

MOVING BODIES, MOVING MINDS: A CASE STUDY EXPLORING TEACHING AND
LEARNING IN A MOVING CLASSROOM

A Dissertation

by

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December 2014

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This dissertation meets the standards for scope and quality of
Texas A&M University-Corpus Christi and is hereby approved.

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ABSTRACT

The qualitative case study explored teaching and learning in a moving classroom, a unique learning environment. “Moving classroom” is a term coined by the researcher and refers to a classroom where instructors and students have the opportunity to move during class. For this study, the mode of movement was stationary bicycles. The purpose of this study was to identify how the moving classroom informs the teaching practices of instructors and the learning experiences of students in undergraduate kinesiology courses in South Texas. The rationale for this inquiry is that physical education requirements have decreased (Flegal, Carroll, Ogden, & Curtin, 2010), and prolonged sitting for students in both K-12 schools and collegiate settings has increased (Desai, Miller, Staples, & Bravender, 2008; Ferrara, 2009) despite findings which link physical activity to improved learning (Sattelmair & Ratey, 2009).

This study was guided using an interpretivism framework which aims to make meaning and understand lived-experiences (Crotty, 2004; Merriam, 2009). This study was further informed through work in brain neuroplasticity which examines how an induced change in the nervous system influences change in function and behavior (Shaw & McEachern, 2001). The bounded case of the moving classroom included two instructors and 76 students across three semesters.

Findings indicated that the moving classroom was favorable for college students who balance multiple demands. Student participants valued the autonomy to choose how to integrate into the learning environment. Findings also indicated that students had body awareness including posture and movement, and the influence of posture and movement on cognitive attributes. Participants also experienced increased caloric expenditure in a variety of ways. The findings indicated that the purpose of movement must be clear as to not be confused with that of

an exercise class. Specific challenges identified included distractions from the physical space, class schedules, instructor workload, and instructor experience.

The implications of this study raise questions about how movement and activity can be integrated into a classroom, and what the role of physical activity is within the learning environment. This study raises further questions about the role of physical activity and movement in cognitive functioning within learning environments. Additionally, this study informs how health may be impacted from less sitting time in educational settings.

DEDICATION

“Many are the plans in a person’s heart, but it is the Lord’s purpose that prevails” -

Proverbs 19:21 NIV

To my Lord and Savior, Jesus Christ, for leading me on this journey. The moving classroom was informed and supported by people of this world, but Lord, you divinely arranged all of it. Thank you for the creative energy, encouragement, provision, and refuge you have provided along the journey. Thank you for the life purpose you have given me through this work to help others have healthier lives.

To my absolutely amazing family who have been unwavering in their support, prayer, and encouragement. To my husband Chris Williams, my best friend, thank you for being a sounding board, a voice of reason, and for your unfailing love and encouragement. To my parents, Ron and Margaret Barnes, thank you for parenting in a way that truly never limited our options or possibilities. Thank you for allowing your children to explore this world and learn from it even if it required clean-up or repair afterward. Most of all, thank you for the love you share with our family and others each and every day!

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I want to acknowledge the faculty at Texas A&M University – Corpus Christi. The late Dr. Caroline Sherritt with whom I first shared my idea of a moving classroom, thank you for believing in me and teaching me so much about what it means to be a female leader in education. You left us before you could see this project to completion, but I feel your warm smile from a distance and I know you would be pleased. I thank my committee: Dr. Kakali Bhattacharya, Dr. Randall Bowden, Dr. Randy Bonnette, and Dr. Marty Ward; the time you have dedicated to offer your mentorship, feedback, and expertise is invaluable. To Dr. Bhattacharya, the countless hours you invested in me and all the students with whom you work is extraordinary. Thank you for introducing me to qualitative research, helping me discover my own story, and teaching me how to share the stories of others. To Dr. Bowden, your tenacity to support students is remarkable, and I believe is a rare find in the political climate of higher education; thank you for being a student advocate, leader, and mentor. Dr. Bonnette and Dr. Ward, your mentorship has extended beyond the bounds of this project, and I look forward to continued friendship and collaboration.

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CHAPTER 1: INTRODUCTION

It is Wednesday morning at 10:45 am. I am racing across town in my ten-year old two-door economy car that I have had since I was an undergraduate student. I am sweating from walking quickly to my car from my office. I immediately turn on the air conditioning as high as it will go, and push my hair away from my face. I am running late to a doctor's appointment. My physician said she wanted me to come in to review some blood work that I had done a couple of weeks ago.

As I start to drive away from campus, I begin to think about my health, "I know I have not been taking care of myself as well as I should. I feel that I am juggling dual responsibilities as a faculty member and those of a student. Another deadline is always lurking. The stress is mounting up, and I take little time out for exercise or to cook a healthy meal." My thoughts start to fade into pondering the medical possibilities I could face today, I think about the possibilities. "Could it be that she saw a blood glucose level that indicates diabetes? Maybe it is my thyroid, I have been gaining weight. . . Perhaps it is anemia, but I don't think I have the symptoms. . ."

As I sit at a red light and anxiously wait for it to change, I think back to the Medical Terminology and Conditions course that I taught this morning. I go over the things I need to do for that course in my head, "Okay, when I get back to the office, I need to grade homework assignments, write an exam, and post the final project assignment to the on-line class management system." My mind quickly shifts to a paper I need to write for my qualitative methods class. I think through the timeline in my mind. "I have two weeks to finish the paper." I go through my timeline and determine that I need to finish writing my subjectivity statement and research purpose and questions. The topic I have chosen for this paper is an "okay topic", but I am not excited about it. I see other students in my class who are passionate about their

topics. I feel like I am settling and wish I was excited like my classmates are. “I want to research a topic that is important, meaningful, and going to make a difference.”

At 11:05 am, I finally arrive at my doctor’s office, quickly walk inside, sign in, and look around for a place to sit. Most individuals in the waiting room are at or over the retirement age, and I realize that I will likely be waiting here for a while. I choose a seat that faces the television that is airing a 24 hour news channel. As I glance around the room, I notice a larger white-haired gentleman who has a bag of medications in his lap. I also notice a mom and her teen daughter, the mother appears to be morbidly obese and tries to comfort her overweight looking daughter who is likely there for a respiratory condition as she has tissues and is coughing continually. Finally, I realize that the number of individuals in this room who appear to be overweight or obese is the majority. I think about myself. “What has happened to me? My body has gotten larger; morphed into a person I do not know. I feel sluggish, worn out, a product of my academic and career sacrifices. I am continually sitting at a desk trying to make an important deadlines.” I begin to ask myself “is all of this worth it? Have I completely minimized the importance of my health at the expense of a busy schedule while striving for career and academic success? What has happened to our society? What has happened to me? This is not an acceptable way to live life.”

I begin to check my e-mail from my phone as I continue to wait to meet with my doctor. I open an article that a colleague sent me discussing how the Texas high school graduation requirements have changed. The state has removed the physical education requirement. I cannot believe what I am reading! I glance again around the room noting the prevalence of unhealthy weighted individuals in this small room. I think again about myself. I think “there has got to be

a better way to have schools help people become healthier rather than contributing to the problem.”

As I sit in the waiting room, looking at the article on physical education, and looking around the room at the people waiting, I recall listening to an interview on NPR radio with Dr. James Levine, an endocrinologist at the Mayo Clinic who was discussing the concept of using treadmill desks in work environments to reduce sitting time, and increase movement. I think to myself “that is what I need to get me moving and help clear this foggy mind. Wait . . . what if we had those kinds of desks in schools? Would it be possible that implementing exercise or simply slow constant movement during a class or throughout a school day could actually make us and our students more productive? Healthier? Could this change the way we do school and the way we think about our health? How could this concept influence the learning environment in the classes that I teach in a college setting, and can this be transferred over to groups of younger school children? Are there implications for this with individuals who have learning disabilities? My mind is spinning. I think I may be onto a novel concept which could change me, my students, and make a small difference in our overweight society.” I smile with excitement and forget for a brief time that I am at the doctor’s office. I now have a more interesting topic for my qualitative research class. Now, how can I pull this off?

I hear my name called, and quickly walk back with the nurse, Maria. She has a welcoming smile, turns to me and says, “okay, let’s get your height and weight.” With a deep breath, I step onto the scale.

Subjectivities

The narrative above includes many of my subjectivities that are interwoven into this inquiry. Subjectivities, or “personal stakes of the researcher” (Peshkin, 1988, p. 17), are present

across all types of studies. Bhattacharya (2007b) framed subjectivities as the researcher's personal and professional investments, assumptions, and values that the "researcher brings to the table" (p. 10). The narrative above demonstrates my values, experiences, personal and professional interests. It also describes the inspiration for this study of the moving classroom where instructors and students are given the opportunity to ride on stationary bicycles during class. Peshkin (1988) urged researchers to acknowledge their subjectivities consciously, and to identify their subjectivity in a systematic way throughout the course of the research.

Acknowledging and monitoring my subjectivities adds trustworthiness and rigor to the study. I work to recognize the assumptions I bring to the study, and the role my assumptions played in constructing a shared understanding of participants' lived experiences. Peshkin further claimed that in the social sciences research, "subjectivity is invariably present" (1988, p. 17) in research. Jackson (2004) explained that subjectivity as a "self that is fluid, contradictory, and produced in relationships with others and everyday practices" (p. 673). Therefore, who I am is connected to why I conducted this study. My personal belief systems about learning, body, and physical health and well-being are integral parts of the research.

This view of subjectivity is consistent within the constructionist epistemology of qualitative research, grounded in the belief that people construct meanings and understanding of their lived experiences in multiple ways (Crotty, 2004; Merriam, 2009). My meaning and understanding of one situation may be very different from another individual's understanding or meaning that they make out of the same situation. Thus, the narrative above reflects not only my interpretation, but also the intersection of my subjectivities with the study. Additionally, in this study, meaning-making is a shared effort between both the participants and the researcher.

Therefore, as part of this collaboration, it was critical to know the ways in which the researcher constructs her understanding.

This study was grounded in the theoretical framework of interpretivism, which focuses on how individuals understand their experiences, and the meanings they attribute to those experiences (Merriam, 2009). In qualitative inquiry, conducted through the lens of interpretivism, the researcher is the instrument; the interpreter. The researcher collects the data, analyzes the data, and represents the data from lived experiences. The researcher's "autobiography and identity – life experiences, knowledge, training, emotions, values, attitudes, beliefs, gender, ethnicity, and so forth – influence and affect how you navigate through the enterprise and approach other important elements, such as the relationship between you and your participants and the analysis of your data" (Saldana, 2011, p. 22). Consequently, researcher subjectivities become interwoven and joined with the data (Peshkin, 1988).

In keeping with constructionism in qualitative research, this study invited participants to share in the process of knowledge construction through various types of verification exercises with the participants about the ways in which the researcher's subjectivities intersect with how meanings are constructed from the participants' stories. The processes of member checks and other elements of trustworthiness and rigor are discussed further in chapter three. The subjectivity narrative found at the beginning of this chapter adds accountability and illuminates the values, beliefs, and investments with which data was interpreted and later constructed into meaningful summations of lived experiences and understandings gained by the process of inductive analysis. Therefore, subjectivity narratives add rigor and transparency which demonstrate how the researcher conducts herself. Such demonstration for this study was done via a first person narrative.

Writing in First Person

Writing in first person is extremely common in qualitative research (Saldana, 2011) because the researcher is the data collector, analyzer, and presenter. Writing in first person reflects not only my interpretation, but also reflects the intersecting of my subjectivities with the study. However, one of the reasons for using first person in this work extends beyond qualitative research. In academic writing, the APA publication manual recommends avoiding the ambiguity that comes with speaking in third person and passive voice. The APA publication manual, instead recommends that authors use personal pronouns such as *we* (if referring to myself and my coauthors) or *I* (when I am and sole author) for clarity (American Psychological Association, 2010).

Background and Context

Physical exercise in school has been shown to have a positive impact on academic performance. Sattelmair and Ratey (2009) stated that “the quality of physical education is vitally important to cognitive and academic outcomes” (p. 361). Vigorous physical activity has been associated with high academic grades in middle school age children (Coe, Pivarnik, Womack, Reeves, & Malina, 2006) as well. The benefits of exercise and physical education on students’ cognitive abilities are widespread and found throughout the literature (Åberg et al., 2009; Coe et al., 2006; T. Dwyer, Blizzard, & Dean, 1996; Hillman, Castelli, & Buck, 2005; Ploughman, 2008; Ratey, 2008; Reilly, Buskist, & Gross, 2012). Ironically, many schools and states have decreased the time spent on physical education during school days due to increased demands for standardized testing. Regardless of the scholarly support for exercise and movement in schools, Burgeson, Wechsler, Brener, Young, and Spain (2001) reported that only 50% of schools in the

United States require physical education in first through fifth grades. This figure decreases to 25% in eighth grade, and ends with only 5% by the senior year of high school.

De-emphasis of physical education and movement in schools is a complex problem that not only includes academic performance, but also has serious health implications. Obesity is becoming an epidemic in the United States. The prevalence of obesity exceeds “30% in most age and sex groups except for men aged 20-39 years” (Flegal et al., 2010, p. 238). Our society as a whole is facing major health risks associated with increased prevalence of obesity, including hypertension and diabetes. Flegal et al. (2010) notes that “the increasing incidence of diabetes worldwide is of considerable concern (p. 241). The problem of decreased movement on a daily basis is multifaceted and impacts not only the health of children, but all members of society either directly or indirectly.

Traditionally, education has involved sitting at a desk while listening to instruction. High stakes standardized testing, as well as additional societal conveniences have quite possibly reinforced prolonged sitting in the classroom and restricted daily physical movement. However, this is not a problem found only in kindergarten through twelfth grade (K-12) schools. Prolonged sitting and inactivity is seen in collegiate settings as well (Desai et al., 2008; Ferrara, 2009), and has negative impacts such as decreased production in the workplace (Musich, Hook, Baaner, & Edington, 2006). Further, sitting and inactivity is costing what is approaching hundreds of billions of dollars in healthcare costs (Wang, Beydoun, Liang, Caballero, & Kumanyika, 2008). On the whole, we have become a sedentary society which is having significant consequences on our health and well-being. Significant impacts of obesity trends are not only limited to health concerns and healthcare costs, but also influence social interaction and workplace production. These concerns are discussed further in chapter two.

Rationale for Study

Sattelmair and Ratey (2009) have recognized the link between physical activity and learning, and argued that physical activity has positive effects on learning. These findings suggest that law makers and educators should rethink and reform the traditional ways that physical activity is incorporated in schools. Ratey (2008) explored the experiences of students and teachers at Naperville Central High School in Chicago, where participants engaged in cardiovascular conditioning prior to the first bell of the day. The researchers termed this zero hour PE as the objective was to incorporate physical activity prior to the start of the school day (Ratey, 2008). Students in the study scored abnormally high compared to other U.S. children on the Trends in International Mathematics and Science Study (TIMSS) which measures global achievement in math and science. Naperville finished first in the world in science, and sixth in the world in math. “In addition to priming our state of mind, exercise influences learning directly, at the cellular level, improving the brain’s potential to log in and process new information” (Ratey, 2008, p. 35). The case at Naperville points to the importance of rethinking the way that we engage students in physical exercise in academic settings.

Kilbourne (2009) focused on physical exercise in the collegiate setting. He utilized stability balls, rather than chairs in an undergraduate kinesiology classroom and found that overall, this small amount of movement required to maintain balance produced a positive experience in the learning environment. Kilbourne (2009) reported that:

The student’s responses to the questionnaires clearly demonstrated an excitement and enthusiasm for having the option to use an exercise ball for a seat during class. Responses to each question, from students’ ability to pay attention, take notes, engage in classroom discussions, and take exams, were all 4.0 (positive) or higher (p. 14).

The work by Kilbourne (2009) indicates that there were positive learning experiences reported by students who engaged in a classroom which was slightly altered with the use of stability balls (also called physioballs) as chairs.

