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IN PURSUIT OF TRANSFORMATIVE LEARNING:
EXPLORING THE STIMULATION OF CURIOSITY THROUGH
CRITICAL REFLECTION IN THE COLLEGE CLASSROOM

by

Bo Bae

A dissertation submitted in partial fulfillment
of the requirements for the degree of

Doctor of Philosophy

May 2018

Dissertation Committee

Cheryl Getz, EdD
Robert Donmoyer, PhD
Marcus Lam, PhD

University of San Diego

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University of San Diego
School of Leadership and Education Sciences

CANDIDATE'S NAME: Bo Bae

TITLE OF DISSERTATION: IN PURSUIT OF TRANSFORMATIVE LEARNING:
 EXPLORING THE STIMULATION OF CURIOSITY
 THROUGH CRITICAL REFLECTION IN THE
 COLLEGE CLASSROOM

APPROVAL:

_____, Chair
Cheryl Getz, EdD

_____, Member
Robert Donmoyer, PhD

_____, Member
Marcus Lam, PhD

DATE: April 9, 2018

ABSTRACT

Educators in higher education are faced with growing pressures to shift pedagogical practices in order to accommodate the growing population of learners and improve student learning outcomes. While the acquisition of knowledge and skills are important to the learning process, they are insufficient in preparing students to function in rapidly changing environments. Curiosity is a vital component in the learning process that, when stimulated, has the potential to increase students' capacity to think critically. Implementing teaching practices that intentionally focus on how curiosity can be stimulated and enhanced develops students' abilities to access higher levels of thinking that are essential for in depth learning to take place.

This study utilized a mixed-methods sequential explanatory design to determine the extent in which curiosity was stimulated and enhanced through critical reflection activities implemented in two sections of an undergraduate psychology course. The Curiosity and Exploration Inventory II (CEI-II) was administered as a pre-and post-assessment to 48 students to assess existing levels of trait curiosity (propensity to experience). Data from the assessments, as well as from the demographic questionnaire were then used to consider how critical reflection activities, as well as other external factors, impacted students' state curiosity (curiosity evoked in a particular environment by situational factors). Critical reflection activities were developed using transformative learning theory and reflective thinking models. In the second step, 11 students were interviewed and a cross-case analysis was conducted to discover similarities and differences in how they understood and made meaning of course content.

The findings of this study indicated that critical reflection activities did impact students' tendencies to be curious in a classroom setting. This was partly due to autonomous processing through journaling, but mostly due to their engagement with other peers about their thoughts, feelings, insights, and inquiries about course content learned. The findings suggest that curiosity in the classroom is stimulated and enhanced when students are able to understand how the content is relevant to their learning, and how they can apply and make meaning of it in their lives.

DEDICATION

To mom and dad.

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I now know myself to be a person of weakness and strength, liability and giftedness, darkness and light. I now know that to be whole means to reject none of it but to embrace all of it. – Parker J. Palmer

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CHAPTER ONE

INTRODUCTION TO THE STUDY

The stimulation of curiosity is an essential component in students' knowledge attainment and decision-making development (Berlyne, 1960; Cranton, 1996; Dewey, 1938; Kolb, Longest, & Barnett, 2014). Research indicates that the capacity for curiosity to grow over time is positively linked to "learning motivation, attachment, identity formation, personal growth, and perceptual learning and development" (Reio Jr., Petrosko, Wisewell, & Thongsukmag, 2006). In the context of a college setting, the benefits of a curious mind range from improved academic performance (Von, Hell, & Chamorro-Premuzic, 2011) to moral development (Fisher, 2000). As a result, students generate the ability to access higher levels of thinking that is critical to their continued learning.

Curiosity is defined as the desire to acquire new knowledge through exploration (Litman & Spielberger, 2003) in order to grow and expand understanding (Kashdan & Steger, 2007). It is viewed as a core motivator in learning and vital to the college-learning environment (Leslie, 2014). Without curiosity, students retain less information and building understanding becomes more of a challenge (Hill & McGinnis, 2007). Research has found that curiosity, described as a state of arousal brought about by complex stimulation and uncertainty (Berlyne, 1960), primes the brain for learning so that knowledge can be acquired (Kang, Hsu, Krajchich, Loewenstein, McClure, & Wang, 2009; Stenger, 2014). This allows students to develop their ability to think critically, communicate clearly, and solve problems, all of which are highly valued in today's workplace (Hart Research Associates, 2015).

College is a time where prior knowledge can be tested and a wide range of perspectives can be considered to develop the capacity to think and reflect in a way that prompts development and higher levels of reasoning. Such thinking is critical in preparing students to function within environments where change is continuous and ambiguity is prevalent. Though pedagogical shifts have been made in more recent times to take into account and promote integrative learning, higher education still often continues to stress the reproduction of information and acquisition of skills in preparation for work readiness (Leslie, 2014; Nutting, 2013; Rateau, Kaufman, & Cletzer, 2015). The appreciation for fostering thinking becomes secondary and the “art of seeking new possibilities” is diminished (Vogt, Brown, & Issacs, 2003). In order to create an environment where complex thinking is supported, educators in higher education need to consider how students develop in their understanding and desire to learn and make meaningful connections.

Background of the Study

American adults are more formally educated than ever before (National Center for Education Statistics, 2016a). As of 2016, approximately 36 percent of 25-29 year olds have attained a Bachelor’s degree or higher in the United States (National Center for Education Statistics, 2016b). In addition, during the 2018-19 academic year, colleges and universities are expected to award 1.92 million Bachelor’s degrees, which is a 20 percent increase from 2008-2009 (National Center for Education Statistics, 2014). The rate at which students will continue to enroll in college and universities is predicted to steadily grow in the coming years (Hussar & Bailey, 2011). Such statistics indicate that attaining a higher education degree is increasingly viewed as a necessity in the United States.

For nearly a century, colleges and universities in the United States have pursued three major objectives; to equip students with the skills and knowledge they need to pursue a vocation, to prepare students to become active and informed citizens of their communities, and to assist students in expanding their capacity for analysis and reflection in their personal development (Bok, 2013). These objectives, embraced during the inception of colleges and universities during the colonial period, are still the foundational learning outcomes of higher education today (Association of American Colleges and Universities, 2007). While these objectives are overarching, and in some ways, overlapping, the aim is to have students complete their undergraduate education with the tools they need to be successful in both their personal and professional lives.

Changing Times

Though these traditional goals have continued to be embraced for the past forty years, colleges and universities have made efforts to respond to a rapidly changing, interconnected global economy by rethinking the way teaching is practiced and learning is promoted in the college setting. For example, access to higher education has expanded to accommodate for the growing demand of students interested in attending college. The enrollment at postsecondary institutions is projected to increase to 23 million by 2020, which is a 13 percent increase from 2009 (Hussar & Bailey, 2011). The cost of attending also has increased 33 percent at public institutions, and 26 percent in private institutions within a 10-year period from 2004-2005 to 2014-15 (National Center for Education Statistics, 2016a). More students are working while obtaining their degree in order to compensate for the high price of tuition, which also impacts timely graduation and retention rates (Bok, 2013). Additionally, the diversity of students in age and

race/ethnicity is projected to shift in the coming years. The enrollment of students between the ages of 25-34 years old is estimated to increase by 23 percent between 2012 and 2023, while the enrollment of students between the ages of 18-24 years old is estimated to increase by 12 percent during the same time period. In addition, the number of students of color is projected to increase; the highest increment in Hispanic (34 percent) and Black (25 percent) students between 2012 and 2023 (Hussar and Bailey, 2016). With the growing demand to access higher education, as well as the changes to the demographic of students who will be enrolling in colleges and universities, institutions and educators are tasked to adapt and respond by considering teaching methods that appeal to a larger and wider range of learners.

In order to provide additional learning opportunities, institutions have expanded college-learning environments through massive open online communities (MOOCs), and online/hybrid courses (Allen & Seaman, 2013). Additionally, more educators are employing non-traditional pedagogies that include flipped classrooms¹ (Gupta, 2016) and service-learning in order to keep students engaged (American Association of Colleges and Universities, 2015). According to a 2013-14 survey by the Higher Education Research Institute, approximately 80 percent of undergraduate courses employ class discussions; 60.7 percent small groups; and 50.6 percent extensive lecturing (Eagan, Stolzenberg, Lozano, Aargon, Suchard, & Hurtado, 2014). Increasing number of educators are shifting their teaching styles to include active learning approaches, which have been shown to provide a number of benefits ranging from improved grades

¹ A pedagogical model in which students are exposed to new material outside the class, typically through lecture videos and readings, and classroom time is spent processing and analyzing the information through activities and discussions (Brame, 2013).

(Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014) to the development of new skills, knowledge, and perspectives (Lewis & Williams, 1994) that prepare students for post-college life (Eagan et al., 2014).

Institutions. The implementation of non-traditional teaching is dependent upon several factors, including the size and focus of the institution. Whereas small colleges and universities may find more opportunities to implement teaching methods in which students can engage more freely as class sizes are smaller and more conducive to class discussions and group work, mid-to large-sized universities have an added barrier of large class sizes that are oftentimes in lecture halls. Yet, the use of technology has assisted in exploring different methods of teaching that has made it more feasible to bring students together from various parts of the world (American Academy of Arts and Sciences, 2015). Additionally, institutions that are considered to be liberal arts focused, adhere to tenets that advocate for an understanding of the arts and sciences that then become the foundation for developing skills in critical thinking, analysis, and oral and written communication (Brint, Riddle, Turk-Bicakci, & Levy, 2005). The educational focus to broaden the perspectives of undergraduate students through the discovery of arts and sciences emphasizes the idea of “learning for the sake of learning” in hopes of encouraging personal development (Kuh, 1999).

Institutions that are considered public research universities have an obligation to make continuous strides in areas where discovery and innovation is needed. As a result, public research universities positively impact state and national economic development (American Academy of Arts and Sciences, 2015). While public research universities are more affordable and accessible to students, teaching at such institutions is viewed in

terms of educating students for future jobs in specific occupational fields (Brint et al., 2005). The consideration of the various types of institutions of higher education and their focus on teaching, learning and research indicates that different types of teaching methods are needed in order to identify which are most effective in specific learning environments.

Measuring Learning

Non-traditional teaching. Non-traditional teaching may include: case-based learning, problem-based learning, and peer teaching (Harris, 2006). These methodologies involve high levels of engagement that challenge students to interact with ambiguous concepts and ideas. The development and implementation of non-traditional teaching methodologies, oftentimes through trial and error, may enhance students' learning in the classroom. Yet, the long process of developing, planning, and implementing different methods of non-traditional teaching and identifying ways in which to assess what type of impact they have on students' learning is unclear. Whereas traditional teaching methodologies may be assessed using measurements of learning that include: individual quizzes, exams, and tests; such modes of evaluation may not be as successful when measuring non-traditional teaching methodologies. Additionally, when such traditional modes of evaluation are used to measure non-traditional methodologies, the frequency and implementation of them may differ (less frequently and through collaborative, group testing) than in traditional classroom settings (Harris, 2006).

An important component of assessing non-traditional teaching methodologies is considering how to put learning into contexts so students are able to retain and relate to concepts, while utilizing their intellect to “test” the validity of their thoughts, insights,

and assumptions through various forms of engagement (e.g. oral presentations, debate, and facilitation) (Wiggins, 1990). This may be accomplished by first identifying specific constructs and tools that will need to be measured, in addition to how they will be measured, in order to capture the type of learning that is being achieved in students during their college years.

Assessing student learning. A major issue that colleges and universities confront today is assessing whether students meet the stated objectives of higher education to: equip students with knowledge and skills, prepare students to become active citizens, and assist students in growing their ability for analysis and reflection (Bok, 2013). Though there are two methods of evaluation in place for institutions to measure specific educational goals: the National Survey of Student Engagement (NSSE), and the Collegiate Learning Assessment (CLA), these assessments are not required by all institutions, and their validity has been challenged by some. Thus, assessing students' cumulative knowledge acquisition and development throughout college is difficult (Bok, 2013). As a result, there is no established method for evaluating *how much* students learn in college (Selingo, 2013). Educators, therefore, are not fully aware of how to best utilize the space and time provided, both in and out of the classroom to ensure that students are acquiring knowledge and skills that meet the articulated goals of higher education. Because there is no agreed upon way to assess students' learning over time, comprehending what quality of education students are receiving is difficult, if not impossible (U.S. Department of Education, 2006). To mitigate the difficulties of assessing overall learning, educators may find it useful to understand the complexities of how students are critically thinking, which is integrating their knowledge, and making

connections to theories, information, ideas, and perspectives discovered in the classroom. Such data may provide insight into how students are able to critically analyze information and apply their knowledge, which then become factors in determining the breadth and depth of students' learning throughout college, and consequently, indicators of the learning that is (or is not) occurring on college and university campuses.

Students' Capacity for Critical Thinking

In recent times, developing skills for critical analysis has become increasingly important in higher education. Many educators and employers alike consider critical thinking vital to the development of the student and employee (Bok, 2013; Hart Research Associates, 2015). According to Bok (2013), "99.6 percent of college professors agree that developing students' ability to think critically is either 'essential' or very important.' More than 90 percent believe that it is *the most important* aim of undergraduate education" (p. 187). Additionally, many employers agree that career success is contingent upon the candidates' ability to think critically, communicate clearly, and solve problems. The most highly valued learning outcomes by employers consist of written and oral communication, critical thinking, ethical decision-making, and the application of knowledge to real-world settings (Hart Research Associates, 2015).

Yet, few employers believe that recent graduates are well prepared when it comes to these types of skills and knowledge (Hart Research Associates, 2015). In fact, studies have demonstrated that, when tested, 45 percent of students showed no gains in their ability to write, reason, and critically think during the first two-years of college. After four-years of college, 36 percent of students showed little improvement (Arum & Roksa, 2011; Selingo, 2013). According to the U.S. Department of Education, Secretary of

Education's Commission on the Future of Higher Education (2006), students are not graduating with the skills that are expected, as less than one-third of college graduates demonstrate the ability to read and make inferences on complex tests (Kutner, Greenberg, Jin, & Paulsen, 2006) and less than 20 percent have basic quantitative literary skills (Baer, Cook, & Baldi, 2006). A landmark study conducted by the Association of American Colleges and Universities (2002), reported that a reorganization of undergraduate education is urgent to "ensure that all college aspirants receive not just access to college, but an education of lasting value" (p. vii). These studies indicate that despite educators' efforts to adapt active learning strategies into the classroom, more deliberate focus will need to be placed on the development of curriculum and teaching strategies in order to see progress in student learning.

Fostering Curiosity in the Academic Setting

One way of ascertaining how students come to analyze information and apply knowledge is by studying how their desire to learn is evoked. In the classroom setting, the stimulation of curiosity may be a contributing factor in how much students learn and make meaning of the information presented. Most educators agree that curiosity is a positive attribute that elevates learning (Engel, 2013), and yet, difficulty in assessing academic progress (Bok, 2013; Selingo, 2013) and the lack of skillsets and knowledge attained while in college (Arum & Roksa, 2011), suggests that students are not seeking opportunities for further learning and critical analysis. This is a cause for concern as the quality of higher education that students are currently receiving is uncertain, and the question of whether graduates will be successful in the competitive, global environment is unknown.

Curiosity, in addition to being a positive attribute, is an important component that links novelty with challenge (Kashdan, Rose, & Fincham, 2004). Furthermore, curiosity “prompts proactive intentional behaviors in response to stimuli and activity...” (Kashdan, et al. 2004, p. 291). This allows students to explore with wonder, productive confusion, and ultimately, inquiry. In short, curiosity encourages students to respond purposively when their interest is piqued. This sort of interest is significant when discoveries need to be made and further examination of phenomena is desired. When curiosity is stimulated and enhanced, students have the ability to expand their boundaries and develop the capacity to make meaning of their learning (Mezirow, 2000).

Unfortunately, opportunities to foster curiosity in the academic setting often go unnoticed or are untapped, at least in part because it is not clear how curiosity can be cultivated in a college or university classroom, or even the degree to which cultivation can occur. As some researchers argue the difficulty of being curious during this time due to the availability and surplus of information (Leslie, 2014), there is continuous question around how to promote curiosity within the academic setting.

Besides effort and intelligence, it is argued that curiosity should be viewed as the third core determinant in identifying predictors of academic performance (Von, Hell, and Chamorro-Premuzic, 2011). In order to continuously stimulate and nurture students’ curiosity, the responsibility is of the educators to see that “...curiosity may be as much a trait as a state (Berlyne, 1960; Loewenstein 1994) suggesting that educational settings should fully exploit their plentiful opportunities to induce and inspire curiosity” (p. 582). In so doing, educators will need to consider how specific teaching methods and experiences impact students’ curiosity.

Statement of the Problem

Research has shown that certain forms of reflection and processing activities bolster critical thinking in students (Brookfield, 2000). Students are able to construct meaning out of their experiences that allows their interest in the topic being studied to grow (Mezirow, 1991; 1998). Reflection calls for active, persistent, and thoughtful consideration of ideas and beliefs, in which deeper contemplation and analysis need to occur in order to draw specific conclusions (Bowen, Burton, Cooper, Cruz, McFadden, Reich, & Wargo, 2011; Mezirow, 1998). In the same vein, curiosity expands the desire to experience and acquire knowledge that can be changed, developed, and reframed over time. Curiosity is viewed as a prime ingredient in developing the ability to reflectively think (Dewey, 1933) Yet, if curiosity is viewed as essential to critical reflection, educators should be intentional in implementing activities that stimulate curiosity and foster an environment where learning can take place.

At this time little research has been conducted to determine how curiosity is stimulated in the classroom through critical reflection activities and to what extent such activities promote learning. We also do not know how external factors impact and enhance dimensions of curiosity (i.e. trait versus state) in college classroom environments. Such studies, however, are essential given the critical opportunities for the acquisition of knowledge and skills that curiosity promotes and the benefits of deeper levels of thinking toward continued development.

Purpose of the Study

The purpose of this research was to better understand how educators could cultivate students' curiosity through critical reflection in order to further develop their capacity to make meaning of their learning and experiences. The emphasis was on understanding *how* students made connections to information, insights, and ideas, by examining *what enhanced* their learning.

The first step was to identify how trait curiosity impacted students in their interaction with state curiosity in the classroom. The second step was to consider what type of intrinsic and extrinsic motivators contributed to or detracted from the stimulation of curiosity in these students.

Research Questions

The following research questions guided the study:

1. To what extent, if at all, do critical reflection activities impact the stimulation and enhancement of curiosity in college students?
2. How do critical reflection activities interact with trait and state curiosity?
3. What extrinsic and intrinsic motivators impact how students' curiosity is stimulated and enhanced?

CHAPTER TWO

LITERATURE REVIEW

The literature reviewed in this chapter explores three specific areas of research: curiosity, critical reflection, and transformative learning that provides context for this study. The first section explores dimensions of curiosity and the psychological theories that account for evoking interest and inquiry in people. The second section examines the role of critical reflection as a reflective activity and the implications of using it as a pedagogical practice for learning. The final section explores transformative learning theory in relation to how students use critical reflection to make meaning of their experiences.

The Classification of Curiosity

There are theoretical distinctions and theories that are especially relevant to understanding curiosity: the perceptual/epistemic theoretical distinction of curiosity; state and trait theories of curiosity; and stimulation of curiosity theories. This section briefly summarizes each of the theories/theoretical distinctions and indicates how they relate to the study.

The Perceptual/Epistemic Theoretical Distinction of Curiosity

Curiosity, in all its complexity, is characterized as two levels of inquisitiveness: perceptual (novelty seeking; aroused by sensory stimulation) and epistemic (deeper, disciplined quest for knowledge; aroused by ambiguities and complex ideas) (Berlyne, 1954; Collins, Litman, & Spielberger, 2004; Gade, 2011; Leslie, 2014). Perceptual curiosity often comes and goes quickly as novelty becomes more and more routine, but epistemic curiosity involves sustained cognitive effort that prompts further investigation

and processing of information. Linked to perceptual and epistemic curiosity are two types of exploratory behaviors: diversive and specific. Diverse exploration is motivated by the desire to seek stimulation out of feelings of boredom (Litman & Spielberger, 2003). Specific exploration is driven by the desire to acquire additional information of a particular stimulus (Berlyne 1960; Collins et al., 2004).

The distinction between perceptual and epistemic curiosity is an important one in this study as cognitive or intellectual curiosity is a prerequisite for the acquisition of new information and learning to take place. Though exposure to perceptual curiosity may spark the desire to explore novel stimuli, epistemic curiosity is focused on encouraging information-seeking behavior that may have long-term developmental implications for learning (Reio Jr. et al., 2006). This study focuses on how epistemic curiosity can be evoked to impact students' capacity to acquire and analyze information that is taught in the classroom.

State and Trait Theories of Curiosity

In addition to articulating the levels of inquisitiveness, theoretical discussions of curiosity often differentiate between two other dimensions of curiosity: state and trait. Loewenstein (1994) described the following about curiosity: "State curiosity refers to curiosity in a particular situation, whereas trait curiosity refers to a general capacity or propensity to experience curiosity" (p. 78). Past studies have focused on the traits that constitute an inquisitive disposition.

Trait curiosity. Trait curiosity has been researched extensively (e.g. see Boyle, 1989; Maw & Maw, 1972; Litman & Spielberger, 2003). Individuals high in trait curiosity may prefer novelty and complexity, actively seeking out activities that may

elicit feelings of uncertainty (Kashdan & Fincham, 2004). Additionally, they may express their curiosity through cognitive, information seeking, as well as physical and thrill seeking, behaviors. Such studies have found that there is no single factor that accounts for curiosity; rather there are several distinct curiosity types that may influence behavior and thinking (Reio Jr. et al., 2006).

In a groundbreaking study, Litman and Spielberger (2003) conducted research to investigate curiosity as a personality trait and the individual differences that motivate exploratory behavior. In the study, the authors administered a questionnaire to 739 undergraduate students to assess epistemic and perceptual curiosity. The scale assessed interest in exploring ideas, figuring out how things work, and finding solutions to problems. In addition, the study identified two components of epistemic curiosity, diversive and specific, as first noted by Berlyne (1960). Litman and Spielberger found that there were moderately high positive correlations between epistemic curiosity and these subscales. Diversive epistemic curiosity was more related to the exploration of unfamiliar topics when learning something new (i.e. the development of ideas), whereas specific epistemic curiosity was more related to the obtainment of information needed in solving a particular problem (i.e. how something works). Such research suggests curiosity should be conceptualized as multifaceted personality traits, with distinctive dimensions.

State curiosity. Fewer studies have been conducted around state curiosity, as the environment in which curiosity is evoked is temporary, with internal and external pressures confounding results (Kashdan & Fincham, 2004). Additionally, external stimuli that arouse curiosity – e.g., complexity, novelty, uncertainty, and conflict (Berlyne, 1960; Borowske, 2005) – are difficult to measure and assess. Situational factors or “in-the-

moment” happenings can also coincide with personality traits, beliefs, and predispositions to higher propensities for trait curiosity that may influence how one acts with respect to state curiosity (Arnone, Small, Chauncey, & McKenna, 2011).

As was noted above, state curiosity is viewed as a “temporary state evoked by an ongoing internal or external activity” (Kashdan & Fincham, 2004, pg. 483) in which transactions occur between individuals and the environment. Context and situation may simultaneously both have bearing on how curiosity is stimulated. For example: the context may be a formal setting (i.e. museum), where typically an individual enjoys learning about art in the Renaissance genre. Yet, situational factors (i.e. friends, unavailable art in the museum, time, etc.) may impact how curious the individual can be in that specific time and place (Arnone et al., 2011). Furthermore, Iskiman, MacInnis, Ülkümen, and Cavanaugh’s (2016) conducted four experiments with college students to determine how situational factors that stimulated curiosity affected their attention of their concurrent activity. They found that the students’ activity enjoyment levels decreased when curiosity-evoking events impinged on positive focal activities, and increased during negative focal activities. To illustrate, a ringing phone (i.e. perceptual curiosity-evoking event) reduced enjoyment of a positive activity (i.e. watching a movie) as it detracted from the experience, but increased enjoyment of a negative activity (i.e. waiting in line) as it distracted from the tedious task. These studies imply that external factors and stimuli compete for the attention of individuals, and can impact experiences positively, or negatively based upon situation and circumstance.

Two factors that influence the understanding of state curiosity are: (a) intrinsic and extrinsic motivators and (b) supportive environments in which inquiry is encouraged

(Kashdan & Fincham, 2004; Markey & Loewenstein, 2014). There are conflicting perspectives on the role played by extrinsic motivators in promoting state curiosity. Some researchers state that activities that are incompatible with individuals' interests can be internalized to become curiosity-inducing activities. For example: students may need to take core classes that they find little interest in completing. Through the internalization of extrinsic motivation (i.e. making the Dean's list), students may find that the trajectory of their curiosity escalates (Kashdan & Fincham, 2004). Other researchers state that curiosity is the desire to obtain information in the absence of extrinsic motivators and rewards (Markey & Loewenstein, 2014). This perspective contends that educational attainment is driven by the innate desire to learn. As one study found, students' levels of curiosity in pursuing challenges and uncertainty, exhibiting a desire to discover, and demonstrating stronger performance in school are motivated by the intrinsic rewards that emerge as they build their competence through further exploration stimulated by curiosity (Hulme, Green, & Ladd, 2013). Additionally, parents, and educators who show encouragement in supporting these developments increase the likelihood that students will ask more questions and explore different perspectives (Markey & Loewenstein, 2014). These various factors, which are essential components in fostering state curiosity, are also influenced by individual variables, which take into account upbringing (Engel, 2015), behaviors, and interests (Kashdan et al., 2004). Individual variables then influence the capacity for higher trait curiosity, which defined earlier, is the propensity to identify and pursue new and challenging experiences (Kashdan et al., 2004).

