in my office.”

Participants expressed a need to extrapolate knowledge from the textbook and put concepts and terms together in their courses. Students recollected having to solve problems using material from the textbook chapters and doing laboratory exercises at home. Such exercises caused some students to go back and forth with the material, thus making the learning process more active.

Self-monitoring of learning. All of the participants described self-monitoring strategies such as rereading portions of difficult or information dense textbook chapters. Many of the participants used highlighting, note-taking, paraphrasing, annotating, and elaboration strategies and even researched the Internet beyond the textbook in order to gain further understanding and clarity. Self-correction was a strategy often utilized by many of the participants. For example, Jim said, “I also studied the study guide” since the guide provided different points that the instructor wanted the students to know. He would use the study guide to examine the areas where he would have “go back” to clarify and self-correct.

Some participants described utilizing a combination of several strategies in the science online courses. Allison, while taking the science online course, claimed to have used several learning strategies in order to understand the material.

> If I had trouble with something or I thought that it was really difficult, I wrote it down. You know those empty little notebooks? I would write down all of that stuff in there so that I could frequently check back to it. If I had a problem, I would write down the chapter term that I needed to work on [and] I would keep working on it.

If a concept was broken down into steps, Allison would write down the steps in her own words and review that area over and over again until she understood it.

In order make the appropriate connection, some participants described constant self-monitoring. The students portrayed a constant back and forth between textbook, homework assignments, paraphrasing and taking notes. For instance, while taking the online science course, Jim used several learning and self-regulatory strategies. First, he would do the homework, which was assigned at the end of each chapter, and then review the chapter study guides after reading each chapter. The study guides explained points the instructor wanted the student to understand. Jim said that although he did not highlight, make flashcards, or take notes while reading, if something in the text seemed confusing, he would reread that section until he understood it. He reported constant self-monitoring between the material in the text and the study guides until he had memorized the material. He stated, "The parts that I didn't remember from the study guide, I would go back and look at those." When he encountered material that was new or confusing, he would "figure it out" by this constant back and forth with the material. Jim stated that there was "a lot of little specific details that you had to remember" for the course, which were helpful for tying in the content by referring constantly to the text and study guides. He said that he remembered some of the basic concepts such as cell division from his previous biology classes, and that this knowledge was helpful in the online course.

Self-monitoring of resources. Participants also depicted a constant monitor and self-regulation of resources through various dimensions. The first dimension included the amount of time students allocated, expended, and put forth. For example, Allison would adjust her studying depending on if there were tests due that week. As a result,

participants were also able to adjust the amount of effort they gave depending on the amount of class assignments and projects that were assigned as well as adjust to approaching deadlines. For example, Jim stated that he would read the textbook and go over "the parts that were confusing." The third aspect was the students' ability to control their study environment and adjust to it when necessary in order to get the course assignments done. Hillary depicted how she has an "office upstairs so that I have a nice, quiet place to go and work or do my studying. My family is very respectful of mom studying, so leave her be."

Interaction and Communication Experiences

Participants depicted the awkward interaction and communication both with each other and their instructor through discussion and email. For example, Allison indicated how the instructor "wasn't really in contact with us; there wasn't any kind of discussion." A few expressed that the electronic discussion boards were not used effectively and did not really add that much to the class experience.

Most participants expressed uneasiness with interaction and communication with the course instructor. Several participants indicated that electronic communication through email was cumbersome because they would have to wait for a response, creating a backlog of questions and therefore slowing down their understanding. Others expressed concerns about their inability to describe their questions through email on content that was highly conceptual and abstract. For Sandy, the course placed too much emphasis on "figuring out" things, and the instructor left out many key points to understanding the material. She felt the course placed too much emphasis on the "mathematical movements of the universe" which was an area that she found difficult to ask questions about through

email. The questions were confusing and the instructors' responses were hard to understand or sometimes unclear.

In order to compensate for such communication barriers, a few students like Jackie and Hillary formed their own study groups with classmates the semester they took the science online course. In this way, Hillary was able to ask questions to her peers and learn from them as well as directly from her instructor. Others, like Michael described how he enlisted the help of neighbors who were well versed in the sciences.

Many of the participants described themselves as independent learners. Charles, Jeannie, Hillary, Allison, Anne, Tom, Jim and Jackie described themselves as comfortable learning on their own. For instance, Tom characterized himself as an independent learner who works well in both groups as well as independently on his own depending on the setting and type of work. For example, if a project involves a lot of thought and attention to specific details, he said he likes to work alone. However, he does like learning from others in a group and getting the stimulation of several ideas coming together to make a work product. His work habit really "depends on what I am doing" and the type of people he is interacting with.

Research Question 5. What are the reasons associated with course satisfaction of community-college students enrolled in online science courses? What challenges and successes do they experience?

Successes experienced. Students described their successes in the form of including self-regulation, time management, self-reliance, self-monitoring and support from peers. Students liked the challenge of learning something new, were not afraid to do

something they never had done before, and liked learning about a topic that interested them. Some students even found the course useful for work or further self-enrichment.

In this particular population of students, participants, in general, were not afraid of trying something new and were eager to learn. Students actually welcomed the "new." The students felt that they could take on the academic challenges, manage their time, and resources in order to be successful with their courses. Academic challenges came in a variety of forms as did the self-regulation of time, resources and study schedules (previously described in Research Question 4). However, despite the challenges students felt that they learned what they needed to learn and the courses allowed them to stretch themselves more than they had before.

Challenges experienced. Students felt they learned best from exchanges of ideas, information, and perspectives and opinions from competent peers. They felt that such an exchange mediated the development of higher mental functions such as understanding difficult concepts, thinking and reasoning. However, the online learning environment afforded minimum interaction and exchange of ideas. This lack of exchange lead to a one-way "push" of content and ideas from the instructor to student with little room for discourse and exchange. A lack of exchange led students to experience negative emotions of feeling anxious, confused, and frustrated. Challenges also came in the form of material/content complexity, busy schedules, and unclear assignments.

Academic Challenge

Academic challenge was heard in four major areas: (a) academic content, (b) course structure, (c) technology frustrations, and (d) time management. In many cases, the expectations of the participants did not match the reality that they experienced with

the academic content in terms of breath and depth. They believed the academic content and background knowledge would be much easier to understand. Most believed, prior to taking the course, that the content would be understandable and they would have the time, intellectual capability, and personal resources required to master the material. They expected that they would be able to keep pace with the content and have the required amount of time to be able to accommodate the coursework. All the participants entered the science online courses with knowledge of computers and most of them had taken an online course in another subject area.

Academic Content. In their experience, the participants expected to find a much less demanding class. The reality was very different. The participants found the science classes concepts that were complex, unfamiliar, abstract, demanding, and not intuitive. Most found the science courses too conceptual with excessive and cumbersome terminology associated the basic understanding of the material. For instance, Anne stated that there was, "a lot of terminology that was thrown at you rather quickly." Specifically, Anne explained, "the vocabulary and measurements in particular, all the different kinds of measurements" made the course difficult.

Some participants were challenged because they lacked the prior academic math skills or appropriate study time for the course. A few discussed how the courses failed to focus on application to everyday matters and relate to a concrete understanding of how things work. This made the science courses abstract, conceptual, tricky to apply to "real world" situations, and demanding to remember for the participants. For several of the participants, the academic content presented in the science courses was cumulative and usually focused on constructivist learning principles. In order to progress, participants

had to grasp the content in a sequential order. Failure to do so left them unable to understand the full nature of processes further along in the course and made them feel lost. Additionally, when the participants were unable to keep up with the pace, they lost the foundation and grounding necessary to stay current with the course. The discord in expectations versus the experience became a significant barrier to the participants' learning experience.

Course structure. In terms of the course structure, participants discussed how science information was presented and the structure left them to feel disconnected, confused, and overwhelmed. Participants were challenged to maintain interest in the subject matter when practical applications were either not discussed at all or were delayed until much later in the course. For example, Anne related how the online astronomy course she took was "definitely higher level thinking and you had to understand what you were reading."

The use of multiple software and technology Web-based platforms throughout the different portions of the course presented barriers. The nature and extent of the problems varied. The challenge was figuring out how to navigate the course management systems such as Blackboard. As Charles indicated, "it was a totally new experience so I had to figure it out" and he felt likewise with the other websites that he had to use. He indicated that it was confusing initially. Others had to resolve hardware and Web compatibility issues. Such technology issues added to the frustration levels of participants as well as causing extra time to be spent needlessly on the course outside of the regular coursework.

Course organization. In terms of course organization, many participants found knowledge gaps in the concepts laid out in the courses. As Anne explained, "you were

expected to just jump into the text and figure things out." In addition, Charles described how the instructor would have questions on the exams that were "serially dependent" so that "if you make a mistake on question A, you going to miss everything for the next 10 questions." This was "poor design" on the instructor's part according to Charles. For example, Tom indicated that the genetics textbook at times left out full descriptions of key concepts and definitions which made it hard to understand some fundamental areas. The knowledge gaps lead many to be confused and apprehensive about the courses. Emily described how the science course left her feeling apprehensive, overwhelmed, and frustrated due to the amount and type of content that was presented so rapidly.

Resource Management. Time management and efficiently acquiring the subject content was another problematical area that participants struggled with due to amount of material presented in the science online courses, while at the same time, managing work and family commitments. Most of the participants, even with prior courses in on-campus science a course, felt that time was usually hard to find. For example, the complexity of the material along with her busy time-crunched schedule made Anne worried and stressed about the course. In order to combat these issues, Anne "would try to start doing thing earlier in the week" and read the homework "as soon as it was posted."

Participants said that they had to put in much more time into studying, doing homework, assignments, journals, and understanding the content than they expected. Many participants expressed having to read and reread chapters and portions of chapters that were information dense with complex interactions and concepts. Charles, even with a strong science background, described how he broke down tasks into chucks to study and assimilate a little bit at a time. Tom detailed using the back of the chapter questions to

check and re-check his understanding of the complex and detailed information his instructor required him to understand.

Research Question 6. What are the reasons underlying the inhibitory dimensions, such as boredom and frustration, that influence success in an online science course?

Negative Emotions Experienced

Many of the participants experienced several negative emotions while enrolled in the course. There were four major types of emotions: anxiety, stress, frustration, and confusion. The various emotions seemed to influence the amount of effort and time that students spent on tasks. Interestingly, none of the 12 participants interviewed expressed any feelings of boredom in the interviews.