An academic conversation about the benefits of movement on the brain exists across multiple disciplines. A review of approximately 45 studies in a meta-analysis examined the effects of exercise on cognitive ability (Tomprowski, 2003). According to this filtered resource, acute bouts of exercise selectively facilitate multiple cognitive processes. In addition, moderate levels of aerobic, steady-state exercise seem to facilitate cognitive functioning (Tomprowski, 2003). This work indicates that both aerobic and anaerobic exercise appear to facilitate cognitive processes.

Although much more work is needed in this area, physical activity and movement seem to have positive effects on learning and cognition. The literature in the fields of learning and pedagogy as well as studies done in the field of sport performance have suggested benefits of movement on brain processing. However, schools, legislators, and researchers have yet to address how physical activity and movement can be best implemented into the school day and within an academic setting. Additional research is needed to discover creative implementations of physical activity and movement in school settings.

This case study explored teaching and learning in the context of a moving classroom, where students and instructors ride on stationary bikes at individualized paces during an undergraduate kinesiology course. A case study is defined as a system which is bounded by the setting or context (Creswell, 2007). For this study, the moving classroom was a bounded system which included both the instructors and students of the three classes who met in the moving classroom. The goal of this qualitative case study was to gather an in-depth understanding of

students' and teachers' experiences within the context of a moving classroom, using multiple qualitative methods of data collection which included interviews, focus groups, observations, and photographs. Findings from all data sources were triangulated.

Research Purpose and Questions

The purpose of this case study was to identify how a moving classroom informs the teaching practices of instructors and the learning experiences of students in undergraduate kinesiology courses in South Texas.

The following research questions informed the study:

1. How do instructors reflect on their experiences of teaching in a moving classroom?
2. How do students reflect on their experiences of being part of a moving classroom?
3. What do instructors and students identify as challenges while teaching and learning in a moving classroom?

Operational Definitions

- Kinesiology courses – refers to an undergraduate courses in which the course content is delivered face-to-face, primarily via lectures and digital presentations, at regularly scheduled meeting times.
- Moving classroom– I have coined this term to refer to a classroom where students are continuously in motion. For this study, the moving classroom involved the opportunity for students to move on stationary spinning bicycles during class. The bikes were outfitted with custom writing desks to allow for note taking and reference material (See Figure 1). Students were instructed to move at an individual pace that would be most efficient for the individual to attend primarily to the instructor and the course content.

- Instructional practices – includes how instructors not only prepare for class, engage with students, and deliver course content, but also how the physical space of the learning environment is configured.
- Learning experiences - includes how students interpret the learning of course content, including the understanding and retention of that course content.



Figure 1. Custom fit bike desk.

Methodological Framework

This study uses a qualitative form of inquiry. Qualitative research is utilized specifically in the study of humans within a particular environment (Merriam, 1998). Grounded in the epistemology of constructionism, qualitative research accepts the existence of multiple truths (Crotty, 2004). Meaning is constructed where these multiple realities or interpretations exist within the context of a single event. The researcher does not necessarily ‘find’ knowledge that exists outside of the self, waiting to be discovered, but constructs it within themselves (Merriam, 2009; Saldana, 2011). Qualitative researchers “try to observe the ordinary, and they try to observe it long enough to comprehend what, for this case, ordinary means” (Stake, 1995, p. 44).

The goal is to come to an insight and understanding about social life, not necessarily to predict or control it. Thus, qualitative inquiry is emergent (Merriam, 2009) and flexible to meet the participants and the environment where they are and to make meaning of their experiences. Unlike quantitative inquiry where the aim is to control variables, qualitative research aims to discover real contexts, situations, and environments. Because no aspect of the study is ‘controlled’, the researcher must be flexible studying people within real life contexts which are capable of dramatic change. The qualitative researcher strives to capture these real situations where social ebb and flow are sure to occur.

In this case study, grounded in the epistemology of constructionism, I accept that each individual makes individualized meanings of their own experiences of the moving classroom. I endeavor to construct knowledge in the form of multiple realities, which can be better understood within a social context.

Interpretivism

Grounded specifically in the theoretical framework of interpretivism, which guided by the epistemology of constructionism, this study aims to interpret meanings of individuals and collective meaning that is made in the social context of the moving classroom environment. Using interpretivism, the researcher becomes the observer of individuals in their natural setting, in order to make sense or interpret phenomena and the meanings people bring to them, and how they construct their worlds (Denzin & Lincoln, 2005; Merriam, 2009). This type of inquiry strives to gain an in-depth and often complex understanding of humans within their environment by empowering individuals to share their stories about these experiences (Creswell, 2007). The researcher interprets what she sees, hears and understands and in this way the researcher observer will be the “primary instrument for research collection and analysis” (Merriam, 1998, p.

7). Because the human is the instrument, limitations of being human will exist such as mistakes, missed opportunities, and personal biases (Merriam, 1998). While there are limitations that do exist, there are also tremendous benefits, including an in-depth understanding of a particular environment, individual, or case. Additionally, a lack of structure allows for the researcher to explore the unforeseen events and change direction in pursuit of meaning (Merriam, 1998).

I chose interpretive qualitative inquiry as a theoretical framework in order to gain an in-depth understanding of how the students and instructor interpret and make meaning of the teaching and learning experiences within a moving classroom. The data collected in this study included instructor interviews, student focus groups, observation field notes, and photos which were collected over the period of three academic semesters (approximately twelve months). Further details are provided in chapter three.

Brain Neuroplasticity

Brain neuroplasticity is largely founded in current science of the brain. Though research in the area of neuroplasticity is largely investigated quantitatively, neuroplasticity does provide a valuable lens in explaining the relationship between movement and exercise and the brain. This connection is an important consideration when considering cognitive functions such as learning, memory, and attention within the academic setting. The term brain neuroplasticity, refers to an “induced change in some property of the nervous system that results in a corresponding change in function and/or behavior” (Shaw & McEachern, 2001, p. xvi). New developments in the study of neuroplasticity suggest that exercise specifically may be important for change to occur in the brain. Ratey (2008) describes that the brain as flexible, or plastic; “more Play-Doh than porcelain” (p.35). Additionally, neuroscientist Van Praag, Kempermann, and Gage (1999) indicates that there is preliminary evidence in the literature to suggest that an ‘enriched

environment’ may produce a variety of brain changes. However, enrichment is difficult to construct. It may include social stimulation, social interaction, physical activity, and learning.

Current research examines exercise and brain plasticity specifically in animal models. For example, Berchtold, Castello, and Cotman (2010), using rats, found that the cognitive benefits of exercise lasted for several weeks after the exercise intervention. Results from the same study indicate that an introduction of a delay between exercise and cognitive training improved rats’ acquisition of a new skill, but did not necessarily improve memory. Additionally, Van Praag (1999) found that mice who had unrestricted access to running wheels showed cell proliferation in the brain compared to other groups. Both animal studies by Berchtold et al. (2010) and Van Praag (1999) demonstrate that exercise/movement of the body may create change in brain tissue and neural pathways, and could influence learning. Further, Ratey (2008) suggests that exercise may help to ‘balance neurotransmitters’ and other neurochemicals in the brain, as well as release brain-derived neurotropic factor (BDNF); an important protein which is a precursor to nerve cell development in the brain. Quantitative work in the area of neuroplasticity indicates that brain changes do occur with exercise in animal models which inform a connection between exercise and the brain. Practical implementation of exercise interventions within human participants in educational settings is lacking in the literature. Therefore, this qualitative case study of a moving classroom allows for understanding of both instructor and student experiences when exercise is incorporated into the learning environment.

Limitations of the Study

Although this study is informed by the study of the brain and neuroplasticity, this study does not aim to discover or reveal specific physiological processes or changes that may occur in the classroom as a result of the moving environment. Therefore, the aim of this study was for

understanding the experiences of participants in a moving classroom environment rather than determining the cause and effect relationship of movement on brain functioning. Other considerations should be made to the transferability of the study findings. The population being studied included kinesiology students who possibly had an existing affinity towards movement and health and are likely more accepting to the approach compared to the general population. Moreover, the instructors that chose to teach the content of health and kinesiology was likely because they believed physical activity to be an important aspect of life. Also, it is important to consider that the student-participants who stepped forward to volunteer for the focus group activities were primarily those students who persisted with the bike riding throughout the course. These existing values of movement and exercise may limit the transferability of the findings to other populations.

Last, this study was conducted in a fitness facility for ease of access to the stationary bicycles. Therefore, the environment was not intended for academic preparation, and had several obstacles to overcome in terms of design and set up of the physical space which included but was not limited to lighting, access to teaching technologies, and noise from adjacent exercise rooms. Specific finding regarding these obstacles are expanded on in chapter four. These limitations should be considered when transferring the findings of this study to new environments.

Significance of the Study

The way that school and learning environments are currently designed favors a sedentary life-style, which has significant implications for obesity and other health-related problems. Additionally, quantitative work in the area of neuroplasticity and exercise suggests that the brain will change with exercise, and could have positive effects on learning and cognitive processes. Therefore, the aim of this study was to increase movement within the context of the classroom in

order to not only give an opportunity for better health, but also understand the learning and teaching experiences of instructors and students within the context of a moving classroom. Specifically, this study is focused on the experiences of students and instructors in higher education.

Chapter Summary

The unique learning environment of the moving classroom was birthed out of a perceived problem about the way we do school in a traditional setting. These settings include increasing limitations on movement within the learning environment, which has been influenced by a sedentary society. At the same time, the obesity epidemic is becoming a greater concern. Additionally, the consequences of high stakes testing has pushed many schools and legislators to focus primarily on the traditional academic disciplines such as math, science, and reading while reducing time for exercise and movement. Therefore, to address a balance of both education and physical health, educators and administrators must be creative in finding ways to incorporate both needs, while meeting the expectations of academic rigor and overcoming the more prevalent norms of society to live a sedentary lifestyle. This case study has the potential to yield insight into how educators can include movement into the classroom. It will explore how both instructor and student participants made meaning of their experiences of moving on stationary bikes while engaging in an undergraduate college level course.

CHAPTER 2: REVIEW OF THE LITERATURE

As mentioned in chapter one, there were many forces driving the inquiry of the experiences of students and teachers in a moving classroom. In this chapter, I will first explain the influence of policy which dictate much of how learning environments are structured. Next, I will discuss the epidemic of obesity both as a national and global concern. Additionally, I will review studies which link movement to positive brain function including possible influences on learning and cognition. Finally, I will describe a limited number of examples which specifically address the influence of exercise and movement in the learning environment.

Policy Influences

A Nation at Risk: The Imperative for Educational Reform (Members of the National Commission on Excellence in Education, 1983) characterized the American public education system and performance of students as “mediocre.” The same report tied educational policy to global economic competition (Spring, 2005). *A Nation at Risk* brought attention to the ways the U.S. was being outpaced by other countries technologically and economically. This led the American system of public education to come under fire by critics. Essentially, “the *A Nation at Risk* report made the public schools a scapegoat for the difficulties the United States was having in the global economy of the 1980s” (Spring, 2005, p. 5). The country’s concern for public education continued over the next two decades, with the government calling for more accountability and testing in education. The culmination of this concern was No Child Left Behind Act (NCLB) of 2001, which has had a significant impact on the way we educate children in the United States. As a result of NCLB, schools, teachers, and students are all subjected to high stakes testing, an accountability system that has placed an emphasis on drilling for multiple choice tests over doing research, projects, and scientific inquiry as other successful nations are

doing (Darling-Hammond, 2007). Often in U.S. public schools, nothing seems more important than students performing well on standardized tests. However, it is clear that schools alone are not responsible for student success. Programs that address healthcare and nutrition, safe and secure housing, and healthy communities for children also contribute to achievement, and require attention (Darling-Hammond, 2007). For now, though, public education is taking the majority of the blame for the nation's lack of global economic competition. As a result, government policy seems to be steering our students in a dangerous direction of relying heavily on standardized testing and teaching practices which are hyper-focused on test scores rather than learning experiences, exploration, and discovery.

On September 23, 2011, President Barack Obama remarked on the *No Child Left Behind Act*:

Now, it is an undeniable fact that countries who out-educate us today are going to out-compete us tomorrow. But today, students are sliding against their peers around the globe. Today our kids trail too many other countries in math, in science, in reading. And that's true, by the way, not just in inner-city schools, not just among poor kids, even among what are considered our better off suburban schools, we're lagging behind where we need to be. Today, as many as a quarter of our students aren't finishing high school. We have fallen to 16th in the proportion of young people with a college degree, even though we know that 60 percent of new jobs in the coming decade will require more than a high school diploma. And what this means is if we're serious about building an economy that lasts, an economy which hard work pays off with the opportunity for solid middle class jobs, we've got to get serious about education. We are going to have to pick up our games and raise our standards (Administration of Barack Obama, 2011, p. 1).

Today more than ever, public education at all levels are bearing the burden of the poor economic climate and the lack of competition in the global economy. According to the 2006 Programme for International Student Assessment (PISA) the highest rankings went to European states (with the exception of Canada and Australia), such as Finland and Estonia, and the emerging of new educational empires of Asia: Singapore, Hong Kong, Taiwan, Korea (Tamir, 2011). A report for the U.S. Department of Education outlined U.S. achievements on two international mathematics exams: Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) (Ginsburg, Cook, Leinwand, Noell, & Pollock, 2005). Out of twelve countries (the U.S., Australia, Belgium, Hong Kong, Hungary, Italy, Japan, Latvia, Netherlands, New Zealand, Norway, and the Russian Federation), the U.S. was ranked 8th on TIMSS mathematics scores for fourth graders, 9th on TIMSS for eighth graders, and 9th on the PISA for high school students (Ginsburg et al., 2005). Clearly, there is a need to improve foundational knowledge in elementary mathematics, and for more real-world applications of mathematics in schools. Tamir (2011) believes that the process of globalization is leading to unexpected consequences and inevitably fear by the citizens and government of the United States; we are not at the top economically or in educational assessments. This fear is causing the U.S. education system to be placed under intense accountability policies, such as NCLB and other state rules and regulations, which may in fact be limiting academic progress.

Many states and schools have decreased the time spent on physical education in schools due to increased demands for standardized testing. This is despite studies which show the benefits of exercise, not only in making children more physically healthy, but also aiding learning. Ideally, physical education programs in schools should “engage students on a daily

basis in cognitively, socially, and aerobically demanding physical activity and provide opportunities for physically strenuous play in order to inspire and instill lasting healthy behavior patterns” (Sattelmair & Ratey, 2009, p. 371). Regardless of the positive findings, the percentage of schools that require physical education is 50% in first through fifth grades and decreases to 25% in eighth grade and ends with only 5% by the senior year of high school (Burgeson et al., 2001).

Physical education in school has been shown to have a positive impact on academic performance, with widespread evidence of the benefits in the research literature. Vigorous physical activity has been associated with high academic grades in middle school age children (Coe et al., 2006). A large twin study ($n > 1,200,000$) examining Swedish men born between 1950-1976 found that cardiovascular fitness levels at age 18 predict educational achievements as well as overall intelligence (Åberg et al., 2009). “Clearly, the quality of physical education is vitally important to cognitive and academic outcomes” (Sattelmair & Ratey, 2009, p. 369).

Policy at the national, state, and local levels impact the implementation of physical activity in schools. Policy processes are constantly in flux and largely influenced by what is relevant for a given jurisdiction. Some states may enact legislation that focuses on the relationship between physical education and physical activity, while others focus on the number of hours or amount of time spent in physical education classes. Still others may make a commitment to teaching skills that encourage lifelong physical activity. While policy is deeply influential, it also varies greatly in terms of local agendas and perceived needs. Additionally, policy may often have to move quickly with the resources available. The process, however, is more than a simple weighing of costs and benefits. It is a political process, which is influenced by “public opinion; pressure/interest groups; election results; partisan or ideological distributions

in Congress (or state legislatures/county or city councils); and changes of administration” (Brownson, Chiqui, Burgeson, Fisher, & Ness, 2010, p. 441). Ideally, policy processes should be influenced by real-world observation and examples, and research done in this area. “Currently, one of the most significant constraints is the intense pressure on schools for students to perform well on standardized tests in reading and math so that the school will make adequate yearly progress as defined by the federal No Child Left Behind Act of 2001” (Brownson et al., 2010, p. 441). Not only is education policy influencing learning, but the way learning environments are constructed are also having an impact on the health of children and adults.