Summary. The connection between trait and state curiosity, especially within the context of a college classroom, is one that needs further investigation in order to

understand the impact it has on student learning. As multiple factors impact the stimulation of state curiosity, possible delineations of the two dimensions are illustrated in Figure 1. This study considered any influences of trait curiosity on state curiosity, and delineated what extrinsic and intrinsic motivators impacted how students' curiosity was stimulated and enhanced. An additional layer to the consideration of state and trait theories is their impact on the discussion on how curiosity is evoked.

Figure 1. Categorization of Trait and State Curiosity

Figure 1. Categorization of trait and state curiosity. An illustration of the differences between trait and state curiosity, and how trait curiosity may influence state curiosity.

Theories about the Stimulation of Curiosity

There are three psychologically oriented theories that attempt to explain and account for inquisitiveness and interest in people: 1. incongruity – curiosity occurs when expectation conflicts with observation, 2. competence – curiosity is aroused from the motivation of mastering the activity/object and 3. information-gap – curiosity is caused when the reference point for information exceeds what is known.

Incongruity theory. Incongruity theorists postulate that human beings need to see pattern, order, and meaning in the world and that this need results in the drive to satisfy incongruent thoughts and beliefs. When stimuli conflict, there is a “violation of expectation” (Loewenstein, 1994; Schmitt & Lahroodi, 2008) in which new information cannot be assimilated into existing paradigms (Piaget, 1936; Case, 1978; Mezirow, 1998; 2000). Curiosity is then evoked when reality bifurcates from expectation and reveals the inadequacy of existing cognitive schemas. An important consideration in this theory is that, in order for curiosity to be sustained, there must be an “optimal level of incongruity” (Hebb, 1955; Loewenstein, 1994) that needs to be met. States of incongruity that fall above or below this optimal point will most likely have negative implications, having either a brief stimulating effect or a disruptive effect in which expectations are disrupted and aversive reactions produced.

Incongruity theorists contend that people are often curious about events that are unexpected and cannot be explained. Various studies have indicated that disrupted expectations stimulate the search for explanations (Wong & Weiner, 1981; Hastie, 1984). Additionally, some theorists state that there is a natural human need for “sense making” in order to make meaning of the explanations and new information obtained through exploration. Making meaning of information through processing and analysis helps to structure and understand a changing world (Gilovich 1991; Parks, 2000). This reinforces the need to make meaning, in order to address incongruities through integrative and structured approaches. Such opportunities to make meaning are further needed as individuals grow in their capabilities.

Competence theory. Just as the incongruity perspective suggests that curiosity is triggered by disrupted expectations, the competence perspective suggests that people are often curious about their own abilities. The tenacity of curiosity hinges on an individual's interest bias that increases the desire to know more about the topic in which they are "specialized," which then deepens knowledge (Schmitt and Lahroodi, 2008). The competence of individuals is further motivated by the desire for mastery over a particular subject-matter or activity (Loewenstein, 1994).

Mastering one's environments through competency may be motivated by intrinsic or extrinsic factors and rewards. A study conducted by Hulme, Green, and Ladd (2013) examined curiosity in high-achieving college students, and their attitudes and behaviors that reflected exploration. They found that curiosity manifested itself through a desire to explore in one of two ways: through the mastery orientation or the performance orientation. Students on the mastery path of exploration demonstrated a desire to deepen and expand their knowledge about an activity or subject. Their interests were broad and questions were asked for learning's sake. Those who were performance-orientated utilized their curiosity to gather information in order to reach an extrinsic standard that would improve their performance in class. The difference between performance and mastery-oriented participants impacted students' levels of curiosity in pursuing challenges and uncertainty, exhibiting a desire to discover, and stronger performance in school. Individuals who were motivated by mastery orientation found intrinsic reward in building their competence through further exploration of their curiosity. In addition to rewards, considerations in preexisting knowledge may also attribute to the cultivation of curiosity.

Information-gap theory. The third theory focuses on two factors that may assist in motivating of curiosity: prior knowledge and the “information gap,” or the ability for information to close the gap between what one knows and what one wants to know (James, 1950; Loewenstein, 1994). Prior knowledge assists in bridging information that is oftentimes viewed as a continuation of what has been learned. Loewenstein (1994) said the following about this third type of theory:

The information-gap theory views curiosity as arising when attention becomes focused on the gap in one’s knowledge. Such information gaps produce the feeling of deprivation labeled *curiosity*. The curious individual is motivated to obtain the missing information to reduce or eliminate the feeling of deprivation (p. 87)

The desire to fill the information gap occurs when the reference point (what one wants to know) of a specific subject or area becomes elevated above one’s current level of knowledge (Loewenstein, 1994).

Reference points may be significant in their connection to what learners may find as relevant information in increasing their knowledge in a particular area or subject. A study of 79 adult learners conducted by Rossing and Long (1981) around the stimulation of curiosity through novel information found that relevance, or the perceived value of information had a stronger influence on epistemic knowledge in participants than curiosity evoked by surprise. Additionally, relevance appeared to have greater influence in the motivation to learn, suggesting that the perceived value of information was critical in arousing curiosity (Schmitt & Lahroodi, 2008). Such studies suggest the consideration of what is relevant is critical in encouraging ongoing curiosity.

Summary. These three theories – incongruity, competence, and information-gap – are the most commonly accepted views in stimulating all curiosity (Loewenstein, 1994). When deliberating about how these perspectives can be cultivated to promote state

curiosity, it may be difficult to distinguish one from the others as curiosity gets played out in a real-world environment. For example, educators may initially think that students are operating from the competence perspective, but then may find that, as a result of, further discourse they are operating in ways that are more consistent with the information-gap theory. Additionally, educators may find that intrinsic motivators may have more relevance in one or more of these theories than extrinsic motivators, and vice versa. The ability to identify which theory of curiosity best explains how students are operating and what motivators are relevant is essential for both cultivating environments in which curiosity can thrive and motivate students to tap into epistemic curiosity.

This study utilizes these three theories of stimulating curiosity as a theoretical lens during observations and in-depth interviews in order to assess state curiosity in the college classroom. Determining the stimulation of state curiosity may take time to emerge through the utilization of thoughtful, and intentional teaching methodologies. One such teaching methodology that appears to promote transformative learning (Mezirow, 1991), and may be effective in explaining how curiosity manifests itself, is through critical reflection.

The Role of Critical Reflection

Exercising how to construct meaning out of experiences is the essence of reflection (Mezirow, 1991; 1998). The pursuing of relationships and connections allows the topic of interest to grow. Haphazard “mulling over” a particular idea or experience is viewed as undisciplined, and not the same as reflection. Reflection calls for active, persistent, and thoughtful consideration of ideas and beliefs on the grounds in which they were learned and the contemplation of further conclusions that may affect them

(Mezirow, 1998). John Dewey (1933) characterized the concept of reflection into four criteria: as meaning making, disciplined thinking, interactive, and valuable in the development of self and others. In the study of reflection, Rodgers (2002) offered a condensed version of Dewey's phases of reflection:

1. presence to experience;
2. description of experience;
3. analysis of experience; and
4. intelligent action/experimentation (p. 856).

Rodgers acknowledged that these steps serve as a function of reflection that assists in the process of making meaning and interpretations of experiences. In phase 1, learners recall elements of the experience; In phase 2, based on "evidence" of their perception and feelings associated with it, learners describe their experience, holding at bay judgments and interpretations until they can be analyzed, and additional data can be gathered; this is where the process of making meaning begins; In phase 3, learners generate possible explanations and hypotheses for their experience by relying on other sources beyond themselves to broaden their understanding; this is where the reconstruction and reorganization of the experience takes place; and In phase 4, meaning has been ascribed to the experience, and learners respond by finding a "resolution to the disequilibrium" (p. 855) they may be facing. In the final phase, the experience, at least temporarily, makes sense and can be relied upon to assist in future interactions and learning.

In the discussion of reflection, most theorists would agree that reflection involves some element of critique implicit in one's beliefs. However, according to Mezirow

(2000) the term critical reflection should be reserved to “refer to challenging the validity of *presuppositions* in prior learning” (p. 12). While in reflection, the check to confirm prior knowledge is considered when contemplating correct processes and procedures; in critical reflection, the validity of presuppositions is questioned, and old ways of thinking are reassessed to reframe meaning perspectives.

Some researchers view critical reflection as a process of meaning construction and problem solving (Dewey, 1938; Kolb 1984). Others consider it a retrospective examination of experiences beyond problem solving, to gain awareness, appreciation, and understanding (Boud, 2001; Mezirow, 1998). Lucas and Leng Tan (2013) examined students’ “ways of knowing” in relation to their capacity to engage in critical reflection. They acknowledged that understanding student beliefs about knowledge – referred to at times as “epistemological beliefs” or “ways of knowing” (p. 104) – affected the way in which they learned and made decisions. Using Baxter Magolda’s (1992) epistemological reflection model, the authors examined students’ capacity to engage in critical reflection and to identify their ways of knowing. Lucas and Leng Tan found that students who possessed an absolute way of knowing were more unlikely to cope well in conditions of uncertainty, and react positively to challenges of deep-seated assumptions and beliefs. In contrast, students who possessed an independent or contextual way of knowing were able to express more confidence, and be more effective in uncertain and ambiguous situations. Thus, the capacity for students to engage in critical reflection requires students to progress from absolute to contextual way of knowing.

Critical Reflection as Reflective Activity

In the evaluation of adult learning processes, oftentimes reflective activities and communicative learning approaches are used to foster critical thinking that lead to finding relevant solutions to problems. In engaging in communicative learning, adults “analogize from familiar to unfamiliar” and infer explanations by analogical reasoning (Roessger, 2014, p. 326). “Reflection requires that the thinker draw on past experience, ‘image-ing’ other events that are similar to or different from the experience being inquired into” (Rodgers, 2002, p. 850). This commonly occurs when learners are asked to articulate abstract ideas, values, and feelings of self and others (i.e. What do they mean).

In addition to problem solving, critical reflection helps individuals create intention to understand their positionality in relation to the ideas and practices they accept. One activity of critical reflection that has been commonly practiced is journal writing. Research has found journal writing can promote critical reflection, while enhancing observation skills based on long-term and short-term memory functions (Chittooran, 2015) and cognitive functioning (Woolfolk, 2013). Such methodical teachings of critical reflection could benefit student learning (Smith, 2011) and their process of making meaning (Moon, 2006).

Another activity that has been shown to be beneficial is reflective discourse with other peers, colleagues, and instructors (Astin, Vogelgesang, Ikeda, & Yee, 2000). Critical reflection through reflective discourse involves “finding agreement, welcoming difference, ‘trying on’ other points of view, identifying the common in the contradictory, tolerating the anxiety implicit in paradox, searching for synthesis, and reframing” (Mezirow, 2000, p. 13). Reflective discourse calls for the suspension of judgment until a better determination can be made about an issue, belief, and topic. Such discourse allows

for active, focused dialogue to be a resource in furthering the exploration of the perceived meaning of experiences.

In communicative contexts, benefits of reflective activities include: improved self-awareness, collegiality, professionalism (Fook & Gardner, 2007), and enhancement of critical thinking capacity in complex situations (Brookfield, 2000). Additionally, in terms of learning outcomes, reflective activities promote improved learning transfer (Bannert, 2006). Despite these benefits, many instructors veer away from adding critical reflection activities to their classroom experience. A study conducted by Griffin (2003) surveyed and interviewed instructors about their perceptions of group learning on academic learning. In the study, the author noted that while most instructors (85 percent) agreed that discussion was the best way of developing critical thinking, and acknowledged that the cultivation of critical thinking was an important part of learning, many turned back to traditional methods of instruction. The lack of time, unpreparedness in implementing reflective activities, and difficulty in applying reflective thinking to real-life situations were the primary reasons cited for not promoting and using methods of reflection (Hatton and Smith, 1995).

Summary. The complexities of implementing critical reflection activities within the contexts of an academic setting prove to be a challenge as various considerations would need to be made outside the traditional forms of teaching. Yet, an integral component of adult learning involves “the process of justifying or validating communicated ideas and the presuppositions of prior learning” (Mezirow, 1991, p. 5). This study will test students’ thoughts, ideas, beliefs, and knowledge in order to build meaning and enhance logical reasoning, which according to Mezirow (2000), is what

makes transformative learning possible. Additionally, opportunities for critical reflection, when implemented purposively, could be instrumental in transforming students' learning, and encouraging cognitive growth.

Overview of Transformative Learning Theories

Transformative learning theory is a constructivist perspective that is rooted in the idea that the interpretation and reinterpretation of one's experiences is essential to the meaning making process, and hence, the learning process (Mezirow, 1991).

Transformative learning enhances awareness in adult learners to become more mindful of their own tacit assumptions, beliefs, and behaviors by assessing their relevance for making interpretations. Transformative shifts may occur suddenly, through a dramatic reorientation, or incrementally, through a series of transformative progressions.

According to Mezirow (2000), transformative learning has "both individual and social dimensions and implications" (p. 8) in which learners must understand the nature of how their knowledge is obtained, and become aware of the values that lead to such perspectives. As cultural conditions such as socioeconomic structures, ideologies, and values oftentimes foster conformity, there is a need to develop a sense of responsibility in individuals to continuously question assumed knowledge. In so doing, learners may have a transformative learning experience in which they make reflective and informed decisions to act upon their insights.

Research has found that specific, intentional use of transformative learning theories in educational settings enhances learning. In conducting research, Chen (2013) found that a course designed using adult learning principles (i.e. transformative learning theory) allowed students to approach learning in a more meaningful way. Participants

made disciplinary content as personal as possible, thus being more fully engaged when reflecting upon their emotional and cognitive processes. Pre-existing paradigms were challenged as participants bridged the gap between their current reality and future possibilities. Such opportunities for critical reflection promotes transformative learning experiences that may allow students to continuously make connections needed to develop their capacity to question, challenge, and ultimately, gain new insight.

Mezirow (1998; 2000) contends that through transformative learning, adult learners are able to problem solve through the process of redefinition or reframing their issues. *Meaning schemes* determine what and how learners see, whether it is through cause-effect relationships, a sequence of events, construed idealized images of self, and considerations of what others may be like. Learners are able to become critically reflective of their assumptions, or of others, and arrive at a new and transformative insight – *perspective transformation*. Yet, as much as these insights are available, Mezirow states that they need to be justified through discourse and analysis. To fully understand and assess the way in which others interpret experiences requires discourse, and to comprehend the reasons for their beliefs requires the ability to critically reflect on assumptions made by self and others.

Within the field of transformative education, though Mezirow (2000) is a primary contributor, Robert Boyd (1991) and Paulo Freire (1970) offer two additional models to consider. Boyd offers a transformative model based on analytical psychology, while Freire offers an emancipatory model. These perspectives of transformative learning deviate from Mezirow's, but are still shaped by the underlying assumptions of self, society, and learning (Taylor, 1998).

Boyd's (1991) model of transformation is influenced by the work of psychologist Carl Jung, and recognizes the whole person, including the psyche and collective unconscious, in the transformative process. Reflection through the psychic structures: ego, shadow, persona, collective unconscious, is an individual journey and process. The central purpose of the transformation is to free individuals from reified cultural norms that prohibit the potential for self-actualization. In the consideration of transformative education, Boyd views the transformative journey not as opportunities to practice problem solving, like Mezirow (1998; 2000), but as a process of discernment. Boyd defines discernment as a holistic orientation that leads to contemplative insight, and understanding of self as part of a larger whole. Dialogue with the unconscious is where transformation is possible. The outcome is resolution with the hidden aspects of one's personality that leads to transformation.

Freire's (1970) transformative model is a theoretical approach that considers the emancipation of individuals through education. Considerably more concerned with social transformation, Freire views people as subjects whom continuously reflect and act to transform their worlds in order to create a more equitable existence for all. The purpose of critical reflection is central to and based upon the premise of the rediscovery of power – the more critical learners there are in the world, the more they are able to transform society and the realities of their lives.

Critics of transformative learning state that the theory is no longer a coherent one as it is used to refer to "any kind of learning outcome and has therefore, strayed from its theoretical foundations" (Hoggan, 2016, p. 58). Throughout the years, theorists have continued to expand upon Mezirow's theory, broadening its scope, and setting the stage

for the theory to become a metatheory. Thus, various outcomes of learning may be labeled as “transformative.” On the other end of the spectrum, some critics view Mezirow’s theory as “unduly restrictive,” arguing that experiences may involve little self-awareness (stage 2 of Mezirow’s model), and instead are more problem-focused, which may engage individuals differently, but with the same amount of emotional disorientation, and critical exploration as the focus on self (Dix, 2016). Additionally, critics claim that transformative learning fails to account for context (Clark & Wilson, 1991), as well as developmental stages of adults (Tennant, 1993). In spite of these critiques, research has found that transformative learning theories are imperative in helping learners make connections, deeply analyze long-held beliefs, and reshape perspectives that can promote opportunities for critical reflection and new learning (Mezirow, 1998; Ross-Gordon, Gordon, Alston, Dawson, & Aacken, 2015; Smith, 2011).

Transformative Learning and Critical Reflection

According to Mezirow (2000), learning “is understood as the process of using a prior interpretation to construe a new or revised interpretation of the meaning of one’s experience as a guide to future action” (p. 5). In order for such learning to occur, learners must pursue a perspective transformation in which an awareness of assumptions is recognized and an understanding of how and why perceptions of the world are constrained by these beliefs are known. Then, changes of these structures are made to create an inclusive and integrative perspective in which decisions are made and acted upon by these new understandings. Mezirow (1991) identifies the following phases of transformation as follows:

1. Experiencing a disorienting dilemma;
2. Self-examination with feelings of fear, anger, guilt, or shame;
3. Critical assessment of assumptions;
4. Recognizing that one's discontent and the process of transformation are shared;
5. Exploration of options for new roles, relationships, and action;
6. Planning a course of action;
7. Acquiring knowledge and skills for implementing one's plans;
8. Provisionally trying out new roles;
9. Building competence and self-confidence in new roles and relationships; and
10. Reintegrating one's life on the basis of the new perspective (p. 168-169)

In Mezirow's theory, the sequence of transformative learning should be viewed as "invariable developmental steps" rather than a sequence, in which "meaning becomes clarified" (p. 193). Indications of individuals moving through a transformation include: taking a more critical perspective and stance; testing assumptions and boundaries; exhibiting greater awareness of emotions and intuition; and viewing authority as helpful resources in the process (Mezirow, 1991).

In the transformative learning process, critical reflection is a necessary component in change occurring. Various studies have found activities that critically evaluate and interpret an individual's thinking allows new forms of meaning to develop and crystallize. In their research, Christie, Carey, Robertson, and Grainger (2015) described three case studies in which students' learning was impacted by Mezirow's transformative theory. In one case study, the first author found that triggering disorienting dilemmas

through a controversial values survey produced stimulating debate about worldviews that led to the start of transformative learning. In this context, transformative learning theory was tested and found to be impactful by triggering disorienting dilemmas. Such findings suggest that through inventories such as surveys, the first step of recognizing embedded values in self can be explored to bring about mindfulness in assumptions and beliefs.

Additionally, a study conducted by Hullender, Hinck, Wood-Nartker, Burton, and Bowlby (2015) found that in a service-learning environment where reflective writings were analyzed, students started to rethink some of their assumptions and perspectives. Findings indicated that approximately half of the participants viewed their service-learning experience as transformative, while the other half did not. One hypothesis of why this may have occurred was in the consideration of the participants' own social identity in relation to the identity of the population being served, and how that may have impacted the way in which students viewed the service experience. Due to this hypothesis, as well as other considerations, the authors proposed that educators offering such experiences allow space, time, and structured scaffolding, as they may be needed for transformative learning to take place.

In further considerations of critical reflection, and the phases of transformative learning, Mezirow (1991) articulates the importance of reflective discourse in the process of examining long-held beliefs and assumptions. Some studies indicate engagement with others and the verbal processing of thoughts assist in the reorganizing and reframing process (Christie, et al., 2015). A study conducted by Ross-Gordon, Gordon, Alston, Dawson, and Aacken (2015) examined the impact of a doctoral program on the transformative learning experiences of students. The authors found a majority of students

attributed their transformative learning experiences to the program, citing reflective writings, portfolios, and other assignments focused on applying theory to practice as consistent determinants of their ability to process and reflect. In terms of impact, the authors found that dialogue with other peers and professors about perplexing issues and topics enabled critical reflection. The availability of space, the encouragement of engaging authentically, and the diversity of experiences, in addition to race, ethnicity, beliefs, and values of participants, contributed to raising students' level of thinking. As educators, offering such spaces for learners to process, while creating opportunities for transformative experiences can be instrumental in encouraging their continuous exploration of knowledge stimulated by curiosity.

The importance of using transformative learning theory as a foundation for developing critical reflection activities is two-fold: 1. Based on the incongruity theory, curiosity is piqued when learners' meaning schemes are challenged (Loewenstein, 1994), and 2. Changes in perspectives are supported through discourse and analysis. To fully understand and assess the way in which others interpret experiences requires discourse, and to comprehend the reasons for their beliefs requires the ability to critically reflect on assumptions made by self and others (Mezirow, 1998). The theory emphasizes that in the absence of critical reflection, individuals' fall into default patterns of forming assumptions, stereotypes, and generalizations that may never be questioned nor evaluated.

Critics of critical reflection state that the techniques and approaches are too vague to assess and measure. In addition, undertaking critical reflection activities requires students to invest time and energy in the exploration and contemplation of alternative

perspectives (Smith, 2011). This could potentially detract from the learning of subject-matter knowledge and technical skills. Additionally, some researchers view critical reflection as an interactive and collaborative process (Brookfield, 2000; Cranton, 1996; Mezirow, 2000), whereas others argue that it can be self-generated and can occur outside of a discursive group (Dix, 2016; Fook, 2010). Disagreements also exist about the process of critical reflection. Traditionalists consider it a rational process (Mezirow, 2000), whereas others view it as an emotional activity (Brookfield, 2000).

Though to some degree valid, the critiques of critical reflection do not consider how measuring critical reflection with a specific construct (like curiosity) may be a useful technique in clarifying how the methodology is impactful to the learning process. Additionally, learning subject matter within the framework of reflection assists students to better understand course content (Litke, 2002). And while critical reflection can be considered introspective, solitary work, the use of discussion encourages the consideration of various perspectives, which deepens learning (Mezirow, 1990). Despite such critiques, supporters of efforts to promote critical reflection in higher education contexts contend that reflective activities are needed in order to understand the intricacies of reflection of self, relationship to others, and situations.

Summary. To date, critical reflection is viewed as a vital methodology for promoting deeper learning than the sort of learning that occurs when more traditional pedagogical strategies are employed (Mezirow, 1991). By practicing critical reflection consistently, educators desire to see students grow in their capacities to become critical thinkers, which may bolster efforts to meet one of the measured outcomes in higher education (to assist students in expanding their capacity for analysis and reflection). Yet,

studies indicate that this is not the current reality (Arum & Roksa, 2011; Hart Research Associates, 2015; Selingo, 2013). Because the means to access higher levels of thinking relies heavily within the interest and willingness for students to learn, understanding the impact of curiosity on the learning process may be essential in building students' capacity to reflect.

Curiosity expands the desire to experience and acquire knowledge that can be changed, developed, and reframed over time. Thus, promoting reflection through reflective discourse in which dialogue occurs and relationships are built may be a way to nurture state curiosity in the college and university classroom, and critical thinking, in turn, may be a way to set the stage for further learning to occur. If "the best avenue for cultivating curiosity is to create social and contextual conditions that facilitate the perceptions and emotions [of individuals] that lead to greater curiosity" (Kashdan and Fincham, 2004, p. 489), then perhaps critical reflection can assist in creating environments where curiosity can be cultivated.

Conclusion

The three areas of research and the theories and theoretical distinctions examined in this section have assisted in defining curiosity, illustrating the importance of curiosity in student learning and the various ways it can be stimulated, and the level of learning required for perspective change. The integration of these theories and the consideration of the impact of critical reflection activities based off of transformative learning theory and a reflective thinking model on state curiosity is highlighted in Figure 2. Individual motivators, factors, as well as critical reflection activities are vital components in increasing curiosity in this model.

Figure 2. A Model for Stimulating State Curiosity

Figure 2. A model for stimulating state curiosity. An illustration of how critical reflection activities may increase state curiosity.

This study determined if critical reflection is an effective method that can be used to stimulate and enhance curiosity in students in the college classroom. In addition, this study employed reflective activities, informed by transformative learning theory, which emphasized the importance of critical reflection. This research added to existing literature on curiosity, in addition to contributing to an understanding of how pedagogy can be refined to inform practices and strategies for stimulating and enhancing curiosity.