Anxiety. Anxiety was expressed as an initial feeling before taking the course. Not having an immediate physical connection with the instructor lead to apprehension about taking a course. Students expressed how they were worried about having questions and being confused about the material and then not having anyone around to help them out. Most participants described how exams in particular were a source of anxiety and apprehension. In addition, as Jim related, "I had a lot of different terms and definitions" to be remembered. Allison expressed anxiety because the online genetics course had "only eight grades", which made the course "terrifying."

In addition, outside personal conflict such as a divorce seemed to negatively impact a student's perception and motivation. For example, Jackie was confronted with a divorce when enrolled in her course. The divorce made the class especially emotionally draining and added to her anxiety. However, when the instructor communicated and emphasized with Jackie, she felt that she could stick to the course and ended up finishing

successfully. She described having her feelings of anxiety and stress lessened through direct instructor support and reassurances.

Stress. Many of the participants felt stress at a variety of conditions: grasping difficult concepts, excessive terminology, juggling employment, and coursework. In terms of concepts, Hillary noted, "It was stressful; I was so busy just trying to grasp some concepts" and "not enough examples were provided in the textbook." The excessive terminology made the content hard to understand. As Anne explained, "It was heavy" and "extremely technical." Bernadette also described extensive reading for her online biology course. Anne felt a lot of stress having to juggle full-time employment, changing jobs in the semester, and coursework causing her to feel time pressures. As Anne described her experience, "I wouldn't have enough time until the weekend and I literally had just the last couple of days to finish everything before I had to get it to him the night of Sunday."

Frustration. Frustration was an emotion that many of the participants expressed which related to the level of support, high degree of math, abstract activities, and the sequential nature of the material for some of the science courses. The level of frustration depended on for many of the students the amount of prior knowledge, feedback, and interactivity students experienced in their online courses. For Michael, the genetics online course was very frustrating because of the inadequate level of support the college provided in terms of tutoring and answering his questions while enrolled in the course. Thus, students' frustration with various aspects of the course led to low overall course satisfaction.

Other students felt underprepared for the level and amount of math that several of the online science courses asked them to do. For Anne, the astronomy online course she

took was “super, super math heavy.” Hillary described how she struggled to “grasp the main concepts and get the math and be able to complete the course.” Jeannie related how the class asked her to use “huge equations.” As a result, Jeannie was very aggravated and annoyed throughout the class.

The last area of frustration came from the sequential nature of the concepts and material. As Hillary expressed, “frequently the stuff we were doing built from what we had done in another lesson. So you had to know how to do a certain section before you could go on and do the next one that was coming up.” The sequential nature of problems and the additive nature spurred on more frustration for students.

> Obviously, if you didn’t come up with one and you had to use a mathematical formula and your answer for that was wrong then obviously down the line then some of your other answers would wind up being wrong. That was a source of frustration for me.

In order to keep building upon what she didn’t quite understand the first time around, Hillary tried to be as clear as she could be with her note taking and references. She would also go back correct her answers to homework so that she “could use them in the future.” Thus, students’ frustration with various aspects of the course led to low overall course satisfaction.

Confusion. Participants also expressed experiencing confusion when taking the science online courses. Confusion came in a variety of forms, such as, difficulty with math, abstract concepts, and technical terminology. Many students complained that the math level expected in the science online courses was much higher than described in the course descriptions. Hence, their expectation was different from what they encountered. The abstract concepts were hard to relate to and even harder to understand without having the immediate presence of an instructor.

Some students related their frustration to the high degree of textual material needed to be read for the course. The textbook, in many instances, was "heavy" with information which made it difficult for students to retain the information. Several students expressed that they felt that there were too many terms to remember. This made it hard for students to retain information.

Structural Themes from Students Enrolled in Science Online Courses (Personal Dispositions)

Although I anticipated developing structural themes based on student responses related to their personal experiences, I also identified a structural theme based on student responses related to their personal dispositions. The unique personal dispositions about these students was their ability not to be afraid to take on new endeavors, desire to learn, self-reliance, self-regulation of their learning, and resourcefulness. Students expressed a desire to learn the material and at the same time not be afraid of new learning environments such as Web-based course management software. In addition, students expressed a belief about themselves as positive worthiness and self-reliance, manifested in a can do attitude. By resourcefulness, this refers to (a) their ability to find and support the appropriate resources, such as teaming up with classmates, friends, or family members to make their own learning environment (create their own collaborate learning experiences) and (b) their ability to schedule time (give appropriate time on task) as well as juggle family and work effectively (multi-task). Also the participants were not deterred for finishing the course even though they experienced many task- and course-specific frustrations. For them, it was just another emotion to be felt, but ultimately, it did not stop them from trying to learn the material and finish the tasks.

Summary of Structures

The nature of online learning allowed for individual variation in the physical environment. Several structures emerged from participants' interviews about their experiences: SRL, communication, academic challenge, and negative emotions. As a result, every student who took an online class was able to work at different times, in different locations, and under different conditions. The students were able to work from a variety of locations. Consequently, participants experienced different online learning environments depending on their own dispositions, individual motivation, perceptions of academic challenge, independence, self-direction, self-reliance, prior comfort level of education, and resourcefulness.

Four major structures emerged in this research study. First, respondents described utilizing many levels of self-regulation such as active learning strategies, self-monitoring, resource, and time management. Second, in most cases, course interaction tended to be an area of difficulty and uneasiness for students because of the limited nature of email communications. Third, respondents indicated many successes and challenges in their courses. Students experienced a variety of successes, such as self-enrichment and learning information to help them with work related endeavors. Participants also expressed numerous types of academic challenges such as hard academic content, encountering difficult course structure, course organization, and resource management issues. Finally, respondents disclosed numerous negative emotions that they associated with the course, such as frustration, stress, anxiety, and confusion. For most respondents, such negative emotions impacted their recommendations to other classmates, and

acquaintances but did not significantly impact their desire to finish or not finish the course.

In addition, one structural theme emerged based on students' personal dispositions. The unique personal dispositions about these students was their ability not to be afraid to take on new endeavors, desire to learn, self-reliance, self-regulation of their learning, and resourcefulness. For student participants, personal dispositions did not impede their motivation to learn material and finish tasks.

CHAPTER 5: DISCUSSION

The present study examined the motivations and experiences of students enrolled in online science courses at a community college. This study was undertaken to provide an understanding of the relationships among each of the following variables: learning strategy (elaboration), self-efficacy, task value, negative-achievement emotions, metacognitive self-regulation, and course satisfaction to student's completion/ performance (course final grade). I used a mixed-method design with survey instrumentation and in depth interviews with 12 community college students who were enrolled in online science courses (astronomy, biology, human genetics, nutrition, and chemistry). Student interviews were used to gain an integrated perspective on the research regarding online learning environments.

Further, this study employed Bandura's (1997) social cognitive conceptual model of self-regulation to describe the relationships among the independent (e.g., self-efficacy, self-regulation, task value, elaboration, frustration, and boredom) and dependent variables. The model contained four interacting components: (a) personal factors, (b) personal behaviors, (c) academic outcomes, and (d) contextual features of the online learning environment. Guided by this model, I developed and explored the following six research questions:

Research Question 1. Are self-efficacy, self-regulatory strategies (metacognition), perceived task value, and prior knowledge statistically significant predictors of elaboration in online courses?

Research Question 2. Are students' achievement emotions (boredom and frustration) statistically significant predictors of overall course satisfaction?

Research Question 3. Are students' elaboration and online course satisfaction statistically significant predictors of final course grades?

Research Question 4. How do community college students experience or make meaning of their online science courses? What underlying themes describe students' online experiences in community college science courses?

Research Question 5. What factors are associated with course satisfaction of community college students enrolled in online science courses? What challenges and successes do students experience in online science courses?

Research Question 6. What factors underlie inhibitory dimensions such as boredom and frustration that influence success in an online science course?

Chapter 5 is organized into four sections. The first section includes a discussion of the research questions with particular emphasis on linking the current results to Bandura's (1997) conceptual model. The next section discusses the limitations of this study. The third section discusses the educational implications of this investigation and offers suggestions for future research. The last section provides a summary of the study and closing comments.

Findings Related to Research Questions

The universal question that guided the current study was "What are the motivations and experiences of community college students enrolled in online science courses?" As such, this study was designed with the goal of learning more about the motivations, opportunities, obstacles, and goals of online science students in a

community college. In addition, interviews provided an in depth examination of students' personal adaptive qualities and behaviors in online science courses.

Overall, findings from this study are compatible with prior research in the fields of academic personal qualities, motivation, self-regulation, academic support, instructor demands, and online learning (Berge & Huang, 2004; Tallent-Runnels et al., 2006). Further, students entered the online environment with certain personal qualities, such as self-sufficiency and a willingness to try new things, which made them suitable for the online environment. Additionally, students' emotions and experiences were shaped by a variety of factors, such as course structure, instructor support, academic expectations, and communication. Specifically, these results indicate that students in a self-paced online learning environment employ several adaptive academic behaviors; however, they can experience a range of negative emotions. The following sections describe, in detail, the extent to which the current findings correspond with the concepts and relationships depicted in the conceptual model.

Predictors of Elaboration: Research Question 1

Research Question 1 addressed whether self-efficacy, self-regulatory learning, perceived task value, and prior knowledge of participants were statistically significant predictors of learning strategies (elaboration) in an online science course. Bandura (2006) suggested that "proficient performance is partly guided by higher-order self-regulatory skills" (p. 308). These self-regulatory skills, according to Bandura, include nonspecific skills such as "diagnosing task demand, constructing and evaluating alternative courses of action, matching alternatives to strategies, and creating self-incentives to sustain

engagement in taxing activities" (p. 308). Students can use such nonspecific skills in other areas to varying degrees (i.e., co-development of skills).

Elaboration, self-regulation, and task value. To augment learning, students enrolled in science courses should match their study strategies to the required learning objectives. Elaboration consists of strategies that involve paraphrasing, summarizing, creating analogies, explaining the material to someone else, and generative note taking, such that the learner actually reorganizes and connects ideas (Lynch, 2010; Pintrich, 1999). Current findings indicate that elaboration increases with increasing levels of SRL strategies and task value within this model. Further, coefficients indicate that SRL and task value were significant positive predictors of elaboration within this model, $\beta = 0.50$, $p < .01$ and $\beta = 0.28$, $p < .01$, respectively. Based on these findings, it appears that students who self-regulate their learning and find the task valuable are also more likely to use elaboration.