Body Composition

Obesity rates in the United States have not improved over the past several years. Data from 2007-2008 shows that the “prevalence of obesity in the United States is high, exceeding 30% in most age and sex groups except for men aged 20-39 years” (Flegal et al., 2010, p. 238). The World Health Organization (WHO) (2000) identified obesity as “a disease in which body fat has accumulated to such an extent that health can be adversely affected” (p. 6). Obesity is a result of an energy imbalance where the energy taken in via calories exceeds energy expenditure. Moreover, the WHO (2000) reports that the “prevalence of overweight and obesity is increasing at alarming rates worldwide” (p. 16). Obesity has become a global epidemic. Developed countries such as Australia and the United Kingdom are seeing Body Mass Index (BMI) numbers - particularly in women - that are nearing those BMI found in U.S. women. This is not merely an issue limited to adults. For American children, BMI values are in the 95th percentile globally just below China (Popkin, 2010). Internationally, the United States ranks in the top two countries (along with Malta) as having the highest prevalence of overweight and obese youth (Janssen et al., 2005).

Within the United States the issue of the obesity is prolific. Rates of obesity vary based on geographic region. The National Center for Health Statistics (2012) summarized information from “self-reported height and weight data that was collected in 2008, which showed that Colorado, Connecticut, the District of Columbia, Rhode Island, and Massachusetts had the lowest obesity rates, whereas Alabama, Mississippi, Oklahoma, South Carolina, and West Virginia had the highest rates” (pp. 19-3). The National Health and Nutrition Survey (NHANES) utilized by the Center of Disease Control (CDC) showed that the prevalence of obesity in the United States was relatively stable from 1960-1980. However, “data from 1988-1994 showed that the prevalence of obese adults had increased by approximately 8 percentage points in the United States” (Flegal et al., 2010, p. 238). Concern for obesity and overweight in the United States led to an ongoing initiative called *Healthy People*. The *Healthy People* document outlines healthy initiatives aimed at decreasing unhealthy body compositions and improving awareness of determinants of major health issues in a multi-year process National Center for Health Statistics [NCHS], 2012). Despite efforts such as *Healthy People*, there is “no indication that the prevalence of obesity among adults and overweight among children is decreasing” (Hedley et al., 2004). Recent data suggest that only 30.8% of persons in the U.S. over the age of 20 years old are at a healthy weight, and 33.9% of adults have met the extreme level of overweight identified as obesity (NCHS, 2012).

The issue of unhealthy weight is further indicated by the current rates in children. Freedman, Khan, Dietz, Srinivasan, and Berenson (2001) found that children who were overweight were “very likely to become obese adults” (p. 713) at a rate of 77% compared to 7% in normal weighted children. Tracking overweight and obesity into adulthood, Magarey, Daniels, Boulton, and Cockington, discovered that “The prevalence of overweight/obesity

increased with age and was higher than that reported in international reference populations” (2003, p. 2). These findings reveal the critical need to address the epidemic of overweight and obesity during childhood and adolescence. Data from 2005-2008 indicate that 10.7% of children age 2-5 years old, 17.4% of children 6-11 years old, and 17.9% of adolescents 12-19 years old are obese (U.S. Department of Health and Human Services, 2010). At face value, these numbers may not seem startling, but considerations must be made for the implications of unhealthy body compositions. Both physical disease, as well as the non-physical consequences of unhealthy weights have significant impacts on individuals, their families, and society.

Health Risks

The high numbers of overweight children and the prevalence of obesity among adults remain a major public health concern. In 1995, total costs (including medical costs and lost productivity) “attributable to obesity alone amounted to an estimated \$99 billion” (U.S. Department of Health and Human Services, 2000). Wang, Beydoun, Liang, Caballero, and Kumanyika (2008) used overweight and obesity trends to predict that by 2030, 86.3% of U.S. adults will be overweight or obese, and that health-care costs “attributable to obesity/overweightness would double every decade to 860.7-956.9 billion U.S. dollars by 2030, accounting for 16-18% of total U.S. health-care costs” (p. 2323). Several health-related conditions such as hypertension and diabetes are increasing with the obesity rate, whereas mortality rates associated with related conditions such as heart disease and stroke have decreased. This decrease in mortality rates is most likely due to improvements in public health care. Of all the conditions associated with obesity “diabetes may be most closely linked to obesity, and the increasing incidence of diabetes worldwide is of considerable concern” (Flegal et al., 2010, p. 241).

Abdominal adipose tissue specifically, has been shown to strongly predict type 2 (insulin resistant) diabetes (Wang, Rimm, Stampfer, Willett, & Hu, 2005), which suggests that health practitioners should not only consider body mass index or complete body fat percentage, but also consider measuring abdominal adiposity using a circumferential measure in predicting risk of diabetes. The U.S. Department of Health and Human Services (2000) reports a host of health problems for individuals who are overweight or at risk of obesity. These include: “high blood pressure, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and some types of cancer” (p. 19-5). Furthermore, Freedma et al. (2001) found that obesity in children correlated to “adult levels of lipids, lipoproteins, blood pressure, and insulin and to morbidity from coronary heart disease (CHD)” (p. 712). The connection between childhood obesity and adult diseases is important in identifying the need to address unhealthy weights in early childhood.

Psychological and Social Considerations

Not only do individuals who are overweight struggle with physical health problems, but they also experience significant psychological and social effects, including low self-esteem, depression, and social isolation (Strauss & Pollack, 2003). Although both males and females can be adversely affected, adolescent obese girls report more social, educational, and psychological problems compared to their male peers (Falkner et al., 2001). Gable, Krull, and Chang (2009) found in a longitudinal study of 8,000 K-3rd grade students that children who were overweight had “difficulties with social relationships” (p. 99), and “self-reported feeling more sadness, loneliness, and anxiety than their never overweight peers” (p. 100). Moreover, at a young age, children associate obese images with descriptors such as “lazy, dirty, stupid, ugly, liar, and cheat” (World Health Organization, 2000, p. 56). Clearly, obesity leads to social discrimination.

Therefore, the social and psychological implications of this disease are just as critical as physical health care treatments and costs.

In adulthood, Ball, Crawford, and Kenardy (2004) reported a decrease in life satisfaction and educational aspirations among overweight women. This indicates that social and psychological consequences of this epidemic could hinder adult career success, particularly among women. Conley and Glauber (2005) observed “a woman's body mass results in a .6 percentage point decrease in her family income and a .4 percentage point decrease in her occupational prestige measured 13 to 15 years later” (p. 1). These findings demonstrate the economic impact of obesity. Additional social findings include women’s decreased likelihood in marrying and decreases in spouse’s occupational prestige and income if she did marry (Conley & Glauber, 2005). Further, Ball et al. (2004) study of young women with obesity found that they were more dissatisfied with work/career/study, family relationships, and social activities when compared with non-overweight women. The literature in this area asserts that there are negative social and psychological outcomes that affect mental health, social relationships, and work/career/academic success.

Health Disparities and Contributors

Although overweightness and obesity occur in all population groups, obesity is most common among Hispanic, African American, Native American and Pacific Islander women (U.S. Department of Health and Human Services, 2000). Across all ages, it appears that minorities and those who have a low-socioeconomic-status are disproportionately affected (Wang & Beydoun, 2007). Significant goals have been established in the objectives of *Healthy People 2020* to strive for equity in health, and not just to reduce health disparities, but to “eliminate disparities and improve the health of all groups” (NCHS, 2012). It is important to

consider health disparities concerning overweightness and obesity in determining the contributors to the disease, as well as the solutions to help decrease the incidence rates.

"Given the global epidemic of obesity, the aim should be: to identify the environmental factors, including societal changes, that have overwhelmed the physiological regulatory process" (World Health Organization, 2000, p. 107). As I discussed earlier, body compositions which include being overweight or obese are a multifaceted and important issues. The most fundamental cause is an imbalance of energy (calories) entering the body and energy being expended from the body (World Health Organization, 2000). The primary culprits include increases in the energy density of food, and a reduction in the level of physical activity (World Health Organization, 2000).

Regarding caloric intake, food security (access to healthy food choices) seems to be one issue, especially affecting minority and low socioeconomic groups. Between 1995 and 2008 "non-Hispanic whites households had the highest (best) rate of food security, 89% in 2008, whereas non-Hispanic black, Hispanic or Latino, and American Indian or Alaska Native households had rates of 74%, 73%, and 77% respectively" (National Center for Health Statistics, 2012, pp. 9-3 - 9-4). One way that policy makers and schools have played a role in improving food security as well as eliminating unhealthy food, is by removing school vending machines and reexamining school lunches. Further, Dietz and Gortmaker (2001), looked at the family in order to identify causes and targets for preventing obesity (see Figure 2). Familial factors include caloric intake such as food choices, and also behavior patterns which influence physical activity such as television watching.

In addition to the behavioral model that focuses on habits which increase energy intake and/or decrease energy expenditure, there may also be social mediators that influence obesity.

For example, Strauss and Knight (1999) found maternal obesity, low family income, and low cognitive stimulation at home were significant predictors of obesity. Furthermore, Egger and Swinburn (1997) considered obesity from an ecological perspective. They concluded that the pandemic of obesity may be related to an obesogenic environment where the host (individual), and the vehicle (i.e. food and exercise), interact with the environment.

A systematic review by Summerbell et al. (2005), considered twenty-two studies on the prevention of obesity in children. Summerbell et al. (2005) concluded that studies focusing on physical activity alone, nutritional training alone, or a combination of physical activity and nutritional education have not been effective. These findings suggest that perhaps the longitude of these studies not adequate to see differences. Another possible explanation is that “the complexity of the problem and its determinants, and the sophistication of the intervention content” (p. 37) need to be considered more closely.

Differences also exist between male and female adolescents in which “weight status of male adolescents appears to be more related to exercise habits than to television or video game habits” whereas “for females, neither videos nor exercise habits appear to be related to risk of being overweight” (McMurray et al., 2000, p. 130). Ethnicity and socioeconomic status were found to be significant indicators. Therefore, the literature suggests that this issue goes beyond simple energy imbalance issues and may be deeply rooted in environmental components, social factors, and gender differences. It is indeed a complex issue.

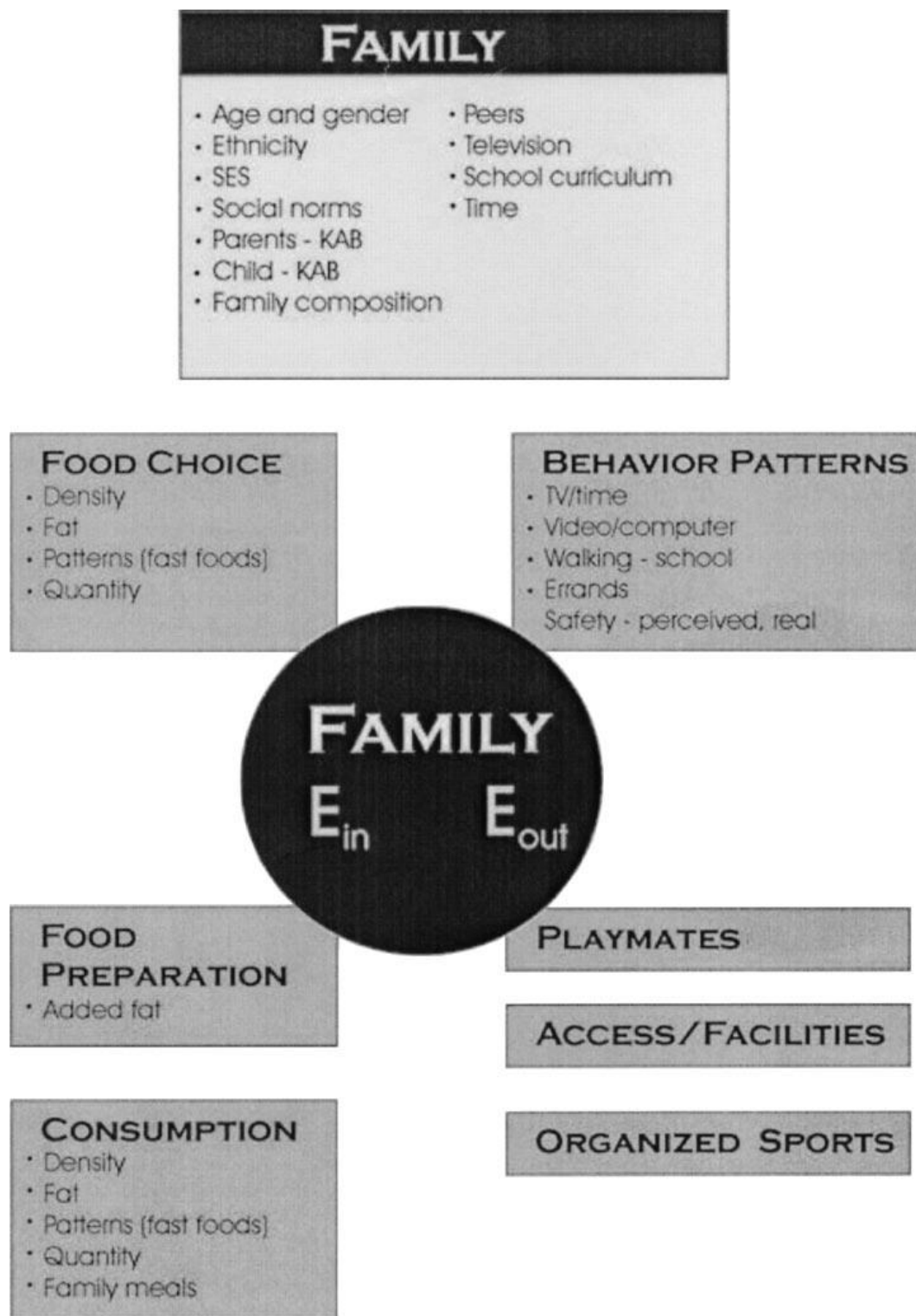


Figure 2. Factors within families which may contribute to obesity or its prevention (Dietz & Gortmaker, 2001, p. 343)

Physical Activity and Movement

Physical activity and movement influence the energy expenditure side of the energy balance equation. It is considered a “cornerstone” in preventing and treating obesity (Bar-Or, 2000), includes a variety of behaviors including exercise or sport-like activities, as well as everyday movement within our environments (e.g. walking, standing). Thus, it is important to look at the energy usage within the human body more closely.

Three major components of energy expenditure include: Thermic Effect of Food (TEF), Basal Metabolic Rate (BMR), and activity thermogenesis (Levine, 2003). The TEF “is the increase in energy expenditure associated with the digestion, absorption, and storage of food and accounts for ~10–15% of total daily energy expenditure” (Levine, 2003, pp. E-675). The energy expended via TEF is a small proportion of the total amount of energy expenditure. It is essentially the energy the body utilizes to digest nutrients taken into the body. The BMR is the energy expended at complete rest and is measured after sleep. Activity thermogenesis is the amount of energy expended when the body is active (Levine, 2003). For the purposes of discussing interventions in prevention and treatment for overweight and obesity, I will be focusing specifically on activity thermogenesis due to physical activity and movement.

Increasing an individual’s activity level along with cutting down sedentary time is central to interventions addressing the energy output side of the equation (see Figure 2). The term ‘sedentary’ has taken on a connotation of meaning relating to a lack of exercise; However, a distinction should be made to differentiate between exercising too little and sitting too much. The term sedentary comes from the Latin root “*sedere* (sit)” (Hamilton, Hamilton, & Zderic, 2007, p. 2660). Obese children are often more sedentary than peers who are non-obese (Bar-Or, 2000). Further findings suggest that lean individuals stand and ambulate approximately nine

hours a day; whereas, obese individuals stand and ambulate only approximately 6.5 hours per day (Hamilton et al., 2007). You may also recall the discussion of the Naperville school study from chapter one where researchers implemented a zero hour PE program with 130 randomly selected male students. The outcome of this intervention was that only one student met the criteria for obesity (Ratey, 2008). Therefore, a plausible approach for addressing overweight and obesity may be to reduce sedentary behaviors which involve sitting in the academic environment.