Research Hypothesis

This study will examine the elements of curiosity and specifically, trait and state curiosity and how they impact student learning in the college classroom. The measurement of trait curiosity is often equated with upbringing and personality, as well as how individuals respond to novelty, complexity, and risk taking behavior. These

factors, developed over time and through various experiences, may be related to how state curiosity is experienced. As such, the following hypotheses for this study are:

Hypothesis 1: It is hypothesized that there will be no anticipated changes in pre- and post-assessment scores of participants or between experimental and control groups.

Hypothesis 2: It is hypothesized that participants with higher scores on the trait curiosity scale (Curiosity and Exploration Inventory II) will also show higher state curiosity.

Hypothesis one will be tested using two-tailed samples t-tests comparing the CEI-II scale, while Hypothesis two will be evaluated with qualitative interviews.

CHAPTER THREE

METHODOLOGY

This study considered the role of critical reflection in stimulating curiosity and the role of curiosity in understanding how students make connections and meaning of content taught in the classroom. Transformative learning theory provided a basis for developing critical reflection activities that were intentional and focused on guiding non-traditional teaching that provided students with opportunities for their curiosity to be evoked and heightened.

This mixed methods study focused on the following questions:

1. To what extent, if at all, do critical reflection activities impact the stimulation and enhancement of curiosity in college students?
2. How do critical reflection activities interact with trait and state curiosity?
3. What extrinsic and intrinsic motivators impact how students' curiosity is stimulated and enhanced?

Research Design

An explanatory sequential, two-phase design (Creswell & Plano, 2011) was used in which both quantitative and qualitative data was collected at different times, assessed and analyzed separately, and then compared to inform additional analysis. Quantitative data were collected and used to select participants in the qualitative portion of the study. Additionally, this study utilized a quasi-experimental design, specifically the nonequivalent groups design in which two similar and relatively comparable intact classes served as the experimental and control groups. Both quantitative and qualitative

data were collected and analyzed to document the impact of the experimental treatment on the course.

This study involved administering a pre-and post-curiosity inventory, a demographic questionnaire, class observations, and in-depth interviews focused on documenting any stimulation and/or enhancement of curiosity. The implementation of critical reflection activities served as the intervention, or catalyst, for possibly stimulating curiosity. There were two units of analysis: the classes and the individuals interviewed for the study. The next section details the specific methods employed in the study.

Curiosity and Exploration Inventory II (CEI-II)

The CEI-II is a self-report instrument that measures individual differences in the pursuit of novel and challenging experiences. In short, it measures specific behaviors and tendencies that were associated with lower or higher levels of trait curiosity in each student. The instrument focuses on defining “features of curiosity rather than different objects that induce curiosity” (Kashdan et al., 2004).

The CEI-II is a 10-item scale with two factors: exploration (desire to explore novel experiences) and absorption (propensity to become deeply engaged in experiences). Studies have demonstrated that the scale maintains construct validity of the two factors when curiosity is being explored (Kashdan & Steger, 2007; Ye, Ng, Yim, & Wang, 2015).

Compared to other curiosity inventories, the CEI-II, was one that was most fitting for this study for three reasons: 1. the CEI-II has demonstrated consistent internal reliability between .83 and .86 (Kashdan, Gallagher, Silvia, Winterstein, Breen, Terhar, & Steger, 2009); 2. it can be taken in a few minutes, which is beneficial for keeping

students' focused as well as not intruding too much on class time; and 3. it is a valid instrument to measure the constructs of exploration and absorption (Kashdan et al., 2009).

Critical Reflection Activities

The utilization of transformative learning theory and the 4Rs Model for Reflective Thinking served as an intentional basis to focus critical reflection activities to motivate deeper forms of critical thinking and analysis. A classification of critical reflection stages in conjunction with Mezirow's Phases of Transformation (1991) structured the reflective activities used in the study. Table 1 categorized Mezirow's Phases of Transformation embedded in his transformative learning theory in the 4Rs Model for Reflective Thinking (Ryan & Ryan, 2013), which is a modification of Bloom's Taxonomy Model (1956). The 4Rs model provided stages that assessed reflective learning in adult learners. The delineation of the phases of transformation to specific stages connected levels of critical reflection that were used to measure curiosity. The listed indicators determined changes in students' capacity to reflect from one stage to the next.

Table 1

A Model for Critical Reflection Activities

Stage	Phases of Transformation	Indicators
Reporting	Experiencing a disorienting dilemma	Conflict/problem relational or school work-related
	Self-examination with feelings of fear, anger, guilt, or shame	Display of emotions
Relating	Critical assessment of assumptions	Expression of doubt
	Recognizing that one's discontent and the process of transformation are shared	Talking about doubts with peers in class
Reasoning	Exploration of options for new roles, relationships, and action	Discussion about different perspectives
	Planning a course of action	Asking: What can be done next time?
	Acquiring knowledge and skills for implementing one's plan	Imagining scenarios where new roles/relationships can be tested
Reconstructing	Provisionally trying out new roles	Reporting real-world scenarios where new roles/relationships were tested
	Reintegrating one's life on the basis of the new perspective	Discussing what was learned from this experience and the impact on current perspective
	Building competence and self-confidence in new roles and relationships	Hashing out what well and what didn't, and what can be changed next time

Using critical reflection activities grounded in transformative learning theory was appropriate for this study because Mezirow (1991) highlights the importance of integrating introspection, reflection, and engagement with others to seek new perspectives through the implementation of such activities. Critical reflection activities employed intentional teaching methods that focused on stimulating or enhancing curiosity. The focus on doing so, through a variety of reflective activities, took into account various learning styles, and different modes of teaching (i.e. inquiry-based, discussion-based). These activities provided outlets for students to reflect on their learning through non-traditional, creative methods, and in a manner in which they could make deeper meaning of in-class experiences.

Observations and In-depth Interviews

Observations were made in both the experimental and control groups during the class periods where the critical reflection activities were implemented. I observed both groups to understand what type of instructional methods the professor was employing and to note any differences between the classes that may have impacted students' curiosity. Within the context of the college classroom, it is highly probable that not just one, but a range of situational factors impact the desire to know. In order to account for these external variables, interviews were conducted to inquire about events, experiences, ideas that may have also impacted students' curiosity, in addition to the critical reflection activities implemented in this study.

Methods

In the following section I describe the research site and participants, as well as the process in which the pre-and post-assessment were administered. Additionally, I describe

how the Curiosity and Exploration Inventory II (CEI-II) was used to select individual participants in the study, and how interviews were conducted and data collected.

Research Site and Participants

The sample for this study consisted of two sections of undergraduate students (n=48) enrolled in a selected upper division Psychology course during the Fall 2017 semester at the University of San Diego (USD). The University of San Diego is a private four-year university. The course was chosen for two reasons. First, the Psychology program at a private four-year university, is considered a teaching university, emphasized the importance of learning through various methods. Second, both sections of the course (26 students in one section and 24 students in the other) were taught by the same professor, which provided consistency in teaching content and pedagogy. In short, the choice of the similar groups of students represented an attempt to engage in consistent teaching practices, while testing the impact of additional strategies intended to stimulate curiosity.

In order to identify a Psychology course with two sections taught by the same professor, I reviewed the Psychology course offerings for fall 2017 and contacted professors who taught two sections of the same upper division course. The nature and goals of the study were shared with them. They were asked if there was any interest on their part in partnering in the study, with the intention that the course content and curriculum of both sections would remain the same, but critical reflection activities would be implemented five times throughout the semester for one of the sections (i.e. the designated experimental group). Two tenured faculty members expressed interest in partnering in my study. I met with both of them and decided to partner with one who

taught a core Psychology course for Psychology and Behavioral Neuroscience majors. My choice was based on the selected faculty member's expressed interest in my study and willingness to collaborate.

The students selected for the study were enrolled part-time or full-time at USD. Students selected to participate in the study were between the ages of 19 to 24, in their third or fourth year, and enrolled in an upper-division Psychology course. As the traditional age of students attending small, private colleges was between 18-24, efforts were made to connect with such students in the third and fourth years of their college experience.

Several weeks prior to the start of the semester, the selected faculty member and I met to compare the demographics of the two sections of the course that would be the study's experimental and control groups. We considered the number of juniors and seniors in each section, in addition to their majors (Psychology/Behavioral Neuroscience vs. non-Psychology/Neuroscience majors). We determined that the sections were not a perfect match, but they were quite similar in that the majority of students in both sections were Psychology and Behavioral Neuroscience majors, with a similar ratio of women to men.

Beyond any other differences, the two sections did differ in terms of when they were delivered. One class was offered in the morning, three days a week for 55 minutes. The other class was scheduled in the afternoon, three days a week for 55 minutes. Based on the class rosters for both sections, in addition to my own teaching load, we determined that the morning class would be the experimental group and the afternoon class would be the control group.

A convenience/purposeful sampling process was used to identify and select participants for the study. The sampling was purposeful because participants were selected based on set criteria, as described above, that included: age, enrollment at a four-year private university, major, and class standing. The study's sample could also be characterized as a convenience sample because I selected the groups of student participants for the study in part based on their availability and on my ability to have access to them.

Data Collection

In this study, multiple methods were utilized to gather and triangulate as much information as possible to most accurately answer the research questions. The various methods of data collection are provided in Table 2.

Table 2

Methods of Data Collection

Data Collection	When	How	Groups
Observations	September 6: Day of Pre-assessment September 20, October 2, November 1 & 8: Classes prior to CR activities September 22, October 6 & 13, November 3 & 10: Day-of CR activities		Experiment; Control
Curiosity & Exploration Inventory II*	September 6: Pre-assessment November 15: Post-assessment		Experiment; Control
Demographic Questionnaire*	September 6: With the Pre-assessment		Experiment; Control
Critical Reflection Activities*	September 6, October 6 & 13, November 3 & 10		Experiment
Interviews*	December 3-8	1) Based off of pre- & post-assess. students were contacted to interview 2) 12 students were emailed from the Experiment & Control groups. 5 students confirmed.	Experiment; Control

3) After 2 more emails to the students who didn't respond, I sent out a general email to ALL students. Students then were selected based on their assessment scores and availability.

4) 9 out of the 11 students interviewed fell into the high/low score categories or larger differences in score category.

Syllabus/course outline/grades	Throughout fall semester	Experiment; Control
Other methods		
Meetings with professor	1 in spring, 2 in summer	
Helped create/find 3 out of the 5 content review activities (CR #2: Neurotransmitter chart, CR #4: Eye & optical illusion videos, CR #5: Vision pathway)	Implemented prior to the CR activities. Other content review activities are implemented during non-critical reflection days as well.	

* Primary methods of data collection

All data collected was used to inform and analyze different stages of this study. However, the primary methods used for data analysis purposes were: CEI-II results, demographic questionnaire data, critical reflection activities, and data generated through interviews provided the most in-depth information about students' insights on their background, critical reflection activities, and indicators of motivation, all of which helped to address the research questions. Each of these data sources is discussed below.

Inventory and questionnaire. The Curiosity and Exploration Inventory II (see Appendix A) was administered to provide a quantitative basis for understanding levels of trait curiosity in the participants. The inventory and its various components were described in the beginning of this chapter. Additionally, a questionnaire (see Appendix B) was administered along with the inventory to gather data on background and demographics. The questionnaire included: students' current class standing at USD, major, perceptions of core curriculum, whether or not students were first-generation

college students, highest level of parents' or guardians' education, household income while growing up, racial identity, gender, and GPA.

Critical reflection activities. Five critical reflection activities were implemented with the experimental group. Table 3 provides a class schedule of the dates, topics, and schedule of events for each day. The critical reflection dates were selected within a 12-week period during the course of the semester.

Table 3

Critical Reflection Activities Days Class Schedule

	CR Activity #1	CR Activity #2*	CR Activity #3	CR Activity #4*	CR Activity #5*
Date	September 22, 2017	October 6, 2017	October 13, 2017	November 3, 2017	November 10, 2017
Topic	Neurophysiology	Drugs & Behavior	Sexual Differentiation	Vision	Food & Hunger
Schedule	30 min - Lecture	31 min - Lecture	29 min - Lecture	12 min - Quiz	13 min - Human vision pathway activity
	14 min - Action Potential puzzle activity	12 min - Neurotransmitter Chart activity	11 min - "New" person activity	18 min - Lecture	25 min - Lecture (Food & Hunger)
	11 min - Critical reflection activity	11 min - Critical reflection activity	11 min - Critical reflection activity	10 min - Eye videos	10 min - Critical reflection activity
				9 min - Critical reflection activity	

* I assisted the professor with creating content review activities for CR Activities #2, #4, and #5.

The critical reflection activities were scheduled to occur during the last 12 minutes of class on the five scheduled days. In actuality, the activities took up between 9-11 minutes at the end of each scheduled class. Routine teaching methodologies were used in control sections instead of critical reflection activities.

For each critical reflection activity, I created a script for the professor to use as a guide to administer the activity. Each script contained an introduction that framed the activity for the professor and the students. Additionally, the script provided a time reference for how long each student or student group should spend on each question. Copies of the scripts can be found in Appendix C.

After all five critical reflection activities were implemented the post-assessment was administered. The post-assessment consisted of re-administering the CEI-II and calculating differences between the pre-and post-assessments. Based on the aggregate scores from the pre-and post-assessments, students in the both the experimental and control sections who had low and high scores, as well as any significant difference of pre-and post-scores from the inventory were asked to participate in an interview. Additional students were asked to participate in interviews when I was not able to obtain a response from these selected students.

Interviews. Based on the scores of the pre-and post-assessment data, 12 students from both the experimental and control groups who indicated low or high scores, as well as any large difference (five points or more) in pre-and post-assessment scores from the inventory were emailed a request to participate in an interview. After only receiving five email confirmations from this selected group, a general email was sent out to all students to capture a wide and diverse sample. Six additional students were chosen for interviews based on the outcome of their assessment scores and availability. Nine out of the 11 students interviewed indicated low or high scores, or a five-point difference or more in their pre-and post-assessment scores.

A total of eleven interviews were conducted based on the scores from the inventory: 7 students from the experimental group and 4 from the control group. One interview per selected participant sufficed for this study and no additional follow-up interviews were needed.

The design and structure of the interview journey was based off on Kvale and Brinkmann's (2009) Seven Stages of an Interview Inquiry. The interviews were informal

conversations, though an interview guide (see Appendix D) was created and utilized based on the three theories of stimulating curiosity to “ensure that the same basic lines of inquiry are pursued with each person interviewed” (Patton, 2002, p. 343). Each interview lasted between 15-40 minutes in person two weeks after the post-curiosity inventory was completed. The interviews were recorded and transcribed.

During the interviews, I used iTalk, an application that recorded the conversation, in addition to writing some notes by hand to keep track of critical information being shared. Note taking was fairly minimal as the goal was to keep and maintain eye contact with the interviewees to create a comfortable flow in conversation. Once the interviews were completed, recordings to transcribe the interviews were submitted to *Transcription Puppy*, a transcription services company. Additionally, analytic memos for each interview were completed to capture my initial thoughts and impressions about each interview.

These interviews were essential for understanding what critical reflection activities, or what part of them, students found useful in their learning. Additionally, the interviews assisted in helping me understand how other factors (i.e. upbringing and activities outside the classroom) influenced how students received and understood what was taught in the classroom.

Data Analysis

A few initial coding categories derived from the research questions were used in analyzing the data. For example, the second interview guide question – How do critical reflection activities interact with trait and state curiosity? – was translated into the initial

coding category: *personality traits, prior interests, and engagement with different perspectives.*

Various quantitative tests, including paired sample and independent sample t-tests, were conducted using MAXQDA and SPSS for the pre-and post-assessments of the curiosity inventory to determine any changes in levels of trait curiosity. Then, once scores were analyzed, interviews were completed; data were transcribed, organized and reviewed. Saldaña's (2009) Descriptive and In Vivo coding was used to identify over 480 codes the first round. All codes were initially analyzed in MAXQDA, a mixed methods software. Then, they were transferred to separate excel documents to identify patterns and relationships.

In the second round of coding, I considered the hierarchy and saliency of codes while looking for connections between them. I did this by categorizing similar and related codes under the frame of each research question. Similar codes such as, "understanding of learning style" and "perception of self" were identified and, with other codes, were collapsed under one category: Awareness of self. From this combining process, a total of 34 categories were identified. After mind mapping these categories, I was able to find similarities. Categories such as, "professor impact" and "learning from peers" were classified as one theme: Interpersonal influences. From this, a total of six themes were found from the data in this study: Perceptions of learning, Application of learning, Intrapersonal factors, Self-awareness, Interpersonal influences, and External challenges.

A comparison of the 11 interviews provided descriptive information about these students' experiences taking a demanding, rigorous Psychology course and the factors that impacted their learning. The interviews provided a glimpse into how students

received and connected with course content, and in the case of seven interviewees in the experimental group, how critical reflection activities impacted how they made meaning of what they learned.

Triangulation

Triangulation methods were used to organize and understand the similarities and differences in data collected. Since one point of triangulation in qualitative research is to understand the similarities and differences in data generated by using different data sources (Mathison, 1988), four data sources were used to provide a holistic picture of how critical reflections impact students in the college classroom: CEI-II results, demographic questionnaire information, comments on critical reflection activities, and additional interview data. These data and the methods used to generate them provided different perspectives from both a quantitative and qualitative position that informed how students' curiosities had been stimulated and enhanced as they engaged in making meaning of course content.

Positionality

According to Banks (2006), and his typology that conceptualizes various kinds of researchers, I was an indigenous-insider researcher in my study. I brought with me the identity of a higher education educator who is invested in finding strategies and identifying pedagogy that is most effective in the college classroom. My current position as an undergraduate Leadership Studies Minor instructor and my goals of becoming a professor influenced the way I thought about this study. I made several assumptions about the college classroom, and the power of critical reflection activities to stimulate curiosity as my belief about the higher education system and the need to reconsider our

current way of traditional teaching is strong. Also, my current experience as a graduate student in the Leadership Studies program, and the motivation that I received from specific professors while in the program to think more critically influenced thoughts about how I could provide similar experiences to my undergraduate students.

In order to maintain a check and balance in the positionality that I brought to my research and ensure that the information collected was accurate, steps were taken to ensure that data collected was in line with the interviews that took place. In order to do so, I fully reported the information provided by the interviewees, writing in detail and as candidly possible (Wolcott, 1990). Additionally, I reread and referred back to my field notes to reassess accounts of the interviewees (Wolcott, 1990). Finally, a copy of the transcripts was sent to the interviewees for review.

CHAPTER FOUR

ANALYSIS OF QUESTIONNAIRE AND PRE- AND POST-ASSESSMENT FINDINGS

Introduction

This study sought to explore the role of critical reflection activities in the stimulation and enhancement of curiosity in the college classroom. Data collection occurred through the implementation of (a) the Curiosity and Exploration Inventory (CEI-II) as a pre-and post-assessment, (b) a demographic questionnaire, (c) critical reflection activities, and (d) in-depth interviews. This chapter summarizes the findings from the demographic questionnaire, the pre-and post-assessment of the experimental and control groups, and a comparison of the pre-and post-assessment data for the experimental and control groups. Two paired samples t-tests were conducted to determine any statistical significance of the experimental and control group pre-and post-assessment results. In addition, two independent samples t-tests were conducted to identify any negative and positive differences in scores between the two groups. The chapter will conclude with an analysis of the two-tailed samples t-tests and limitations of the analyses and methods.

Summary Statistics

Demographics

A total of 25 students successfully completed the demographic questionnaire from the experimental group and 23 students from the control group. With the exception of four sophomore students in the control group, all other survey participants were in their junior or senior years. The majority of participants identified as female in both groups (68 percent for the experimental and 65 percent for the control group); all were either

Psychology or Behavioral Neuroscience majors. Additionally, 60 percent of participants in the experimental group and 74 percent in the control group indicated they had taken three or more Psychology courses prior to taking Biological Psychology, which indicates a higher level of exposure to and background in the field than would be the case if fewer classes had been taken. Participant information is summarized in Table 4.

Table 4

Questionnaire Participant Data

	Experimental %	Control %
Gender		
Female	68%	65%
Male	28%	35%
Non-binary	4%	-
Psychology or Behavioral Neuroscience majors	88%	100%
≥ 3 prior Psychology classes taken	60%	74%
First Generation students	8%	44%
Parent's/Guardian's education - BA, MA, Advanced degree, PhD	84%	57%
Household income of ≥ \$75,000 growing up	60%	48%
Students of color	44%	65%
≥ 3.0 GPA	80%	57%
	N=25	N=23

The differences between the experimental and control groups include the following: whereas eight percent of participants in the experimental group identified as first-generation college students, 44 percent of participants in the control group identified as such students. In addition, participants in the experimental groups had more parents/guardians with college degrees or advanced degrees (84 percent experimental; 57 percent control), and higher household incomes (60 percent experimental; 48 percent control). The experimental group had fewer students of color than the control group had

(44 percent versus 65 percent). Additionally, the experimental group participants had a greater number of students with GPAs of 3.0 or higher (80 percent versus 57 percent).

Pre-and Post-assessment Statistics for Experimental and Control Groups

A total of 25 students from the experimental group, and 23 students from the control group completed the Curiosity and Exploration Inventory II (CEI-II) pre-assessment. These numbers differed from the number of students who completed the CEI-II (21 for the experimental and 17 for the control) post-assessment. In other words, there were four students from the experimental group and six students from the control group who did not complete the post-assessment. Table 5 provides the number of students who completed the pre-and post-assessments.

The reasons for the students not completing the post-assessment are unclear. One explanation may be that students completed a quiz during the class prior to the class in which the post-assessment was implemented. This may have caused some students to be absent from class, and thus, unable to take the post-assessment on the day it was administered.

Table 5

Number of Participants for the Pre- and Post-assessments

	Pre-assessment	Post-assessment
Experimental	25	21
Control	23	17
Total	48	38

A comparison of the demographic data to the pre-and post-assessment CEI-II results found that participants in both the experimental and control groups had higher exploration scores than absorption scores in the pre-and post-assessments. This indicated

that students' desire to explore novel experiences (exploration) was consistently more prominent than their propensity to become engaged in their experiences (absorption). The range of scores is provided in Tables 6 and 7 for the pre-assessment data.

There are several findings from these data sets that are important to consider within the context of this study. A total of eight demographic factors were identified in the demographic questionnaire, and gender was one in which there was a disparity in scores between female and male scores in both the experimental and control groups. While female students accounted for nearly 70 percent of both groups, the male students (exploration/absorption male: 3.57/3.23 experimental and 3.7/2.98 control pre-assessment) had higher exploration and absorption scores in the experimental and control sections than the female students (exploration/absorption female: 3.42/3.24 experimental and 3.52/2.77 control pre-assessment).

Additionally, participants in both the experimental and control groups whose household incomes while growing up indicated they grew up with mid-to-upper level socioeconomic status had mean high exploration scores of 3.57 (experimental pre-assessment) and 3.69 (control pre-assessment) and mean absorption scores of 3.4 (experimental pre-assessment) and 2.93 (control pre-assessment). Parent/guardian education level in both groups provided an interesting contrast in that students whose parent/guardian obtained a four-year degree or higher degree in the control group had a higher exploration mean (3.58 control versus 3.55 experimental), but lower absorption mean (2.8 control versus 3.26 experimental).

Another finding indicated that students of color in both groups scored similarly in exploration (3.42 experimental and 3.45 control), but not in absorption (3.22

experimental and 2.76 control). Yet, for students of color in the experimental and control groups, the exploration and absorption scores were one of the lowest measured, and for students of color in the control group their absorption score was the lowest of all the factors measured.

Table 6

Experimental (Pre-assessment)

	Exploration (Q1, 3, 5, 7, 9)			Absorption (Q2, 4, 6, 8, 10)		
	Mean	Median	Sum	Mean	Median	Sum
Gender						
Female, N=17	3.42	3.5	290.5	3.24	3.4	275
Male, N=7	3.57	3.4	125	3.23	3	113
Non-binary, N=1	4.6	4.6	23	3.4	3.4	17
Psychology or Behavioral Neuroscience majors, N=22	3.63	3.6	399.5	3.25	3.5	358
3 or more prior Psychology classes taken, N=17	3.49	3.4	296.5	3.22	3.4	274
First Generation students, N=2	3.2	3.2	32	2.8	2.8	28
Parent's/Guardian's education - BA, MA, Advanced degree, PhD, N=21	3.55	3.6	372.5	3.26	3.4	342
Household income of \$75,000 or higher, N=15	3.57	3.4	268	3.4	3.4	255
Students of color, N=11	3.42	3.4	188	3.22	3.4	185
3.0 GPA or higher, N=20	3.66	3.6	365.5	3.26	3.5	326
Total N=25						

Table 7

Control (Pre-assessment)

	Exploration (Q1, 3, 5, 7, 9)			Absorption (Q2, 4, 6, 8, 10)		
	Mean	Median	Sum	Mean	Median	Sum
Gender						
Female, N=15	3.52	3.4	264	2.77	2.8	208
Male, N=8	3.7	3.8	148	2.98	3.1	119
Non-binary	-	-	-	-	-	-
Psychology or Behavioral Neuroscience majors, N=23	3.58	3.6	412	2.84	2.8	327
3 or more prior Psychology classes taken, N=17	3.64	3.8	309	2.99	3	254
First Generation students, N=10	3.58	3.7	179	2.9	3.1	145
Parent's/Guardian's education - BA, MA, Advanced degree, PhD, N=13	3.58	3.4	233	2.8	2.8	182
Household income of \$75,000 or higher, N=11	3.69	3.8	203	2.93	3	161
Students of color, N=15	3.45	3.6	259	2.76	2.8	207
3.0 GPA or higher, N=13	3.69	3.4	240	2.89	2.8	188
Total N=23						

Tables 8 and 9 summarize data on post-assessment results. The experimental group, in the post-assessment, scored higher in the exploration questions than in the pre-assessment. However, experimental group members' absorption scores were lower in the post-assessment. The low absorption scores for the first-generation college participants in the experimental section may have been attributed to the fact that only one of the two first generation students completed the post-assessment, skewing the mean and sum scores in that category. Additionally, with the exception of one category (household income of \$75,000 or higher), the absorption scores for the control group in the post-assessment were higher than they were the pre-assessment.