Elaboration helps students develop their own foundation of knowledge by summarizing, creating analogies, and generative note taking (Lynch, 2010). Additionally, the various techniques used to process and help make sense of information include copying notes, paraphrasing, outlining, comparing, reading aloud, and discussing course content with classmates (Boyd, 2004). Because of their effectiveness, teachers encourage students to effectively utilize elaboration strategies to improve learning performance (Artino, 2008; Lynch, 2010; Pintrich & De Groot, 1990). Furthermore, students who self-regulate their learning use elaboration as part of their learning strategy to help make appropriate connections and improve learning performance. The findings from the current study support this conclusion.

Also of importance, students who believed the course was important and useful (task value) also reported using more elaboration. This finding is consistent with prior research in both traditional and online settings (Artino, 2008). Furthermore, one could speculate that a student's positive task value belief might be critical in online learning success (Artino, 2008). Moreover, in an environment as highly autonomous as online learning, adaptive motivational beliefs, such as how much a student values the course for future use, may be vital to initiate and sustain engagement (Artino, 2008; Lynch, 2010; Zimmerman, 2005).

Self-efficacy, prior experience, and elaboration. A student's self-efficacy can be viewed as a self-appraisal, or "I can do" feeling of his or her ability to master a task rather than an "I will do" feeling (Bandura, 2006; Lynch, 2010). The can stresses a student's judgment of self-capability to execute performance (Bandura, 2006). Efficacy beliefs are important because they influence whether students think optimistically, pessimistically, or strategically (Bandura, 2006). Self-efficacy beliefs also influence the course of "action people choose to pursue, challenges and goals they set for themselves, and how much effort they put forth" (Bandura, 2006, p. 309) as well as "how much to persevere in the face of obstacles" (Bandura, 2006, p. 309). Studies suggest that efficacious students report fewer negative achievement emotions such as anxiety, boredom, and frustration (Artino & Stephens, 2009), a greater use of SRL strategies (Artino & Stephens, 2009; Joo et al., 2000), and greater satisfaction with their learning experience (Artino, 2006, 2008; Lim, 2001). Highly efficacious students are also more likely to enroll in future online courses (i.e., improved continuing motivation; Artino,

2006; Lim 2001) and demonstrate superior learning and performance (Joo et al., 2000; Wang & Newlin, 2002).

According to Bandura (1997, 2006), self-efficacy is thought to vary in strength and level depending on the individual learner. A learners' self-efficacy influences three major areas: confidence, amount of effort, and emotional state. In addition, Bandura (1997) described that some self-efficacy beliefs have a broad range; that is, they encompass many situations, whereas others have a narrow range. Bandura also revealed that very high perceptions of self-efficacy may affect an individual negatively in terms of preparation and performance; specifically, too much self-efficacy can under motivate a student. For example, highly self-efficacious students may feel little need to invest in preparatory effort; therefore, some self-doubt and uncertainty has preparatory benefits that are beneficial to learning. Of note, optimal performance has been associated with a reasonable sense of self-efficacy to withstand failure, which is coupled with some uncertainty, as reflected in terms of the level of challenge in the task. Conversely, low self-efficacy can result in impaired performance since the student would be more likely to dwell on personal deficiencies and exaggerate potential difficulties.

Overall, the students who participated in the current study demonstrated high self-efficacy. Surprisingly, the participants' self-efficacy and prior experiences in online courses were not significant predictors of elaboration within this model. This finding supports the research of Artino (2008), who stated that self-efficacy beliefs did not add significantly unique information to the prediction of elaboration. However, it is plausible that self-efficacy was a predictive factor of elaboration but that it merely was weaker than task value and SRL learning such that it was overshadowed by the other two and thus did

not show any significant additive correlation coefficient. Also in line with Artino's perspective, I attribute this finding to the generalized nature of the self-efficacy scale used in this study. Specifically, the self-efficacy subscale employed in the current study was broad in that the subscale asked very general, overarching questions, particularly when compared to other self-efficacy scales that have been used to measure students' confidence in narrow academic domains, such as a scale for measuring adolescents' algebra self-efficacy (Bandura, 2006). According to Bandura (2006), self-efficacy scales should be "tailored to the particular domain of functioning" (p. 308) that is under investigation. Pajares (1996) also suggested that broader self-efficacy scales weaken the effects of assessments of self-efficacy. Therefore, future research should consider the extent that domain-specific self-efficacy scales might better explain students' elaboration behaviors.

Another possible explanation for the relationship between self-efficacy and elaboration in this model is that students who were enrolled in online science courses had a relatively high level of self-efficacy at base line as indicated in the descriptive statistics. Further, the current sample appeared to be very independent learners. Perhaps online science students who are less likely to rely on motivational beliefs, such as self-efficacy, have learned that effort pays off. The interviews conducted in this study support the idea of increased effort; that is, many of the online science students, when faced with difficult course material, increased their effort by studying earlier, rereading chapters or sections of chapters, and doing further investigation of a particular area via independent online research. Additionally, many of the students described themselves as independent

learners who were comfortable with figuring things out when they encountered unclear material.

Since many of the students interviewed in this study expressed that they used a variety of learning strategies, another explanation for the unexpected relationship between self-efficacy and elaboration in this model could be that the generalized elaboration subscale did not detect all types of elaboration. For example, students expressed several strategies not mentioned in the subscale, such as chunking, outlining, summarizing, rehearsing, generative note taking, paraphrasing, and studying with peers as well as metacognitive self-regulation.

The current study also revealed that prior online course experience was not a significant predictor of elaboration. Perhaps prior experience with online courses in other subject areas did not prepare the students for the types of elaboration and higher thinking that science courses require. One could speculate that, in addition to elaboration, science courses demand a specific combination of skills and learning strategies.

Predictors of Overall Course Satisfaction: Research Question 2

Research Question 2 addressed the extent to which the participants' achievement emotions, boredom, and frustration were statistically significant predictors of overall course satisfaction.

Frustration. According to control-value theory, negative emotions of achievement, such as frustration, can influence learning and performance through a variety of factors, which include attention, effort, and the use of cognitive and metacognitive learning strategies (Pekrun, 2006). Negative emotions "may well facilitate the use of specific kinds of learning strategies, even if such effects do not appear in more

consistent ways when self-report measures of learning strategies are used" (Pekrun et al., 2002, p. 99). Thus, researchers have suggested that, when students feel worried or frustrated, such emotional reactions negatively affect their academic performance (Artino, 2008).

The current study revealed that as course satisfaction increases, frustration levels decrease. The coefficients indicated that frustration was a significant negative predictor of overall course satisfaction, $\beta = -0.98$, $p < .01$. Wosnitza and Volet (2005) theorized that "in [the] solo online-learning environment, emotions are typically directed at the self, the task, or the technology" (p. 455). In the research study conducted here, all three kinds of directed emotions (e.g., self, task, and technology) were identified as factors via an analysis of the interviews. Some students discussed expressing several emotions due to their feeling pressured by time limitations and having too many other commitments, while other students described their emotions as directed toward different tasks, such as reading dense technical content and dealing with abstract homework assignments and confusing directions. Additionally, a few students complained about their frustration with technology and the asynchronous nature of online communication.

Based on the findings from the survey instrument, respondents were not highly frustrated. However, results from the interviews provided a more variable understanding of emotional responses. Specifically, many participants reported experiencing feelings of frustration while enrolled in their online science courses. This could be due to the generalized nature of the survey subscale; that is, respondents mentioned other types of frustration specific to the material, homework assignments, and courses that were not measured in the subscales.

When interviewed, participants cited a variety of specific reasons for their frustration including task-directed, self-directed, and technology-directed frustrations (Wosnitza & Volet, 2005). Task-directed frustration occurs when a task is ambiguous, such as abstract activities students are required to complete. Self-directed frustration revolves around the learner's difficulty in understanding the material, such as the amount of math involved or the sequential nature of the material in some science courses. Technology-directed frustration involves problems with the course management system or technology connectivity. Among the technology-directed frustrations that were expressed by students, specific frustration concerned using different course platforms, the level of support given in the course by the instructor, and a lack of computer help and after-hours help for their questions. For example, one student found the online genetics course to be very frustrating due to an inadequate level of support provided by the college in finding either tutoring or answers to his questions. Other students felt underprepared for the level and amount of math that several of the online science courses required.

Boredom. The survey and interview responses further revealed that participants who took online science courses experienced a relatively low degree of boredom, overall. Most students, when interviewed, said they experienced emotions related more to anxiety, stress, confusion, and feeling overwhelmed as opposed to boredom. The students may have been too involved with the terminology, concepts, and other abstract theories to experience feelings of boredom as evidenced by a number of respondents who reported that they were often overwhelmed during their class.

Additionally, the results of this research reveal that course satisfaction increased when the level of frustration decreased. In contrast, previous research from Artino (2008)

found frustration to have a positive relationship with metacognition. However, Artino did not explore the relationship with overall course satisfaction.

Although boredom was highly negatively correlated with course satisfaction (r = -.48), surprisingly, the multiple regression coefficients indicated that boredom was a significant positive predictor of overall course satisfaction ($\beta = 0.16$, $p < .05$) when considered in combination with frustration. In previous research, Artino (2008) found boredom emerging as a negative predictor of SRL strategies (metacognition); however, boredom was not studied in terms of its predictive nature with respects to overall course satisfaction.

One possible explanation for the positive and unexpected relationship between boredom and overall course satisfaction is that it could be a measurement issue. The results indicated a significant relationship ($p = 0.014$) between boredom and overall course satisfaction, which would speak to a low probability of a Type I error. If the positive relationship between boredom and course satisfaction is an artifact (Type I error), one consideration is the number of items in the measurement scale for boredom (measurement issue). The scale was a five-item scale, which may or may be a true reflection of the construct of boredom that it was originally designed to capture. By increasing the items within a scale, a scale could be made more thorough in order to assess all aspects (or dimensions) of the items in the boredom scale. Within this sample population, perhaps more items could be added in the future in order to capture an accurate picture of boredom as a construct. Also, perhaps scale is not really measuring boredom per se but rather a related construct such as attention that is labeled inappropriately.