Activity thermogenesis is made up both of energy expended from exercise and Non-Exercise Activity Thermogenesis (NEAT). While exercise stems from the deliberate attempt to expend energy, NEAT is a byproduct of daily activities such as “walking to work, typing, performing yard work, undertaking agricultural tasks, and fidgeting” (Levine, 2003, p. E-675). Therefore, NEAT is the “energy expended for everything that is not sleeping, eating, or sports-like exercise” (p. E-675). Although the activities that are classified as NEAT may be small, the cumulative effect of the many movements falling into this category make it a “significant contributor to Total Energy Expenditure” (Tremblay, Esliger, Tremblay, & Colley, 2007, p. S209). Making simple adjustments in the way individuals interact with their environment could have a substantial effect on energy balance and body composition.

Non-Exercise Activity Thermogenesis is critical to preventing and treating obesity. Automation and technology which are used to facilitate everyday tasks and create conveniences in advanced societies has decreased the time spent using NEAT (Lanningham-Foster, Nysse, & Levine, 2003). This has resulted in an obesogenic environment (Egger & Swinburn, 1997). Lanningham-Foster et al. (2003) found that energy expenditure was “significantly greater and numerically substantial when daily domestic tasks were performed without the aid of machines or equipment” (p. 1550). These tasks include clothes washing, transportation to work, and stair

climbing. Everyday activities are essential to maintaining the body's energy balance, and "to reverse the energetic impact of mechanization is readily within the grasp of us all" (Lanningham-Foster et al., 2003, p. 1181). Furthermore, the opportunities to engage in NEAT activities far exceed those for organized physical activities which may require a particular location, equipment, or teammates (Tremblay et al., 2007). Levine et al. (2005) estimates that obese individuals could expend an additional 350 Kilocalories (Kcal) per day if they adopt the NEAT-enhanced behavior of their lean counterparts. Incorporating less sitting time in a work or school day may be key in counterbalancing the conveniences of mechanization such as computers, elevators, and drive through windows.

School and Academic Achievement

Obesity is damaging to children and adolescents in terms of overall health, and risk of disease (Freedman et al., 2001). It also includes psychosocial consequences, such as less acceptance by peers (Falkner et al., 2001). There are also significant relationships between obesity and decreased school performance. Gortmaker, Must, Perrin, Sobol, and Dietz (1993) found that "women who had been overweight had completed fewer years of school (0.3 year less)" (p. 1008) compared to non-overweight women. This finding indicates a significant negative relationship between being overweight and school longevity.

Further, Crosnoe and Muller (2004) found that before controlling for confounding variables, obesity predicted lower academic achievement. They concluded that although the difference in achievement was small, "it could impact college admittance or other achievement-based transitions, especially if it cumulated across high school" (pp. 399-400). In a longitudinal study of adolescent health, a gendered link between education and obesity was found where "obese girls were less likely to enter college after high school" compared to their non-obese

peers (Crosnoe, 2007, p. 241). Beyond the implications for academic success and college entry, being overweight or obese may also affect the economic and financial well-being of women and their families (Gortmaker et al., 1993).

Interestingly, being overweight during adolescence is was associated with poorer school performance in terms of GPA (Mo-Suwan, Lebel, Puetpaiboon, & Junjana, 1999). However, this relationship only was found with adolescence in seventh through ninth grade, and the same relationship was not found with children in third through sixth grades. The relationship between overweightness and school performance seems to strengthen as an individual becomes older. Furthermore, evidence from Soyeur, Ünalan, and Elmali (2010) indicate that in a vocational college setting, there was an inverse relationship between physical activity and fatigue. Fatigue, in turn, may negatively affect school performance. Overweight children have lower math and reading scores compared to non-overweight children (Datar, Strum, & Magnabosco, 2004; Gable et al., 2012). Thus, research has demonstrated general associations with overweight and obese body composition as well as subject-specific struggles for individuals in these groups. This is particularly important, considering current legislative efforts, which overemphasize success on standardized tests. The increased focus on testing has resulted in an increase in overall sitting time for students, and reduced opportunities for exercise and movement.

The activity level of children and youth is decreasing while obesity rates within this population are on the rise (U.S. Department of Health and Human Services, 2010). Physical activity has decreased both at home and at school. There are several contributors to the decrease in physical activity levels at home, which include increased time sitting watching TV, playing video games, and less outdoor play time (Costley & Leggett, 2010). In essence, our children and youth are spending more time being sedentary. In school, there are decreases in play and

physical education time (Burgeson et al., 2001), and greater emphasis on core curriculum subjects (Costley & Leggett, 2010). The result is that students are sitting for a large portion of the school day. Although schools may only be part of the solution, it is imperative that they do their part by increasing the opportunity for children to engage in physical activity during the day (Costley & Leggett, 2010). To accommodate the increasing pressure and accountability for students to perform well on standardized tests, it is important that school leaders identify creative and practical ways to include movement and reduce time sitting during a school day.

Movement and the Brain

Body movement positively influences the brain and learning. Success in schools may be found in the positive effects that exercise has on the brain. Therefore, there is a need to implement more movement in a school day for both physical health and effective mental processes. Here, I will discuss the interaction of exercise and brain function including research on brain plasticity in animals and humans, the relationships between movement and cognition, and the limited studies which have incorporated movement into school and academic environments.

Brain Neuroplasticity

As discussed in chapter one, the work done in the area of neuroplasticity has informed this study. Neuroplasticity is defined by Shaw & McEachern (2001) as a change in the nervous system resulting in a corresponding change in behavior or function. Ratey (2008) describes the brain as being moldable much like that of “play-doh” (p. 35) with the addition of exercise. Brain-Derived Neurotrophic Factor (BDNF) is released in the brain during exercise. This neurochemical is thought to encourage neurogenesis, promote resistance to injury and disease, and improve overall mental performance (Cotman & Berchtold, 2002). Ratey (2008) likens

BDNF to “Miracle-Gro for the brain” (p. 40) stimulating neurons to grow and develop new branches. Similarly, Ploughman (2008) refers to exercise as “brain food” (p. 236), adding that along with changes and growth to existing nerve cells, there is also evidence of increased brain vascularization and development of new nerve cells (neurogenesis) which may all be facilitated by exercise. Cotman and Berchtold (2002) explain that “mechanisms that induce BDNF gene expression, such as exercise, can enhance learning” (p. 296). Therefore, BDNF is likely an important link between exercise and body movement and subsequent neuroplasticity. Further, Ratey (2008) indicates that exercise not only acts on the BDNF system, but also likely acts on and balances neurotransmitters between nerve cells and other important neurochemicals within the brain. Research investigating the connection between exercise and promotion of brain function is still emerging, with a limited number of studies done in this area.

Animal Studies. Many of the first studies looking at the effects of exercise on brain plasticity were done using mice and rats in highly controlled laboratory settings. The primary focus of these studies has been on the hippocampus, located in the medial temporal lobe of the brain. In rodents, the hippocampus has been associated with spatial learning and memory tasks (Kramer, Erickson, & Colcombe, 2006). Moreover, molecular and cellular biological research has “established that exercise increases BDNF levels in the hippocampus” (Kramer et al., 2006, p. 1240). Cognitive benefits following exercise lasted for several weeks after an exercise intervention in rats in a controlled laboratory setting (Berchtold et al., 2010).

Mice with access to running wheels (an enriched environment) show greater brain cell proliferation compared to mice who did not have access to running wheels (Van Praag, 1999). Furthermore, rats which had been exposed to a swimming intervention performed better on cognitive tasks than rats which did not have the exercise intervention (Radak et al., 2001). These

findings suggest that providing options for individuals to interact through movement and exercise within daily environments can encourage brain health and that multiple modes of exercise should be considered in developing exercise interventions for the purpose of brain plasticity. A review of the literature on exercise and the brain concluded that “exercise increases cognitive performance in both young and aged animals and increases mRNA and protein levels of BDNF, which may be contributing to exercise induced neurogenesis” (Kramer et al., 2006, p. 1241), as well as affecting neurotransmitter systems. Moreover, the findings from the animal studies “overlap with the results from human studies and suggest that exercise is an effective enhancer of neurocognitive functioning in both young and old animals” (Kramer et al., 2006, p. 1241). This overlap is valuable in beginning the investigation and scholarly discussion about the connection between body movement and brain function.

Human Studies. Recently, the concept of neuroplasticity observed in animals has been investigated in humans. Rasmussen et al. (2009) measured levels of BDNF in eight volunteers during a four hour rowing exercise. Blood samples were taken from both the radial artery as well as the internal jugular vein. They found that “BDNF released from the brain was observed at rest ($p < 0.05$) and increased two-to threefold during exercise ($p < 0.05$)” (p. 1062). Thus, not all BDNF produced in the body comes from the brain, but there is a significant increase in the amount of BDNF released during exercise.

The relationship between fitness levels ($VO_2\text{Max}$) and hippocampal volume was investigated in 10 year-old children using magnetic resonance imaging (MRI) of the brain during performance on a relational memory task (Chaddock et al., 2010). The results of this study showed that “higher-fit children showed greater bilateral hippocampal volumes and superior

relational memory task performance compared to lower-fit children” (p. 172). Therefore, aerobic fitness may be related to the structure and function of the preadolescent brain.

The findings that physical activity increases BDNF and stimulates growth and development of new cells appears consistent across the research literature. In a review of the literature, Dishman et al. (2006) note that some presumed mechanisms for the connection between cognitive function and exercise, such as learning being mediated by “the action of BDNF on synaptic plasticity, which has the potential to underlie cognition” (p. 346). Therefore, the relationship between brain plasticity and exercise influences learning and cognitive processes within the brain.

Cognition and Attention

Cognition is "the science of how the mind is organized to produce intelligent thought and how it is realized by the brain" (Anderson, 2010, p. 1). Theories about human cognition can be traced back to early Greek philosophers such as Plato and Aristotle, who speculated about elements of the mind such as memory and thought. Today, cognition is approached as a complex system, which include information processing, attention, linguistics, and perception (Anderson, 2010). The relationship between exercise and cognition, memory, and learning has been studied in animal models, and there is growing research interest in trying to understand these connections in humans as well.

Cognition. The support for the relationship between aerobic fitness and cognitive task performance has been shown across ages and with a variety of measures. In children, neuroelectrical activity is associated with high fitness levels, as determined by fitnessgram testing in children (mean age 9.6 years old) (Hillman et al., 2005). “Behaviorally, high fit children responded faster to target stimuli compared to low fit children” (p. 6). Thus, high

fitness levels are linked not only to neuroelectrical activity, but also greater neural processing and response time in children. Another study conducted by Williamson et al. (2009) used a randomized trial of physical activity for one year among 102 sedentary persons between the ages of 70 and 89 years old who were at risk of disability. The experimental group received a moderate-intensity physical activity intervention, and the control group received health education. The findings showed that “improvements in cognitive scores were associated with improvements in physical function” (p. 688).

Furthermore, Åberg et al. (2009) focused on early adulthood, stating that this was a developmental phase “in which important cognitive traits are shaped” (p. 20906). They studied Swedish men in sibling pairs, twin pairs, and monozygotic twin pairs. The findings of this study revealed that cardiovascular fitness (measured by cycle ergometer) was positively associated with high cognitive scores, but muscle strength was not associated with cognitive performance (Åberg et al., 2009). The support for the relationship between aerobic fitness and cognitive task performance has been shown across ages and with a variety of measures.

Etnier, Nowell, Landers, and Sibley (2006) conducted a meta-analysis using meta-regression statistical techniques in order to more closely examine the relationship between aerobic exercise and cognitive function. Although many studies (Åberg et al., 2009; Chaddock et al., 2010; Gordon et al., 2008; Hillman et al., 2005; Podewils et al., 2005; Williamson et al., 2009) have individually concluded that there is a strong relationship between aerobic exercise and cognition, the results of the meta-analysis were not conclusive. This was largely because of inconsistencies across the literature in terms of how cognition is measured, as well as varying dosages and measurements of aerobic fitness. Therefore, more work in this area is needed in

order to learn more about the relationship between aerobic exercise and cognitive processes in humans.

Neurodegenerative Diseases. The protective effects of exercise in neurodegenerative diseases such as dementia, Alzheimer's disease, and Parkinson's disease has received an amount of recent research attention. In such diseases, neurons degenerate, leading to cognitive decline. Researchers believe that exercise may help to protect against the natural cognitive decline that comes with aging, and may in fact delay the progression of neurodegenerative diseases (Colcombe & Kramer, 2003; Larson et al., 2006; Laurin, Verreault, Lindsay, MacPherson, & Rockwood, 2001; Podewils et al., 2005).

A study of 41 high-functioning older adults with no known psychiatric disability or dementia found that a cardiovascular fitness training intervention (aerobic exercise from ~40% heart rate up to 70% heart rate) increased neural functioning (Colcombe et al., 2004). Furthermore, individuals over the age of 65 who are in the highest quartile of physical activity (most fit group), have a low relative risk of dementia and Alzheimer's disease compared to those in the lowest quartile participants (unfit group) (Laurin et al., 2001; Podewils et al., 2005).

Additionally, measurements of volumetric differences in the cerebrospinal fluid and gray and white matter as well as neuropsychological outcomes suggest that "fitness and education may both be predictive of preserved cognitive function in aging" (Gordon et al., 2008, p. 825). Therefore, physical activity and overall high fitness appear to be protective factors against cognitive decline in an older population. These findings point to the importance of fitness over the entire lifespan, which begins in childhood. Therefore, introducing preventative programs and exercise interventions starting in childhood may serve to reduce health care costs in adulthood and old-age.

Attention. Attention is the cognitive process that allows for selective concentration on one aspect of an individual's environment while ignoring other things (Anderson, 2010). In other words, it represents an allocation of processing resources. Lack of attention and focus is a common complaint within the school setting. Budde, Voelcker-Rehage, PietraByk-Kendziorra, Ribeiro, and Tidow (2008) studied 150 healthy adolescents. Students who participated in a coordinative exercise group performed better than a control group on a concentration and attention test. Findings "support the request for more acute coordinative exercise in schools" (Budde et al., 2008, p. 223). For individuals who have attention deficit disorder, physical activity and play assist by increasing focus. According to Panksepp (1998), "alternative strategies to implement play and movement in schools is needed and may have positive effects for individuals with Attention Deficit Hyperactivity Disorder (ADHD)" (p. 56). It is plausible that finding new ways of adding movement within the school environment could improve attention not only in fully functioning children, but also in those with an ADHD.

Exercise and Movement in Schools

Based on the available literature, I found no empirical studies which looked at movement interventions within non-physical education classroom settings during class time. However, there are several practitioners who are currently implementing movement within the classroom in unique and interesting ways. These cases were obtained via periodical sources. One example of a practitioner implementing movement in a unique way was done by Kilbourne (2009) who implemented the use of stability balls rather than chairs in a traditional undergraduate kinesiology classroom. Survey findings from Kilbourne's (2009) work did find that this small amount of movement produced a positive effect in the learning environment. "The student's responses to the questionnaires clearly demonstrated an excitement and enthusiasm for having

the option to use an exercise ball for a seat during class. Responses to each question, from students' ability to pay attention, take notes, engage in classroom discussions, and take exams, were all 4.0 (positive) or higher" (Kilbourne, 2009, p. 14).

Another example is from Mulrine, Prater and Jenkins (2008) implemented an active classroom project, attempting to increase concentration and decrease problem behaviors in children with ADHD. The project teachers used physical transition exercises between activities or topics, completed pre-lesson energizers, and included structured movement games for recess. Although the idea for creating an active educational climate came from the need to increase attention and focus with students who had ADHD, it became an intervention for all students. The teachers reported that all students, not just those with ADHD, were "focusing better and paying closer attention" (p. 16). This is a terrific example of how movement can be added into the classroom in fun and creative ways to help all students succeed in school.

Reilly, Buskist, and Gross (2012) tell a story of Daisy Elementary School in Hamilton County Tennessee where students take periodic energizing breaks throughout the day. The "Take Ten" program implements simple movement patterns such as jumping jacks and toe touches intermittently over the course of the school day. Programs like these not only assist student learning and cognition, but also decrease sedentary time, which as noted earlier, is linked to obesity.