Overall, the exploration and absorption scores for the post-assessment were higher for the experimental group than for the control group. Though many internal and external factors could have impacted the results, which are explored and discussed later on in this section, one factor that could have contributed to the difference was the larger number of participants who completed the post-assessment in the experimental group (n=21) versus the control group (n=17).

Table 8

Experimental (Post-assessment)

	Exploration (Q1, 3, 5, 7, 9)			Absorption (Q2, 4, 6, 8, 10)		
	Mean	Median	Sum	Mean	Median	Sum
Gender						
Female, N=15	3.71	3.8	276	3.16	3.4	237
Male, N=5	3.68	3.6	92	3.04	3	76
Non-binary, N=1	5	5	25	3	3	15
Psychology or Behavioral Neuroscience majors, N=19	3.8	3.8	359	3.07	3.2	292
3 or more prior Psychology classes taken, N=15	3.8	3.8	283	3.09	3.2	232
First Generation students, N=1	3.8	3.8	19	1.8	1.8	9
Parent's/Guardian's education - BA, MA, Advanced degree, PhD, N=18	3.81	3.8	341	3.18	3.3	286
Household income of \$75,000 or higher, N=14	3.8	3.8	264	3.34	3.4	234
Students of color, N=8	4.1	4	182	3.15	3.2	134
3.0 GPA or higher, N=18	3.8	3.8	340	3.06	3.1	275
Total N=21						

Table 9

Control (Post-assessment)

	Exploration (Q1, 3, 5, 7, 9)			Absorption (Q2, 4, 6, 8, 10)		
	Mean	Median	Sum	Mean	Median	Sum
Gender						
Female, N=11	3.64	3.6	200	3.04	3	167
Male, N=6	3.63	3.6	109	3.03	3.3	91
Non-binary	-	-	-	-	-	-
Psychology or Behavioral Neuroscience majors, N=17	3.64	3.6	309	3.04	3	258
3 or more prior Psychology classes taken, N=11	3.8	3.6	209	3.29	3.6	181
First Generation students, N=7	3.74	3.6	131	3.2	3.6	112
Parent's/Guardian's education - BA, MA, Advanced degree, PhD, N=10	3.56	3.6	178	2.92	2.9	146
Household income of \$75,000 or higher, N=7	3.57	3.6	125	2.86	2.8	100
Students of color, N=11	3.45	3.6	190	3.07	3	169
3.0 GPA or higher, N=10	3.68	3.6	184	3.06	3.1	153
N=17						

Pre-and Post-assessments Test Groups

A total of 21 students completed the Curiosity and Exploration Inventory (CEI-II) as a pre-and post-assessment in the experimental group and 17 students from the control group completed the post-assessment. Analyses were conducted for two constructs measured by the CEI-II: exploration (Q1, 3, 5, 7, and 9) and absorption (Q2, 4, 6, 8, and 10). The exploration construct measured the desire for students to explore new experiences; the absorption construct measured the propensity for students to become deeply engaged in their experiences (Kashdan et al., 2004).

This study examined two hypotheses. The first hypothesis, discussed in this chapter, was that there would be no anticipated changes in pre-and post-assessment scores of participants or between experimental and control groups. The second hypothesis, discussed in chapter five, was that participants with higher scores on the Curiosity and Exploration Inventory II (CEI-II), which measures trait curiosity, would show higher state curiosity. The first hypothesis was tested using two-tailed samples t-tests to compare the results of the CEI-II scores, and the second hypothesis was evaluated using qualitative interviews. The pre-and post-assessment scores of the participants were calculated to identify high, low, and large differences in scores of the participants.

Two-tailed samples t-tests were conducted to determine if there were any positive or negative differences in scores between the two groups. The first two paired samples t-tests measured the pre-and post-assessments for the experimental and control groups. The last two independent samples t-tests measured the pre-and post-assessments between the experimental and control groups. The t-test results are described and discussed below.

Experimental paired samples t-tests. The experimental paired samples statistics, provided in Table 10, found that students in the experimental group scored higher on the exploration construct sum and mean on the post-test (18.714 and 3.7643) than on the pre-test (17.643 and 3.529). For the absorption scores, students in the experimental section scored higher on the pre-test (15.952 and 3.19) than on the post-test (15.619 and 3.124).

Table 10

Experimental Paired Samples Statistics, N=21

		Mean	Std. Deviation
Exploration construct sum (5 items), Pair 1	pre-test	17.643	3.6233
	post-test	18.714	3.5797
Exploration construct mean (5 items), Pair 2	pre-test	3.529	0.7247
	post-test	3.7643	0.65938
Absorption construct sum (5 items), Pair 3	pre-test	15.952	3.3388
	post-test	15.619	3.6397
Absorption construct mean (5 items), Pair 4	pre-test	3.19	0.6678
	post-test	3.124	0.7279

For the experimental paired samples t-test, the data showed variation in the results, which are provided in Table 11. The mean for the exploration construct sum was -1.0714, which indicated a higher post-test than pre-test score. In addition, the absorption construct sum was 0.3333, which indicated a higher pre-test than post-test score. With the exception of the pre-and post-exploration construct mean ($p = 0.033$), which was statistically significant at the $p < .05$ level, there was no statistical significance in the pre- and post-assessment scores for the experimental group.

Despite the exploration construct sum not showing significance at the $p < .05$ level, the sum was 0.064, which was significant at the $p < .10$ level. This result, in addition to the construct mean, may have been impacted by the critical reflection activities and other classroom factors (i.e. class activities, lectures, etc.) had on students' desire to increase their exploration of course content.

The absorption scores in the experimental group did not vary much between the pre-and post-assessments. The slight decrease in scores in the post-assessment may highlight the potential difficulties of students to connect and understand course content deeply due to the rigorous nature of the course, especially when needing to memorize lengthy pathways, models, and concepts. An additional factor may have been the lower number of students who completed the post-assessment.

Table 11

Experimental Paired Sample Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Exploration construct sum (5 items), Pair 1	pre-test - post-test	-1.0714	2.5014	0.5459	-2.2101	0.0672	-1.963	20	0.064
Exploration construct mean (5 items), Pair 2	pre-test - post-test	-0.23571	0.47253	0.10311	-0.45081	-0.02062	-2.286	20	0.033
Absorption construct sum (5 items), Pair 3	pre-test - post-test	0.3333	1.6228	0.3541	-0.4053	1.072	0.941	20	0.358
Absorption construct mean (5 items), Pair 4	pre-test - post-test	0.0667	0.3246	0.0708	-0.0811	0.2144	0.941	20	0.358

Control paired samples t-test. The control paired samples statistics, provided in Table 12, found that students in the control group scored higher on the post-tests for the exploration and absorption constructs than on the pre-tests. The exploration construct sums and means for the pre-tests were 18 and 3.6 versus the post-tests were 18.176 and

3.635. Additionally, the absorption construct sums and means for the pre-test were 14.176 and 2.835 versus post-tests were 15.176 and 3.035.

Table 12

Control Paired Samples Statistics, N=17

		Mean	Std. Deviation
Exploration construct sum (5 items), Pair 1	pre-test	18	3.2016
	post-test	18.176	3.1471
Exploration construct mean (5 items), Pair 2	pre-test	3.6	0.6403
	post-test	3.635	0.6294
Absorption construct sum (5 items), Pair 3	pre-test	14.176	3.6782
	post-test	15.176	3.5923
Absorption construct mean (5 items), Pair 4	pre-test	2.835	0.7356
	post-test	3.035	0.7185

The results of the control paired samples t-test are provided in Table 13. The mean for the exploration construct sum was -0.1765, which indicated that the post-test was higher than the pre-test score. Additionally, the mean for the absorption construct sum was -1, which also indicated that the post-test was higher than the pre-test score. Overall, there was no statistical significance in the pre-and post-assessments for the control group.

While the results did not indicate any statistical significance in the pre-and post-assessment scores of the control group, the absorption and construct sum and pair was 0.059, which was statistically significant at the $p < .10$ level. Additionally, the absorption construct sum was one point higher in the post-assessment than the pre-assessment, which may indicate that participants in the control group were more willing to engage with the course content than students in the experimental group throughout the semester. In the context of the classroom, this level of engagement may have led to students asking

more questions about the course content, connecting with the professor about the material, and discussing subject matters with their peers both in and out of the classroom.

The exploration construct sum and mean were slightly higher in the post-assessment than in the pre-assessment for the control group. This finding indicated that students in the control group were just as likely to seek out new information and knowledge in the beginning of the semester as they did toward the end of the semester.

Table 13

Control Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Exploration construct sum (5 items), Pair 1	pre-test - post-test	-0.1765	2.2146	0.5371	-1.3151	0.9622	-0.329	16	0.747
Exploration construct mean (5 items), Pair 2	pre-test - post-test	-0.0353	0.4429	0.1074	-0.263	0.1924	-0.329	16	0.747
Absorption construct sum (5 items), Pair 3	pre-test - post-test	-1	2.031	0.4926	-2.0442	0.0442	-2.03	16	0.059
Absorption construct mean (5 items), Pair 4	pre-test - post-test	-0.2	0.4062	0.0985	-0.4088	0.0088	-2.03	16	0.059

Experimental and control independent samples t-tests. The pre-assessments and post-assessments scores of the experimental group compared to the control group were also tested. For the pre-assessment, the exploration construct sum and mean were higher in the control group (17.913 and 3.583) than in the experimental group (17.54 and 3.508). On the other hand, the experimental group scored higher than the control group in the absorption construct sum and mean (16.2 and 3.24 versus 14.217 and 2.843) (see Table 14). Additionally, the absorption construct sum was approximately two-points higher in the experimental group than in the control group.

Table 14

Experimental & Control Pre-assessment Independent Samples Statistics

		N	Mean	Std. Deviation
Exploration construct sum (5 items), Pair 1	Experimental	25	17.54	3.5471
	Control	23	17.913	3.4891
Exploration construct mean (5 items), Pair 2	Experimental	25	3.508	0.7094
	Control	23	3.583	0.6978
Absorption construct sum (5 items), Pair 3	Experimental	25	16.2	3.3166
	Control	23	14.217	3.4106
Absorption construct mean (5 items), Pair 4	Experimental	25	3.24	0.6633
	Control	23	2.843	0.6821

The results of the experimental and control pre-assessment independent samples test are presented in Table 15. The mean difference for the exploration construct was -0.373, which indicated that the control group scored higher than the experimental group on exploration measures. Interestingly, the experimental and control groups had only a slight difference in their pre-assessment exploration construct sum and mean scores, which indicated that the level of motivation at the start of the semester was similar of participants in both groups.

In the analysis of the absorption construct in the pre-assessment, the mean difference of the sum was 1.9826, which indicated that participants in the experimental group scored higher than the control group. The two-point difference between the experimental and control groups for the absorption construct ($p=0.047$) was statistically significant at the $p<.05$ level. This finding indicated that students in the control group may have been more cautious in how they were initially willing to embrace uncertain and unpredictable activities than students in the experimental group.

Table 15

Experimental & Control Pre-assessment Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Exploration construct sum (5 items), Pair 1	Equal variances assumed	0.135	0.715	-0.367	46	0.715	-0.373	1.0169	-2.4199	1.6738
	Equal variances not assumed			-0.367	45.784	0.715	-0.373	1.0162	-2.4187	1.6726
Exploration construct mean (5 items), Pair 2	Equal variances assumed	0.135	0.715	-0.367	46	0.715	-0.0746	0.2034	-0.484	0.3348
	Equal variances not assumed			-0.367	45.784	0.715	-0.0746	0.2032	-0.4837	0.3345
Absorption construct sum (5 items), Pair 3	Equal variances assumed	0.002	0.969	2.041	46	0.047	1.9826	0.9713	0.0274	3.9378
	Equal variances not assumed			2.039	45.419	0.047	1.9826	0.9725	0.0244	3.9408
Absorption construct mean (5 items), Pair 4	Equal variances assumed	0.002	0.969	2.041	46	0.047	0.3965	0.1943	0.0055	0.7876
	Equal variances not assumed			2.039	45.419	0.047	0.3965	0.1945	0.0049	0.7882

The experimental and control post-assessment independent samples t-test found that the exploration construct sums and means of the experimental group (18.714 and 3.7643) were higher than the control group (18.176 and 3.6353). In addition, the absorption construct sums and means of the experimental group (15.619 and 3.124) were higher than the control group (15.176 and 3.035). Table 16 provides data on the post-assessment results.

Table 16

Experimental & Control Post-assessment Independent Samples Statistics

		N	Mean	Std. Deviation
Exploration construct sum (5 items), Pair 1	Experimental	21	18.714	3.5797
	Control	17	18.176	3.1471
Exploration construct mean (5 items), Pair 2	Experimental	21	3.7643	0.65938
	Control	17	3.6353	0.62943
Absorption construct sum (5 items), Pair 3	Experimental	21	15.619	3.6397
	Control	17	15.176	3.5923
Absorption construct mean (5 items), Pair 4	Experimental	21	3.124	0.7279
	Control	17	3.035	0.7185

The results from the experimental and control post-assessment independent samples test found the exploration construct mean difference sum was 0.5378, which indicated the experimental group participants scored higher than the control group. Additionally, the absorption construct mean difference sum was 0.4426, which indicated the experimental group participants scored higher than the control group. See Table 17 below. Overall, the data from the post-assessment scores for the experimental and control groups indicated no statistical significance between the groups.

The results of the post-assessment may have been impacted by how many participants completed the post-assessment (21 in the experimental and 17 in the control) versus pre-assessment Curiosity and Exploration Inventory II (CEI-II) (25 in the experimental and 23 in the control). Additionally, the comparison of the experimental group versus control group in the post-assessment was relatively small as there were a total of ten students absent in both the experimental and control groups during the administering of the post-test.

Table 17

Experimental & Control Post-assessment Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Exploration construct sum (5 items), Pair 1	Equal variances assumed	0.182	0.673	0.486	36	0.63	0.5378	1.1074	-1.7081	2.7837
	Equal variances not assumed			0.492	35.72	0.625	0.5378	1.0922	-1.6778	2.7534
Exploration construct mean (5 items), Pair 2	Equal variances assumed	0.076	0.784	0.612	36	0.545	0.12899	0.21084	-0.29861	0.55659
	Equal variances not assumed			0.615	34.974	0.543	0.12899	0.20978	-0.2969	0.55488
Absorption construct sum (5 items), Pair 3	Equal variances assumed	0.001	0.978	0.375	36	0.71	0.4426	1.1806	-1.9518	2.837
	Equal variances not assumed			0.375	34.553	0.71	0.4426	1.1789	-1.9519	2.8371
Absorption construct mean (5 items), Pair 4	Equal variances assumed	0.001	0.978	0.375	36	0.71	0.0885	0.2361	-0.3904	0.5674
	Equal variances not assumed			0.375	34.553	0.71	0.0885	0.2358	-0.3904	0.5674

These descriptive data and two-tailed samples t-tests showed the differences between the two groups based on demographics and pre-and post-assessment scores. There are various and multiple factors that could have influenced students' responses on their questionnaire and CEI-II that cannot all be accounted for in this study. However, in order to identify factors that may have impacted trait curiosity of students and, thus, students' level of state curiosity in the classroom, the next section discusses the comparison of factors that are relevant to this study.

Demographic Sub-groups

Students' trait curiosities are developed and nurtured through various factors that include: background and upbringing (Engel, 2015), behaviors and interests (Kashdan et al., 2004), as well as through the support of parents and educators (Markey & Loewenstein, 2014). As such, a paired samples t-test on parents'/guardians' level of education and several comparisons of factors that influence trait curiosity and that may

have impacted state curiosity in students in this study were identified and further analyzed.

Experimental paired samples t-tests of parents'/guardians' level of education. A paired samples t-test on parents'/guardians' level of education was conducted for students who indicated their parents/guardians did not complete their Bachelor's degree, Master's degree, or advanced graduate degree. This was to further analyze the impact of parents' education level on students' pre-and post-assessment scores. In the experimental group, there were four students who indicated their parents/guardians did not have a college degree. Three out of the four of this sub-group of students completed the pre-and post-assessment in the experimental group.

The results of the experimental paired samples t-test on the parents'/guardians' level of education for students who indicated that their parent/guardian did not have a college degree are provided in Table 18. The pre-assessment scores (17.33 and 3.467) of these students in the exploration construct sum and mean were the same as the post-assessment scores (17.33 and 3.467). For the absorption construct sum and mean, the pre-assessment scores (15.33 and 3.067) were higher than the post-assessment scores (14 and 2.8).

Compared to the paired samples t-test of all students in the experimental group, students who indicated that their parents/guardians did not have a college degree had lower pre-and post-assessment scores in both the exploration and absorption construct sums and means. While there was a range of variability between the overall experimental group pre-and post-tests and this sub-group of students, the largest difference of scores was found in the post-assessment absorption construct sum and mean. The absorption

construct post-assessment sum of students in the experimental group was 1.5 points higher than the students who indicated that their parents/guardians did not have a college degree in the experimental group (15.619 versus 14).

Table 18

Experimental Paired Samples Statistics – Parents’/Guardians’ Level of Education, No College Degree, N=3

		Mean	Std.
Exploration construct sum (5 items), Pair 1	pre-test	17.33	0.577
	post-test	17.33	1.528
Exploration construct mean (5 items), Pair 2	pre-test	3.467	0.1155
	post-test	3.467	0.3055
Absorption construct sum (5 items), Pair 3	pre-test	15.33	4.509
	post-test	14	5.568
Absorption construct mean (5 items), Pair 4	pre-test	3.067	0.9018
	post-test	2.8	1.1136

For the experimental paired samples t-test in which the scores of students whose parents/guardians did not obtain a college degree, the mean for the exploration construct was 0, and the mean for the absorption construct was 1.333 (see Table 19), which indicated that students scored higher for both constructs in the pre-assessment than the post-assessment. The exploration construct sum and mean was 1 and the absorption construct sum and mean was 0.184, indicating that there was no statistical significance for this sub-group of students in the experimental group.

Table 19

Experimental Paired Samples Test – Parents’/Guardians’ Level of Education, No College Degree

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval				
					Lower	Upper			
Exploration construct sum (5 items), Pair 1	pre-test - post-test	0	1	0.577	-2.484	2.484	0	2	1
Exploration construct mean (5 items), Pair 2	pre-test - post-test	0	0.2	0.1155	-0.4968	0.4968	0	2	1
Absorption construct sum (5 items), Pair 3	pre-test - post-test	1.333	1.155	0.667	-1.535	4.202	2	2	0.184
Absorption construct mean (5 items), Pair 4	pre-test - post-test	0.2667	0.2309	0.1333	-0.307	0.8404	2	2	0.184

Control paired samples t-tests of parents’/guardians’ level of education. In

the control group, there were nine students who indicated their parents/guardians did not have a college degree. Six out of the nine students in this sub-group completed the pre- and post-assessment in the control group.

For the control paired samples t-test on the parents’/guardians’ level of education for students who indicated that their parents/guardians did not have a college degree, the pre-assessment scores for the exploration construct sum and mean were higher than their post-assessment scores (19.17 and 3.833 versus 18.83 and 3.767). For the absorption construct sum and mean, the post-assessment scores were higher than the pre-assessment scores (15.67 and 3.133 versus 14.33 and 2.867). Results are provided in Table 20.

Compared to the paired samples t-test of all students in the control group, students who indicated that their parents/guardians did not have a college degree had higher pre- and post-assessment scores in both the exploration and absorption construct sums and means. The largest difference was in the pre-assessment score of the exploration construct sum. The overall score of the control group for the exploration construct was 18

versus 19.17 for students who indicated that their parents/guardians did not have a college degree.

Table 20

Control Paired Samples Statistics – Parents’/Guardians’ Level of Education, No College Degree, N=6

		Mean	Std. Deviation
Exploration construct sum (5 items), Pair 1	pre-test	19.17	1.941
	post-test	18.83	2.787
Exploration construct mean (5 items), Pair 2	pre-test	3.833	0.3882
	post-test	3.767	0.5574
Absorption construct sum (5 items), Pair 3	pre-test	14.33	2.875
	post-test	15.67	3.83
Absorption construct mean (5 items), Pair 4	pre-test	2.867	0.575
	post-test	3.133	0.7659

The control paired samples t-test in which the scores of students whose parents/guardians did not obtain a college degree found that the mean for the exploration construct was 0.333, which indicated the pre-assessment scores were higher than the post-assessment scores. The mean for the absorption construct was -1.333 (see Table 21), which indicated that students scored higher in the post-assessment than the pre-assessment. The exploration construct sum and mean was 0.709 and the absorption construct sum and mean was 0.191, indicating that there was no statistical significance for this sub-group of students in the control group.

Table 21

Control Education Paired Samples Test – Parents’/Guardians’ Level of Education, No College Degree

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval				
					Lower	Upper			
Exploration construct sum (5 items), Pair 1	pre-test - post-test	0.333	2.066	0.843	-1.834	2.501	0.395	5	0.709
Exploration construct mean (5 items), Pair 2	pre-test - post-test	0.0667	0.4131	0.1687	-0.3669	0.5002	0.395	5	0.709
Absorption construct sum (5 items), Pair 3	pre-test - post-test	-1.333	2.16	0.882	-3.6	0.934	-1.512	5	0.191
Absorption construct mean (5 items), Pair 4	pre-test - post-test	-0.2667	0.432	0.1764	-0.7201	0.1867	-1.512	5	0.191

The results of the paired samples t-test in which the scores of students whose parents/guardians did not obtain a college degree were analyzed found variability in scores in the pre-and post-assessments. The lower scores of both the pre-and post-assessment for students whose parents/guardians did not obtain a college degree in the experimental group compared to the overall scores of students in the experimental group may have been due to various factors that included students’ capacity to connect to the material, work in other courses, in addition to other obligations. Another factor may have been students’ desire and ability to ask and receive assistance and support from their professor, peers, and family members. In addition, the post-assessment absorption construct sum and mean were lower than the pre-assessment for this sub-group. Students may have felt that they were able to engage less with the course material as the semester progressed possibly due to some of the factors stated above.

For the control group in which the scores of students whose parents/guardians did not obtain a college degree were analyzed, the higher scores of this sub-group compared to the overall pre-and post-assessment scores may indicate that regardless of parents’/guardians’ level of education, these students exhibited high trait curiosity.

Additionally, the post-assessment scores were higher than the pre-assessment scores, indicating that students may have felt more connected to the course material as the semester progressed.

Parents’/Guardians’ education and gender. The percentage of male to female students in both the experimental and control groups was comparable (males consisted of 28 percent of the experimental group and 35 percent of the control group). A comparison of the two groups in parents’/guardians’ education and gender, summarized in Tables 22 and 23, showed that 43 percent of the male students’ parents/guardians in the experimental group did not have a college degree. In the control group, approximately 62.5 percent did not have a college degree. For the female students, parents/guardians in both groups had high percentages of college degrees (94 percent for the experimental group and 73 percent for the control group).

Table 22

Experimental Group Bivariate Analysis: Parents’/Guardians’ Education and Gender

	No college degree		BA or higher degree		Total
	#	%	#	%	
Male	3	43%	4	57%	7
Female	1	6%	16	94%	17
Non-Binary	0	0%	1	100%	1
Total	4		21		25

N=25

In both groups, the gap between the number of males and female students’ whose parents/guardians completed a four-year degree or higher degree may have been due to various reasons. In light of this study, one consideration may be how female students are more prone to choose Psychology or Behavioral Neuroscience as a major than male

students. This may be due to encouragement and support from their parents/guardians to pursue such majors. Additionally, *how* female students were supported in their interests versus the male students may be a factor that considers upbringing, encouragement of interests, as well as culture.

Table 23

Control Group Bivariate Analysis: Parents'/Guardians' Education and Gender

	No college degree		BA or higher degree		Not sure		Total
	#	%	#	%	#	%	
Male	5	62.5%	2	25%	1	12.5%	8
Female	4	27%	11	73%	0	0%	15
Total	9		13		1		23

N=23

An additional factor analyzed in how female and male students differ based on gender indicated that, when looking at both the experimental and control groups, there was a difference in academic achievement. Table 24 provides data on what percentage of male and female students from both groups had a GPA below, at, and above 3.0. Overall, there were twice as many male students who had a GPA below 3.0 than female students, and four times as many female students who had a GPA at and above 3.0 than male students. The large difference in GPA between the male and female students may have been due to a variety of competing factors, and, for this study, one of them may have been due to how female students perceived and were interested in the content they learned in the course, and possibly in their majors in general, in addition to what type of support they received from their professor(s) and peers before, during, and after the course.