If the positive relationship between boredom and overall course satisfaction is not an artifact, then an alternative explanation could be that community college students have different motivations for taking science online courses than do service-academy undergraduates. This concept was identified by Artino (2008) who indicated that students probably are more motivated since they would see a direct link to the course content and future career aspirations. There could be several moderating variables that affect motivation such as the type of student (traditional vs. nontraditional), course type, course expectations, professors' empathy, time, skill level, and the learners' experience online which complicate findings on the nature of the online academic self-concept. Two elements of online experiences examined in this study were frustration and boredom.

In this current population of students, overall most students were found to have low frustration and boredom but high overall satisfaction. Conversely, most students who were found to have high frustration and high boredom also had relatively low overall course satisfaction. However, nine students did not demonstrate either combination of these variables and outcomes with respect to boredom when frustration was considered, which occurred in opposition to indicated levels of frustration—when frustration was high, boredom was low, and when frustration was low, and boredom was high. In all cases, overall course satisfaction remained consistent with expected levels of frustration.

Although these nine anomalous students cannot technically be considered outliers, they are interesting from a mixed-method point of view. For this reason, I looked at their related data individually then made some observations and developed potential scenarios based on my understanding of the associated conditions and of human nature in general. Because only two of the nine anomalous students agreed to be interviewed, my insight

with regard to the personal perspectives of these students and how those perspectives might have affected their survey responses with regard to boredom (the anomalous variable in these instances) is limited. I concluded that although some scenarios may be more likely than others, the possibilities most likely worked simultaneously to produce the anomalous results.

Of the anomalous students (n = 9), three demonstrated low frustration, high boredom, and high overall course satisfaction (see Table 29). When I looked individually at these students, I observed that the students were all female and relatively young. Because the sample was predominately female, I would not necessarily consider this demographic a contributor to the anomaly. Although all the students would be considered non-traditional students, they all were 30 years old or younger. Of the possible scenarios offered for this group, it is most likely that this represents a generational phenomenon, where younger students may be more prone to being bored than are older adults. This may be a manifestation of digital natives, who expect high levels of stimulation, and because they are tech savvy, they are not being stimulated in this situation. Because they are used to the technology, they are not frustrated; however, they are bored with it.

At first it appeared that prior experience with online classes might have been contributing to the students' low frustration and high boredom, but case number 105 did not fit the pattern. With further consideration, it appeared that experience with technology may be the stronger indicator. Regarding final course grades, one might guess that despite being bored, students were satisfied with the course overall because they had

Table 29

Anomalous Participant Group (n = 3): Low Frustration, High Boredom, Low Overall Course Satisfaction

Case no.	Sex	Age	Reason for taking course	Prior online courses	Course grade	Prior math courses	Prior English courses	Experience with technology	Self-efficacy	Task value	Elab.	SRL
34	F	24	Nursing requirement	5	B	2	2	Extremely experienced (7)	6.4	7.0	6.0	5.9
105	F	30	Prerequisite or other reason	0		4	3	Very experienced (6)	6.0	7.0	5.8	5.1
19	F	27	Nursing requirement	3	B	2	1	Very experienced (6)	3.6	6.2	6.5	6.0

received an above average grade. That students had been enrolled in prior math and English courses before enrolling in their current online science class might indicate that they were in general prepared for the challenges of an online science course requiring math and writing skills and thus were not challenged but rather bored.

The values for self-efficacy, task value, elaboration, and SRL were all relatively high, with only one noticeable exception. The scores suggest another, yet less likely possibility—that these students considered themselves capable and found strong relevance of the course content to their person experiences, and for this reason, they activated their organizational strategies for learning. With the engagement of these strategies, their frustration levels would inherently be on the lower side, but also, they may have then found the class to be easier and thus felt highly bored. The second group of anomalous students (n = 6) demonstrated high frustration, low boredom, and low overall course satisfaction (see Table 30). When I looked individually at these students, I observed that again the students were all female. However, in this group, the students appeared to be older than the first group. Although like the first group, they would be considered non-traditional students—all 28 years of age or older, with 5 of the 6 being over 42. This also may be evidence of a generational phenomenon, the most likely scenario for this group, whereas while younger students may be more prone to boredom as digital natives, older, digital immigrants, may feel less comfortable with technology and therefore experience less boredom.

The majority of this subgroup, with the exception of Hillary (Case 26), had no prior online courses experience. This may have contributed to their lack of familiarity with the online environment, thus increasing their levels of frustration. In the interview

Table 30

Anomalous Participant Group (n = 6): High Frustration, Low Boredom, High Overall Course Satisfaction

Case no.	Sex	Age	Reason for taking course	Prior online courses	Course grade	Prior math courses	Prior English courses	Experience with technology	Self-efficacy	Task value	Elab.	SRL
26	F	57	General studies	5	C	1	6	Experienced (5)	4.2	4.5	7.0	6.8
96	F	42	Graduation requirement	0		1	3	Very experienced (6)	3.8	5.0	4.8	6.2
8	F	28	Physics	0	B	1	1	Very experienced (6)	4.4	6.7	5.8	6.8
45	F	54	Interest/fun	0		6	10	Extremely experienced (7)	3.8	5.0	4.8	6.2
14	F	46	Nursing requirement	0		3	4	Experienced (5)	5.4	6.8	6.3	4.7
28	F	44	Nursing requirement	0	B	1	1	Extremely experienced (7)	5.6	6.8	7.0	6.9

with Hillary, the student indicated that her particular cause of frustration was related to the nature of the course content. She described feeling extreme frustration over the complexity and extent of the math used in the course, which required extensive personal investment of time. In addition, she expressed frustration over the amount of terminology she had to learn and not having enough examples to help her guide her learning. But also, lack of prior online course experience may have resulted in greater degrees of intellectual challenge for this group in general, and thus the students were not bored. In the interview with Jeannie (Case 45), a student who took the class for fun, she indicated that she was a life-long learner. Apparently then, although she had not indicated a high level of task value, she still found the course interesting and thus may not have been bored.

Regarding final course grades, one might surmise (when examining this data in isolation), that lack of boredom indicated that students were engaged and/or interested in the material and/or kept busy with the course work. Perhaps, however, this interest and personal investment yielded grades lower than expected for these students and thus they were not satisfied overall with the course. That students had been enrolled in prior math and English courses before enrolling in their current online science class might indicate that they were in general prepared for the challenges of an online science course requiring math and writing skills. However, the majority of the group had only one prior math class, and perhaps this contributed to their lack of boredom because much of the material was new. This may have contributed to their frustration levels, which lead to low overall course satisfaction.

Regarding the values for self-efficacy, task value, elaboration, and SRL, this group appeared overall to be moderately lower in self-efficacy than the other group.

However, the values for task value, elaboration, and SRL appeared to be only slightly lower than that other group. This, although less likely than other scenarios, suggests that although the students did not find the course content as relevant or perceive themselves as being as capable, the students still were engaging and using organizational strategies, and thus were may not have been bored.

To gain a better understanding of the scenarios I created for the anomalous data groups, I compared the variables that had afforded the most feasible scenarios across the two anomalous groups and the remaining students in the sample (general population; see Table 31). Looking at the data, I found that the high frustration, low boredom, low satisfaction group was a good deal older than the both the other groups. Also, the differences between the low frustration, high boredom, low satisfaction group and the high frustration, low boredom, low satisfaction group were almost equally above and below the average scores for prior online classes, respectively. Looking at these data in conjunction suggests a connection between age and experience with online classes, which is inherently linked to experience with technology. One would have expected then, that the older students in the high frustration, low boredom, low satisfaction group would also then indicate having less experience with technology, but this was not the case. They did indicate having less experience with technology than the low frustration, high boredom, low satisfaction group, but they were still above the average level of technological experience indicated by the general population. Perhaps then, the connection between age, prior online courses, and low boredom stems not from technological experience but from the challenge posed by the course content itself. It is possible that the science concepts and math used in the classes were more familiar to the younger students because

Table 31

Comparisons Among Anomalous Participant Groups and the General Population

Variable[a]	General population[b] (Low frustration, low boredom, high overall course satisfaction / High frustration, high boredom, high overall course satisfaction)		Low frustration, high boredom, low overall course satisfaction group[c]	High frustration, low boredom, high overall course satisfaction[d]
Age (in years)	28.12	(*n* = 95)	27	45.2
Prior online courses	1.6	(*n* = 97)	2.7	0.8
Experience with technology	5.6	(*n* = 97)	6.3	6.0
Self-efficacy	5.9	(*n* = 98)	5.3	4.5
Task value	6.2	(*n* = 99)	6.7	5.8
Elaboration	6.1	(*n* = 99)	6.1	5.1
Self-regulated learning	5.8	(*n* = 99)	5.6	6.3

[a] Excluding age and prior online courses, all variable scores represents results on a 7-point scale. [b]Total participating students minus the nine anomalous students. Reported in terms of respondents for that subset. [c] *n* = 3. [d] *n* = 6.

they more recently would have experienced similar material in their high school classes. Excluding age, and very close to the prior online class's variable, the greatest difference in averages appears for self-efficacy. This concept though, seems more congruent with frustration than boredom. Differences in task value for both groups did not appear to be notable. Elaboration clearly was lower than the average for the high frustration, low boredom, low satisfaction group. However, like the concept of self-efficacy, this variable seems more closely related to discussion of frustration than boredom. Again, information provided during interviews by Hillary and Jeannie did not provide relevant data for explaining the anomalous boredom results.

This study's unexpected finding that boredom (when considered with frustration) was a positive predictor of overall course satisfaction suggests that some amount of boredom during an online course could contribute to course satisfaction if frustration is low. This very tenuous suggestion is certainly not meant to imply that courses should be designed to intentionally bore students but rather points to the multidimensional, complex, and intricate interplay between emotions and cognition.

Ultimately, the positive predictive relationship between boredom and overall course satisfaction when frustration is in the mix requires replication of this study to determine whether researchers can verify the data and to generalize results to other populations and other learning situations. Another avenue of future research would be to examine the specific links and the different subcomponents between boredom and course satisfaction with more detailed and extensive scales of measurement in different student populations.