Lastly, Naperville Central High School provides a model program in implementing movement (Ratey, 2008; Reilly et al., 2012). This school has made a commitment to movement in something they call "zero hour PE", which takes place before school starts (Ratey, 2008). However, this program was not specifically targeted for children with health risks such as obesity, but rather was targeted for children who were scoring low in reading. The school found

that reading scores did increase after the program was implemented. Today, Naperville has an expanded physical education program focused on exercise for learning called Learning Readiness Physical Education (LRPE) (Reilly et al., 2012). The entire community (teachers, administrators, parents, and students) have successfully embraced the value of exercise as an investment into education. Examples like Naperville support the notion that, through adding movement, schools can become more productive and healthy environments.

Chapter Summary

There is an epidemic of overweightness and obesity within our society that is calling for a significant change in the status quo. However, there is a fundamental issue with school policies which create an environment of sitting and a low level of activity. We are learning more about the benefits of exercise and activity level, not only on the body and physical health, but also on the brain and mental health. In the field of neuroscience, most of the research is done with animals (rats). The majority of this research has focused on cognitive development, and most has been done in isolated laboratory studies. Very few people have made the connection between cognition and obesity. Therefore, a study that explores the relationship between cognition and obesity through movement is one that connects many fields. This present study is multidisciplinary, and has implications for educational administrators, instructional designers, and teachers. Therefore, this study situates itself in multiple fields. Designing instruction through a specific kind of pedagogy can allow for learning which both activates the brain and increases physical activity level. All of these elements intersect within the bounded case (Merriam, 2009) of the moving classroom.

Based on the above review of the literature, I have outlined the need for the present study. The purpose of this case study is to identify how a moving classroom informs the teaching

practices of instructors and the learning experiences of students in undergraduate kinesiology courses in South Texas. In the next chapter, I will describe the methods I used to answer the research questions.

CHAPTER 3: METHODOLOGY

Research Purpose and Questions

Recall, the purpose of this case study was to identify the ways in which a moving classroom concept informs instructional practices and learning experiences of students within an undergraduate kinesiology courses in South Texas. The following research questions inform the study:

1. How do instructors reflect on their experiences of teaching in a moving classroom?
2. How do students reflect on their experiences of being part of a moving classroom?
3. What do instructors and students identify as challenges while teaching and learning in a moving classroom?

Rationale for Qualitative Research

This study has a qualitative methodological approach. As Merriam (2009) points out, “there are many definitions of research, but what they all have in common is the notion of inquiring into, or investigating something in a systematic manner” (p. 3). Specifically, qualitative research aims to study the natural social life of individuals (2011). Thus, qualitative research is utilized in order to gain an understanding about people in their social settings and context. Often grounded in the epistemology of constructionism, qualitative research accepts that multiple truths and realities exist in a single social setting (Merriam, 2009).

Rather than using data analysis methods to distinguish qualitative from quantitative research, Stake (1995) explains the difference by describing that quantitative searches for a cause whereas qualitative research searches for a happening. Unlike quantitative research which often aims to identify cause and effect, qualitative inquiry is interested in a single event, culture, or social setting and the uniqueness that exists (Stake, 1995). Another way to distinguish between

qualitative inquiry compared to quantitative inquiry is the trade-off between breadth and depth; “qualitative research permits inquiry into select issues in great depth with careful attention to detail, context and nuance” (Patton, 2002, p. 227).

Merriam (2009) further identifies a goal of qualitative research which is to understand as opposed to finding cause or relationship. “Scientific, then, becomes a term that is situational and unfixable within qualitative research and calls for contingent methodologies, emergent designs, and critical reflections about subject positions and the need to inhabit them” (Bhattacharya, 2007a, p. 1107). The qualitative researcher allows for flexibility within an informed methodological framework where the researcher plan requires plasticity to meet the events, relationships, and environment in which the study takes place. Metaphorically, Creswell (2007) describes qualitative research as a tapestry with various colors, textures, and blends of material. The goal of the qualitative researcher, then, is to understand and describe the many layers, attributes, and interactions one may discover. This study involves a systematic approach to understanding the social context and unique experiences of students and instructors teaching and learning within a moving classroom environment.

Theoretical Framework–Interpretivism

Interpretivism is a qualitative framework which aims to understand and explain experiences of participants (Merriam, 2009). Stake (1995) further explains that “to a qualitative scholar, the understanding of human experience is a matter of chronologies more than cause and effects” (p. 39). Thus, interpretivism strives to tell the stories of participants and their experiences. Interpretivism accepts the constructionist epistemological framework to reality which asserts that there are multiple realities rather than a single reality or truth (Crotty, 2004). In order utilize interpretivism within a qualitative inquiry, the researcher acts as the instrument

who does not discover or find knowledge, but rather, constructs it (Merriam, 2009). “We emphasize placing an interpreter in the field to observe the workings of the case, one who records objectively what is happening but simultaneously examines its meaning and redirects observation to refine or substantiate those meanings (Stake, 1995, pp. 8-9). Interpretation in qualitative inquiry requires that the study is situated within its social, political, or cultural context (Creswell, 2007). Therefore, interpretivism is a naturalistic approach which studies in a true-to-life setting (Denzin & Lincoln, 2011). In this qualitative case study, the natural context and setting is an undergraduate classroom which includes the participants (instructor and students) along with all content, equipment, social context, and expectations.

The researcher is the interpreter, the instrument, who objectively observes while making meaning and constantly refines meaning. In interpretive inquiry, “researchers make an interpretation of what they see, hear, and understand” (Creswell, 2007, p. 39). The human researcher is not a machine which simply measures, but rather, aims to understand lived experiences. Understanding occurs at a deeper level than simple information gathering. Understanding employs a psychological component and is an intentional process whereas explaining is not; “explaining can promote understanding, but it is not the same” (von Wright as cited in Stake, 1995, p. 38). The researcher and their interpretation cannot be separated from themselves, and includes all of their subjectivities, past experiences, knowledge and prior understanding (Creswell, 2007).

As the researcher, I acknowledged these parts of self through the process of exploring my subjectivities and acknowledging previous knowledge and understanding by reviewing the literature and bracketing. Bracketing is where I made every effort to set aside all preconceived notions of the phenomenon through reflective writing (Saldana, 2011). In summary,

interpretivism is primarily interested in how individuals interpret their experiences, make meaning of those experiences, but essentially, it aims to understand (Merriam, 2009). Meaning making and understanding is a process which is constantly changing and evolving as new information and contexts emerge.

During this constant analysis, I worked up from the data inductively. That is, interpretivism is an inductive approach to qualitative research where the researcher/interpreter builds from the specific details of experiences and multiple meanings of participants and researcher to generalize findings in the form of codes, categories, and ultimately themes of the data (Merriam, 2009). LeCompte (2000) likens this process to that of taking apart a jigsaw puzzle and reassembling it. The researcher collects and interprets the data, and then represents the findings like that of an artist creating or reconstructing what is available to them. Denzin and Lincoln (2005), compare the process to quilting or bricolage where the “interpretive bricoleur produces a bricolage; that is a pieced-together set of representations that are fitted to the specifics of a complex situation” (p. 4). Much like a jazz improvisation, interpretive representation creates “that sense that images, sounds, and understandings are blended together, overlapping and forming a composite, a new creation (Denzin & Lincoln, 2011). A completed qualitative work, then, includes voices of the participants, the response of the researcher, and the complex description and interpretation of the phenomenon which extends the literature (Creswell, 2007).

Methodology-Case Study

I chose to use a case study as a methodology aimed at explaining teacher and student reflections of their experiences within a unique learning environment of a moving classroom. Merriam (1998) contributes to the understanding of a case study research by stating that “the

single most defining characteristic of case study research lies in delimiting the object of the study, the case” (p. 27). Limiting, or “fencing in” the case helps to provide focus and eventual conclusion to the study as without these boundaries one can continue to collect data infinitely (Merriam, 1998).

Yin (1981), further defines the role of a case study by identifying two distinguishing characteristics of the “case study is that it attempts to examine: (a) a contemporary phenomenon in its real-life context, especially when (b) the boundaries between phenomenon and context are not clearly evident” (p. 59). Stake (1995) explains that this ‘uniqueness’ is central and critical to understanding a particular case. Therefore, because the moving classroom was a unique teaching and learning environment, the case study approach to qualitative inquiry was chosen. Creswell (2007) defines case study as a “bounded system (i.e. setting, a context)” (p. 73) of one or more cases.

In this study, the single bounded system includes instructors and students who have experienced the moving classroom as an academic learning environment. The aim of studying a single case qualitatively is to gain an in-depth “understanding of the dynamics present within a single setting” (Eisenhardt, 1998, p. 534). The single unique setting for this case was a learning environment called the ‘moving classroom’. Stake (1995) explains that researchers “try to observe the ordinary, and they try to observe it long enough to comprehend what, for this case, ordinary means” (p. 44). For this case study, I was in the field for three academic semesters, roughly twelve months, as a participant observer. During this time, immersed in the moving classroom environment, I engaged with participants directly with the intention of understanding what was unique about teaching and learning in this setting. Case study aims to find the particularity and complexity of a single case, uniqueness (Stake, 1995). The purpose of this case

study was to better understand the teaching and learning experiences of the participants in the unique learning environment of a moving classroom.

Qualitative data collection within a case study is not limited by ethnographies or participant observation (Yin, 1981), but can “combine data collection methods such as archives, interviews, questionnaires, and observations. The evidence may be qualitative (e.g. words), quantitative (e.g. numbers), or both” (Eisenhardt, 1998, pp. 534-535). Additionally, case study does not have a particular data collection or analysis method that may be found within other methodological traditions such as survey or historical research (Merriam, 1998). During my twelve months in the field experiencing and interacting with participants within the moving classroom, I interacted with two instructor participants and 76 student participants. Data collection for this study included six instructor interviews, seven focus groups, 30 observation field note entries, course documents, and 25 photos (see data inventory in Table 1).

Like all research, there is an expectation to have a trustworthy and rigorous study. Merriam (1995) provides guidelines that can be employed in case study research to address trustworthiness by using triangulation (multiple methods or sources to confirm findings), member checks (getting verification from participants of findings), peer examination (having peers examine data and provide comments), audit trail (detailed description of methods), thick description, multi-site designs (use of multiple sites, cases etc.), modal comparison (description of how the given strategy is typical or similar to other sites etc.), and sampling within (using all entities within a given case to collect data); she identifies these methods as essential. Elements of trustworthiness and rigor are discussed in more detail later in this chapter.

Research Design

The research design includes the integral components of participant selection, site selection, and the role of the researcher; careful consideration of each adds to the rigor of a qualitative research study. Although the word ‘design’ may suggest a very detailed plan such as a blueprint, Patton (2002) eludes to the research design as being similar to that of a broad plan which allows for some flexibility in exploration; it is a logical sequence or plan of getting from here to there (Yin, 2009). Saldana (2002) also states that the research design should be approached provisionally because this mode of inquiry is emergent and ever-changing. Participant, site selection, and the role of the researcher were all considered when developing a plan for this study.

The research design was a case study using an inductive analysis approach to data analysis. This will be a single-case design which is called for when the “case represents an extreme or unique case” (Yin, 2009, p. 47). The moving classroom is a unique concept developed by the researcher, and not an approach used by others in pedagogical setting. This case is typified by the moving classroom itself and those who engaged in both teaching and learning within the unique environment where students and instructors had the opportunity to ride on stationary bikes during class.

Selection of Participants

Since this is a qualitative study, with the goal of developing an in-depth understanding, purposeful sampling (Patton, 2002) was employed. Purposeful sampling is aimed at discovering, gaining insight, and understanding; therefore, a sample must be selected from which much can be learned (Merriam, 2009). Patton (2002) further defines purposeful sampling that which deliberately selects “information-rich cases” (p. 230). As there are no clear rules on sample size

in qualitative research, the sample should “depend on what you want to know, the purpose of the inquiry, what’s at stake, what will be useful, what will have credibility, and what can be done with available time and resources” (Patton, 2002, p. 244). In qualitative case study research, two levels of sampling are employed: the sampling of the case and “unless you plan to interview, observe, or analyze all the people, activities, or documents within the case, you will need some sampling within the case” (Merriam, 2009, p. 81). The sample selection within this case study included the twenty-three students and two instructors who represented the case.

The participants were selected from three undergraduate kinesiology nutrition classes who utilized a moving classroom environment during an undergraduate course. The instructors and students of the classes were solicited for their participation; thus, the case includes both undergraduate student and instructor participants. Participation was voluntary and included an informed consent process. Participants were allowed and informed that they could withdraw from the study at any time.

How participants chose to engage in the moving classroom environment was completely voluntary and had no influence on course grades. The classroom setting allowed for alternative seating options which included tables with chairs, physioballs, and mats which were available in the room if students chose not to participate on the bicycle either on a specific day or for the entire duration of the course. Thus, the environment was flexible and allowed participants to choose if they wanted to ride on a stationary bike each class day.

Gaining Access

Stake (1995) identifies that the procedures for gaining access should be based on both enduring expectation and gaining permissions where needed. First, I established access to the site via approval of the Institutional Review Board (IRB). Also, I solicited instructors and

students for participation in the moving classroom. During the initial meeting with participants, I explained the expected role of participants and the purpose of the study. All participants were informed that their participation was voluntary and that they could withdraw from the study at any time. Additionally, I asked the potential participants if they had any questions. When and only when the potential participant agreed that his or her questions and concerns had been adequately addressed, then and only then, the participant was asked to sign the consent form (can be found in the appendices). Additionally, participants were granted anonymity via a unique number and pseudonym which was unique to each participant. In most cases, participants determined their own preferred pseudonym.

During their participation in the moving classroom, instructor and student participants were asked to further participate in interviews and focus groups. During the initial meeting, contact information was exchanged between the participants and me. After participants had begun to experience the moving classroom, further solicitation via e-mail and class announcements were made for involvement in interviews and focus groups. Once participants replied to solicitations for involvement in these additional meetings, times for interviews and focus groups were scheduled. Two instructors volunteered to teach in the moving classroom and also participate in numerous interviews during and after their time teaching in the moving classroom. A total of 76 students across three semester-long courses participated in the moving classroom study and 23 volunteered to participate in focus groups. A total of two instructors participated across the three semesters, and both agreed to participate in interviews.

Trust and rapport is a critical component to gaining access (Creswell, 2007); therefore, granting anonymity and pseudonyms along with building a rapport was important to gaining trust of the participants. Stake (1995) recommends taking the opportunity to get acquainted with

people, spaces, and schedules of the case early on; in a sense, make a quiet entry. Thus, building this initial relationship with the case and participants is critical to acquiring trust and gaining access. My role as a researcher was a participant-observer which means that I was continually present during the majority of class meetings as to allow instructors and students to become comfortable with my presence in the classroom as if I was a permanent member of the class. This role of being both an insider and an outsider is discussed later in this chapter.

Site of Research

The site of research was at a South Texas University which I will refer to as Cambiar University. Participant interviews and focus groups took place in a meeting room on the University's campus, and in one rare occasion via a phone conversation. The interview and focus group participants included two instructors and 76 student participants who were enrolled in the undergraduate nutrition course. Instructors agreed to participate in the study, and subsequently, students enrolled in the course were given the opportunity and choice to participate in the moving classroom. Moving classes were held in a group fitness room within the student wellness center on this University's campus. Media resources such as a computer, projector, and screen were made available to the instructor and the class during the moving classroom sessions. Students moved on stationary spinning bikes which had custom made 'bike desks' to allow access for note taking. This site was chosen for ease of access to the participants and the class was in "my own backyard" (Creswell, 2007) where a familiarity existed between myself, the participants, and the setting.

Membership Role, Reciprocity, and Ethics

In this study, I assumed the role of both an insider and an outsider. That is, I was an insider as a member of the academic community which I was studying. Not only is this

community located at the same institution of higher education which I was employed, but more specifically, I studied my colleagues and students within the same academic department which I resided. Moreover, I became an insider in each of the moving classroom courses by being a participant-observer. As a participant-observer, I was present as an active member of the course during nearly every class meeting. However, it was nearly impossible to completely become an insider relative to each student and instructor role because my purpose for attending was very different than participants in each course. In this way, I assumed the role of outsider by entering the experiences of another instructor's learning environment for the purpose of conducting research. Both of the roles of insider and outsider come with both risks and benefits.