Table 24

Both Groups Bivariate Analysis: Gender and GPA

	Male		Female		Non-Binary		Total
	#	%	#	%	#	%	
Below 3.0	8	67%	4	33%	0	0%	12
3.0 or higher	6	18%	26	79%	1	3%	33
N/A	1	33.3%	2	66.7%	0	0%	3
Total	15		32		1		48

N=48

Parents’/Guardians’ education and racial identification. Data analysis between parents’/guardians’ education and racial identification indicated a disparity between students of color and their parents’/guardians’ level of education. Tables 25 and 26 highlight these differences. Whereas the experimental group had approximately 18 percent of students of color whose parents/guardians did not have a college degree, the control group had approximately 47 percent who did not. Additionally, for white students in the control group, 75 percent of parents/guardians had a college degree or advanced degree, and in the experimental group, approximately 85 percent had parents/guardians with a college degree or advanced degree.

Table 25

Experimental Group Bivariate Analysis: Parents'/Guardians' Education and Racial Identification

	No college degree		BA or higher degree		Total
	#	%	#	%	
Student of color	2	18%	9	82%	11
White	2	15%	11	85%	13
No response	0	0%	1	100%	1
Total	4		21		25

N=25

Table 26

Control Group Bivariate Analysis: Parents'/Guardians' Education and Racial Identification

	No college degree		BA or higher degree		Not sure		Total
	#	%	#	%	#	%	
Student of color	7	46.7%	7	46.7%	1	6.7%	15
White	2	25%	6	75%	0	0%	8
Total	9		13		1		23

N=23

Students of color in the experimental group had parents/guardians with higher levels of education than the control group. While no single explanation could have accounted for this difference, the breakdown of students of color in each group indicated that there were more Hispanic and Latino mixed race, Native Hawaiian or other Pacifica Islander and API mixed race, and Black or African American and BAA mixed race students in the control group than in the experimental group. Such added diversity could have contributed to the breadth of data that were collected, which included students'

background, and parents'/guardians' education level. Figures 3 and 4 illustrate the array of responses to the question of racial identification for the experimental and control groups.

Figure 3. Experimental Group Racial Identification

Figure 3. Experimental group racial identification. An illustration of how students in the experimental group responded to the racial identification question in the demographic questionnaire.

Figure 4. Control Group Racial Identification

Figure 4. Control group racial identification. An illustration of how students in the control group responded to the racial identification question in the demographic questionnaire.

Parents’/Guardians’ education and household income growing up. In both the experimental and control groups, approximately 62 percent of students whose parents/guardians had (at least) a college degree grew up in a high-income household ($\geq \$75,000$). Tables 27 and 28 provide data on these two factors. There were significantly less students in the experimental group (two students) who grew up in a low-to-middle-income household compared to the control group (six students). This may have been due to a variety of reasons. One of them being that students from low-to-middle-income households who identified as Psychology and Behavioral Neuroscience majors *and* who may have befriended each other in previous courses decided to register for the same section in order to take the class together.

Table 27

Experimental Group Bivariate Analysis: Parents’/Guardians’ Education and Household Income Growing Up

	No college degree		BA or higher degree		Total
	#	%	#	%	
Low-mid (<\$75,000)	2	33%	4	67%	6
High (≥\$75,000)	2	13%	13	87%	15
I prefer not to answer	0	0%	4	100%	4
Total	4		21		25
N=25					

In this study, 87 percent of students grew up in a high-income household in the experimental group and 73 percent of students from the control group. Students who grew up in such households may have benefited from additional privileges not available to students who grew up in low-to-middle-income households, such as tutoring services, more time with parents to go over homework, etc. Also, another interesting note, the data from both the experimental and control groups support research that shows obtaining a Bachelor’s degree increases the likelihood of higher earning potential (National Center for Education Statistics, 2017).

Table 28

Control Group Bivariate Analysis: Parents'/Guardians' Education and Household Income Growing Up

	No college degree		BA or higher degree		Not sure		Total
	#	%	#	%	#	%	
Low-mid (<\$75,000)	6	67%	3	33%	0	0%	9
High (≥\$75,000)	3	27%	8	73%	0	0%	11
I prefer not to answer	0	0%	2	67%	1	33%	3
Total	9		13		1		23

N=23

The bivariate factors analyzed in this section compared components of data collected from the demographic questionnaire that may have, to varying degrees, accounted for students' trait curiosities. In addition, the comparisons allowed me to examine various factors that may have impacted students' capacity to utilize their trait curiosity to engage with their environments (state curiosity). Although it was difficult to assess all the factors that contributed to students' trait curiosities, the factors that were examined in this section were pertinent to this study.

Analysis of Two-Tailed Samples T-tests

The paired and independent samples t-tests showed variability in responses of participants in the pre-and post-tests, and between the experimental and control groups. The results of the experimental and control paired samples t-test for the exploration construct found that students scored higher in their post-assessment than in the pre-assessment. In addition, for the experimental group, the exploration construct mean ($p=0.033$) was statistically significant at the $p<.05$ level, indicating that as students discovered more about the course, their desire to explore may have increased throughout

the semester. This was also true for students in the control pre-assessment t-test for the absorption construct. However, the absorption construct for the experimental group showed that students scored higher in their pre-test than on the post-test, indicating that their inclination to embrace their learning and experiences in the course may have decreased throughout the semester. As a result of the variation in data and the nature of trait curiosity and the impact of upbringing, background, and learning that would most likely take years to develop and change, overall, there was no statistical significance between the pre-and post-assessment scores of the participants.

For the experimental and control pre-assessment independent samples t-test, participants in the control group scored higher than the experimental group in the exploration construct, but lower in the absorption construct. Though the difference of the exploration construct was minimal between the groups, a two-point difference was found between the absorption sum of the experimental and control groups. The absorption construct sum for the experimental group was 16.2 and 14.217 for the control group. The difference ($p=0.047$), which was statistically significant at the $p<.05$ level, may have been due to several factors: one of them being the time of day the course takes place – in the afternoon on Mondays, Wednesdays, and Fridays. Students in the control group, when asked about their levels of uncertainty and unpredictability, may have found it difficult to embrace such statements during an afternoon class where rigorous subject matters were being explored. The idea of adventure and risk may have not been as present in their minds while taking the inventory.

Data of the experimental and control post-assessment independent samples t-test showed that the experimental group scored higher in the exploration construct and in the

absorption construct. The test indicated no statistical significance between the two groups, and the critical reflection activities had no bearing on the outcome of the data. This may have been due to several factors that may have included time, and how long it takes in order for critical reflection activities to impact how students engage with the material, in addition to external factors like other classwork and obligations that disrupted their capacity to focus on their learning in the course. As a result of the variation in data, overall, there was no statistical significance between the experimental and control groups, in part, supporting Hypothesis one, that there would be no anticipated changes in pre-and post-assessment scores of participants or between experimental and control groups.

Limitations

A limitation of this study was the external variables that influenced the outcomes of the pre-and post-assessment tests. There were multiple competing factors that were present while implementing the assessments that I could not account for when considering how students responded to the questionnaire and inventory. Statistical significance found in the data could have been attributed to the intervention of the critical reflection activities, but they also may have been impacted by variability that increased due to the small sample size of the study, the way students in the experimental group interpreted the statements compared to the control group, and the differences in behaviors and personalities of the students in the two groups. These factors may have impacted the effectiveness of the critical reflection activities.

Additionally, external factors could have influenced statistical outcomes of the study. Personal situations, physical ailments, and other course demands were all factors outside my control in which I could not anticipate or prepare for while administering the

assessments, but could have impacted the way in which students felt they could respond authentically to the tests. For example, depending on how students were feeling on a particular day, their realization of how they took risks, or viewed challenges may have changed their responses to the assessments. These factors could have skewed data toward a more positive or negative outcome for either or both the experimental and control groups.

Despite these limitations, the results of the questionnaire and pre-and post-assessment tests were useful in determining how students responded to the constructs of exploration and absorption holistically and individually. The findings provided a basis for understanding what construct was viewed more favorably (exploration) and what differences existed between the two groups. Additionally, I was able to use the assessment scores to determine high, low, and large differences in scores, to then identify students who participated in an interview. These interviews allowed me to inquire about factors that impacted students' learning, in addition to exploring how students in the experimental group received the critical reflection activities.

This chapter provided the findings of the demographic questionnaire and analysis of the pre-and post-assessment scores for the experimental and control groups and between the two groups. Additionally, the chapter provided an analysis of the two-tailed samples t-tests and limitations of analysis and methods. The next chapter will present an analysis of the findings from the interviews and critical reflection activities.

CHAPTER FIVE

ANALYSIS OF INTERVIEW AND CRITICAL REFLECTION ACTIVITIES FINDINGS

A total of 11 participants were interviewed to understand how students make meaning of course content, insights, and ideas shared from peers and professor by examining what enhanced their learning. Specifically, I sought to identify how students' trait curiosity may have impacted their state curiosity in the classroom, in addition to considering what type of intrinsic and extrinsic motivators contributed to or detracted from their learning. Additionally, for the seven students who were exposed to critical reflection activities, specific questions were asked to examine how their curiosities may have been stimulated and enhanced through these activities.

Interview Participants' Questionnaire and Pre-and Post-assessment Findings

Questionnaire Findings

Of the 11 students who participated in the interviews, eight identified as female, and three identified as male. Additionally, two female participants, and two male participants identified as students of color. All the participants were Psychology or Behavioral Neuroscience majors, and with the exception of one participant, they were not first-generation college students.

Demographic data of the 11 interviewees are provided in Table 29. These data indicate that eight out of the 11 participants grew up in households with incomes of \$75,000 or more. Additionally, ten out of the 11 participants had a parent or guardian who obtained a Bachelor's degree, Master's degree, or advanced graduate degree. The participant whose parent or guardian attended some college grew up in a low socioeconomic household (under \$25,000/year); this individual also identified as a first-

generation student and had a 2.78 GPA, well below the second lowest GPA in the group of 3.2.

Table 29

Interview Participant Demographics

Pseudonym	Class standing	Major	First-Generation student	Parent's/Guardian's Highest Level of Education	Household income growing up	Ethnicity	Gender	GPA
D3	Sophomore	Behavioral Neuroscience	N	BA	Over \$100,000	Black or African American	Male	3.5
BB1	Junior	Behavioral Neuroscience	N	MA	\$75,000-\$99,999	White	Female	3.21
CM5	Senior	Behavioral Neuroscience	N	BA	\$50,000-\$74,999	NA	Female	3.83
BA7	Sophomore	Behavioral Neuroscience	N	Advanced grad degree/PhD	Over \$100,000	White	Female	3.58
EA3	Junior	Behavioral Neuroscience	N	BA	\$50,000-\$74,999	White	Male	3.65
AP8	Sophomore	Psychology	N	Advanced grad degree/PhD	Over \$100,000	Asian	Female	3.83
CY2	Junior	Behavioral Neuroscience	N	BA	\$75,000-\$99,999	White	Female	3.7
BA9	Junior	Behavioral Neuroscience	Y	Some college	Under \$25,000	Multi-racial	Male	2.78
EL6	Senior	Psychology	N	MA	Over \$100,000	White	Female	3.34
BB8	Junior	Behavioral Neuroscience	N	BA	\$75,000-\$99,999	Asian	Female	3.4
DR4	Junior	Behavioral Neuroscience	N	BA	Over \$100,000	White	Female	3.2

Pre-and Post-assessment Findings

Of the participants interviewed, seven out of the 11 exhibited high pre-and post-assessment scores, two had low scores, and two had average scores. One additional high scorer had a difference of five points between their pre-and post-assessment scores. The pre-and post-assessment data of all participants interviewed is provided in Table 30. Nine of the 11 participants interviewed were selected as interviewees because they fell into one

or more of the categories: high, low, and large differences categories. However, there were two participants interviewed who did not fall in one of these three categories but were still asked to participate in an interview. They were selected for two reasons: 1) to note and compare the similarities and differences in responses from those that did fall in one of the three categories (high, low, and large differences), and 2) to acquire the perspective of an additional minority voice, as one was a student of color. One of the interviewees did not complete the post-assessment. Despite not being able to acquire this interviewee's post-assessment data, the information obtained from the interview shed additional light on the complexities of critical reflection activities in the scope of this study.

Table 30

Interview Participant Pre- and Post-assessment Data

Pseudonym	Total sum pre-assess	Total sum post-assess	Difference of scores	Total
D3	40	41	-1	81
BB1	25	21	4	46
CM5	26	26	0	52
BA7	43	38	5	81
EA3	41	-	-	-
AP8	38	40	-2	78
CY2	40	40	0	80
BA9	40	37	3	77
EL6	44	43	1	87
BB8	29	32	-3	61
DR4	40	37	3	77

Although efforts were made to interview participants representative of the overall sample population, emphasis was placed on connecting with students based on their gender, racial identification, and household income growing up, in addition to their

Curiosity and Exploration Inventory II (CEI-II) scores that indicated low/high or large differences between their pre-and post-assessment. These categories were chosen to get potentially diverse perspectives from the interview participants based on their backgrounds, upbringing, and culture that presumably impacts trait curiosity and determines how trait curiosity gets enacted in various environments including the classroom.

Analysis of Interview Categories

Participants with High Scores

The seven participants who scored high in the CEI-II came from various socioeconomic backgrounds, and had different gender and racial identities. The total combined pre-and post-assessment scores of these participants ranged from 77 to 81 points. The average of the pre-and post-assessments total score of all participants was 66.9 points. The means of the assessment scores of all the interviewees are provided in Table 31.

Table 31

Low/High Scores and Large Difference Between Pre- and Post-assessment Scores

	N	Exploration Mean	Absorption Mean
Low	2	2.55	2.5
High*	7	4.3	3.7
Difference (5 points)	1	4.5	3.6
None	2	3.6	3.1

Note: *One participant from this category is also in the Difference category.

Participants with Low Scores

The two participants who scored low in the inventory came from a mid-to upper-middle class socioeconomic background and were both female. The total scores of these participants were 46 and 52 points respectively. Compared to the exploration and absorption means of all participants, found in Table 32, the scores of these participants were low, averaging 2.55 for exploration and 2.5 for absorption.

Table 32

Mean and Post-assessment Scores of All Participants

Exploration Mean	Absorption Mean
3.6	3.1

Participant Exhibiting a Large Difference in Pre-and Post-assessment Scores

There were seven students who had between a five to seven-point difference between their pre-and post-assessment scores in both the experimental and control groups, which were considered “large,” and worth additional examination. While not considered statistically significant, I was interested in understanding what may have contributed to the differences in scores. The participant who had a five-point difference in the pre-and post-assessment, and who participated in an interview, came from an upper class socioeconomic background and identified as female. This participant’s score was 81 points, which was also considered a high score.

The average difference of all assessment participants was 0.93, less than a one-point difference. The particular participant’s pre-assessment total score of 43 points decreased to 38 points in the post-assessment. Regardless of this decrease, the exploration and absorption means remained high at 4.5 and 3.6 respectively.

Interview Themes

A cross-case analysis of the data derived from the interviews identified 34 categories that were combined into six major themes: Perceptions of learning, Application of learning, Intrapersonal factors, Self-awareness, Interpersonal influences, and External challenges. This was accomplished through two rounds of coding, as well as mind mapping. The first round of coding consisted of using descriptive and In Vivo coding (Saldaña, 2009) in order to identify over 480 codes. The codes were analyzed using MAXQDA. During the second round of coding, I categorized similar and related codes, and through the utilization of mind mapping identified six themes. Each theme is illustrated by relevant quotes from the key experiences of the interviewees. This chapter describes the findings from the interviews related to each of these six themes.

Perceptions of Learning

Students implemented various studying strategies to learn content taught in Biological Psychology. The course consisted of content ranging from learning the impact of drugs on the brain to memorizing the human vision pathway. The course required a lot of rote memorization, and quizzes and exams were regularly scheduled to ensure students were staying up to date with course content. While there was no one particular strategy that was identified to meet the needs of all students in memorizing, reciting and learning content, the majority of interview participants found that they needed to figure out a system that helped them learn and retain information. One participant stated,

And, so, I think, as I kept taking all the quizzes and all the tests I kind of learned how to...almost finesse the strategy of how to study so I can spend less time and still get good grades because I know exactly how to turn the material into what works for me.

Similar to this participant, other interviewees discovered that content needed to be absorbed and stored, and to do so effectively entailed various methods of and strategies for studying.

Strategies. The various strategies of learning that students employed were contingent upon the type of learning that they strived to achieve. The following methods of learning content were discussed: 1. Memorizing information using flashcards, 2. Using the “blank page” method in which students wrote down all that they remembered from their textbook, lectures, and Power Point slides, 3. Review of Power Point slides and notes, 4. Reading the textbook and drawing diagrams, and 5. Studying with a partner.

All the participants interviewed stated that they utilized more than one of these methods to come up with a strategy that worked for them in learning course material. For example, one student stated that he found it most useful to attend class, learn about the material covered that day, and then read the chapter afterward. He found that studying for a quiz or exam a week or two in advance with a study partner was the best use of his time in terms of learning the material. The student and his study partner would study individually in 45-minute increments and then “quiz and drill” each other on content until they were able to articulate the right answers to each other. The 45-minute study method, suggested by the professor, allowed the student to focus on the subject matter and then take a break as the brain “checked out” after so much time of intense studying. The student stated that this strategy of attending the lecture, reading the textbook, and studying a couple of weeks before the quiz or exam with his study partner was helpful in absorbing and understanding course content.

A majority of participants interviewed stated that they memorized information to do well on quizzes and exams, primarily using flashcards and the “blank page” method to see how accurately they were able to capture data learned. Other students, who also had the goal of doing well on the tests, additionally had a desire to understand content to retain knowledge about a specific topic or area. One student stated,

So I think when you like looked at a concept and you learn about it in multiple ways it gives you a more broad understanding where you may be able to teach it to someone instead of just like hear about it and kind of know what's going on. And you become...really knowledgeable about that concept. When you kind of dissect it and really try to understand it rather than just memorizing it.

These students were intentional about finding study partners with whom they were able to work through content together. They also utilized creative measures of drawing diagrams and pictures to absorb and process information.

While more than half of the participants felt that they underestimated the amount of memorization and repetition needed for the course, a few had a “trial and error” type of mentality in which they would try a tactic and see if it worked. If it did not, then they would try something new. For example, one student stated that she tried studying from just the Power Point slides and her notes, but doing so was not enough to successfully understand the material. This student had to find another strategy to help her connect her learning. A few other participants provided the same insight in having to “shift” how they were studying. This process, however complex, was not viewed negatively. Rather, as one participant expressed, the idea was “not be afraid to try new methods to study.” This positive perspective of discovering new ways of learning allowed some students to envision how their strategies of studying learned throughout the semester could be useful in future courses.

Students who seemed to be enjoying the course, while earning the grades they wanted on their tests, embraced the idea of “do it early, do it well.” In short, preparation was done in advance in order to know and understand information. In so doing, one participant stated,

I think that I kind of view Bio Psych... the class specifically as more manageable almost because I thought it would just take diligence in doing the work beforehand. But now I feel even more comfortable with that and being able to master the material as long as I do the reading and I put in the time to study it.

Having a vested interest in the time it took to filter through the material and recognizing that it took time to do so reinforced the idea of “knowing one’s stuff.”

All the participants recognized the complexities of the topics that they learned in the course. As one student stated, “It’s like we’re just scraping the surface but not of basic stuff, of really pretty advance stuff.” Thus, some students found that the course content they were studying for spilled over into other similar topics. Another student, while studying with a partner said, “We’ll be talking about the subjects that are explicitly going to be on the exam, but we will fall down rabbit holes that are related.” This led to connecting two thoughts together that then “cemented” the concept and assisted in recalling (“oh yeah, that’s when we fell down that rabbit hole”) information during the test. This experience then became the means in which the students connected to their learning.

Application of Learning

Interview participants found great value in applying their learning to themselves, other people, and real-world situations. As one participant put it, “I think what makes me be excited about a topic is if I can see how I’m going to engage with it...elsewhere.” In considering the various categories and levels of application that the interviewees

discussed, I created a chart (see Figure 5) that delineates four quadrants of thinking that encompasses students' internal and external processes and actions.

Figure 5. Application of Learning Quadrants

Figure 5. Application of learning quadrants. The four quadrants encapsulate both the internal and external processes of students and how they applied their learning to self and others.

Quadrant I. Participants, in obtaining Knowledge, viewed course content objectively within the framework that it was presented. For example, if the professor discussed psychological disorders that impacted behavior, students would retain information based on the scenarios and examples that were illustrated in class. Students then processed information contingent upon how content was *represented* in class. Students were able to use this knowledge, obtained from the professor, textbook, and other scholars in the field, to apply to their various assignments, quizzes, and exams in the course.

Quadrant II. As participants listened to and absorbed what the professor was teaching, students were able to start relating to content, making sense of certain subjects (i.e. disorders, drugs, sleep, hormones, etc.) that they came into contact with on a daily or

regular basis. The knowledge of these areas allowed participants to grow in their Abilities/Skills to recognize, analyze, and speak to them if necessary. One participant spoke about her roommate who was dealing with depression and family issues. She stated that she reflected upon her roommate's situation and used it as an opportunity to think about biological implications that impacted how she was functioning. The participant shared her knowledge with her roommate in hopes that it provided understanding to the way she was feeling.

Another student whose brother has a processing disorder shared that learning biological psychology content in class taught people "sympathy in a way or just deepens your ability to [be sympathetic]; to look more past the surfaces of people." Learning about such content that impacted students personally added another layer of connection that deepened the meaning of their learning.

Quadrant III. Students were able to identify how they made a Connection to other classes, future research, and future careers. As one participant stated, "...the material that I learned in this class isn't limited to just this class and it's also a concept that's being taught in another class but just from a different perspective." Additionally, participants understood the value in learning content to assist in identifying what more they wanted to research and study. As one interviewee stated, "...it just gives me more incentive to learn the material, to figure out what I want to specifically study." Another opportunity that students found to apply their learning was in real-world experiences:

...so one of the things that I spend a lot of time doing this semester was like on my trauma surgery internship. And so one of my experiences in the trauma internship was I got to do a cranial exam on a patient from one of the doctors, testing all their cranial nerves and I was in the patient's room but I was going through, in my head, the acronyms that Dr. Galvan taught us.

And beyond USD, participants were hopeful that the content would be useful in graduate school "...I'm expecting to be able to say...'Oh, I remember this from Bio Psych as well as in their future occupations...so I'm interested in like the anatomical part of like biology...and also, how to treat patients...if they have sports injuries.'"

For participants, like the one whose brother has a disorder, the connection to finding a career was linked to a deeper purpose. The participant stated, "And so, eventually I want my career in academic pursuits to take me where it's learning more about him and maybe finding more resolutions." This student, like a few other participants, identified a desire and passion to select a career path in which possible solutions could be explored to improve the lives of those who were affected with psychological disorders and mental illnesses.

Quadrant IV. Participants who were able to envision the effects of course content on themselves or people in their lives were able to show a degree of Consciousness that showed sensitivity in how they thought about their learning. Students, in this quadrant, were able to utilize their learning to relate to other people. One participant stated,

I think it makes you really aware of the real problems that you can face if you do drugs. Not like I'm gonna go into drugs! It was just a really interesting thing to learn about and see the real effects it has because when you're in college, it happens.

This student imagined the possibilities of the impact of doing drugs to her brain, as learned in class, and developed an awareness of what could potentially be affecting other students on campus.

One participant who noted that her friend was "struggling with certain things this year" stated, "I think that's been the most prominent thing...is throughout the semester I

could tell different things happening based on different things we learned.” Another student shared that when she was studying for the course with her roommate, her third roommate would listen in and become “super excited to hear” what they were learning. The participant stated that this was due to her roommate’s grandma having one of “the disorders we learned about...so she was interested when we were talking about that.” The interest of this other peer, who was not taking the course, served as motivation for the participant to learn content in order to share their knowledge and pass on useful information with intention and purpose.

Intrapersonal Factors

Two personality traits surfaced as prominent indicators of interest and desire to learn in the course: being competitive and contemplative. Participants, for the most part, were honest about their competitive natures within the context of the course and even within their majors (Psychology versus Behavioral Neuroscience). They expressed a need and urgency to do well to prove to themselves and others that they were capable of understanding intricate processes, pathways, and theories. Additionally, students who were well integrated and/or highly invested in the field, indicated a contemplative nature in which they wondered about areas of research that have yet to be proven, and in some cases, discovered.

Competitive. The majority of interview participants stated that they were, by nature, competitive people. Those who did not outwardly state that they were competitive showed that they were through their language. One student who had a friend who completed the course a year prior, shared that when “they told me their grade or what they got on a certain exam, I’d be like, ‘Alright, you know what, I’ll try to get better than

that.' And so, I've always had a competitive nature." Another participant who described taking a Behavioral Neuroscience class as a Psychology major stated,

I'm kind of a competitive person...a lot of my friends in BN [Behavioral Neuroscience] had been in psych classes before, and now I'm in their turf this time. I want to do well, so that kind of really helped to motivate me.