Predictors of Course Completion: Research Question 3

I was interested in better understanding to what degree students' elaboration and overall course satisfaction were significant predictors of their overall course completion. First, I conducted a binary logistic regression to address Research Question 3, which was appropriate for predicting the dichotomous criterion. However, the binary logistic regression planned for course completion (pass or fail) could not be conducted because there was only one failure among the participants; therefore, there was a lack of variability. The coefficients indicated that elaboration and course satisfaction were not significant predictors of course completion within this model. Therefore, this researcher continued with another logistic regression using course grades as a dependent variable (A and B/C) and elaboration and course satisfaction as the independent variable. Overall, this logistic regression was not significant.

This researcher then conducted a Spearman correlation since there were scale limitations and a lack of variability in the criterion. For example, only one person failed the courses, which invalidated the logistic regression approach. The correlations (see Table 31) indicated that elaboration and overall course satisfaction were not significantly related to course grade, $r_{sp} = .02$, $p > .05$ and $r_{sp} = .12$, $p > .05$, respectively. However, an unplanned finding was that elaboration was significantly related to overall course satisfaction, $r_{sp} = .40$, $p < 0.01$. Thus, students who elaborated more often were also likely to be more satisfied with their course.

Online Student Experience: Research Question 4

To provide a greater understanding of the above quantitative data, qualitative interviews were conducted with a sample of online community college students.

Specifically, these interviews addressed the influence of student experience on creating meaning of their online science courses. Themes that emerged from these interviews provided a rich description of student online experiences in community college science courses.

In general, many participants expressed positive feelings about their online science courses. Additionally, most students indicated in the quantitative questionnaire that they would likely take another online science course in the future. However, the interviews revealed specific areas within online science courses that could be improved. For instance, students expressed areas of concern, such as the need for further clarification of math requirements and unclear material with corresponding homework, which some students found confusing. According to the students, these areas should have associated examples, models, and detailed explanations to increase clarity and understanding.

Further, abstract homework assignments and course material often led student to feel considerable frustration, anxiety, stress, and confusion. This was interesting given that, according to the survey, participants were not highly frustrated. This finding could mean that the survey only captured generalized types of frustration (generalized measurement by the frustration subscale) and that individuals experienced other types of frustrations that were task or technology specific.

Additionally, the survey results indicated that most students who took online science classes were very experienced in the online environment and were comfortable studying independently. As a population, most students had taken about two prior courses online before enrolling in the online science course. Further, participants indicated a

familiarity with the course management platforms used by the community colleges, such as Blackboard and WebCT. Taken together, online science students were highly motivated, utilized self-regulated strategies (metacognition), and had a high degree of task value. In addition, their learning exhibited high self-efficacy and high elaboration skills. Frustration was low for most students who took the survey; however, it was high for those students who participated in the interview. The dichotomous findings between levels of frustration in the surveys compared to the interviews could be related to the fact that the interviews captured a richer and more detailed multi-dimensional nature of students' frustration types, levels, and specific nature of frustration as an emotion rather than the generalized parameters captured in the survey instrument.

Personal dispositions. The personal dispositions of students varied. Respondents expressed a reasonable level of comfort with novel experiences and with their abilities to initiate more effort when facing a challenge. Participants also reported having self-reflective natures. Many participants liked working in a self-paced environment and were comfortable learning independently online. Several students indicated that they were self-driven, self-regulating, and resourceful, had a strong work ethic, comfortable with technology, and loved to learn new areas on their own. Many students also recounted making adjustments and self-regulating their learning during their course experience.

Online student experience. Four major themes encompassed the students' experiences: academic challenge, SRL, student communication, and the negative emotions that shaped student experiences. Academic challenge was a significant theme that ran through the course experience due to advanced terminology, fast paced schedules, abstract concepts, intensity of required math skills, and the breadth and depth

of learning skills that the students had to perform successfully. In the face of such challenges, many students reported feeling a sense of accomplishment that they were able to make adjustments, find support, and overcome the challenges of the science courses.

This research also found that students self-regulated on a variety of levels. For example, many students described how they decided to adjust their studying through self-management strategies or by adjusting their schedules. Such adjustments came in a variety of forms, such as self-regulation and the use of learning strategies, resource management, and collaborative learning with peers. Concerning resource management, time spent on the material, and studying course content required students to do several things: allocate sufficient time, select the appropriate place to study, utilize learning strategies, and manage environmental conditions. Further, regulation of effort by students was instrumental to the amount of effort they spent on learning. Finally, several students, when interviewed, indicated that they felt they had improved their learning by working with peers or by asking for help from the professor via email.

Lynch (2010) found a significant correlation between time spent studying and the study environment in college level face-to-face physics classrooms. Perhaps the amount of time spent studying, as an indicator of effort by the student, in conjunction with the study environment, are important factors that enhance student performance, which could merit further investigation.

Dimensions of Course Satisfaction: Research Question 5

Research Question 5 addressed reasons associated with course satisfaction and the influence of challenges and successes within the course on student satisfaction levels.

Findings indicated that most students who took the online science courses were satisfied upon course completion.

Challenges faced in online science courses. The literature supports the notion that students experience a variety of challenges in the online environment (Bambara, 2007; Piccoli G., Ahmad, R., & Ives, B., 2001). Specifically, Bambara (2007) found that (in other student populations) many students taking online courses experienced low retention rates because students were challenged by the subject matter or unfamiliar with the content, or experienced difficulties and frustration with the course organization, content sequence, or technology. Additionally, findings from Bambara's study, although in a different student population, reported that students often struggled with new terminology, complicated formulas, and foreign content.

Many of the challenges that students experienced in online science classes also came in a variety of forms. For example, students mentioned the unfamiliarity with science terms and concepts, which presented some challenge for students. The quantitative nature of the courses was also a challenge for some students. For other students, the heavy emphasis on mathematical equations and computations involved in the coursework presented challenges. Further, students expressed feelings of being overwhelmed and experiencing difficulties with the amount of information presented to them. Some students reported having to read a lot of textual material on difficult concepts. Along these same lines, many students felt this primary reliance on reading without practical application contributed significantly to the difficulties they experienced in maintaining interest. Other students explained that the courses lacked audio-visual learning components, such as videos, that are often found in a traditional face-to-face

class. In short, multiple methods of presenting material and teaching, which reinforce each other, were not only lacking, but were wanted by students in the online environment.

Students identified a major source of challenge were significant communication gaps between themselves and the instructor. The communication of complex information via email and asking appropriate questions was an area of difficulty due to complex concepts presented in the course material. Additionally, communication and the lack of interaction in online science courses was a challenge for most students. The interviews did reveal that some students either felt uncomfortable about expressing or were unable to express their confusion in an email. In addition, some students described that they felt uncomfortable repeatedly emailing the instructor with difficulties on abstract concepts and often did not know how to appropriately ask for help on complex topics. Minimal instructor feedback with unclear explanations also hampered learning for students. Students also felt they learned best from the exchanges of ideas, information, perspectives, and opinions from competent peers. However, it was not possible to replicate these activities in the online environment as the online science courses did not incorporate a lot of discussion, debate, or interaction.

Another issue relevant to communication within the course centered on student familiarity with the electronic platform in which the course was presented. Specifically, students who were unfamiliar with the navigation of the course management software found the multiple platforms and websites used in some of the science courses challenging. One student criticized the college for not having tighter parameters for course prerequisites in place for the science course.

Successes experienced in online science courses. Students described enjoying many triumphs and achievements from their online science course experience. Specifically, participants indicated being drawn to the opportunity to learn in a self-paced environment where they could learn anywhere at any time, which was in agreement with studies in other student populations (Bambara, 2007). Additionally, the courses allowed students to learn on their own time. The flexibility of online learning helped students manage multiple commitments and busy schedules. One of the biggest successes was that students praised the online science courses for enabling them to balance family, work, and coursework in a time-efficient manner. The science courses also allowed students access to education and complete coursework that they would have otherwise been unable to pursue. As indicated by the results, the option to learn in a self-paced, self-driven environment was attractive for some students. As Bernadette verbalized, "I like learning by myself."

Students also described their course successes in numerous ways. Many interviewees described being comfortable with technology and thought that prior content knowledge in the area of study helped make their coursework easier. Several participants described a high comfort level with new experiences and learning on their own. Some forms self-learning included self-regulation, time management, self-reliance, self-monitoring, and support from peers and family members. Additionally, some students described the enabling nature of online communication; that is, the ability to reach out and ask questions directly of the instructor without having to feel intimidated or self-conscious. To compensate for the feelings of isolation, some students reported that they reached out to others and formed informal study groups. Further, students described

constructing their own supportive environments by seeking comfort from peers, family, spouses, and significant others, such as boyfriends or girlfriends.

Finally, some students expressed a strong sense of task value for their respective science courses. These students wanted to use the information they gained to help them with future work-related tasks, such as earning a teaching certificate or gaining background knowledge for work-related functions. Others expressed the desire to learn and use the material simply because of a long-standing interest in the particular subject; they thought the course could help fill-in their knowledge gaps.

Emotional Components: Research Question 6.

In the online environment, social and emotional areas are less visible; however, they do influence student learning (Wosnitza & Volet, 2005). A number of concepts exploring the influence of emotions on learning have emerged in recent literature on online learning (Gunawardena, Lowe, & Anderson, 1997; Kreijns, Kirschner, & Jochems, 2002; Volet & Wosnitza, 2004). These areas include social presence, sociability, and distributed emotions. Analyses of student interactions in both synchronous and asynchronous environments have provided some support for the significance of emotions on the process of learning (Wosnitza & Volet, 2005). However, the mediating role of student appraisals of online learning activities and the process of emotional involvement during the online learning process remains unclear and warrants further investigation (Wosnitza & Volet, 2005). As such, Research Question 6 examined reasons that underlie inhibitory dimensions, such as boredom and frustration, and their influence on success in an online science course. Many participants experienced several negative emotions while enrolled in their course. Specifically, four major emotions emerged: anxiety, stress,

frustration, and confusion. Each student experienced negative emotions on a variety of occasions during the course; however, such emotions were the result of feeling overwhelmed.

Additionally, there were three primary levels of negative emotions that were directed at the self, the task, and the technology (Wosnitza & Volet, 2005). Self-directed emotion included anxiety because the students felt underprepared: "That was much too hard for me." Task-directed emotions occurred due to a lack of clarity in the task. For example, students reported that science courses had too many unfamiliar terms, complex concepts, and unusual homework assignments. One student expressed her concerns in despair, "What should I do? I really don't understand how to do this assignment." Materials and course concepts were presented sequentially and then made more complex, building upon each other, which lead many students to feel overwhelmed when they were unable to link the information together appropriately. Finally, technology directed emotions came in the forms of confusion and despair of having to use multiple course platforms which were unfamiliar and not well explained.