For the insider researcher, access is easily gained and participants are more open yielding greater depth to the data; conversely, role conflict and issues of research and participant loyalty can arise (Dwyer & Buckle, 2009). Further, Patton (2002), suggests that 'empathetic neutrality' is a middle ground between becoming too involved and risking a loss of judgment and remaining too distant which inhibits understanding. Therefore, as both an insider and an outsider, it was important to try to maintain empathetic neutrality for the sake of neither becoming too close or too distant to the case.

For the purposes of this case study, participants were asked to engage in the following: (a) participate in three to five one-hour focus groups or interviews by sharing experiences about their time within the moving classroom and (b) participate in two to three thirty- minute member check meetings to review the information collected in the previous focus group or interview meetings. However, "consenting to a research project and holding a participant to what was formally consented to are not driven by fixed understandings" (Bhattacharya, 2007a, p. 1102). Rather, the relationship that develops between the researcher and the participants determines the

course of the study, and “the extent to which data are extracted from the participant and the quality of such data” (Bhattacharya, 2007a, p. 1102). Therefore, I was prepared throughout my time in the field for insider/outsider relationship challenge the ethics involved in researching in real-life contexts.

Additionally, Cannella and Lincoln (2011) outline four components of the ethical axis of self which include: (a) ethical substance or the ways in which the researcher legitimizes self morality, (b) mode of subjectification or the rules that one submits to, (c) ethical work which involves transformation of the self into what is ethical and involves self-criticism and reflection, and (d) *telos* or disassembly of oneself where the researcher is willing to disassemble and reassemble the self; self-bricolage. The methods that were utilized to carry out the four components of the ethical axis of self include: reflective journaling, subjectivity statement, member checks, peer debriefing, and bracketing. Each of these processes is discussed in further detail in the following section on academic rigor and trustworthiness.

Within any given research site, there are multiple opportunities to gain data (from the Latin word datum meaning *something given*); we must remember that participant members are *giving* data (Saldana, 2011). The researcher’s role is to collect what is given to them by the participants. This concept of giving and receiving comes with a great deal of responsibility on the part of the researcher. Reciprocity refers to the exchange of something to the participants in exchange for their role in the research study. Reciprocity can include small gifts in return for attending a focus group or interview, but can be more extensive and can include monetary compensation for participation. Participants in this study receive snacks and refreshments during focus groups and interviews.

Methods of Data Collection

Case study data collection can include a wide variety of data sources as the researcher aims to “build an in-depth picture of the case” (Creswell, 2007, p. 132). For the purpose of this case study, course documents such as class syllabi were utilized. Additionally, photographic data, observation field notes, interviews, and focus groups which included students’ and instructors’ verbal and nonverbal behaviors were included. The data collected includes a total of six instructor interviews, seven student focus groups, 30 field note observation entries, 25 photos, and course documents such as course syllabi. The data inventory depicts the amount of data that was collected in this case and was included in the subsequent analysis and representation.

Table 1

Data Inventory and Data Collection Methods

Data Source	Pages Per Source	Total Pages
Interviews (1-hour) 6 (20 pages/hour)	6 x 20	120
Focus Groups (1-hour) 7 (20 pages/hour)	7 x 20	140
Observations (1-hour) 30 (10 pages/hour)	30 x 10	300
Photos 25 (5 pages/photo)	25 x 5	125
Journal Reflections (1-hour) 5 (5 pages)	5 x 5	25
Bracketing (1-hour) 2 (10 pages/hour)	2 x 10	20
Member Check (1-hour) 3 (10 pages/hour)	3 x 10	30
Peer Debriefing (1-hour) 2 (10 pages/hour)	2 x 10	20
Total Pages of Data = 780		

Interviews

Qualitative interviews are utilized when a researcher wants to gain an in-depth knowledge from participants about a specific phenomena, experience, or set of experiences (deMarrais, 2004). An interview is literally "an inter-view, where knowledge is constructed in the inter-action between the interviewer and the interviewee" (Kvale & Brinkmann, 2009, p. 2). I utilized an exploratory interview style which is semi structured, and allows the participants to have conversations to generate unexpected areas and insights for further probing in inquiry

(Saldana, 2011). Merriam (2009) explains that a semi-structured interview should include open-ended questions, and the questions should serve as a guide for the conversation (deMarrais, 2004). Spradley (1980) outlined two major types of descriptive questions, grand tour questions and mini tour questions. Grand tour questions describe the sequence of events within a particular setting or situation; whereas mini tour questions deal with a much smaller unit of an experience (Spradley, 1980, p. 79). The following interview questions were used as a guide for the conversation between the instructor participants and me:

1. Describe your typical class, start to finish, within the moving classroom (include events, feelings, etc.). (mini-tour question)
2. Describe your typical interaction and preparatory time for the course while teaching in the moving classroom. (descriptive question)
3. Tell me about your one particular day that stands out to you while instructing your class within the moving classroom. (descriptive question)
4. Can you tell me about a time where the moving classroom enhanced classroom instruction? (example question)
5. Can you tell me about a time when the moving classroom was detrimental to your classroom instruction? (falsification question)

I used both interview data from the instructor participants during the semester they were teaching in the moving classroom as well as collecting reflective interview data following the instructor's participation in the moving classroom to allow instructors to reflect on their experiences of teaching in hindsight.

Focus Groups

The focus group or focused interview is a social science research method that can be traced to the mid-twentieth century and is seen frequently in market research (Merriam, 2009). In the tradition of constructionism, a focus group allows for experiences to be shared among a group of people who have knowledge about the topic of consideration (Patton, 2002). For this inquiry, I conducted focus groups with student participants across all three classes that participated in the moving classroom. The focus group guide included the following questions:

1. Describe your typical day in the moving class (include events, feelings, etc.) (mini-tour question)
2. Describe your typical class experience with the content of KINE 2375. (descriptive question)
3. Tell me about one day you particularly remember or stands out to you within the moving classroom. (descriptive question)
4. Can you tell me about a time where the moving classroom enhanced your learning experience? (example question)
5. Can you tell me about a time when the moving classroom was detrimental to your learning experience? (falsification question)

Some elements of the interview and focus groups that were considered include: phraseology of questions, power distribution, reflexivity, equipment issues, transcription, and documentation. Interview questions were phrased as open-ended questions as much as possible to avoid single word or short answers (Saldana, 2011), and avoid influencing the participant to our assumptions/beliefs/values or leading them to answer the questions in a way that agrees with the researcher (Yin, 2009). Therefore, I was aware of these possibilities and tried to maintain the

open-ended in-depth spirit of the interview and focus group meetings by allowing participants to share their stories.

Additionally, the goal of a qualitative interview is “a hierarchical relationship with a asymmetrical power distribution between the interviewer and the interviewee” (Creswell, 2007, p. 140). Therefore, I made every attempt to treat the interviewees as if they are valued guests (Saldana, 2011) that were empowered to share (Creswell, 2007; Kvale & Brinkmann, 2009) their stories. Further, perceived power differences, reflexivity, or the interviewee giving the interviewer what they want to hear (Yin, 2009), can hinder the interview process. Knowledge about reflexivity lead me to try and create an interview environment which is safe in terms of participants sharing all elements of their experiences regardless of whether they are perceived as positive or negative.

Equipment and technology issues can be a concern while audio recording a conversation with participants. Although recording interviews and focus groups allowed me to maintain a record of the exact words of the participants, malfunctioning equipment and respondent’s uneasiness about being recorded could have been drawbacks (Merriam, 2009). Therefore, I utilized a recording device which is as unobtrusive as possible, and I also had a backup device (laptop with microphone) available in the event that there is an issue with the equipment or technology. Moreover, I made small notes on a note pad during interview and focus group meetings to assist me in developing follow up questions and probing where more information is needed. Manual note taking allowed for short notes about non-verbal communication which cannot be captured via an audio recording. Stake (1995) states that “perhaps the most important thing is to insist on ample time and space *immediately* following the interview to prepare a facsimile and interpretive commentary” (p. 66) in order to capture the unspoken elements of the

conversation. When possible, I set aside a specific time following each interview and focus group to journal about the unspoken and spoken elements of each conversation. Not only was this time set aside for journaling, but also to listen to and transcribe the interview as quickly as possible to avoid losing any details that could be forgotten over time.

Participant Observation

Participant observation is a method which is deeply rooted in ethnographic research and is valuable in allowing the documentation of human processes to capture the “mundane, the typical, and the occasionally extraordinary events that compose human life” (Saldana, 2011, p. 46). Observational data collected in the moving classroom was situated where I assumed the role of “observer as participant” where the activities of observing were known by the group and participation was seen by the participants as my secondary role (Merriam, 2009). That is, the observer participant comes to the environment or social situation with two goals “1) to engage in activities appropriate to the situation and 2) to observe the activities, people, and the physical aspects of the situation” (Spradley, 1980, p. 54).

During my time in the moving classroom, I participated by riding on a stationary bicycle and on occasion I was asked to contribute to the class conversation. Spradley (1980) further identifies the experience of a researcher in this role as an insider and an outsider simultaneously as a participant and an observer. Field notes that were taken from my three semesters in the moving classroom environment will be utilized as a data source in this inquiry.

Documents

According to Merriam (2009) documents utilized in qualitative research can include a broad range of materials, which may be existing, gathered public or private documents, or can be

documents generated by the research such as journals and analytic memos. Course documents such as the course syllabi were included in the data collection and analysis process.

Photos

Photographs are considered visual documents, and in this study were taken in conjunction with participant observation for the purpose of learning more about the situation, people, or events of the environment (Merriam, 2009). Photographs were observed using Spradley's (1980) descriptive question matrix which include noting the elements of the space, objects, activity, actors, and feeling/emotions, and codes for each photo were generated.

Data Management and Analysis

Due to the large volume of data collected in a qualitative inquiry, it is imperative to have clear data management and analysis plans. Data analysis "which makes interpretation possible requires researchers first to determine how to organize their data and use it to construct an intact portrait" (LeCompte, 2000, p. 147). After all, the goal of data analysis is to make sense or to gain understanding which involves "consolidating, reducing, and interpreting" the data (Merriam, 2009, pp. 175-176), and this cannot be achieved without a plan and clear organization.

Data Management

Data management refers to not only "tidying up" (p. 148) the data by creating organizational systems which are electronic and/or hard copy, creating backup files, and creating an index or table of contents of data documents, but also finding holes in the data and returning to the field to fill in gaps (LeCompte, 2000). Additionally, data management includes organization of codes (Merriam, 2009) and code keys and lists (Stake, 1995). Therefore, I describe my organizational plan for data management in the following paragraphs.

Interviews and focus groups were audio recorded using HT Recorder software on a secure password protected device to maintain the confidentiality of the participants. I kept all data collected confidential, and participant information was identified with a pseudonyms to ensure anonymity. All data, consent forms, and participant information were stored in a locked filing cabinet. Written consent from participants was obtained prior to participation in the moving classroom and subsequent interviews and focus group interviews. The consent form for this study can be found in the appendices of this document. For the purpose of member checks, peer debriefing, and re-listening for both verification and clarification, audio-recordings were kept until all methodological procedures were completed. Audio-recordings will be destroyed after three years from the completion of the study based on standard protocol in qualitative research.

Audio-recorded interviews and focus groups were transformed into written transcripts, and were managed electronically using Microsoft Word and MAXQDA qualitative analysis software. Electronic data was saved in folders by participant descriptor (e.g. instructors, students) and dates collected. All coding was done electronically using MAXQDA software where codes were assigned to chunks of written data from interviews, focus groups, course documents, and observation field notes. Further, photos were coded in MAXQDA by assigning codes to photo segments. Original documents were stored electronically and backed up using Dropbox cloud based technology. My Dropbox account is password protected. Data was organized electronically in folders with file names which indicated the date the data was collected. Second cycle coding and categorizing was accomplished via the use of folder organizational systems within MAXQDA along with poster paper and color markers to organize codes into categories and further themes (Figure 3). Saldana recommends (2009) stepping away

from a computer screen in order to handle and touch the data. In this study, I organized both categories and themes in a tangible way using large sheets of poster paper and color markers. As I was organizing codes and categories and themes, I used free writing as well as peer debriefing to clarify my interpretation of findings.

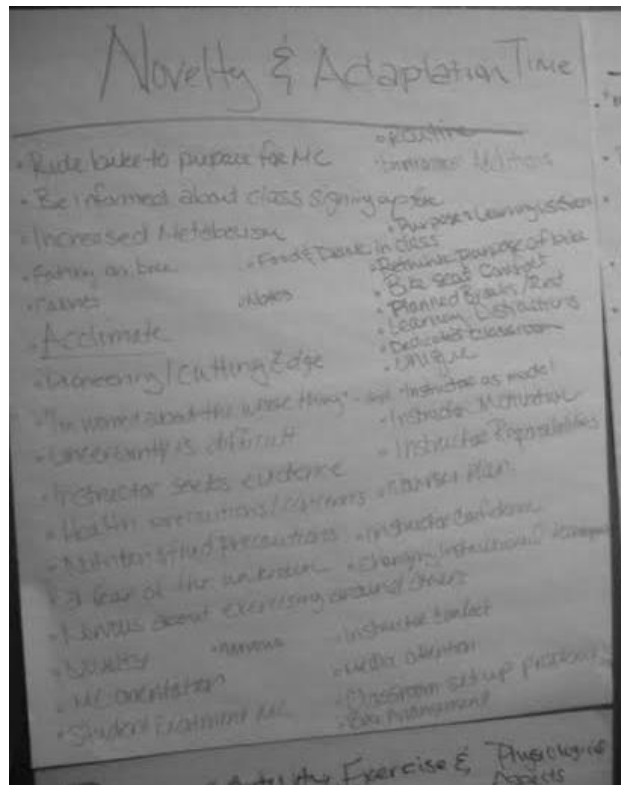


Figure 3. Photo of paper organization of codes into categories using large poster paper.

Data Analysis

Data analysis in qualitative research is a process of understanding and constructing human meaning with the purpose of revealing “fresh insights” about what has been observed and discovered (Saldana, 2011, p. 89). The data I collected via open-ended in-depth interviews, focus groups, observation field notes, photos, and documents was analyzed inductively by organizing information into codes, categories, and themes. Inductive analysis is a process of working up from the data (Figure 4); however, in qualitative research, it is an iterative rather than a linear

process where I moved back and forth between data collection and data analysis throughout the analysis process.

Data analysis is a process of making sense of the data which involves consolidating, reducing, and interpreting, essentially, it is the process of making meaning of the data (Merriam, 2009). LeCompte (2000) refers to data analysis like that of taking apart and reassembling a jigsaw puzzle in order to both organize the data to create an “intact portrait” (p. 147) and “tell the reader what the portrait means”(p. 147). This process of data analysis began with careful transcription of the interview and focus group data.

Saldana (2011) recommends listening to the interview beginning to end as soon as you are able following the interview, and adds that transcription is a valuable process that adds meaning and begins the analysis process. During the analysis process, I returned to the original interview and focus group recordings for clarification, and listened to the interviews and focus groups several times. Because qualitative research is not a linear process (Merriam, 2009), data transcription and coding was done intermittently with data collection. LeCompte (2000) likens the process of moving between data collection and analysis to the ‘sifting of flour’ in which the researcher returns to the collection of data for more details and information.

In order to conduct inductive analysis, I began by identifying codes. The first round of identifying codes is called first cycle coding. First cycle coding is the processes that occurs during initial coding of the raw data which is lumped together and labeled. As I mentioned earlier, this process of first cycle coding was done using the MAXQDA software where chunks of text were labeled using a variety of strategies. Some examples of the type of coding I utilized in my first cycle coding included in vivo, descriptive, attribute, and emotion

coding (Saldana, 2009). The following is a description of each of these types of first cycle coding:

- In vivo codes - a term which means “that which is alive” (Saldana, 2009, p. 74), and is a code which represents the exact word or short phrase used by the participant.
- Descriptive codes - summarize information in one word or a short phrase.
- Attribute coding - also referred to as setting and context codes, and include setting, demographic information, and time frames.
- Emotion codes - used to label the feelings and “emotions recalled or experienced by the participants” (p. 86).