Additionally, the level of rigor that the students described concerning the course led to comments like, "I don't think the class is just for anybody." A participant who discovered that another section of the course, that was taught by another professor, was more challenging, stated, "I know the other class would have been more effort and time, but I feel like I would have enjoyed it more because I enjoy learning complex things...like Bio-Chem was my favorite course." These students described a desire to striving to do their best in the course.

Contemplative. A second personality trait that surfaced during the interviews was one of contemplation, or a sort of philosophical wondering. One participant in particular, stated, "I mean, it's just like when you spend enough time thinking, [you] just kind of wonder what goes on in this thing...this brain?" The student viewed the course content from a philosophical perspective, wondering about what is yet unknown. He came up with a hypothesis about neurons that have not been proven scientifically. Yet, it was evident that he spent some time thinking about it – "So, it just becomes an action potential that was dispersed across the entire neuro-organism. It's being summated and then turned into another one that will go back this way." Another student discussed debunking myths in Biological Psychology and provided her perspective, "So, that's where I would like to see...if they're real, how to differentiate a mirror neuron from a regular neuron." These students viewed specific content beyond the scope of what was

known as they saw the need to process and reflect on what was unknown – to further the scope of their understanding.

Self-awareness

The level of self-awareness that participants exhibited ranged from knowing when they functioned at their “best” and “worst” academically to understanding the impact of new and different perspectives on how they viewed situations and people. One participant shared the difficulties of taking back-to-back rigorous and demanding courses, one of them being Biological Psychology, that then impacted his mental capacity to learn. The student stated,

I am a morning person. So, I try to get kind of a lot of my productive work done before I go to class. And I think after Genetics, like by the time I get to Bio Psych, I’m kind of just like a less highly functioning version of myself.

This level of awareness, articulated by one participant, was also present in others, particularly as they discerned how to best navigate challenging quizzes and tests.

One student, to understand why he was doing so poorly on the exams, took it upon himself to meet with the professor to discuss and process what he was doing incorrectly. By doing so, he discovered that he would, “have the right answers circled but then I’d second guess myself last minute. And so, all the questions I would end up getting wrong I would second guess myself.” This student continued by sharing how he had to “take a step back” and stop questioning himself. Through this process the student recognized the need to be more confident in how he responded to questions, understanding that he might be right the first time he selected an answer on a test. This self-awareness, developed with the help of the professor, assisted in creating positive self-talk around his ability to be successful in the course.

One participant who grew up in a Catholic family shared how her viewpoint about mental illness changed as she learned, from a biological psychology perspective, that the illness was “not the person’s fault.” She emphasized growing up understanding one perspective, but how there are other peoples’ perspectives that she wants to hear about so that they could be incorporated to “get the bigger picture.” This insight also included hearing and learning about mental illness from fields outside of Behavioral Neuroscience and Psychology. This participant stated,

...[to] see other approaches and actually learn about mental illness for what it is, how it's represented in this course and how it's represented in my religion class and how it's represented [in] genetics- 'cause everything like it just really...makes me more eager to...tie everything together...

Similarly, the participant with a brother who has a disorder showed a sensitivity and awareness about how there were factors that went beyond our understanding and control that influenced how we functioned. He shared this insight:

It’s so weird that your personality can be entirely changed based on things that are kind of out of your control and like it’s something that at least a lot of times I think about like people’s character or behavior is like something of their own, some combination of their own upbringing and values and actions. But to some degree, it’s very influenced by things that we might...they’re so beneath the surface that we might not even know.

These insights connected students to the course content personally and with a perspective that, as one participant described it, was “part of my educational journey.”

Interpersonal Influences

Perspectives about the course and how well participants did were connected and contingent upon how they were engaged with the professor, peers, friends, and parents about the process and content of the course. Not underestimating the amount of work that they would have to do themselves, the participants were aware of how engagement with others helped them in their learning. As one student stated, “I’m excited for this class, it's

going to be interesting with my parents in the medical field so I kind of rely on them to help me out, but I'm going to have to work.” Additionally, the impact of the professor, her availability and willingness to connect was important. Participants emphasized, “having someone to reach out to” and caring about “whether or not I understand what’s going on” was a large part of how they grew in their understanding of the subject matters covered in class.

One participant, whose roommate was in another Biological Psychology section taught by another professor, stated the impact of her roommate’s interest piqued her interest. She stated, “When she [roommate] is studying I’d be studying.” This influenced study habits that were the same as her roommates. Another participant described the process of what his study partner, a peer in the same section, did to study together. They had studied together in the past, but in the same space, “...she’d be across studying up her stuff and I’d be studying my stuff.” But, in the context of the course, he stated that they “actively engaged in each other’s study sessions.” Doing so, allowed them to quiz one another and reveal where they needed to put more time and attention into specific areas of their studying.

Upbringing. Upbringing was a major factor in how participants felt about the course. The vast majority of participants stated that their parents’ influence, support, and encouragement in exploration helped to broaden and deepen their interest in the course and the field of Psychology in general. One participant shared,

My parents used to push me to do all those science fair projects and enter in all these different science competitions and just be engaged. I would say, yeah my parents have definitely always kind of pushed me to be out in the world or like outside and kind of exploring different things.

Another participant stated that because she exhibited a desire to “want to know how things worked and look at why” as a kid, her parents allowed her to get out of the car to look at road kill “because it was the only time you could see the insides of the animal out.”

One participant described the complexities of being raised Catholic and coming into the course with preconceived ideas. As she was exposed to a variety of ideas and insights from her peers and professors, she realized, “‘Oh my point of view isn't right.’ I mean it's like I'm not the only right thing. Like there are others, so instead of either/or approach, it's like you can do an and/ both approach.” This student grew up in an Asian culture where her family tended to ignore mental illness. “...my family hasn't emphasized it...we don't really place an importance on it.” Yet, allowing herself to be open to new experiences and points of view, particularly in the course, helped to reframe her understanding of mental illness and possibly other topics that were difficult to explore openly while growing up.

External Challenges

Managing time and commitments outside of the course was difficult for many participants and affected the amount of dedication they could put into studying and learning the material. One participant described how she was able to spend more time studying, as she was no longer committed to the soccer team. She stated,

...so I was on the soccer team like here my first two years...and this is my first semester that I wasn't. I didn't want to play anymore. So I think just having more time to be able to study...when I was on the soccer team there was more like a mental fog. So just having more clarity this semester...cause it wasn't that I wasn't motivated before, but [I] just have more energy towards it.

Deciding to quit soccer, gave this student more freedom to find ways in which she could devote more time and attention to her studies. She appreciated how she could make

office hours and if another peer asked if she wanted to study together at a certain time, she could say yes.

Balancing a full load of classes, especially with multiple rigorous classes, was taxing to participants. As one student stated, “but just because everything else is picking up, so you don’t have little much time to study and finish.” The decision to pick and choose what needed to be done to do well in the course was necessary. One participant shared, “at the beginning of the year Dr. Galvan told me that it is possible to get an A in the course without ever reading the book. So, I was like, check.” This student, based upon the information shared by the professor, opted not to read the textbook and use other means to do well in the class. This allowed her to devote time reading for other classes that may have had a stronger emphasis on completing the readings.

Trait Versus State Curiosity

In the evaluation of the six themes, Perceptions of learning and Intrapersonal factors derived from students’ trait curiosity, Application of learning and External challenges influenced students’ state curiosity, and Self-awareness and Interpersonal influences were impacted both students’ trait and state curiosity. Students understanding of how to best learn, and their ideas of what it means to learn most likely developed as they grew from adolescence to adulthood (Perceptions of learning). In addition, their tendencies to show competitiveness and contemplation were most likely impacted in the same way (Intrapersonal factors). These themes were identified as trait curiosity as students’ comprehension of learning and their behaviors in sharing what they know through their personality traits impacted their propensity to experience curiosity.

Students' internal and external processing of how to apply their learning to self and others (Application of learning) were explored as content was taught and connections first made in the classroom. Additionally, situational factors that influenced students' ability to spend more time focusing on course content, as well as their study strategies for the course also impacted how they may have experienced learning barriers and/or successes (External challenges). These themes were identified as state curiosity as they were factors that influenced students' ability to be curious in a particular situation.

The development of how students understood how they operated and functioned (Self-awareness) was contingent upon both their preferences learned through their experiences (e.g. morning versus night person) and how they viewed the importance of new learning. Whereas the former was discovered as a result of personality traits and behaviors (trait curiosity), the latter was impacted by their willingness to engage with ideas and concepts in a specific environment (state curiosity). Similarly, students' connection with others impacted their learning (Interpersonal influences). Through the perspectives of professors, peers, friends, and family members, students insights and ideas may have shifted in the classroom (state curiosity), while also being impacted by students' upbringing (trait curiosity). As such, these themes were viewed as having components of both trait and state curiosity.

Experimental Versus Control Groups

Within the context of these six themes, there was no difference in how participants in the experimental and control groups connected to Perceptions of learning, Intrapersonal factors, Interpersonal influences, and External challenges. All participants interviewed had similar if not completely overlapping thoughts and insights into how

they viewed their learning within the context of the course, as well as how they utilized their personality traits and relationships to leverage their learning, and manage various challenges.

Variations between the experimental and control groups surfaced when examining the Application of learning and Self-awareness themes. The seven students interviewed who were in the experimental group made stronger connections to their learning by being able to articulate their knowledge to situations and people outside of the classroom. These participants were able to do this methodically and in a structured manner through the critical reflection activities. Through writing and drawing their thoughts on paper and sharing them with their peers, these participants were able to analyze what knowledge they retained, how they were connecting them to real-world situations, and then considering how they would approach situations and people with sensitivity and open-mindedness. The four students interviewed who were in the control group were able to apply their learning, but were ambiguous in their explanations. One of the four participants provided a concrete example in relating course content to their research they were conducting in a lab.

Self-awareness also was a theme that differed between the experimental and control groups. While participants in both the experimental and control groups shared a level of self-awareness when it came to understanding how they functioned at their “best” or “worst” academically, in addition to knowing where they could build up confidence in how they experienced the course, participants in the experimental group also showed self-awareness in how they *felt* and *thought* about their learning in the course. They were able to identify how aspects of the course “pushed” them to think, in addition to knowing

the benefits of looking at course content differently. This additional layer of self-awareness complemented how they were able to then engage with the material on a deeper level.

Participants with High, Low, and Large Differences Scores

The interview participants, based on their high, low, and large differences scores, indicated some differences in how they responded to the six themes identified. The participants with high scores of the Curiosity and Exploration Inventory II (CEI-II) portrayed a higher level of competitiveness and contemplativeness that was more overt during our interviews, which are aspects discussed in the Intrapersonal theme. The high scoring students' drive of competition and their capacity to be contemplative, in addition to their overall trait curiosity scores, were emphasized in how they were then willing to engage in the material within the classroom. These students were open to discussing the importance of comprehending and reflecting on course content during the interviews.

You can literally see the implications of the Bio Psych like in your own life or in your friend's life, because everybody has a brain, everybody's body does these things. So I think, obviously that's why I'm a science person because you can apply it to people.

These participants with high scores in the CEI-II, displayed more confidence in engaging with a variety of teaching methodologies (e.g. lectures, activities, videos, critical reflection activities).

Yet, participants in the other two categories, low scores and large differences scores, also displayed a drive to connect their learning through various strategies in the classroom. While the two participants with low scores had divergent thoughts about External challenges – whereas one stated that the balance of courses and coursework was difficult to manage, the other stated she wished she could be challenged in her courses,

and specifically Biological Psychology – both these students emphasized the need to find ways to identify strategies of learning both in and out of the classroom that worked for them.

In addition, the two students who did not fall in any of the low, high, and large differences categories were the participants who had the most to share in terms of their personal association and background with the course content. Within the classroom, these students expressed a need and desire to engage with the course material through discussion and connection with their peers just as much as the high trait curiosity students. As a result, though there were some differences between high trait curiosity participants and low trait curiosity students, mostly through how they articulated their competitiveness and desire for contemplation, these factors did not significantly show that high trait curiosity equated with higher state curiosity. Thus Hypothesis two, high trait curiosity students show higher state curiosity was not supported.

Critical Reflection Activities Findings

Five critical reflection activities were implemented in the experimental section that focused on creating opportunities for students to connect with the content and engage with their peers about what they learned that day. The critical reflection activities were developed using Mezirow's transformative learning theory, and, specifically his Phases of Transformation (1991) that were differentiated based on the 4Rs Model for Reflective Thinking (Ryan & Ryan, 2013). The listed indicators of the Phases of Transformation determined changes in students' capacity to reflect from one stage to the next. Students' critical reflection responses were analyzed within the framework of the 4Rs: reporting,

relating, reasoning, and reconstructing. The critical reflection activities were implemented during the last 12 minutes of each of the five classes in the course.

Critical reflection questions for the activities were developed using three perspectives: feelings on content (CR #1, 3), connection to another experience (CR#2, 5), and thoughts of importance and application (CR #4, 5). The critical reflection activities were structured to include questions that connected to the stages represented in the 4Rs model and Phases of Transformation. With the exception of the first critical reflection activity, all of the activities incorporated all four stages (reporting, relating, reasoning, and reconstructing). The first two critical reflections introduced students to the idea of critical reflection and processing through sharing, and the last three asked the students to analyze and apply their perceptions and thoughts to people and situations beyond the classroom. Each of the critical reflection activities and the findings are discussed in detail below.

Critical Reflection Activity #1

The focus of the first critical reflection activity was to get students to consider their thoughts and feelings and connect with their peers to discuss them. The first reflection was intentionally broad to welcome any and all insights that students wanted to write about and share. The reflection included the first three stages of the 4Rs model, but not Reconstructing. The first three stages were included so that students could become familiar with the practice of critical reflection. Tables 33-35 summarize details about the responses of some of the student answers that were written or drawn out during the time allotted for the activity. *Italicized words and phrases highlight important insights provided by students.*

As the charts show, during the time of the first critical reflection activity, students were generally interested, overwhelmed, confused, engaged, but still confident about the topic of Neurophysiology. While some felt that the content learned that day was interesting and exciting, many students were overwhelmed by the amount of content that they had to memorize. Yet, a few expressed that, with review and practice, they were confident that they could have a “strong understanding” of the content.

Table 33

Critical Reflection Activity #1: Question 1

CRITICAL REFLECTION ACTIVITY #1	STAGES
I. On your own, write AND/OR draw a couple of thoughts about how you feel about what you learned today (answer on front). (Ex: It might be confused, complicated, makes sense, insightful)	Reporting
I feel like I have a <i>pretty decent understanding</i> of steps on their own but need to review even more exactly how one causes the next...it's a lot of info and so interesting! But, we went sort of quickly through it. (Drawing of brain)	Reporting
What we learned today is very <i>interesting</i> . It is dense material that I definitely need to review but I like it. It will be something I need to comprehend rather than just memorize.	Reporting
A little <i>overwhelmed</i> , curious (Face with round mouth & question mark drawings)	Reporting
I'm <i>definitely confused</i> about how all the material we learned fits together, but I know going home and rereading my notes will solve the problem. It's just a lot of info given in not a lot of time.	Reporting
I feel like I don't completely understand what is going on and will probably have to go over the process a few times. I'm not sure where all the steps fit in.	Reporting
Complicated material with a lot of parts, but will be very learnable with studying. Slightly <i>overwhelming</i> , but also very <i>interesting</i> .	Reporting
Drawing of stick person with a <i>thumbs up</i> .	Reporting
Interested: <i>Excited</i> – I have taken bio since high school; I love how it all fits together! <i>Interconnected</i> - So cool to learn about bio in the context of psychology. <i>Engaged</i> - It's so crazy to think that what it took to learn over 2/3 class periods happens all the time in our bodies!	Reporting
Somewhat <i>confident</i> that after some review sessions I can have a strong understanding of the nerve signal process.	Reporting
It seems pretty linear, many things happen at once, but there's generally a logical flow to what's happening.	Reporting

Students were able to engage with each other to discuss their writings and/or drawings. A majority of the responses for the second question included having shared feelings about the topic and also strategizing ways in which they could memorize content. Students related to each other's situation based on their feelings and thoughts about how they processed the information.

Table 34

Critical Reflection Activity #1: Question 2

2. In your group of three, briefly share your words. What different words did you hear?	Relating
My group said basically the same thing: she needs to practice the material and go over it a couple times to get it nailed down.	Relating
My partner was pretty much <i>on the same page</i> , where we know it's all relevant and the big picture, but will need to go over the basics again.	Relating
Partner <i>feels the same</i> – dense material, interesting concepts	Relating
Review, practice, confused	Relating
Practical and enlightenment and logical	Relating
<i>Enlightened</i> , review, confused in middle	Relating
A little overwhelmed by the amount of material, but can group concepts together to help memorize.	Relating

A majority of students stated that they felt better after having connected with their groups about the material, as they did not feel alone in their struggle to understand what they were learning. Feelings were affirmed and new perspectives were shared. One student described how it would have been “discouraging” if one of them knew the material better and “felt good about it.”

There were some responses that reached the Reasoning stage that included additional processing about self, questioning their own thoughts, and considering how they thought about the way they made sense of the material. One student stated that hearing content from her peers was a “bit easier” and “less stressful” than hearing it from the professor.

Table 35

Critical Reflection Activity #1: Question 3

3. Journal question (answer on back): How does hearing what others say help you make sense of the material?	Relating/ Reasoning
Hearing what others say was very insightful because <i>others usually put things together differently than myself.</i>	Relating
<i>Hearing others thoughts can be helpful but was a bit confusing this time around</i> since it seemed like we had a good grasp on the same concepts and were confused on the same one too (refractory periods... what?!)	Relating
Hearing what other say makes me feel that we are all on the same learning level. I'm not the only one that feels confused or that it is complicated material. <i>I guess it helps to not bring myself down for thinking its dense material. But we all agreed that with studying we should be able to master the material, which gives me hope.</i>	Reasoning
I think it was <i>reassuring</i> to help me appropriately and accurately assess my comfort level as well briefly discuss how others approach mastering the material.	Relating
Hearing my partner have <i>similar struggles makes me feel a little better.</i> Knowing that I'm not the only one, slightly confused makes me feel right on track, and not behind. I think if I can go over the whole process and it's steps and talk it over with someone, I will be able to better understand.	Relating
The fact that others feel the same way as I do makes me feel <i>relieved.</i> I can feel like I'm not the only one that feels that I need to study a lot to learn the material. It also is <i>relieving to know other's find it interesting and I can now have people to talk and study with about this class!</i>	Relating
Hearing this makes me feel <i>more solidified in my own feelings.</i> I think we all equally felt like we learned something new, and it was of importance and "relevance" as one of my members put it.	Relating
When others are confused it <i>sometimes makes me question my own original thoughts more.</i> After seeing it put together at the end everything clicked. Because of the blanks it wasn't just about memory recognition... we actually had to brainstorm together.	Reasoning
Hearing what others said gave me a <i>new perspective in the material</i> and put it into a <i>simpler form to understand.</i> Going based off of slides and textbook only makes the information overwhelming and complicated but being able to talk it out allowed the information to make more sense.	Relating
Hearing what others had to say helps me make sense of the material in the sense that it <i>makes me think about the way I make sense of it.</i> Am I approaching the information in the efficient manner? If not, how else should I study?	Reasoning
My group also mentioned how they are feeling confident on the material we are learning about because they believe that the activity and lecture made the subject very cool. <i>It is also nice to hear that they are excited about this subject and learning about the brain. Maybe I will be able to study with them in the future.</i>	Relating
It helps to know that we're all kind of in the same place, but <i>I think it would've been discouraging if one of us like really understood the material and felt really good about it.</i>	Relating
I've always been a pretty individual and independent learner, but I'm <i>trying to grow as a collaborative learner.</i> Even for this exercise, my group members brought new perspectives that I hadn't considered. Also, hearing the material and interacting with it with others' voices besides my own and Dr. Galvan's will hopefully make it more <i>memorable.</i>	Reasoning
Hearing what others say helps me to understand the material more because it's being repeated which will help me remember it. It's also a little bit easier and <i>less stressful to learn because it's coming from other students and not the teacher.</i>	Reasoning
Hearing others tell me that it to them is confusing as well which helps me feel better about it. But that it gives me <i>confidence that I can learn this material.</i>	Relating

Critical Reflection Activity #2

The second critical reflection activity was focused on Drugs and Behavior.

Students were asked to think of a personal experience/situation that related to drugs and

behavior. They wrote or drew about the experience and reflected on how the experience/situation helped to make sense of what they learned in class that day. Afterward, they shared their experiences in groups of three. Data from this critical reflection activity were not collected as I thought students might have written or drawn personal experiences that they did not want me to read or see. Also, I felt that if students knew in advance that I would not be reading or viewing their responses, they might be inclined to share more personal experiences.

During the interviews, two participants discussed what they wrote and shared with their peers in critical reflection activity #2, and how it impacted their perspective on what was learned about Drugs and Behavior. These two participants did not describe their experiences with me in detail, and this may have been due to two reasons: 1. they shared something personal that they did not want to repeat to me, or 2. they did not remember the type of details that they shared and were concerned about over sharing with me. Regardless of what the reason may have been, I am not sure if there would have been any major differences in how students portrayed their experiences in the critical reflection activity versus how they shared their experiences within the context of their groups.

Critical Reflection Activity #3

For question one, students' responses ranged about the course topic for the day: Sexual Differentiation, from being confused to feeling good about what they learned that day, as shown in Table 36. The question, focused on eliciting Reporting responses, also included Relating and Reasoning responses. One student, who had a friend with Turner's syndrome, stated learning about how sex chromosomes and their altered state helped them understand how their friend's body functioned "more clearly." Additionally,

another student shared how learning about such content made them wonder about exploring “different ways to look at ‘male’ and ‘female’” so that it was less rigid and more fluid.

Table 36

Critical Reflection Activity #3: Question 1

CRITICAL REFLECTION ACTIVITY #3		STAGES
I. On your own, write AND/OR draw 2-3 thoughts about how you feel about what you learned today.		Reporting
I understand the material, but <i>baffled</i> that this can be possible and <i>thinking about how hard this would be for the people who go through these abnormalities.</i>		Reporting/ Relating
<i>Confused</i> , it's kind of complicated to understand each path and get it super clear. <i>Interested</i> – it's amazing how the body works. <i>Afraid, I'm going to fail.</i> Drew face with squiggly line mouth.		Reporting/ Relating
I feel like what we learned helps to explain how many ways things could go wrong in the early stages of life. Even the littlest thing, like a protein or receptor change could affect the rest of your life. <i>It made me realize how little control we have over our bodies.</i>		Reporting/ Relating
I'm <i>very intrigued</i> about what we learned today. I've never been in a class that covers this content and it was interesting to see how one hormonal manipulation affected the body so drastically!		Reporting
Kind of complicated, but it should be easier to get down after studying. Interesting to see how genetic alterations can effect external/internal structures of the sex organs. <i>Helpful to discuss in groups about the material.</i>		Reporting/ Relating
I feel confused about what we learned. <i>Overwhelmed because of all the parts that go into production and intrigued to learn about how complicated it is.</i>		Reporting
It's really interesting to see how people with altered sex chromosomes function. <i>I have a friend with Turner's syndrome and now I understand her body function more clearly. The impact of hormones on differentiation is cool!</i>		Reasoning
Really interesting to learn how things go wrong. There's so many more things that could happen than I knew about. I wonder how many people are affected? And <i>how it impacts their life.</i>		Reporting/ Relating
I feel really good about what I learned today. <i>Exploring the different ways we look at "male" and "female" makes me consider the different ways we can all find ourselves to be fluid in form and emotions and not so rigid towards our gender and sex.</i>		Reasoning
Feel good about what I learned today. <i>Very interesting. Doesn't seem too complicated.</i>		Reporting

In their groups, students shared words like: mind blowing/confusing, nervous, interesting, and difficult. Table 37 provides more detailed data on their reactions. The students connected with each other in wondering how their bodies could change, and how abnormal conditions could impact other lives. Some groups were curious to learn more despite the fact that they found the material confusing. One student stated how learning about abnormalities rather than focusing on normal, standards functions was interesting and made them think about how everything is not “black or white” when it comes to gender fluidity.

Table 37

Critical Reflection Activity #3: Question 2

2. In your group of three, briefly share your thoughts and drawings. What did you hear? Write some thoughts down.	Relating
<i>Mind blowing/confusing</i>	Reporting
<i>Interesting to learn about how particular the body is. You don't have control on your body.</i>	Relating
<i>We had heard of this happening in real life, but never knew how it worked. Its crazy.</i>	Relating
<i>Nervous – especially with memorizing the material. We have less control over our body that we think?</i>	Relating
<i>All agreed it was interesting to think about how our bodies can change.</i>	Reporting
<i>This lesson is difficult because if one step is unclear along the path, then so is everything after that step.</i>	Reporting
<i>My group was confused but also curious to learn more about the parts and structures.</i>	Reporting
<i>Societal implications? Gender roles.</i>	Relating
<i>Wonder of how these conditions impact others lives and how many are affected. Also, that the material is interesting and not too difficult to grasp.</i>	Reasoning
<i>Interesting learning about how things can go wrong, instead of just what's supposed to happen. Makes you think more about gender fluidity and how everything isn't black and white.</i>	Reasoning

For the last section of this critical reflection activity, students were asked to journal their thoughts about what they learned in class and shared in their groups. Table 38 provides data on how students responded with various levels of Reporting to Reasoning. While some concentrated on identifying how the framing of information in different contexts could impact their understanding of content, other students focused on their discussion about the “consequences for people and picturing together what life would be like.”