These various emotions seemed to influence the amount of effort and time that students spent on tasks. Many of the students expressed putting in more effort as a compensatory response to the challenging material and assignments. Despite feeling overwhelmed, the majority of students described feeling capable and they expected the extra effort to make a difference in their course performance.

Limitations of the Study

The current findings regarding community college students in online science courses provide relevant and much needed information about online learning; however,

they must be considered within the limitations of this study. These limitations may reduce the ability to generalize the findings from this study to other populations. The main limitations concern the sample size examined and the population of the sample in terms of scope and gender.

Sample

The current study used a convenience sample of students from two community colleges. As such, the results may not be generalized to other community colleges or other types of higher education institutions.

Online Science Students

The study was delimited to students enrolled in online science courses. Since online science courses are highly technical, mathematical, autonomous, and self-paced, a particular subset of the typical community college population may self-select themselves to enroll in such courses. Therefore, current findings may not be representative of students in all online courses at community colleges or of students taking online courses at 4-year universities. Also, because of the small sample size of interviewed students and the fact that the students self-selected themselves, this population may not have been representative of all community college students.

The Role of Gender in Motivation

The role of gender in learning strategies and motivation may be one dimension that remains unclear from the results of this study; specifically, the population in this study was predominantly female (88.6%). Gender differences in various motivational constructs such as self-efficacy, task value, and elaboration have been reported among college physics students (Lynch, 2010). For example, Lynch (2010) found a large

correlation between male self-efficacy scores and final grades. Task value and rehearsal were also correlated in males but not in females. Further, metacognition and study time environment scores for males were significantly correlated with lab scores. In contrast, self-efficacy and elaboration for females correlated with effort. Perhaps some of these differences can be related to the composition of the population in terms of gender. Future research in this area is warranted.

Study Implications and Future Research

The literature reports concerns for creating learning environments in which students remain motivated, integrated, and interested. In response to a need for more effective, student-focused science education in the online environment, this study examined the motivation and perspectives of successful online students in community colleges. Specifically, this study focused on students who were enrolled in a variety of courses offered online at two community colleges—one in Colorado and one in Illinois. As a note of caution, instructional implications of this investigation assumed causality although doing so requires additional empirical evidence.

Task Value

Students in this study exhibited a high degree of task value overall. According to Artino (2008), task value may play a facilitative role in motivating the performance of students. Research by Sun, Tsai, Finger, Chen, and Yeh (2008) confirmed that perceived usefulness by students significantly influences course satisfaction. One could speculate that making tasks relevant or connected to the personal world of students could enhance the motivation of online students. Perhaps faculty and institutions should consider integrative projects focused on individualized (task value) orientations such as using

problem-based learning, providing modeling to support learning, scaffolding learning through the use of learning modules, integrating field work that interests students, interviewing real people, visiting zoos or museums, shadowing professionals in the field, incorporating kitchen labs, or engaging in internships connected with the coursework. Alternatively, faculty could embed various learning activities into homework to reinforce specific learning strategies such as introducing short case studies or problem solving of real-life situations.

Moreover, future investigations should examine whether instructional intervention that is designed to increase task value, or bolster the task-value beliefs of students, improves student course satisfaction and performance. In addition, further research into how student learning can be better integrated toward future utility of course content in their daily lives is also warranted. Alternatively, further studies that examine how instructors positively influence their subjective perceptions of the learning environment could improve learning and performance in the online environment.

Student Motivation

Many respondents who were interviewed were highly and intrinsically motivated, loved to learn new material, and reported a desire to master assignments; respondents depicted themselves as having a strong work ethic and being independent learners. Some students described that doing their best under all circumstances was very important. Specifically, the qualitative results indicates that respondents who put forth greater learning strategies, such as elaboration, organization, and rehearsal strategies, also described themselves as being generally more satisfied with their online learning experience. Perhaps students who put forth their best effort feel more satisfied because

they feel that they did the best they could in a difficult course (even though their grade did not necessarily reflect this).

Concerning instructional implications for online students, some possible suggestions to foster motivation include sending out motivational emails, providing positive feedback on a frequent basis, sending out recorded MP3 files for students to hear and respond to, and adding visual aids or diagrams. Future investigations into sustaining and developing motivation in the online environment warrants inquiry to determine what parameters could optimize student motivation in course-specific areas and further develop approaches to enhance the use of learning strategies.

Emotional Influences on Performance

Respondents experienced many emotions while enrolled in their online science courses. Several negative emotions, including frustration, were consistently high in this (interviewed) population of students. However, these negative emotions did not appear to diminish the continued motivation of students to succeed in the course, rather it affected the student's recommending of the science course to friends or acquaintances. As a result, faculty and institutional administrators should examine emotional factors within online science courses (and within the college) that could be managed better to suit the needs of students to mitigate the influence of negative feelings such as frustration, anxiety, and confusion on course success.

Wosnitza and Volet (2005) reported that a "responsible teaching presence and appropriate leadership and direction" are important for the knowledge constructions and continued motivation of students (p. 458). Faculty must be cognizant to give appropriate direction to students in areas where anxiety, confusion, and frustration may occur. In the

absence of social cues, instructors might encourage their students to disclose their emotions regarding areas of confusion and anxiety by developing open discussion forums online for peer-peer communication; instructors could periodically monitor such forums so proper intervention can occur. In addition, online instructors should (a) be sensitive to the areas within their online courses that could trigger negative emotions such as confusion, anxiety, or stress and (b) act proactively by giving detailed directions, creating handouts with screenshots, and providing clear instructions through short animated instructional multimedia programs to combat these emotions or increase communication with students within these areas. Thus, it is important for online instructors to monitor and understand the processes that trigger negative emotions in order to intervene effectively (Wosnitza & Volet, 2005).

Future suggestions for instruction may encompass a wide range of strategies, such as frequent instructor communication (e.g., weekly motivational emails to online students), an open forum to discuss online emotions within the course, online tutorials or handouts that explain the details of various course platform systems, and the incorporation of online math websites with tutorials into the course to help reduce negative emotions. Accordingly, further research should consider understanding the connections between students' feelings, thoughts, and actions during online learning. A range of questions for such future research include (a) What types of emotions tend to be disclosed and which do not?; (b) What are the positive and negative implications of emotional disclosures in online courses?; and (c) When and why do students decide to disclose their emotions (Wosnitza & Volet, 2005)?

The Importance of Timely Feedback

Faux and Black-Hughes (2000) compared traditional, online, and hybrid sections of an undergraduate course in social work and found that online students sought more instructor feedback and auditory stimulation; they wanted to listen to historical material rather than read about it. Emotionally, students in enrolled in online science course in this study reported that receiving regular feedback made them feel they were in touch with the instructor and it was helpful to know that a person would respond in a timely manner. In short, instructor feedback helped support the students' learning and maintain progress in the right direction. Some respondents expressed a need to have short, incremental activities, perhaps on a weekly basis, with feedback so they could gauge their own progress.

Many students discussed how important they felt it was for an instructor to provide clear, specific, and timely feedback. Feedback was critical to maintaining and building upon past mistakes as well as nurturing and fostering improvement and skill building. Basically, students would like to use the instructor feedback on assignments to better adjust to conditions and to self-monitor their progress. One student stated, "I always appreciated her [the instructor's] comments." Another participant, Bernadette, discussed that knowing exactly how she performed by reviewing the instructor's comments, which were integrated alongside each assignment, was important to her continued motivation and understanding.

Supportive Role of Faculty

Current findings corroborate those of Sun et al. (2008), Piccoli et al. (2001) and Smeets (2005). Specifically, instructors play an important supportive role in online learning environments and can influence students through enthusiasm, their own attitude, empathy, and responsive communication. Further, many students stated that they felt open, consistent, and frequent communication with the instructor was critical to their online learning experience. Further, some felt that just knowing someone was there if they needed them was valuable. Sun et al. (2008) confirmed that a key dimension to online course satisfaction is timeliness of the instructor's response. Sun et al. (2008) indicated that when instructors exhibit positive attitudes and have enthusiasm for the online class, the positive attitude further motivates students. In light of this, administrators should be careful in selecting instructors for online courses or provide appropriate training for teaching online since a negative perception might hamper students' motivation to continue their online course.

In addition, faculty could support student learning with weekly Web conferencing (with Elluminate or Webinar sessions) by creating and emailing MP3 files or designing customized instructions with screen shots or screencasts (Jing or Screenr.com). Perhaps future systematic research can explore the support faculty can offer to positively influence online learning environments, especially in terms of student motivations. Future research focusing on increasing faculty communication with students, lessening anxiety, promoting the use of learning strategies, and enhancing online motivation for students would also help structure online science courses to be more learner-centered.

Institutional Support

Better online support services, staff development, and academic advising are activities that Berge and Huang (2004) advocated to ease the transition of students into an institution. In circumstantial variables, Berge and Huang encouraged institutions to assess the perceived utility and satisfaction of students in order to make improvements to their courses. Additionally, Sun et al. (2008) advocated for college administrators to identify different assessment schemes, such as self-assessments and peer assessments, to evaluate student performance so students could monitor their own achievements. Future research investigating how to best tailor online modules for online student orientation and assessments could be of value to help the student self-monitor progress.

Summary

Many community colleges implement online learning to meet students' needs, especially those of nontraditional students. Since online learning is conducted using course management platforms and the Internet, the learning experience becomes complicated. The complex nature of online learning precipitates the need to use multiple methods and multiple sources of data to understand individual learning. Hence, students' motivations, emotions, and experiences that results in perceived course satisfaction will determine whether they will use online learning.

As a whole, the current research study suggests that individual variation occurs in the online learning environment. The dimensions that appear important for online science learning are the personal dispositions of students prior to coming to the online environment, their ability to self-regulate learning (the behavioral dimension), and the role of various emotions that impact academic performance. Moreover, in the online

environment, constructing extensive, flexible knowledge generation involves having several activities: extensive communication, the students engaging in self-monitoring, and having the instructor provide extensive timely feedback.