In vivo, descriptive, attribute, and emotion coding are just some of many types of first cycle codes outlined by Saldana (2009). Throughout the analysis process, there were times when I needed to recode or refine first cycle codes before embarking on second cycle coding as I refocused the lens of my methodology to ensure research questions, methodology, and framework were being considered throughout. The goal of the coding process is to move towards finding an answer to the research questions (Merriam, 2009). Therefore, first round codes will be reevaluated with the researcher lens more focused through the framework of interpretivism, case study methodology, and the research questions regarding teaching and learning in a moving classroom environment.

Second cycle coding can be utilized, if needed, “to develop a sense of categorical, thematic, conceptual, and/or theoretical organization” (Saldana, 2009, p. 149) from the array of first cycle codes. Second cycle coding was done using MAXQDA where codes were organized into folders or groups of similar concepts. Some examples of second cycle coding that I utilized and which have been identified by Saldana (2009) include:

- Pattern coding – codes that are explanatory and identify an emergent theme, configuration, or explanation.
- Focused coding – searches for the most frequent or significant codes to develop broader categories.
- Axial coding – to strategically reassemble data that were ‘split’ or ‘fractured’ during the initial coding process where the axis is a category.

Of these second cycle coding strategies, patterns are often cited as most important to case study (Stake, 1995; Yin, 2009). Patterns are important particularly in case study analysis where reappearance of patterns gives understanding about the normalcy of the case. Therefore, to understand behaviors, issues and contexts regarding teaching and learning within a case study of the moving classroom environment, I used a great deal of pattern coding during secondary cycle.

Following this second cycle of coding within MAXQDA, I moved from folders of codes organized electronically within MAXQDA to creating broader categories on large poster paper. Once the categories were developed on poster paper. I then examined these categories for concise themes once saturation of the data has occurred, which is “the point where no new information, insights, or understandings are forthcoming,” the analytic process switched from being inductive to being more deductive as I tested the categories and themes to see if they hold up (Merriam, 2009). In summary, I began with first cycle and second cycle coding electronically using MAXQDA software, and then moved to identification of categories and then major themes using an organizational system on large sheets of poster paper. Throughout, I engaged in an iterative process going between data collection and data analysis. Finally, the final process is to assemble structures (LeCompte, 2000) or themes that are extended phrases or sentences that summarize apparent underlying meaning (Saldana, 2011). My final representation of the data

includes three themes with five subcategories which were identified across all themes. These are discussed further in chapter four.

Critical ongoing processes to the inductive analysis included keeping a researcher journal and writing analytic memos about what was being learned. I kept a researcher journal which is meant to simulate critical thinking (Merriam, 2009) about what is learned and observed. This journal also served in a reflexive capacity (Saldana, 2009) and was kept to jot down notes or thoughts during data collection. Analytic memos are similar to journaling in that the writing is from the researcher to the researcher, similar to writing notes to self.

Merriam (2009) advises “keeping track of your thoughts, musings, speculations, and hunches as you prepare your data for analysis” (p. 174). Where journaling takes place in the data collection phase or in the field, analytic memos are specific to the analysis processes. Saldana (2009) refers to analytic memo writing as a conversation about ourselves with our data for the purpose of reflecting on the data analysis where the researcher blogs or dumps their brain. Charmaz (2009) explains that “memo-writing is the pivotal intermediate step between data collection and writing drafts of papers” (p. 72). Analytic memo writing will be routine during analysis of the data “whenever anything related to and significant about the coding or analysis comes to mind” (Saldana, 2009, p. 33). Analytic memos were written and stored in MAXQDA where codes were attached to the written memo. Continual journaling and analytic memo writing is accounted for in the data inventory found in Table 1.

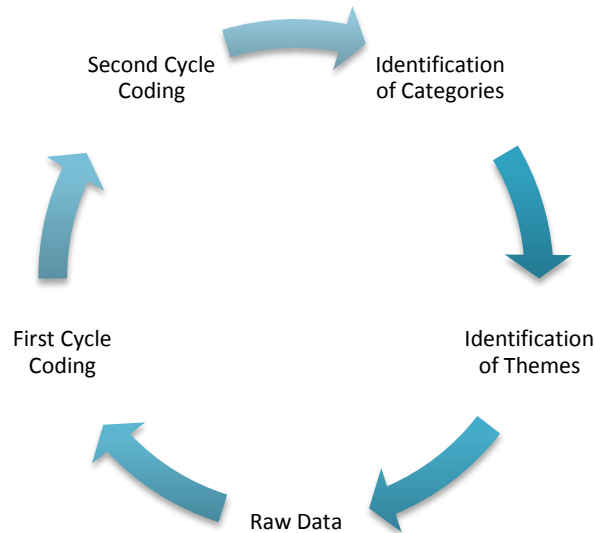


Figure 4. Inductive data analysis. Working up from the raw data into first and second cycle coding, categories, and finally themes is an iterative process.

Data Representation

How the data would be best represented was a decision that was reserved for after the analysis process was complete. The representation was not predetermined because “*representation of a project refers to the best form and format that will credibly, vividly, and persuasively document*” (Saldana, 2011, p. 77). For this case study, three themes emerged which had five common subcategories which was a very unique finding. Therefore, the data for this case study is represented by the organization of these themes with sub-categories.

Trustworthiness and Rigor

Trustworthiness of a study includes credibility, authenticity, transferability, and confirmability (Lincoln & Guba, 1985). Elements of qualitative research that make a study trustworthy and rigorous include: member checks, bracketing, thick description, peer debriefing, subjectivities, and triangulation. I will discuss each of these in the following paragraphs.

Member checks are a way for the researcher to return to the participants and verify the findings thus far (Saldana, 2009) which assists in making the data both credible and useful (LeCompte, 2000). Lincoln and Guba (1985) state that member checks are “the most critical technique for establishing credibility” (p. 314). In the spirit of constructionism, the process of member checks has allowed me to share findings and my understanding with the participants so that meanings can be shared, and participants could provide feedback regarding interpretation of meanings by the researcher. Because “actors play a major role in directing as well as acting in case study. . they regularly provide critical observations and interpretation” (p. 115) the participants should be asked to review the materials for accuracy (Stake, 1995).

The participants in this study are the ‘actors’ that Stake (1995) speaks about, and their lived experiences that I am observing and aiming to understand belong to them. Thus, it was important that I return to them with my findings to verify accuracy, and for additional insights. I asked the participants in this study to participate in member checks to review materials and findings and had conversations regarding the findings and interpretation. Member checks are accounted for in the data inventory in Table 1.

Peer debriefing is another process which adds rigor and trustworthiness to qualitative work. Peer debriefing is the process of touching base with peers to review the findings of the inquiry. Saldana (2009) refers to this process as “shop talk” with a colleague or mentor about coding and analysis. Whereas, Merriam (2009) reminds us of the common practice of peer reviewing in academia whether it takes place by members of a thesis or dissertation committee reviewing a student’s work or when an article is sent into a peer-reviewed journal for publication. I have participated in peer debriefing with my methodologist and mentor for

discussion of the data analysis and representation. Peer debriefing is included in the data inventory found in Table 1.

Another element of qualitative research that adds trustworthiness and rigor is acknowledgement of subjectivities and bracketing. Subjectivities are qualities of an individual researcher that can affect the results of a qualitative inquiry which typically remain unconscious (Peshkin, 1988). While the subjective nature of qualitative research is a given, “subjectivity is not seen as a failing needing to be eliminated but as an essential element of understanding” (Stake, 1995, p. 45). Therefore, it is the process of acknowledging subjectivities that adds rigor and trustworthiness to the study. Peshkin (1988) likens subjectivities to that of “a garment that cannot be removed” (p. 17), and stay with us across the various activities and interactions that include both research and non-research activities. It is this process of confessing and shedding light on such subjectivities (Peshkin, 1988) that adds trustworthiness and rigor to the process. I have disclosed many of my subjectivities regarding the moving classroom in the narrative which introduces to chapter one. This narrative serves as my subjectivities statement for this study. I have diligently continued to evaluate and examine my subjectivities throughout the course of this study.

One way of acknowledging researcher subjectivities is via bracketing. Bracketing is a process that was founded within the phenomenological tradition where the researcher would bracket their subjectivities by acknowledging and set aside all preconceived notions about a particular phenomenon (Creswell, 2007). Husserl (1900/2003), who is considered the father of phenomenology, refers to this as the epoche process which comes from the Greek word meaning to “refrain from judgment, to abstain from or stay away from the everyday, ordinary way of perceiving things” (Moustakas, 1994, p. 33).

Although bracketing has a history in phenomenology, I separate from the notion of putting aside one's judgment or preconceived notion. Instead, I align with Peshkin (1988) and Jackson (2004) who speak to acknowledging subjectivities and reflect on the role which they play in the research. I used free writing to not only acknowledge subjectivities, but to also be vigilant of them. Moreover, I have engage in a bracketing interview with a peer as another form of inquiry into self which allows for questioning of my own position to take place. Bracketing data is accounted for in Table 1.

Yet another element of rigor and trustworthiness includes utilizing thick description in qualitative writing and representation of the data to provide a "highly descriptive, detailed presentation of the setting and in particular, the findings of the study" (Merriam, 2009, p. 227). Rich description of the details helps the reader make decisions regarding transferability of findings to other cases, settings, or situations (Creswell, 2007). Thick description, therefore, is important so that the reader can relate to the information. While writing up the findings of this qualitative inquiry, I have include detailed descriptions in the form of narratives by leaning on classic examples such as Geertz's (1973) descriptive interpretation of a Balinese cockfight.

Last, triangulation is used in qualitative inquiry to confirm or "increase credence in the interpretation" and to "demonstrate commonality of assertion" (Stake, 1995, p. 112). Triangulation remains the principal means of ensuring validity and reliability within the interpretive perspective where multiple sources of data are cross-checked across observations, conversations, and settings (Merriam, 2009). Triangulating the data, is an evaluative tool that can be utilized to see if the understanding and interpretation remains the same "at other times, in other spaces, or as persons react differently" (Stake, 1995, p. 112).

In this study, I have triangulated the data from multiple data sources of interviews of instructors, focus group interviews of students, documents, observational field notes, as well as photographic data. Therefore, during the analysis phase, I looked for “converging lines of inquiry” (Yin, 2009, p. 115) across multiple sources of data to ensure the findings corroborate across time, setting, datum, and individual perspective.

Chapter Summary

This study was grounded in the epistemology of constructionism which accepts that there are multiple realities, and have been investigated through a theoretical lens of interpretivism which aims to gain understanding. Specifically, the purpose of this inquiry was to gain understanding about teaching and learning experiences within a unique learning environment; the moving classroom. I have utilized the case study approach in which the case is delimited, and includes only those individuals who have experienced a class held in this moving classroom setting. A purposeful sample of two instructors and three classes of students agreed to participate. Data collection included instructor interviews and student focus groups which aimed to prompt reflection of participant experiences in the moving class. Additional processes such as journal reflections, bracketing, member checks, and peer debriefing were implemented for the purpose of adding rigor and verification data findings. Data analysis was inductive in nature; I started with raw datum to determine codes, categories, and themes. Finally, I employed several processes including member checks, peer debriefing, and triangulation to ensure trustworthiness and rigor.

CHAPTER 4: FINDINGS

This study was grounded in context of constructionism which strives to make meaning of experiences through a process of taking apart the data into codes, and then reassembling the data into a meaningful representation (Denzin & Lincoln, 2011; LeCompte, 2000). Using interpretivism as a framework, the researcher is the interpreter of meaning (Merriam, 2009). The findings which are represented in this chapter are not based on my experiences alone, but rather represent the meaning constructed by both myself and the participants. In the spirit of qualitative research, the purpose of this study focused on understanding the lived experiences (Crotty, 2004; Merriam, 2009; Saldana, 2011) of participants within the moving classroom. The purpose of this case study was to identify how a moving classroom informs the teaching practices of instructors and the learning experiences of students in undergraduate kinesiology courses in South Texas.

This research inquiry aims to answer the following questions:

1. How do instructors reflect on their experiences of teaching in a moving classroom?
2. How do students reflect on their experiences of being part of a moving classroom?
3. What do instructors and students identify as challenges while teaching and learning in a moving classroom?

The findings represented within this chapter provide a description of the moving classroom environment, description of the participants, and the three major themes which emerged from the inductive analysis of codes and categories. The three themes include:

1. College Students Learn, Stay Awake, and Engage in the Moving Classroom
2. Awareness of Bodies in Space is Important for Learning
3. The Purpose of Movement Must be Clear for Effective Teaching and Learning

Research Site

The research took place at Cambiar University in South Texas. The moving classroom was created via utilization of a multipurpose exercise room in the Recreational Sports department in a university setting. The primary purpose of the exercise room used for the moving classroom was to accommodate group fitness courses such as aerobics, yoga, and bicycle spinning classes to name only a few. This space was selected because of the convenient access to spinning bicycles. These stationary spinning bikes were wheeled out prior to each class as part of setting up the moving classroom, and also rolled back into storage at the end of the class. Additionally, this space was chosen because the Recreational Sports multipurpose room had enough bicycles in this space to accommodate the typical class size of 20-30 students for the nutrition course offered by the Department of Kinesiology. I obtained permission to use the multipurpose exercise room in Recreational Sports for the sole purpose of the moving classroom during the course meeting time for three consecutive semesters to conduct the moving classroom study. All interviews and student focus groups were conducted on the campus of Cambiar University in the Department of Kinesiology conference room, faculty offices, and in one rare occasion by telephone conversation.

Equipment

Thirty Keiser® M3 stationary spinning bicycles were available for the class, and could be wheeled in and out of storage at the beginning and end of each class meeting respectively. A custom bike desk, which fit over the bicycle's aerobars, was designed and produced for the purpose of the moving classroom (refer to Figure 1 in Chapter 1). Aerobars are the centrally located parallel handle bars at the front of the bicycle. Other than the bicycles and bike desks, an audiovisual cart was provided each class period by the technical support personnel on campus.

The cart included a laptop computer and projector. For the purpose of the moving classroom, a portable projector screen was purchased that could be easily assembled and adjusted prior to each class meeting. Also, a wireless microphone headset was available for instructor use. Lastly, as a result of the feedback from the initial moving class, gel bike seats were purchased and available for students to use during the final two semester courses.

Participant Descriptions

The moving classroom included participants from three undergraduate classes in nutrition during the successive spring, fall, and spring semesters. Two instructors agreed to participate by teaching the undergraduate course in nutrition within the moving classroom. Instructor participants included one female and one male instructor. There were a total of 76 undergraduate students who participated in the moving classroom over three consecutive semesters. Of these, there were 39 female student participants and 37 male student participants. All student participants were kinesiology majors who were seeking a Bachelor of Science degree in kinesiology.

Instructor Participants

Both instructors were full time faculty within the Department of Kinesiology at Cambiar University. Although both faculty members were in the same department teaching the same course, these two professors entered the moving classroom at very different points in their professional academic careers. Dr. O'Malley was an Associate Professor who previously taught undergraduate nutrition at two different institutions of higher education including Cambiar University. She had been a faculty member for four academic years at Cambiar when she first taught within the moving classroom. Dr. O'Malley instructed two different undergraduate nutrition classes within the moving classroom. Dr. Daily was an Assistant Professor in his first

year as a university instructor when he taught in the moving classroom for the first time.

Although this was Dr. Daily's second semester teaching at Cambiar University, this undergraduate nutrition course was one of several new course preparations required of this instructor. Dr. Daily taught within the moving classroom for one semester. Founded primarily on field notes from observations of each instructor, the following narratives aim to represent each in a traditional teaching setting.

Dr. O'Malley. It is Tuesday morning on the campus of a South Texas University. At 9:20 a.m. students begin to enter the classroom, and find their usual location among the chairs covered with blue and peach geometric pattern fabric. Long tables that create the light wood grain and modern looking desks are arranged in three long parallel rows. The classroom has bright white walls and is illuminated with bright florescent lighting.