Table 38

Critical Reflection Activity #3: Journal Question 1

Journal Questions	Relating
a. How does hearing what others say help you understand more of the material covered today?	Relating
<i>Helps me understand real life effects that accompany these abnormalities.</i>	Relating
<i>I have the same understanding of the material after the discussion. There are a lot of steps to remember and it could get confusing.</i>	Reporting
<i>It makes me understand the consequences/affect of people with this disorder who live with it every day.</i>	Relating
<i>It's helpful because discussion and group activities are ways to interact with the material in new ways.</i>	Reporting
<i>Framing the information in different context can significantly impact our understanding and recall.</i>	Relating
<i>It gives different interpretation and perceptions of the same material taught in class.</i>	Relating
<i>Talking about it makes me realize where I am confused or where I can really understand what is happening.</i>	Relating
<i>I enjoy working in groups because it shows me what I don't understand and also helps me to organize my thoughts when trying to explain myself to others logically.</i>	Relating
<i>Prompted us to discuss further examples/curiosities. We talked about whether or not you could inject receptors for T. My visual responses reframed my partner's responses to part 2.</i>	Reasoning
<i>I think it helps to know everyone is very interested. Maybe we can form study groups?</i>	
<i>Hearing others perspectives helps me to feel more solidified in my own thoughts in that the material is interesting and ranges a wide array of ways in which to look at it.</i>	Relating
<i>When people ask questions it is helpful to hear what other people are confused about and work through the problem with them.</i>	Relating
<i>Talking about the consequences for people and picturing together what life would be like.</i>	Reasoning

The last reflection question asked students how they could further their learning and understanding of the content covered in class that day. Table 39 provides information on students' responses. Many students responded with reviewing notes, reading the textbook, and visiting the professor during office hours. One student responded with continuing to "contemplate ideas put forth by the group" and considered a trying out a new role – to notice more of the ways that people play into the roles of male and female.

Table 39

Critical Reflection Activity #3: Journal Question 2

b. What can you do in the next week to deepen your understanding of the material learned today?	Reasoning/ Reconstructing
Read the textbook. Go to visit the professor in office hours. Watch videos.	Reporting
I could read the textbook in more depth or do some research online.	Reporting
<i>I'm going to start testing my recall and writing notes sheets to study/synthesize the information.</i>	Reasoning
<i>Go over notes, explain the disorders to people outside of class.</i>	Reasoning
<i>Reread and look over my notes. Ask for other students' notes and see what they have that I don't and add that to my notes.</i>	Reasoning
<i>To help understand is to find some connection to the material that I can relate it to so when time comes I can recall it in a cleverer, maybe pneumatic way.</i>	Reasoning
<i>Go over the tables more and talk it through with classmates.</i>	
<i>Drawing the flowcharts</i>	Reporting
<i>I can review and study the slides, focusing on the parts I don't understand. I also can read the textbook to get another viewpoint/explanation.</i>	Reasoning
<i>Talk about and go over what different alterations/variations would do to ones inner/outer self.</i>	Reasoning
<i>Review/rewrite material, find a way to visually represent the disorders.</i>	Reporting
<i>Make quiz questions for material.</i>	Reporting
<i>I can continue to contemplate on the ideas my group put forth and also try noticing more of the ways everyday people play into these forms of male and female that we find "rigid" but I now see are quite variable.</i>	Reasoning/ Reconstructing
<i>Look over the notes, ask more questions, talk to my friends about it.</i>	Relating
<i>Try to recall as much material as possible without looking at notes.</i>	Reporting

Critical Reflection Activity #4

Students, in their response to the topic of Vision, wrote or drew some portion of the visual pathway and/or eye. Table 40 shows students also described what they understood blind spots to be and the importance of knowing these concepts. The responses to the question were more scholarly than in previous critical reflection

activities, as the content of the class was primarily about the way the eye works and how that then translates to vision.

Table 40

Critical Reflection Activity #4: Question 1

CRITICAL REFLECTION ACTIVITY #4		STAGES
1. On your own, write AND/OR draw 2-3 most important concepts/ideas that you learned today. Consider: Why are they the most important?		Reporting
The visual pathway; the fovea, where the "T" of cones; if you hear or see something on the right it will go to the left side of the brain; drew a picture of the visual field representation		Reporting
1. The steps of the visual pathway: <i>it's important because we now know how the brain processes visual info. 2. How optical illusion work (not the most important but I thought it was cool).</i>		Reporting
Blind spot position; Then the two visual fields work together to allow one to experience one continuous image		Reporting
There are two types of ganglion cells (on and off center); acuity = best at fovea because of cone and ganglion density; how anatomy of eyes lends to 1. Receiving visual info (blind spot) differently and 2. Functions		Reporting
Drawing of eye: a lot of process to just seeing; How we see or problems could be through one of three axons; that our eyes naturally have a blind spot and just don't have rods and cones		Reporting
I learned more about the blind spot and how we don't have rods and cones there; I learned about visual pathways and how the nose plays a role in that. <i>It is important to understand these concepts because I am interested in learning the way our body works.</i>		Reporting
How the eyes work over a wide range is interesting; How the fovea is distinct from the rest of the eye crossing over and the visual pathway		Reporting

Due to the complexity of the eye, students shared their thoughts and drawings that centered on discussing blind spots, visual pathways, and the processing of information.

Table 41 shows students did more Reporting than Relating as the content covered was more technical and nuanced, and more steps had to be memorized and learned.

Table 41

Critical Reflection Activity #4: Question 2

2. In your group of three, briefly share your thoughts and drawings. What did you hear? Write some thoughts down.	Relating
Fovea because brain space; blind spot; talked through bipolar cell layer	Reporting
Cool optical illusion; visual pathway; how brain process info	Reporting
The steps of the visual pathway proves and how we know how it works; the iris muscle	Reporting
Visual field representation is important because it's the start of vision and not what you would think. It's important to know where we are missing rods and cones	Reporting
Importance of anatomy of eye; Blind spot	Reporting
Blind spot and acuity and visual pathways are alllll important!	Reporting
One group member focused in more detail on fovea. The other focused on more general descriptions of perception. <i>We all drew some part of an eye (drawing of eye).</i>	Relating
<i>I love driving, blind spot</i>	Relating

The journal questions for this critical reflection activity asked students to identify what they found relevant and apply what they learned to other classes and life outside of USD, as shown in Table 42. Students responded with answers that ranged from connecting their learning to their major, future occupation, and future research. A few students moved beyond these connections to include perceptions of individual people, and unique circumstances (disorders). One student stated that there should be “less blame/judgment on people for what they cannot control.” Another student stated that understanding how people perceived the world allowed for them to consider how people’s perceptions may be different.

Table 42

Critical Reflection Activity #4: Journal Question 1

Journal Questions	Relating/ Reasoning
a. How is what you learned today relevant to your other classes and life outside of USD?	
<i>I want to work in this area of my major so it's really helpful. This class helps me understand more and more how our brain functions.</i>	Relating
<i>Important for my major to understand how the human body works and this could aid me in understanding more about visual disabilities as I work as a therapist.</i>	Relating
<i>Relevant to my cell processes class to an extent; for life outside USD, it will help me with future classes in PA school</i>	Relating
<i>It's super applicable to our lives. Seeing is so important and something we take for granted.</i>	Relating
<i>Vision is a huge aspect of my world! Helps to explain how I see the thing I do and why there are errors.</i>	Relating
<i>I use my eyes all the time! Perception is so important understanding how people are able to perceive the world allows me to understand some differences in people's perceptions. Bio 494 class and PHIL mind class!</i>	Reasoning
<i>Understanding the basic processes of how my body works is very relevant! Also, gives perspective on others – additions, disorders, etc. and the process of that...less blame/judgment on people for what they can't control.</i>	Reasoning
<i>This can be applied to the eye tracking research I participate in; Know to be more conscious of blind spot when driving</i>	Reasoning
<i>In learning and behavior we talk about how learning occurs with eyesight</i>	Relating
<i>I had a better understanding of why there is a blind spot, especially since I love driving</i>	Relating
<i>In a broad scope, most of us rely heavily on our visual system in daily life. Learning more about the brain's complexity makes us appreciate all that it does.</i>	Relating

For the question about application (see Table 43) students responded with how they understood more of their vision problems, or made the connection to informing someone else who may have problems seeing. A couple of students responded with

answers that could be categorized in the Reasoning/Reconstructing stages as they stated they will be trying out a new role based on the material they learned in class that day.

Table 43

Critical Reflection Activity #4: Journal Question 2

b. How can you apply what you've learned today in your life?	Reasoning/ Reconstructing
<i>How to increase my focus in class by positioning the most important info within my fovea.</i>	Reasoning
<i>I struggle with vision problems because I have to wear contacts so this can help me understand what is happening in my eyes.</i>	Reasoning
<i>If someone has a problem seeing something on one side we have a good chance of guessing what and where the problem is.</i>	Reasoning
<i>Telling others about how the eye works. Think about how eye actively differs in a dark room vs in the sun at the beach.</i>	Reasoning
<i>I learned about my brain's blind spot which will keep me more aware while driving and while moving through the world.</i>	Reasoning
<i>I can use this in other classes that might use anatomy, vision, or optical illusions and I can explain why my eyes do and see the way they do in all situations. I can also explain blind spots and use that info while driving.</i>	Reasoning
<i>To appreciate when I wake up in the morning and know that my eyes allowed me to see. Also, I don't know how I would apply more just experience it and be aware of it.</i>	Relating
<i>I will definitely use the grandma approach to change lanes.</i>	Reasoning/ Reconstructing
<i>Use most adequate light at home as to not strain my eyes, as well as be more aware when driving.</i>	Reasoning/ Reconstructing

The last question asked students to consider what they still might want to know that had not been covered during class that day. The intention of the question was to allow students to connect inquiry to learning, and think about what areas they may want to continue to explore as highlighted in Table 44. While the majority of questions were Reporting, a couple of them were Relating, as they were more hypothetical and “wondering” inquiries.

Table 44

Critical Reflection Activity #4: Journal Question 3

c. What's one lingering question you still have about today's class?	Reporting
How do disturbances in the visual pathway lead to different kinds of blindness?	Reporting
Why do we see things on the right side and then side that information to the left side of the brain?	Reporting
The evolutionary purpose/advantage of blind spots?	Relating
Where does glutamate do to on and off center bipolar cells respectively?	Reporting
I wanna talk about sight disorders, i.e. color blindness or age-related molecular degeneration	Relating
Adaptively, why have we not evolved to correct for our blind spot?	Relating
How large is this blind spot actually?	Reporting
What happens to the fovea when you need eye glasses?	Reporting
How did people discover all of these functions of the eye and brain?	Relating

Critical Reflection Activity #5

The last critical reflection activity focused on Food and Hunger. The first question asked about an experience or situation that related to food and hunger. Students shared various stories that connected to travel, family, holidays, and restaurants. Table 45 provides data from their responses.

Table 45

Critical Reflection Activity #4: Question 1

CRITICAL REFLECTION ACTIVITY #5	STAGES
1. Think of an (personal) experience or situation – funny story, tradition, meal while traveling, accident – that relates to food and hunger.	
Draw or write about the experience.	Reporting
Every morning when I wake up, no matter how early, I am always hungry and have to make breakfast first thing!	Reporting
Last summer I was traveling to Columbia and after the 15+ hours of flying I was dying of starvation. As soon as we got there we went to the nearest restaurant and ordered all of Colombia's signature meals and didn't leave anything on the table.	Reporting
I was starving while at work, hostess at a restaurant, went in the back to eat, customers came in at the same time and I had to greet them with food still in my mouth.	Reporting
At boarding school, we never got sweet food and people would mix like gross things together to try to make something sweet.	Reporting
My parents would go to bed super early so we would always eat dinner when I got home from school! By bed time I was super hungry again.	Reporting
My roommate taking funny videos of me while eating when I'm stressed and really hungry	Reporting
During Thanksgiving my family often skips lunch to save room for the Thanksgiving dinner and then we end up eating much more than we normally would have	Reporting
I come late to family dinner on vacation once and they pretended all the food was already gone and I was so hungry. I stomped off to buy more but they had just hid it in the oven.	Reporting
Ate some giant pizza 2 years ago in one sitting, now have my picture on the wall of the restaurant.	Reporting
When we had finals last semester I would survive hours without eating besides only coffee because of the pressure of limited of time.	Reporting
When we were on our way back from Hawaii we knew we'd be hungry so we packed our backpacks with chocolate bars	Reporting
We bake two turkeys on Thanksgiving so that we can have a whole other turkey to make sandwiches for a month after Thanksgiving. The sandwiches are much better than the food on the actual day of Thanksgiving.	Reporting

Students were asked to process how they were then able to use the experience/situation to make sense of what they learned in class. As highlighted in Table 46, many students related their experiences to ghrelin, energy, and hunger. Students were able to use a past experience and integrate their current learning to bridge their understanding of the material.

Table 46

Critical Reflection Activity #5: Question 2

2. How does this experience/situation make sense of what you've learned today?	Relating
Ghrelin is the evolutionary reason why I would be hungry at this early time in the morning, even though rationally there would be no reason for me to eat.	Relating
The reason for my hunger, even at really early hours, is explained with ghrelin, the appetite stimulant.	Reporting
What I learned helps explain what happens to my body after eating huge quantities of food, and possibly how or why ghrelin	Relating
When my parents go to sleep so early, they stop producing appetite stimulants like ghrelin, whereas I stayed up and got hungry again	Relating
My body was likely spending a lot of energy and my blood sugar was low so my brain was signaling that I needed to eat something and eat it fast.	Relating
Thinking about suppressants and stimulants could explain why we get more hungry. It also reminds me of how insulin vs. glucagon works.	Relating
There are many hormones driving and driven by hunger, likely to have effect on mood as well.	Relating
I had just swam at a meet, so it makes sense that I likely wanted more energy...more ghrelin.	Relating

In their groups, students were able to relate through their various experiences as shown in Table 47. Students stated that they had shared experiences of “being hungry at odd hours” and “excessive eating.” One student connected their friend’s head injury to possible brain damage that impacted how they could not stop eating. Another student, learning about ghrelin, stated, “we can make ourselves wait” for the next meal, expressing a “consciousness about eating.”

Table 47

Critical Reflection Activity #5: Question 3

3. In groups of three, share your experience. What stood out to you from your sharing?	Relating
<i>We all had the same shared experience of being hungry at odd hours.</i>	Relating
<i>We all get hungry late at night and crave food, especially junk food, but I was the only one who gets hungry every morning.</i>	Relating
<i>We all talked about excessive eating and how it ties into ghrelin.</i>	Relating
<i>Someone's friend hurt her head and now can't stop eating—brain damage to ventromedial hypothalamus?</i>	Reasoning
<i>Our consciousness about eating. We can make ourselves wait to save ourselves for each meal.</i>	Relating

Students, asked to apply what they learned, provided a range of responses from learning to control their hunger to practicing mindfulness when envisioning what goes on in the body when they eat. Table 48 provides data on this question. A few responses corresponded to the Reasoning/Reconstructing stages. Two students stated that they would practice different habits of eating regularly throughout the day and sleeping earlier to avoid snacking. One student stated that they would connect with their friends who struggled with eating disorders to help them understand what goes on in their bodies when it comes to food.

Table 48

Critical Reflection Activity #5: Journal Question 1

Journal Questions	
a. How would you put into practice what you've learned today?	Reasoning/ Reconstructing
<i>Learn to control my hunger and understand that at early morning hours, eating isn't essential and will probably benefit me more to go to sleep.</i>	Reasoning
<i>I'll pay attention to what and when I eat, and be able to know whether insulin or glycogen is being used or not.</i>	Reasoning
<i>One of my best friends has diabetes so knowing what I learned today helps me to understand his situation more.</i>	Reasoning
<i>Eat at regular times throughout the day to avoid feeling like I'm starving</i>	Reasoning/ Reconstructing
<i>Remember how satisfied I was instead of how hungry I am</i>	Reasoning
<i>Being aware of my hunger</i>	Reasoning
<i>More mindful about how many cool things go on in my body when I eat!</i>	Reasoning
<i>Help my friends who struggle with eating problems and underweight disorders. Maybe I can help them see things they are doing to their body from a scientific standpoint.</i>	Reasoning/ Reconstructing
<i>How I know/understand why I feel hungry when I do and what is going on in my body.</i>	Reasoning
<i>Sleep earlier so that I do not continually snack past 12:00 AM</i>	Reasoning/ Reconstructing

In addition to asking a lingering question, students were given the opportunity to provide a lingering thought as well. As Table 49 shows, students' responses ranged from asking technical questions about content they learned in class, to general questions about health conditions and weight loss. One student expressed the desire to see hormones could be "used in the future to control hunger." Another student stated that they liked to learn about Type II diabetes compared to Type I diabetes.

Table 49

Critical Reflection Activity #5: Journal Question 2

b. What's one lingering question OR thought you still have about today's class?	Reporting/ Relating
Does ghrelin have a specific amount it lets off depending on how hungry you are?	Reporting
Why is it only the brain that developed the ability to work without insulin interactions?	Reporting
Why is it so hard to lose weight?	Relating
I'd like to learn about type 2 diabetes and compare it to type 1	Reasoning
How does diabetes develop from environment (aka: how our lifestyles are)?	Relating
I want to see how these things/hormones get used in the future to control hunger.	Reasoning
Is it all the same for thirst? How is it different?	Relating
What attributes to excessive hunger the morning after having a meal before bed. Are there any hormones involved?	Relating
How does stress can affect your appetite?	Relating
What do most weight loss pills rely on?	Relating

This chapter provided the findings from the interviews, in addition to highlighting some of the similarities and differences between interview participants in the experimental and control groups, as well as in the high, low, and differences categories. The chapter also discussed the analysis of the findings from the critical reflection activities administered in the experimental group. Key insights, thoughts, and questions from participants were highlighted to show the levels of thinking and reasoning that occurred during the critical reflection activities. A wide range of ideas and insights were shared, from the technical "what and how," to the more complicated "why and what ifs," that expanded and deepened reflection around course content and perspectives.

Conclusion

The demographic survey, pre-and post-assessment, critical reflection activities, and in-depth interviews provided insight into how students process and make meaning of the content they learned in the classroom. Specifically, the interview participants shared what strategies they employed to learn content, who they connected with in order to learn, and how their upbringing and background influenced their perspectives on course content. The study found that the application of their learning to self, others, and situations heavily impacted how students view the importance and relevance of what they learned in the course. Additionally, self-awareness about how and what they learned broadened and deepened the students' ability to make sense of material and indicated openness to hearing different perspectives.

In the next chapter I provide a discussion of the data obtained from the pre-and post-assessments, interviews with selected participants from the experimental and control groups, and the critical reflection activities implemented in the experimental group to answer the research questions for this study. The discussion provides an opportunity to consider how the themes might inform how educators can foster classrooms where curiosity can be stimulated to deepen students' learning and meaning making processes.

CHAPTER SIX

DISCUSSION OF FINDINGS AND CONCLUSION

The purpose of my study – a study that utilized the Curiosity and Exploration Inventory II (CEI-II) as a pre-and post-assessment tool, a demographic questionnaire, and in-depth interviews – was to explore how critical reflection activities could be utilized to stimulate and enhance students' curiosity to develop their capacity to make meaning of their learning and experiences. This study was conducted to help educators better understand how to cultivate students' curiosities in the college classroom.

I identified how trait curiosity impacted students' interaction with state curiosity in the classroom. Additionally, I examined the intrinsic and extrinsic motivators that elevated, as well as diminished, the stimulation of curiosity in students.

The research questions were:

1. To what extent, if at all, do critical reflection activities impact the stimulation and enhancement of curiosity in college students?
2. How do critical reflection activities interact with trait and state curiosity?
3. What extrinsic and intrinsic motivators impact how students' curiosity is stimulated and enhanced?

First, I utilized the Curiosity and Exploration Inventory II (CEI-II) as a pre-and post-assessment tool to measure trait curiosity in students. These assessments were administered to both the experimental and control groups. After the pre-assessment, critical reflection activities were administered to account for any stimulation and enhancement of state curiosity in students. Once the post-assessment was administered, scores were analyzed and students contacted to participate in interviews. I then conducted

11 interviews (seven from the experimental group and four from the control group). The experiences of the students in the course answered my research questions and provided insight into what educators can consider and actively do to stimulate and enhance curiosity in students.

The analysis of interviews uncovered the following six themes: Perceptions of learning, Application of learning, Intrapersonal factors, Self-awareness, Interpersonal influences, and External challenges. Chapters five and six extensively examined the themes that emerged from the interviews and critical reflection activities. This chapter will discuss the findings of the pre-and post-assessment tests, interviews and critical reflection activities as they pertain to the research questions.

Research Question One: To What Extent, If At All, Do Critical Reflection Activities

Impact the Stimulation and Enhancement of Curiosity In College Students?

It is evident from this study that critical reflection activities stimulated and enhanced curiosity in students in the college classroom in four areas: processing information, making sense of content, finding relevance, and connecting with peers. Figure 6 illustrates these areas and the flow of the cycle. The first area allowed students to reflect upon how they were processing information learned in class. This included absorbing new material and reconfiguring existing knowledge. The second area was then making meaning of course content for understanding. The third area was identifying what of the course content the students found relevant to their life and the lives of others. Lastly, the fourth area was then connecting with other peers to discuss the material that they found relevant to further their learning and at times, to reexamine their current ways of thinking.

Figure 6. Utilizing Critical Reflection Activities to Stimulate and Enhance Curiosity

Figure 6. Utilizing critical reflection activities to stimulate and enhance curiosity. The diagram illustrates the cycle in which students processed their learning through critical reflection activities.

The figure indicates that *finding relevance* for students in what they learned occurred in all of the other three areas. This was primarily because it was an important factor when internally and externally processing and reflecting upon course material. A secondary reason was because it helped to sustain students' interest in what they were learning, in addition to piecing information together for their own meaning making processes.

The findings from the seven interviews conducted on the experimental group and the critical reflection activities showed similar outcomes in how students perceived and utilized opportunities to reflect and connect with their peers. Many students shared the same sentiment as one who stated, "*Just being able to breathe and process it (course content) with other people is great.*" These types of response demonstrates that critical

reflection activities provided the necessary room to “breathe” and engage with other students around complex material.

Students’ curiosities were most stimulated and enhanced in the area of competence and furthering their knowledge around subject matters in Biological Psychology. Many students interested in the course content utilized the critical reflection activities as a way of processing information and analyzing theirs/others thoughts and insights. This did not mean that students used the critical reflection activities as a means to learn new material, but rather as a tool to make connections. The self-reflective component of the critical reflection activities prompted students to identify what they remembered and what part of the content resonated with them that day. Then, as they connected with peers, their thoughts and insights either affirmed their understanding, thus supporting the continuation of how they made meaning of content, or challenged them to think about the material from another perspective. This then broadened students’ perceptions about the material in a new way, helping them become more knowledgeable about their area of study.

Students benefited most from engaging with their peers about course content to “fill in the gaps” of information that was difficult to process alone and/or missed completely until it was discussed during the critical reflection activities. Students used each other’s knowledge, perspective, and interest in the subject matter to complete their own thoughts or to build upon others as a way of “sharing their learning.” Additionally, these information gaps were looked upon as opportunities to execute an action (i.e. research on their own) that helped to fill the void of “not knowing.”

Research Question Two: How Do Critical Reflection Activities Interact with Trait and State Curiosity?

The pre-and post-assessment scores of participants and the scores between the experimental and control groups indicated that students with high trait curiosity scores did not have higher state curiosity than students with low trait curiosity. While the experimental pre-and post-assessment exploration construct mean ($p=0.033$), as well as the experimental and control pre-assessment absorption construct and mean ($p=0.044$) showed statistical significance at the $p<.05$ level, the variation may have been due to a variety of factors that included the: small sample size, impact of critical reflection activities and interpretation of statements between the experimental and control groups.

Data from the interviews and critical reflection activities revealed that for students in the experimental section, the critical reflection activities served as opportunities to continue to explore and wonder about the material, sometimes beyond the field of Biological Psychology. Some students in the experimental group used these opportunities to reflect on how learned content applied to their lives, in addition to examining future application in how they could utilize the material. Often students discussed their desire to help friends, family members, and other people with disorders and illnesses, and imagined what type of impact their knowledge would have upon what they wanted to continue to research and the choice of career they wanted to ultimately pursue. The reciprocity of ideas with one another and the professor helped to strengthen strategies for recalling information on tests, as well as develop students' abilities and capacities to acknowledge differences and practice empathy.

As a result of my understanding of curiosity and the assumptions I made as a result of the interviews, within the classroom, *state curiosity* increased when students were able to inquire about material and how it pertained to themselves and what occurs in their daily life. For example, during the lecture on food and hunger, one student asked how many calories were needed when one was inactive and “just sitting on the couch.” Asking these types of questions helped to justify the learning for students as they learned about how the content made sense within the context of how they lived and their day-to-day actions.