These findings largely support the existing literature on self-regulation, task value, and motivation. The results offer support that academic self-regulation and the use of learning strategies is complex, interrelated, and multidimensional in the autonomous self-paced online environment. In particular, the findings shed light on some of the emotions and several adaptive behaviors that students engage in to enhance their academic performance.

Further research on motivation, the role of emotions, and factors that may increase self-regulation in online science courses is definitely warranted. In particular, the role of emotions and how to have students disclose them in an appropriate and timely manner in the online environment warrants attention. Having access to students' emotions, especially negative ones, is vital to instructors so that they may provide immediate and effective intervention, therefore improving course retention. Thus, future research in the areas of emotions, motivation, and self-regulation could help online instructors and administrators design reliable instruments and provide explanations for improving student motivation, learning, and retention.

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APPENDIX A: ELECTRONIC LETTER TO DIRECTOR OF RESEARCH/ ADMINISTRATION REQUESTING ACCESS TO STUDY SITE AND PARTICIPANTS

Director of Institutional Research
Community College
XXX, Illinois xxxxx

Dear XXXX (Director of Institutional Research),

Thank you for allowing me to conduct my dissertation research at your site and for agreeing to assist me in gaining access to potential participants. As a reminder of my background, I am a doctoral candidate in Education at Colorado State University located in Fort Collins, Colorado. My study is "The Experience of Community College Students Enrolled in Science Online Courses." I would like to begin my study in the next few weeks. As requested in our April XX, 200 X phone conversations, I am enclosing the approval letter from Colorado State University Human Subjects Review Board as well as a copy of my approved research proposal.

My research will involve an initial survey followed by some selected interviews with students who are enrolled in science online courses at the community college.

To gain access to these courses and students, I will need your assistance. Attached is a letter of invitation and explanation of my study for all faculty teaching online sections of these courses. I would appreciate your assistance in identifying faculty members. For those instructors who agree to participate, I will provide an invitation for students to be posted on the announcement section of the course web page and distributed to students through the courseware email system. Please have interested faculty contact me by (date) in order to prepare for participant recruitment.

I am most grateful for your assistance with my dissertation research. If you have any questions, please call me at 847-681-1572 or email me at urbighosh@gmail.com
Sincerely,
Urbi Ghosh
Doctoral Candidate
Colorado State University

APPENDIX B: E-MAIL TO SCIENCE ONLINE FACULTY REQUESTING COOPERATION

Dear Faculty member:
I am a doctoral candidate at the Education and Human Resource Program at Colorado State University (CSU) located in Fort Collins, CO. My research will involves a short survey followed by a selected number of interviews with students who are enrolled in online science courses at the community college. My study is "The Experiences of Science Online Students at the Community College" and will include community college students enrolled in selected online science courses in plant biology, biology, astronomy, chemistry and physics. Dr. Linda Kuk, Associate Professor of Education at CSU, is serving as my dissertation advisor.

I need your assistance in obtaining student volunteers for my study. I have attached an invitation letter to students explaining the purpose of the study and their student's role and requirements for participation. I am asking your assistance in two areas. First, please distribute in the body of an email the announcement for participation in the study. Second, please distribute this request directly though a class email list. In this announcement, students were asked to respond confidentially to me though Survey Monkey. All the students are given a $5 gift certificate to either Starbucks or Amazon.com.

I will follow up to provide students with additional information about the study and obtain contact information to arrange for interviews. Students are assured confidentiality and pseudonyms will be used to describe participants and the study site. Participation in my study is strictly voluntary.

I am most grateful for your assistance with my dissertation research. If you have any questions about my request, please call me at (847) 681-1572 or email me at urbighosh@gmail.com. If you have any questions about your rights as a volunteer in this study research, please do not hesitate to contact me.
Sincerely,

Urbi Ghosh
Doctoral Candidate, Colorado State University

APPENDIX C: STUDENT LETTER

Dear Student,

You have been selected to participate in an important research study about your online experience in science courses. We wish to understand the students' perspective of online science classes at the community college.

In a few days, you was receiving a link to an online survey that we're asking you to complete when it arrives. Through your participation is voluntary, the more students who, the more reliable and valid the results was.
Your participation in this survey is completely voluntary and confidential. Please understand that your participation or non-participation will not affect your enrollment in this class. Your identity was held confidential and any personal information obtained will only be used for data collection and analysis purposes. Your college will never know your survey results. You will not be personally identified in any reports or publications that may result from this study.

It should only take 10 to 15 minutes to confidentially respond. For your benefit, a small incentive was offered. Students who voluntarily participate in this survey will receive a $5 gift card to Starbucks or a major online retailer such as Amazon.com at the end of the study.

If you have any questions, please ask us. If you have any additional questions, contact me at urbighosh@gmail.com or 847-681-1572.

This email is to alert you that a survey was delivered within the next few days. Detailed instructions about the study was included with the survey.

Sincerely,

Urbi Ghosh

Doctoral Candidate

Colorado State University

School of Education

APPENDIX D: SURVEY INSTRUMENT

This course critique is concerned with your opinions about the online science course you are currently enrolled in. This survey was confidential and will not be distributed to your instructor or the college.

However, before you take the survey please have your student ID number ready. Your student ID will only be used for data collection and coding purposes for analysis of the study. No personal data will ever be published.

The following statements relate to your opinions regarding the **value** of the online science course.

Using the scales below, select the extent to which you agree with each statement.

Completely disagree	Mostly Disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely Agree
1	2	3	4	5	6	7

1. It is personally important for me to perform well in this course	1	2	3	4	5	6	7
2. This course provides a great deal of practical information	1	2	3	4	5	6	7
3. I am very interested in the context of this course.	1	2	3	4	5	6	7
4. Completing this course will move me closer to attaining my career goals.	1	2	3	4	5	6	7
5. It is important for me to learn the material in this course	1	2	3	4	5	6	7
6. The knowledge I gain by taking this course can be applied in many different situations.	1	2	3	4	5	6	7

The following statements relate to the various **learning strategies** you may have used while completing the science online course, which you are currently enrolled in.

Using the scale below, select the extent to which you agree with each statement.

Completely disagree	Mostly Disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely Agree
1	2	3	4	5	6	7

While working through this online course …..							
1. I try to relate what I was learning to what I already know.	1	2	3	4	5	6	7
2. I try to make all the different ideas fit together and make sense to me.	1	2	3	4	5	6	7
3. I make up my own examples to help me understand the important concepts.	1	2	3	4	5	6	7
4. I try to connect what I was learning with my own experiences.	1	2	3	4	5	6	7
5. If I become confused about something I read, I go back and tried to figure it out.	1	2	3	4	5	6	7
6. If the course material is difficult to understand, I change the way I studied it.	1	2	3	4	5	6	7
7. I ask myself questions to make sure I understood the material I was studying.	1	2	3	4	5	6	7
8. I try to think through each topic and decide what I was supposed to learn from it, rather than just reading it over.	1	2	3	4	5	6	7
9. I try to determine which concepts I didn't understand well.	1	2	3	4	5	6	7
10. I set goals for myself in order to direct my activities.	1	2	3	4	5	6	7
11. If I get confused during online activities, I make sure I sorted it out before proceeding to the next section of the course.	1	2	3	4	5	6	7
12. I keep track of how much I understood, not just if I am getting through the material.	1	2	3	4	5	6	7
13. I stop once in a while and went over what I had learned.	1	2	3	4	5	6	7

The following statements relate to your **overall satisfaction** with the online science course.
Using the scale below, select the extent to which you agree with each statement.

Completely disagree	Mostly Disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely Agree
1	2	3	4	5	6	7

1. Overall, I am satisfied with my online course	1	2	3	4	5	6	7
2. This online course meets my needs as a learner	1	2	3	4	5	6	7
3. I would recommend this online course to a friend who needed to learn the material.	1	2	3	4	5	6	7

The following statements relate to your **beliefs in your ability** to learn with a science online course.

Using the scale below, select the extent to which you agree with each statement.

Completely disagree	Mostly Disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely Agree
1	2	3	4	5	6	7

1. Even in the face of technical difficulties, I was certain I can learn the material presented in an online course.	1	2	3	4	5	6	7
2. I am confident I can learn without the presence of an instructor to assist me.	1	2	3	4	5	6	7
3. I am confident I can do an outstanding job on the activities in an online course.	1	2	3	4	5	6	7
4. I am certain I can understand the most difficult material presented in an online science class.	1	2	3	4	5	6	7
5. Even with distractions, I am confident I can learn the material presented online.	1	2	3	4	5	6	7

Participation in an online course can induce different emotions. Please indicate **how you felt about your prior experiences** while completing the online science course.
Using the scale below, select the extent to which you agree with each statement.

Completely disagree	Mostly Disagree	Tend to disagree	Neutral	Tend to agree	Mostly agree	Completely Agree
1	2	3	4	5	6	7

While completing this online course …

1. I felt my formal educational background has given me adequate preparation for this course	1	2	3	4	5	6	7
2. My work experience and other prior experiences from outside formal school have prepared me for this course.	1	2	3	4	5	6	7
3. I have had four course science and/or math courses previously.							

While completing this online course …

1. I am feeling frustrated	1	2	3	4	5	6	7
2. I am angry.	1	2	3	4	5	6	7
3. I feel as though I was wasting my time.	1	2	3	4	5	6	7
4. I am irritated.	1	2	3	4	5	6	7
5. I am bored.	1	2	3	4	5	6	7
6. I feel the course was fairly dull.	1	2	3	4	5	6	7
7. My mind wandered.	1	2	3	4	5	6	7
8. I am uninterested in the course material.	1	2	3	4	5	6	7
9. I thought about what else I would rather be doing.	1	2	3	4	5	6	7

Background Questions:

1. Are you male or female?

   a. Male

   b. Female

2. What is your age?

_____ years

3. Is this course required for your major or are you taking it as a graduation requirement?

   a. I am taking it because I need it for my major.

   b. I am taking the course because I need as a graduation requirement

   c. I am taking the course for other reasons.

4. What is your major or intended major ? _____

5. How many online courses (doesn't have to be science) have you completed prior to taking this course?

a. None

b. One

c. Two

d. Three

e. Four

f. Five or more.

6. How many college courses in math have you completed prior to taking this course?

a. _____ course(s), number

7. How many college English courses have your completed prior to taking this course?

a. _____ course(s)

8. Given your experience with this online course, how likely would you to enroll in another science course?

Definitely will not enroll						Definitely will enroll
1	2	3	4	5	6	7

How much did you **learn** by taking this online course?

Very little						A large amount
1	2	3	4	5	6	7

How experienced are you with computer technologies?

Extremely inexperienced						Extremely experienced
1	2	3	4	5	6	7

Thank you for taking the time to complete this survey!
Your responses will help us improve future courses offered online in the sciences.

Incentive Registration

Part 1. Please provide your name and mailing information in order to receive the $5 gift card.

* Please provide your first and last name:_____

Street Address:_____

City/State/Zip: _____

* Enter your email address: _____

Part 2.

Some participants was selected to participate in an interview either in person or on the telephone. There was two interviews of approximately 30-60 minutes, so that the researcher may gain valuable insight into your online class experience.

If you are selected and participate, after the interviews you was given a $25 gift card for your time and participation to a well know online retailer. Please take a moment to provide your name and contact information below so that the researcher my contact you for an interview:

Name:_____ _____

Address: _____

Phone Number: _____

Email: _____

Thank you for taking the time to complete this survey and the registration form for the prize drawings.

APPENDIX E: INTERVIEW QUESTIONS

Fall 2010 Script for Interview

My name is Urbi Ghosh and I am a doctoral student in the School of Education at Colorado State University. You have been randomly selected for a follow-up telephone interview. You had returned a survey and indicated it was acceptable to be contacted for a voluntary follow-up interview. Your participation is completely voluntary and you still may elect not to participate.

Interview (sample questions):

Background questions	Please tell me about yourself to help me get to know you better? Please tell me about your educational experience at the community college?
Course expectations	Please tell me about your experience as a community college student enrolled in an online class in science. Did you learn what you expected to learn? What has the experience meant for you? How did the experience affect you? How do you know you are doing in your class?
Course questions	Are there specific characteristics of your online course that you feel enhanced your learning?
Content questions	Are there specific characteristics of your online course that you feel could be improved? Or that you did not learn that much from? That detracted you from learning? What did you learn from this class? How did you learn it?
Strategies	How are you dealing with working independently? Do you prefer working alone or with others? How do you feel about the things have been doing in class? (Learning Strategies) What is your reading strategy? (Learning Strategies) How did you prepare for the quizzes? How did you locate resources for your assignments? (Learning Strategies) Did your preparation for tests, projects, assignments work for you? Did you make any changes in what you did based on feedback? Where did you usually do your work for class? Where did you find the resources you needed? What helped you learning best? What did you do well? What would you do differently if you took this class again?

Emotions	What dimensions, incidents and people intimately connected with the experience stand out for you? How did this experience affect significant others in your life? What feelings were generated by the experience? What thoughts stood out about your online course experience?
Opportunities Gained	What changes do you associate with the experience? What opportunities has the experience provided for you?
Probes	What other factors or conditions contribute to your in online course experience? Is there anything else that you would like to share that is significant in your online course experience?
Obstacles/road blocks	What obstacles has the experience presented for you?
Help seeking	When you needed help with something in class, whom did you ask? What did you do?
Course satisfaction	How satisfied are with this class?
If taken in summer	Would you have taken it the summer if it was not offered online?
Feedback	What suggestions do you have for future students taking science courses online? What suggestions would you have for future online instructors?

APPENDIX F: CONSENT FOR COMMUNITY-COLLEGE STUDENTS TO

PARTICIPATE IN THE STUDY (DRAFT)

TITLE OF STUDY: "The Experiences and Motivations of Community College Students Enrolled in Science Online Courses"

PRINCIPAL INVESTIGATOR: Dr. Linda Kuk

CO-PRINCIPAL INVESTIGATOR: Urbi Ghosh, Doctoral Candidate

WHY AM I BEING INVITED TO TAKE PART IN THIS RESEARCH?
You have been invited to participate in this research because you are studying for a degree at a community college and you are enrolled in an online course in a science online course. Many students find these courses challenging in an online class environment. My study involves research to better understand the experiences of community college students enrolled in science online courses in the sciences.

WHO IS DOING THE STUDY?
I am a doctoral student at Colorado State University who is conducting this study to complete the requirements for a dissertation.

WHAT IS THE PURPOSE OF THIS STUDY?
I am conducting the study to better understand the student experience in online courses in the sciences because many students find these courses challenging in an online class environment.

WHERE IS THE STUDY GOING TO TAKE PLACE / HOW LONG WILL IT LAST?
The study will take place Community Colleges in Illinois through an online survey or through a telephone interview. The interview will last approximately 60 minutes for each participant interview. The interview was tape recorded, I will transcribe the interview tapes and provide you with a written copy within two weeks. I will schedule a second interview by email or telephone within three weeks to confirm the accuracy of the interview transcript and to allow for follow-up questions that either of us may have. This follow-up interview will take approximately 15 to 30 minutes. I will record and transcribe the follow-up interview and send the transcripts to you. I will follow-up with an email to verify the accuracy of the transcripts and invite you to provide any final thoughts.

WHAT WILL I BE ASKED TO DO?
You was asked to describe in detail your experiences as a community college student enrolled in online courses. I will ask you a series of open ended questions to assist you in telling me about what and how you have experienced your online course(s).

Page of Participant's initials _____ Date _____

ARE THERE REASONS WHY I SHOULD NOT TAKE PART IN THIS STUDY?
You should not take part in the study if you are not a student enrolled in a degree program at a community college.

WHAT ARE THE POSSIBLE RISKS AND DISCOMFORTS?
It is not possible to identify all potential risks in research procedures, but the researcher(s) have taken reasonable safeguards to minimize any known and potential, but unknown, risks. The only known potential risks are a) you may be embarrassed by disclosing information that may adversely reflect on you, your institution, or one of its employees and b) breach of confidentiality. Private, confidential interviews and pseudonyms will help minimize this risk.

If a breach of confidentiality occurs, the specifics of the breach was immediately recorded and analyzed and a response designed with the primary objective of protecting the participant was implemented. The principal investigator will also will complete and transmit the HRC Human Subjects Reportable Event Report to the Human Research Committee, 321 General Services Building, Campus 2011 within 24 hours.

WILL I BENEFIT FROM TAKING PART IN THIS STUDY?
There are no direct benefits to participating in this study. The anticipated benefit of the research is that through presentation or publication of research results, community colleges, community college practitioners, and their constituencies may learn about the lived experience of community college students enrolled in high risk online courses. This understanding may help community colleges, community college practitioners, and their constituencies improve advocacy for groups and interests not traditionally included in discussion about community college students enrolled in high risk online courses.

DO I HAVE TO TAKE PART IN THE STUDY?
Your participation in this research is voluntary. If you decide to participate in the study, you may withdraw your consent and stop participating at any time.

WHAT WILL IT COST ME TO PARTICIPATE?
There is no monetary cost associated with your participation in this study. You was asked to spend 60 minutes of your time to participate in a first interview as well as 15 to 30 minutes of time in a second interview for follow-up questions. I will schedule a second interview for these follow-up questions (by email or telephone) within three weeks of the first interview. I will follow-up with an email to verify the accuracy of the transcripts and invite you to provide any final thoughts.

WHO WILL SEE THE INFORMATION THAT I GIVE?
We will keep private all research records that identify you, to the extent allowed by law. Your information was combined with information from other people taking part in the study. When we write about the study to share it with other researchers, we will write about the combined information we have gathered. You will not be identified in these written materials. We may publish the results of this study; however, we will keep you name and other identifying information private.

We will make every effort to prevent anyone who is not on the research team from knowing that you gave us information, or what that information is. For example, your name was kept separate from your research records and these two things was stored in different places under lock and key. You should know, however, that there are some circumstances in which we may have to show your information to other people. For example, the law may require us to show your information to a court.

CAN MY TAKING PART IN THE STUDY END EARLY?
If you fail to show up to your interview session or do not respond to follow-up questions, you may be removed from the study.

WILL I RECEIVE ANY COMPENSATION FOR TAKING PART IN THIS STUDY?
There was a compensation for participation in this study. Survey participants was given a $5 gift certificate to an online retailer (such as Amazon.com) or Starbucks for their participation.

WHAT HAPPENS IF I AM INJURED BECAUSE OF THE RESEARCH?
The Colorado Governmental Immunity Act determines and may limit Colorado State University's legal responsibility if an injury happens because of this study. Claims against the University must be filed within 180 days of the injury.

WHAT IF I HAVE QUESTIONS?
Before you decide whether to accept this invitation to take part in the study, please ask any questions that might come to mind now. Later, if you have questions about the study, you can contact me, Urbi Ghosh at 847-681-1572 or email urbighosh@gmail.com.

If you have any questions about your rights as a volunteer in this research, contact Evelyn Swiss, Human Research Administrator at 970-491-1381. We will give you a copy of this consent form to take with you.

WHAT ELSE DO I NEED TO KNOW? If you are under the age of 18, you are required to have your parent provide consent for you to participate in this study.
Your signature acknowledges that you have read the information stated and willingly sign this consent form. Your signature also acknowledges that you have received, on the date signed, a copy of this document containing pages.

Page_of_Participant's initials _____ Date _____

_____ _____

Signature of person agreeing to take part in the study Date

_____

Printed name of person agreeing to take part in the study

_____ _____

Name of person providing information to participant Date

Colorado State University

DISSERTATION BUDGET

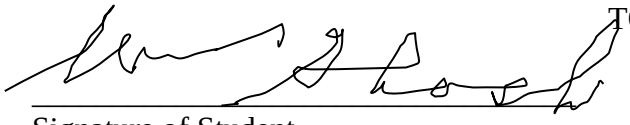
Student's Name: Urbi Ghosh

Advisor's Name: Dr. Linda Kuk

Dissertation Title: The Motivations and Experiences of Science Online Students in the Community College

Listed below (in detail) are the anticipated expenses for the proposed dissertation.

Category	Explanation	Amount
Expenditures for Data Collection		
Expenses for Survey Incentives (200 x $ 5)		$1000
Interviewing Expenses (10 x $25)		$250
Transcription Service		$500
SPSS Software (Student Version)		$250
Expenditures for Travel to a Conference to Present		$1,500
Estimated Expenses for Completion (Binding, Copying, Printing)		$640
	TOTAL	$4140



Signature of Student