The days on which critical reflection activities were implemented, these engaging environments were further fostered. During the vision class, students wrote about the importance of the visual pathway, the fovea, and blind spots. Then, students discussed their ideas, insights, and drawings about these and other concepts about the eye with one another. From this activity, students were able to compare, contrast, question, and grapple with content together. Afterward, students were able to journal about their conversation and determine how they were going to apply what they learned. As was the case in the Food and Hunger class, students when contemplating Vision, asked questions about how they could increase their focus in class by positioning important information within their fovea. Another student wondered what happened to the fovea when eyeglasses were needed. Allowing such spaces where students were able to freely exchange their thoughts and ideas with their peers served as opportunities to bridge content from knowing content to understanding content. Additionally, students were able to assist in each other’s learning.

One major impact that critical reflection activities had on students was allowing them to view course content differently than they had in other classes. This occurred in two ways: 1. in “forcing” students to think about course content critically, and 2. listening to different perspectives. According to responses from the activities and the interviews, the structured time of the critical reflection times were useful in getting students to think, however abstractly, how they would apply the content to other courses and life outside of USD. Some students did not find this easy to do, but found it helpful in thinking about course content beyond the confines of the course.

The second, as stated previously, occurred as students engaged with peers about their perceptions and thoughts about content learned that day. The time provided opportunities for students to consider and listen to different perspectives, as well as receive support for their perspectives as well. Experiences and stories provided additional context to their learning. For example, though data from critical reflection activity #2 was not collected, during the interviews a couple of students discussed their perspectives about drugs and behavior based on their experiences. Such exchanges developed awareness in some students to continue to reflect upon their learning and how it applied to their personal relationships.

Research Question Three: What Extrinsic and Intrinsic Motivators Impact How Students’ Curiosity is Stimulated and Enhanced?

The data from the interviews revealed distinct extrinsic and intrinsic motivators that impacted students’ curiosity. The extrinsic motivators included: connection of content to other classes, connection of content to a future career/profession, good grades, and desire to help loved ones and others. The intrinsic motivators included: learning for

the sake of learning and the building up of confidence and competence (Loewenstein, 1994). It is clear that these motivators, to a varying degree, influenced how students perceived and thought about content from the course.

Extrinsic Motivators

During the interviews, many students discussed their connection to what they learned to things, people, and places outside of the classroom. This included, applying what they learned to current internships, relationships, and situations. For many students, curiosity around the topics discussed in Biological Psychology developed when they could “see” content in their day-to-day activities and relationships. For example, one student who interned at a trauma center had the opportunity to perform a cranial exam on a patient by putting to use the acronyms learned in the course. And the student who has a brother with a developmental disorder was compelled to find a career that would allow him to find resolutions about the disorder that was impacting his brother. The trajectory of students’ curiosity escalated as they became mindful of how their extrinsic motivators impacted their desire to learn (Kashdan & Fincham, 2004).

The bridge between the connection of learning course content and application to the world was found in how students perceived how they could help people they loved and/or others that would need assistance. As was with the case with the student who has a brother with a developmental disorder, many students’ knowledge growth about specific topics learned in the class equated to their desire to make a difference in the lives of people they knew or population of people they were interested in working with. As these students developed their capacity to learn more about various abnormalities or disorders, they expressed the need to think about and ultimately decide how they could be of service

to their loved ones and others using the information they learned. This factor motivated many students to ask additional questions and share comments that showed that they were curious to know more and “be more” for many people.

The one extrinsic motivator that contributed to *and* also detracted from students’ curiosities was grades. Many students were motivated by obtaining good grades, which is essential as they come to terms with whether they know the course content or not. However, in this study, grades alone were found to be insufficient in stimulating and enhancing students’ curiosities. Students who discussed grades during the interview and stated that they did not do well on the quizzes and exams shared two insights: 1. Their grades on those tests were not indicative of how much they learned in the course, and 2. They were interested in knowing more about certain course topics as they related them to their friends, other coursework, and jobs. These same students, optimistic in their perspective, also felt pressure to do better on their tests. This pressure served as a stumbling block for these students to become additionally curious about content. Rather than making connections to apply their learning, they had to task themselves to practice memorizing and recalling information during tests to score high marks.

Students who strived toward earning good grades *and* expressed at least one other factor in their desire to learn the material did have curiosity inspired by multiple insights. For example, many students expressed the need to do well in the course in order to understand future course content in other Behavioral Neuroscience courses, as well as in graduate school. These students had another motivator that encouraged them to not only strive for good grades, but to also look for opportunities to connect what they learned. This provided the space needed for students to look to grades in order to feel inspired to

utilize strategies for memorizing content, but to also move beyond the regurgitation of material to understand and deepen their learning.

Intrinsic Motivators

In this study, some students' curiosity were stimulated and enhanced by an innate desire to learn. This innate desire was due to various reasons that included upbringing and personality, in addition to other factors that could not be fully explored in this study due to limitation in time and resources. However, students who were identified as having this innate desire, showed an interest in the course content, as well as the tendency to ask questions, speak to an experience, and/or research additional information that was not covered in class. One specific student in the experimental group spoke to how they routinely did additional research on their own. This student also described the importance of critical reflection activities on ensuring that they remembered to do this.

The last intrinsic indicator that impacted students' curiosity was in the growth and development of their confidence and competence in the course. Many students found their competence in the course developed throughout the semester. A few participants stated that as this happened, their ability to enjoy and appreciate the learning grew. This also led to a building of confidence in a couple of students that assisted in encouraging them to continue with their studies and application of the learning.

Pursue Passion

The data revealed that pursuing passion did not fall into either one of the extrinsic or intrinsic categories. Rather, students who were curious about Biological Psychology were motivated by their passion for the content both inherently and through various external motivators. Students' passion for the course stemmed from their inherent desire

to learn, in addition to their desire to acquire new knowledge in order to make connections to other disciplines and life situations. Thus, passion could not be identified as either an intrinsic or extrinsic factor, but as a factor that overlapped the two, as illustrated in Figure 7.

Figure 7. Intrinsic and Extrinsic Motivators

Figure 7. Intrinsic and extrinsic motivators. The Venn diagram differentiates intrinsic and extrinsic motivator, in addition to the overlap that occurred when considering pursuing passion.

The students who were passionate about the course content exhibited an *ownership in their learning* because they were intrinsically motivated. These students showed an excitement in wanting to learn more about complex subject matters as they found the course deeply interesting overall. As one participant stated, “*If I wasn’t interested in what we were learning, I would not do as well with what I’m studying in.*” This interest most likely developed over the years, as they learned more about the topic that increased their desire to know more.

Additionally, these students were also inspired to *continue on their path* of learning as they associated their learning with other people and places that were extrinsically motivated. They took the onus of connecting with the professor during office hours to seek assistance, found a study partner in the same class, and seized opportunities to apply their learning to real-world situations. Through continued research and internship opportunities, these students continued to “feed” their passion to help them grow in their understanding of the field and identify ways in which they could may an impact in their future courses and careers. Thus, passion was viewed as a connector between intrinsic and extrinsic motivation in stimulating and enhancing curiosity.

Implications for Practice

The findings from this study suggest that educators, when utilizing critical reflection activities in the context of the classroom, should critically consider how the course content is relevant to student learning. The relevance, or how students’ perceive the relevance of course content then impacts students’ desire to acquire additional knowledge and perspective about a specific subject. Additionally, in the development of critical reflection activities, providing opportunities for students to reflect on their own learning through the analysis of their personal feelings and experiences, and afterward sharing those thoughts and insights may allow students to apply their learning to real-life settings.

Limitations

The focus of this study was to capture the experiences of undergraduate Psychology students and their capacity to experience curiosity through the use of critical reflection activities. A primary limitation was in the design decision to select the

participants using a convenience/purposeful sampling strategy. The specific criteria limited the number of students' experiences available for examination. Thus, the interpretation of findings became specific to the experience of the 48 participants in the study. Though contemporary views of generalizability were not synonymous with large samples (Donmoyer, 1990), the study's findings were, in no way, generalizable to all students who took this course.

Additionally, though similar, the participants in the experimental and control groups were not the same in terms of background and other demographic factors. The control group had more first generation students and less parents and guardians who had a college degree or advanced degree. The experimental group contained more students who grew up in mid-to upper-socioeconomic households compared to the control group. And, whereas students of color consisted of 44 percent of the experimental section, the control group had close to 65 percent of students who identified as non-white students. These factors, as well as others, may have influenced how students responded to the Curiosity and Exploration Inventory (CEI-II) and the critical reflection activities.

In terms of the interviews, though efforts were made to connect with students from various backgrounds, seven out of the 11 exhibited high pre-and post-assessment scores, two had low scores, and two had average scores. Additionally, the demographics of the interviewees showed that the majority of participants came from affluent backgrounds, where their parents/guardians had Bachelor's degree and for at least half of the participants, advanced degrees. With the exception of one student, all the interviewed participants had GPAs of 3.0 or higher. Thus, not having a more balanced breadth of interviewees may have highlighted some results found in the study and not others.

Additionally, various external factors that may have impacted students' state curiosities were not all accounted for in this study. This was due to the inability to control for all the different variables and situations prior to and during class, which may have influenced students' perceptions, thoughts, feelings, and attitudes about the course and content learned during the five critical reflection activity days. Though steps were taken to measure relevant factors discovered in the questionnaire through comparison analyses, not all could be taken into account and controlled during this study.

Another limitation was in the subjectivity of the researcher. Peshkin (1988) stated that researchers needed to be aware of "how their subjectivity may be shaping their inquiry and its outcomes" (p. 17). My subjectivity as the researcher in this study was most likely to have an impact when interview questions were being generated and asked. In pursuit of data that would support the consideration of the stimulation and enhancement of curiosity through critical reflection activities, I was aware of the issue of subjectivity and sought to monitor and maintain my perspective through analytical memos and member checking.

Despite these limitations, the study represented an important first step in developing a nuanced understanding of how critical reflection activities stimulated and enhanced curiosity in students. These findings contributed to the long-term study of curiosity in college classrooms and the implementation of critical reflection activities as a pedagogical practice for meaningful learning.

Future Research

Long-term studies on how the initial stimulation of curiosity leads to the stage of Reconstructing, according to the 4Rs model, would be beneficial in continuing the study

of sustained, epistemic curiosity. Researching students who utilize critical reflection activities throughout their college journey in a specific area of study would provide insight into how they interact with the content, and develop their curiosity in the subject matter to a level where transformative learning could take place. This type of study would be useful in: 1. Deepening educators' understanding of how critical reflection activities should be implemented, and 2. Discovering the degree in which critical reflection activities impact students' curiosity in the classroom.

Another area of future research could include how educators who implement critical reflection activities and actively participate in the classroom simultaneously do their own processing on the course content with their students. They could evaluate and reflect upon how they make connections and meaning in order to understand how their students may be perceiving and reflecting upon what they are taught. Educators would then be able to participate in their own internal dialogue about the content, which would perhaps allow for changes and shifts to occur in curriculum, discussions, and inquiry. Additionally, educators could test out different methods of teaching course content that aim to optimize how students identify and resonate with the material to then apply their learning to various situations and opportunities outside of the classroom.

In order to test for reliability, this same study could also be implemented again on college students in other disciplines to compare how different personalities, behaviors, and backgrounds (trait curiosity) impact how students engage with their environments (state curiosity). To widen the breadth of study, researchers should consider expanding the population of students to include those who attend public, four-year colleges and universities as well. This would provide a diverse and wide range of perspectives that

would continue to inform the role that state curiosity has on the development and growth of students.

Conclusion

This study was conducted to inform how educators can continue to cultivate students' curiosity in the college classroom. As the findings indicated, students who took the time to critically reflect on their learning were able to evaluate and analyze material from various perspectives. This allowed students to engage with other students to learn about and contemplate other point of views that provided additional context for curiosity to grow. Carving out time to implement critical reflection activities also provided the space that students needed to process information on their own and with others, to consider how their learning applied to their day-to-day life. This provided students the opportunity to think about how they would consider implementing new ideas to create changes in perspective and thus, make additional meaning of what they have learned.

Making meaning of course content, like Biological Psychology, which is known to be a rigorous course, is a difficult process. Students must see passed the need to memorize content to simply make the grades in order to engage in deeper learning. The critical reflection activities assisted in doing this to some extent, as they were able to help some students pause to assess their understanding and seek support in their learning from their peers through discussing what they did and did not know, as well as identifying what more they would like to learn in future classes.

This led students to consider what steps they could take to broaden and deepen their knowledge and understanding to build their confidence and competence in their learning. Additionally, as students saw how their learning mirrored what occurred in the

real world, they were able to envision where they could and would like to make the biggest impact. Such development resulted in more mindful students who understood the complexities of connecting learning-to-reflection-to-action that enhanced how they were able to make meaning of their experiences in the classroom.

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APPENDIX A

Curiosity and Exploration Inventory II

Curiosity and Exploration Inventory (CEI-II)		Very Slightly or Not At All	A Little	Moderately	Quite a Bit	Extremely
<i>Instructions:</i> Rate the statements below for how accurately they reflect the way you generally feel and behave. Do not rate what you think you should do, or wish you do, or things you no longer do. Please be as honest as possible.						
1.	I actively seek as much information as I can in new situations.	1	2	3	4	5
2.	I am the type of person who really enjoys the uncertainty of everyday life.	1	2	3	4	5
3.	I am at my best when doing something that is complex or challenging.	1	2	3	4	5
4.	Everywhere I go, I am out looking for new things or experiences.	1	2	3	4	5
5.	I view challenging situations as an opportunity to grow and learn.	1	2	3	4	5
6.	I like to do things that are a little frightening.	1	2	3	4	5
7.	I am always looking for experiences that challenge how I think about myself and the world.	1	2	3	4	5
8.	I prefer jobs that are excitingly unpredictable.	1	2	3	4	5
9.	I frequently seek out opportunities to challenge myself and grow as a person.	1	2	3	4	5
10.	I am the kind of person who embraces unfamiliar people, events, and places.	1	2	3	4	5
Stretching: 1,3,5,7 / Embracing: 2,4,6,8,10. ©2009 Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D., & Steger, M. F. (2009). The Curiosity and Exploration Inventory-II. Development, factor structure, and psychometrics. <i>Journal of Research in Personality</i> , 43, 987-998.						

APPENDIX B

Questionnaire

Please take a few minutes to complete this questionnaire. All responses will be confidential. Thank you!

1. What is your class standing at USD?

- ☐ Freshman/First-year
- ☐ Sophomore
- ☐ Junior
- ☐ Senior

2. What is your major (i.e. Psychology)? _____

3. Are you a transfer student? Please skip Question 4 if you are NOT a transfer student.

- ☐ Yes
- ☐ No

4. If you're a transfer student, what year did you transfer to USD?

- ☐ First-year
- ☐ Second-year
- ☐ Third-year

5. How many Psychology courses have you taken prior to this one? _____
(i.e.1, 2, 3, etc.)

6. For this question, please indicate the extent in which you agree or disagree with the following statement about participating in the core curriculum at USD.

The core curriculum challenged me to think outside the box and to explore scholarly topics (outside my major) in greater depth.

- ☐ Strongly Agree
- ☐ Agree
- ☐ Neutral
- ☐ Disagree
- ☐ Strongly Disagree

7. Are you a first-generation college student? The first in your family to attend a four-year college/university

- ☐ Yes
- ☐ No

8. What is your parents' or guardians' highest level of education?

- ☐ Did not complete high school
- ☐ High school/GED
- ☐ Some college
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Advanced graduate degree/PhD
- ☐ Not sure

9. What would you say was your household income growing up?

- ☐ Under \$25,000
- ☐ \$25,000 - \$39,999
- ☐ \$40,000 - \$49,999
- ☐ \$50,000 - \$74,999
- ☐ \$75,000 - \$99,999
- ☐ Over \$100,000
- ☐ I prefer not to answer

10. How do you identify? One or more categories may be selected

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other _____
- ☐ I prefer not to answer

11. How would you describe yourself?

- ☐ Male
- ☐ Female
- ☐ Trans*
- ☐ Other _____
- ☐ I prefer not to answer

12. What is your current GPA? _____ (i.e. 2.71, 3.50)

APPENDIX C

Scripts for Professor

Critical Reflection Activity #1

(~12 minutes)

FRAMING FOR PROFESSOR:

- We'd like students to make meaning of what they've learned today by connecting to how they feel about the material with each other.
- Hopefully they can do this creatively through this reflection.

Professor Galvan to students:

My hope is that you're processing this material in a way that makes sense to you. I think that the puzzle activity is helpful in getting you all to know the steps. To start you all thinking about this material in a meaningful way, we're going to do the following reflective activity.

Please be open and honest, as I won't see your answers.

1. On your own, write AND/OR draw ☺ a couple of thoughts about how you feel about what you learned today (answer on front). **3 mins.**

(Ex: It might be confused, complicated, makes sense, insightful)

2. In your group of three, briefly share your words. What different words did you hear? **5-7 mins.**
3. Journal question (answer on back): How does hearing what others say help you make sense of the material? **2 mins.**

*Bo will give professor a signal for time when students need to move on to the next step.

Critical Reflection Activity #2

(~12 minutes)

FRAMING FOR PROFESSOR:

- We'd like students to make meaning of what they've learned today by connecting to how they feel about the material with each other.
- Hopefully they can do this creatively through this reflection.

Please take out a piece of paper for this reflection activity.

- Think of a personal experience or situation that relates to drugs and behavior.

Draw one or two items on your paper that reminds you of the experience or situation. (3 mins.)

Wait 3 mins. before reading second prompt:

- How does this situation/experience make sense of what you've learned? (4 mins.)

Wait 4 mins. before reading third prompt:

- In groups of three, share your experience. (5 mins.)

Conclusion: Think about these drawings as you study for your exam!

Critical Reflection Activity #3

(~12 minutes)

FRAMING FOR PROFESSOR:

- We'd like students to make meaning of what they've learned today by connecting to how they feel about the material with each other.
- Hopefully they can do this creatively through this reflection.

Professor Galvan to students:

My hope is that you're processing this material in a way that makes sense to you. I think that the activity today is helpful in getting you all to process the material in a new way. To further your thinking about what we learned about today, you're going to do the following reflective activity.

Please be open and honest, as I won't see your answers.

1. On your own, write AND/OR draw ☺ 2-3 thoughts about how you feel about what you learned today. **3 mins.**
2. In your group of three, briefly share your thoughts and drawings. What did you hear? Write some thoughts down. **5-7 mins.**

ON THE BACK ANSWER THE JOURNAL QUESTIONS:

3. Journal questions: How does hearing what others say help you understand more of the material covered today? What can you do in the next week to deepen your understanding of the material learned today? **2 mins.**

*Bo will give professor a signal for time when students need to move on to the next step.

Critical Reflection Activity #4

(~12 minutes)

FRAMING FOR PROFESSOR:

- We'd like students to make meaning of what they've learned today by connecting to how they feel about the material with each other.
- Hopefully they can do this creatively through this reflection.

Professor Galvan to students:

My hope is that you're processing this material in a way that makes sense to you. I think that the activity today is helpful in getting you all to process the material in a new way. To further your thinking about what we learned about today, you're going to do the following reflective activity.

Please be open and honest, as I won't see your answers.

1. On your own, write AND/OR draw ☺ 2-3 most important concepts/ideas that you learned today. **3 mins.**
2. In your group of three, briefly share your thoughts and drawings. What did you hear? Write some thoughts down. **5 mins.**

ON THE BACK ANSWER THE JOURNAL QUESTIONS:

3. Journal questions: How is what you learned today relevant to your other classes and life outside of USD? How can you apply what you've learned today in your life? What's one lingering question you still have about today's class? **4 mins.**

*Bo will give professor a signal for time when students need to move on to the next step.

Critical Reflection Activity #5

(~12 minutes)

FRAMING FOR PROFESSOR:

- We'd like students to make meaning of what they've learned today by connecting to how they feel about the material with each other.
- Hopefully they can do this creatively through this reflection.

Professor Galvan to students:

Please be open and honest, as I won't see your answers.

1. Think of an (personal) experience or situation – funny story, tradition, meal while traveling, accident – that relates to **food and hunger**. Draw or write about the experience. **3 mins.**
2. How does this experience/situation make sense of what you've learned today? **2 mins.**
3. In groups of three, share your experience. What stood out to you from your sharing? **5 mins.**
4. Journal questions: How would you put into practice what you've learned today? What's one lingering question OR thought you still have about today's class? **2 mins.**

*Bo will give professor a signal for time when students need to move on to the next step.

APPENDIX D

Interview Guide

For Experimental Section:

BACKGROUND:

1. Can you describe your interest in Psychology?
2. What compelled you to become a Psychology/Behavioral Neuroscience major?

PERCEPTIONS OF COURSE:

3. What are some thoughts you had about PSYC 342: Biological Psychology *before* starting the course? What are your thoughts about the course now?

STIMULATION OF CURIOSITY (STATE):

4. How, if at all, did your perspective of the course change throughout the semester?
5. What were some of the factors that resulted in the perspective change?
6. Describe what the critical reflection activities meant for you.
7. In what ways, if any, did the critical reflection activities present information that was different than your understanding of PSYC 342: Biological Psychology prior to the class (**incongruence**)?
8. In what ways, if any, did the critical reflection activities broaden and/or deepen your understanding of PSYC 342: Biological Psychology (**competence**)?
9. In what ways, if any, did the critical reflection activities fill any gaps in your understanding of PSYC 342: Biological Psychology (**information-gap**)?

TRAIT CURIOSITY IMPACT ON STATE CURIOSITY:

10. What are some reasons why you found PSYC 342: Biological Psychology particularly interesting/uninteresting?
11. What behaviors and experiences may have impacted your motivation in this course?
12. How did these behaviors/experiences connect with _____ factors and/or critical reflection activities that you described above?

For Control Section:

BACKGROUND:

1. Can you describe your interest in Psychology?
2. What compelled you to become a Psychology/Behavioral Neuroscience major?

PERCEPTIONS OF COURSE:

3. What are some thoughts you had about PSYC 342: Biological Psychology *before* starting the course? What are your thoughts about the course now?

STIMULATION OF CURIOSITY (STATE):

4. How, if at all, did your perspective of the course change throughout the semester?
5. What were some of the factors that resulted in the perspective change?
6. Describe what these factors meant for you.
7. In what ways, if any, did these factors present information that was different than your understanding of PSYC 342: Biological Psychology prior to the class (**incongruence**)?
8. In what ways, if any, did these factors broaden and/or deepen your understanding of PSYC 342: Biological Psychology (**competence**)?
9. In what ways, if any, did these factors fill any gaps in your understanding of PSYC 342: Biological Psychology (**information-gap**)?

TRAIT CURIOSITY IMPACT ON STATE CURIOSITY:

10. What are some reasons why you found PSYC 342: Biological Psychology particularly interesting/uninteresting?
11. What behaviors and experiences may have impacted your motivation in this course?

12. How did these behaviors/experiences connect with _____ factors and/or critical reflection activities that you described above?

APPENDIX E

Text of Email Solicitation

PARTICIPANTS NEEDED IN A RESEARCH STUDY:

In Pursuit of Transformative Learning: Exploring the Stimulation of Curiosity through Critical Reflection in the College Classroom

Hello! Thank you for taking the Curiosity and Exploration II inventory that was used as the pre-and post-assessment for my study. Based off of the results, I would like to ask you to participate in an interview in order to further analyze the effects of critical reflection activities in the stimulation of curiosity in college students. Selected students for the interviews are currently enrolled in PSYC 342: Biological Psychology fall 2017. Participation involves one approximately 20-30 minute in-person interview. Participants who complete an interview will be presented with a \$5 gift card. Please contact Bo Bae at 253-343-4498 or bbae@sandiego.edu for more information.

irb@sandiego.edu irb@sandiego.edu

Fri, Jun 23, 2017 at 9:37 AM

To: bbae@sandiego.edu, cgetz@sandiego.edu

Jun 23, 2017 9:37 AM PDT

Bo Bae
Sch of Leadership & Ed Science

Re: Exempt - Initial - IRB-2017-161, In Pursuit of Transformative Learning: Exploring the Stimulation of Curiosity Through Critical Reflection in the College Classroom

Dear Bo Bae:

The Institutional Review Board has rendered the decision below for IRB-2017-161, In Pursuit of Transformative Learning: Exploring the Stimulation of Curiosity Through Critical Reflection in the College Classroom.

Decision: Exempt

Selected Category: Category 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Findings: None

Research Notes:

Internal Notes:

Note: We send IRB correspondence regarding student research to the faculty advisor, who bears the ultimate responsibility for the conduct of the research. We request that the faculty advisor share this correspondence with the student researcher.

The next deadline for submitting project proposals to the Provost's Office for full review is N/A. You may submit a project proposal for expedited or exempt review at any time.

Sincerely,

Dr. Thomas R. Herrinton
Administrator, Institutional Review Board

Office of the Vice President and Provost
Hughes Administration Center, Room 214
5998 Alcalá Park, San Diego, CA 92110-2492
Phone (619) 260-4553 • Fax (619) 260-2210 • www.sandiego.edu