A group of five students enter with windblown hair and backpacks over their shoulders. Two students on the right side of the room, near where I am seated, communicate quietly with one another as they set up their work stations; some with notebooks and others with laptops. The two students, one female and one male, who are setting up laptops, sit near the end of each row so that they can access the power outlets which can be found around the perimeter of the classroom. The power cords drape the walkway between the desks and the wall. As 9:30 a.m. approaches, four disheveled looking students briskly enter one at a time from the two doors that enter the back of the classroom. These four students are breathing heavily as they enter the second story room, and begin to take their seats.

Dr. Lisa O'Malley walks with long quick strides into the institutional looking classroom on the second floor in her pencil skirt and a white blouse with a grey tweed fitted vest. Situated about 4 inches from the hem in her skirt are black boots. Dr. O'Malley takes firm steps towards

the front of the classroom as her boots announce her arrival. As she walks briskly to the front of the classroom, she begins turning on the computer at her teaching station. As she presses the buttons to power on the desktop computer at the teaching station and the overhead projector she begins to engage with students by asking “how are you?” and smiles at two students sitting nearest the teaching station at the front of the classroom. A fit-looking male student dressed in athletic shorts and a t-shirt sitting in the second row from the front of the room asks Dr. O’Malley “do you know when the mid-term exam will be” as he stands to plug in his laptop. Dr. O’Malley answers “um, based on where we are in the notes, it should be sometime in the next week to week and a half based on where we are in the notes.” The student asks “we are covering the rest of macronutrients before the test, right?”, and Dr. O’Malley replies “Yes, that’s right.” A soft spoken student sitting in the front row of the classroom tells Dr. O’Malley “did you find any more information on the benefits of teas”. Dr. O’Malley excitedly smiles and replies, “Oh, good, I am glad you mentioned that.” Dr. O’Malley continues stating “I brought you guys a short article about green tea. Can you pass it out for me?” The female student in the front row stands up and starts handing out the article on teas to the twenty-seven students who were in class that day. At five minutes after the official class meeting time, Dr. O’Malley concludes her set up of the computer station, handouts, and notes, and begins to walk away and fully engage in a discussion with the students about the article on green tea stating “as I mentioned last time, tea is a good choice minus the sugar and cream”. . . “this article presents some possible benefits of tea, specifically green tea.” As is habit for Dr. O’Malley, the first five minutes of class time is devoted to speaking with students while she opens her computer programs and allows the last few students to enter.

As O'Malley begins to lecture, she continually paces and adds in arm and hand gestures as she shares her knowledge of nutrition with the class. As she takes each step across the front of the classroom, she gestures with importance and speaks with enthusiastic inflection in her voice. With a cup of coffee in her right hand and a presentation pointer in her left, she continually shifts her attention and eye contact across the wide span of the classroom as she states "let me tell you the facts". As she advances through the PowerPoint slides which provides an outline of the day's topic, she occasionally takes a long pause indicating the importance of the material allowing the student time to record the vital information.

No more than five minutes into Dr. O'Malley's lecture two students enter the classroom. One female student sits in the last row near the right side. The other male, enters more assertively with quick steps straight to the far right chair in the front row. The attention of the instructor and the students shift to this male student as he opens his back pack, takes out his laptop and plugs it into an outlet on the right wall of the classroom. The cord for the laptop spans across the walking isle on the right side of the classroom like those on the left side of the room. The attention of the students quickly focus back to the animated Dr. O'Malley at the front of the room. Students quickly resume writing down the points from the notes which are projected on large screen across the center portion of the front wall.

The student's vigorous writing of the notes from the PowerPoint slides reflect the importance of the specific information on those slides in future testing. The students and Dr. O'Malley understand the importance of clear delivery of this information as the progress in the class is measured predominately via multiple choice exams with the most heavily weighted one being the mid-term exam. Students must do well on the mid-term exam in particular to do well in the class. O'Malley recognizes that not all students may be good at taking exams but chooses

this method based on the importance of the material presented during the first half of the semester. Some other grades are given for homework and quizzes, but the majority of the student's grades hinge on the midterm exam.

Despite Dr. O'Malley's high energy presence in the classroom, some students struggle to attend and stay awake in the back row. Of these twelve students in the last row, which is completely full, there is a trend that those who are leaning back against the back of the chair are the same students struggling to stay alert and awake. As their eyes close, their heads start to duck forward and back as they quickly open their eyes again. On the other hand, the students with a more upright posture or a slight lean forward are more engaged in taking notes and with non-verbal nods of support directed towards Dr. O'Malley. One particular student, Mandie, who chose to sit in the front row is catching her head nodding forward and back in-between note taking, and question asking. What is unique about Mandie is that she is the only student sitting in the front row, leaning forward, engaged in note taking, and asking questions who is fighting her body's attempts at sleep.

An attentive student in the middle row raises her hand and waits for O'Malley to pause long enough to answer by gesturing towards the student. The student asks "what about protein before a workout?" The conversation of the class following these questions often shifts to the practical application of the material and how the students can apply this new information to their everyday lives. O'Malley answers the student by stating "although each sport is different, we do know that the pre-event or exercise meal should be about 2-3 hours prior to, and should be a mix of proteins, carbohydrates, and fat that will not upset the digestive system." Occasionally, Dr. O'Malley will pick up a drink or a wrapper from a food product from a student sitting in the front row and will use the nutritional nutrition label on the back or the side of the container to aid

the discussion on micronutrients. Towards the end of the class, Dr. O'Malley uses a sports drink bottle to discuss the carbohydrate content in sports drinks "We can see that one serving has 34 grams of carbohydrate, so this would be something we would want to use during a long workout for the quick calories."

As the hour and fifteen minute class concludes, O'Malley keeps a frequent eye on the clock which hangs on the back wall. At 10:40 am, students start to collect the handouts from their desk, and place them in their note books. The distracting unzipping and zipping of backpacks is noticeable as Laptops and notebooks are placed in bags. Although Dr. O'Malley is discussing the bullet points on the PowerPoint slide, by 10:44 am, students are mostly packed up and ready to leave. At 10:45 am, Dr. O'Malley says "Okay, next time we will pick up here" and delivers the last few announcements before she formally dismisses the class "Remember, to check Blackboard for the assignment information".

O'Malley continues to answer individual questions at the front of the room as several students make their way up to speak with her. Dr. O'Malley places her black bag over her shoulder as she continues to speak with a student as they exit the classroom, and the next class of students begin to file in.

Dr. Daily. Dr. Daily arrives and enters the classroom at 12:53 p.m. with three students who have been waiting for the previous class to exit the room. The narrow classroom seats approximately 30 students comfortably, and is divided with a walkway down the center of the classroom leading to the teaching station. The black plastic backed chairs are aligned along rows of tables on each side of the center isle with each row ending at an articulation with the white walls of the classroom. There are five rows of desks on each side of the room with four chairs in each row except for a shorter row in the front of the room which only seats three. The lighting is

dim at the front of the classroom as to illuminate the large projector screen which boasts from the front of the classroom.

Dr. Donald Daily walks with a brisk pace as he enters the classroom. His quick strides and upright posture are focused towards arriving at the teaching station. While keeping his attention pressed forward, he converses and laughs with a student who is entering the room simultaneously. While at the teaching station, Dr. Daily quickly navigates the USB portable device which holds his lecture notes. Dr. Daily is silent as he navigates the folders organized on his device. As the light in the projector turns on and the file opens, Dr. Daily takes a subtle yet quick breath. The darkly colored running shoes, shorts, and corresponding Dri-fit shirt all have a discrete Nike check. Dr. Daily maintains a continuous smile and an occasional quick witted comment with students as they arrive over the next several minutes.

At 12:55 p.m., the majority of the students make their way into the room. They find their seats and get out their notebooks and pen or pencil. One female student wearing a t-shirt and jeans with her hair pulled into a pony tail is standing at her desk taking out her notes for class as she turns to the male student sitting next to her and asks “did you do the assignment for Dr. West?” The male student who is sitting at the desk ready to take notes responds “yea, did you?” The two of them go on to quietly discuss a specific question from their assignment in a different class.

At the same time, Dr. Daily carries on a conversation with a male blond haired student who is sitting in the front row. The student asked Dr. Daily “what do you think about protein supplements?” Dr. Daily replied, “we will talk about that more today in class, but it can be important for some athletes.” Dr. Daily goes on to say “you really need to figure out the individual needs of the person and how much protein is required for the sport or activity. . . I

don't know if you need to drink a protein shake every meal." The two smile and laugh at the sarcastic comment.

Promptly at 1:00 p.m., Dr. Daily begins the lecture "okay, guys we left off talking about protein last time." He takes off like an airplane aiming for a very specific flight path and target as he clicks through each point on the power point slides, and explains each bullet point. With practical examples and occasional humor sprinkled in, it is clear that there is a specific target for what must be accomplished today. Once Dr. Daily gets to the last topic of the PowerPoint presentation, at approximately 1:35 p.m., he slows down a bit and asks "Okay, so let's talk a about the recovery. . . what do you guys do after a workout?" A student in the middle of the room says "I heard that chocolate milk is good." Dr. Daily responds, "good, so there are several options, but chocolate milk is a popular one right now because of the ratio of macronutrients." Other students join in the conversation by asking about recovery drinks, foods, and supplements they have heard about. The class conversation lasts approximately five minutes. At 1:40 p.m. Dr. Daily passes out a one page handout and says "Okay, I want you guys to get into groups and work on this handout together. . . you have about eight minutes to work together and then we will talk about it."

Students quickly get into groups of three to four students each, and discuss the problems on the handout. It appears that group work is something that Dr. Daily's students are accustomed as they do not hesitate to start discussing the questions and write down their answers. The students appear to be quite comfortable working in groups together. Dr. Daily moves around from group to group and answers any questions that students have, and gives feedback to each. With about a minute left in the group work time, Dr. Daily announces "okay guys, lets knock it out so we can discuss it."

As Dr. Daily walks back to the front of the room, the groups jot down their last thoughts, and Dr. Daily motions to a group in the middle of the room “okay, can you guys share a little bit about your answer to the first one?” One male student from that group reads their questions out loud, and Dr. Daily replies “okay, good”, and motions to the next group to share. After the three questions and answers are shared, and promptly at 1:50 p.m., Dr. Daily states “Okay guys, good job, that is it for today, we will see you on Wednesday.” Students pack up their notes, and one group member turns in the group work as they exit the classroom. Because there is another class waiting to come into the room, Dr. Daily quickly closes his PowerPoint presentation and removes his flash drive. A male student waits to ask him a question “can I ask you a question about that assignment?” As the two exit the classroom Dr. Daily replies, “yea man, what’s up?”

Student Participants

Although there were a total of 76 student participants, 23 of these students volunteered to participate in focus group meetings. Thirty-nine female students participated in focus group meetings, and thirty-seven male students participated in focus groups. Focus group participants were solicited from each class that met in the moving classroom. Students volunteered for focus groups, and students who participated in these additional conversations represent a sample of students who shared their stories and experiences about the moving classroom in greater depth than what could be observed by the researcher.

Themes

Three themes emerged with five common categories (Figure 5) across all themes. In this section I will describe each category in the context of the larger theme while providing excerpts from the data. Excerpts may be from instructor interviews, student focus groups, observation

field notes, or photos taken during the courses. Pseudonyms are used to represent the participant's direct quotes from interviews and focus groups.

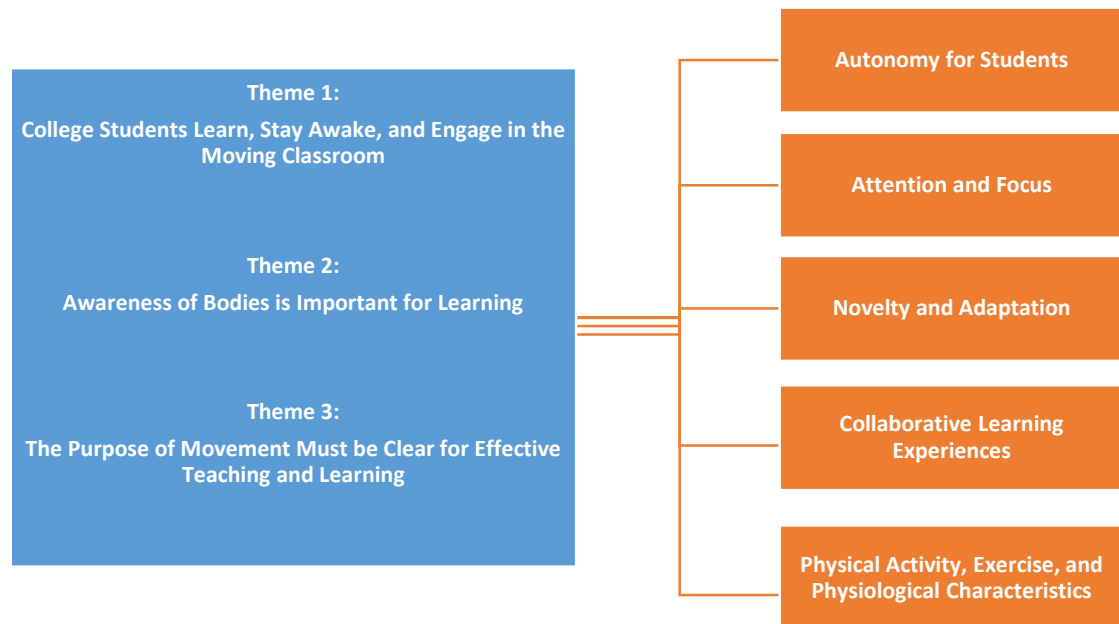


Figure 5. Themes and categories across themes.

College Students Learn, Stay Awake, and Engage in the Moving Classroom

College students have unique schedules and activities compared to other populations. Many of the twenty-three students who participated in the focus group process reported having many other obligations such as work, extracurricular activities, and community involvement outside of their academic endeavors. This was an important factor in making the moving classroom uniquely beneficial for the very busy college student for a variety of reasons. The following excerpts from student Amanda describes her typical day and the variety of activities she balances:

At eight I have an observation for my class; I have to do an observation, I have to watch a PE class and then at nine-thirty I have nutrition and then right after nutrition is ten-forty-five and I go to work. I have to be to work by eleven. And then I work til seven. And

then I led a bible study at seven-thirty, so I have to go home and get ready for that and then we do that until like nine and then I do homework.

Like Amanda, Hermine also was a student who was required to balance a job with classes and academic work:

Well, I'll give you a Tuesday so Tuesdays I normally go to work, then I have class, then I work out, then I go to class again for like hours until 5.

In the second of the three classes of students who participated in the moving classroom, several student-athletes participated in the study and volunteered for the focus groups. The student-athletes who participated, like other students, had very busy schedules. What is different with this faction of student participants is that not only did they have unique demands on their time, but they also had extraordinary demands physically. Bailey shared her typical day with both the moving class and athletic workouts included:

Um, for me they're like, I have a practice at 8 till like as soon as that class starts so I was just kind of rushing over and Tuesday-Thursdays are my long days going till 9 and I work out between breaks so it just makes, like, it harder. I mean, 'cause I get – I spend like a lot more time lately doing extra workouts on my off workout days.

Like Bailey, Sanders also was a student-athlete aiming to balance both academic and physical demands. Although Bailey and Sanders were athletes in different sports, they have a shared experience of having both demands on their time and their bodies. Here Sanders describes her typical day and the increasing physical demands of her sport participation which was a barrier at times to her participation in the moving classroom:

Kind of the same thing he has, like we had workouts in the morning and stuff and then lately we've had a lot more harder practices because it's towards the end of our like fall

season so I haven't like wanted to ride because I know like afterwards I'm gonna go out there and have to run a whole bunch more after, so...

The unique scheduling demands on college students emerged as a common theme across student participants at Cambiar University. These demands only set the stage for further understanding of how this busy lifestyle lends well to the moving classroom model.

Autonomy for students. A category which was an important finding is autonomy or self-governance. Because of the college student lifestyle and time demands, students expressed the ability to choose how they wanted to integrate into the classroom environment as being important. Although students overall did enjoy having the option to ride the stationary bike during class, this was not the first choice for all students on all days. For a variety of reasons, students did take days off from riding the bike and chose to engage in the learning environment in a variety of ways. Just as Sanders noted in the excerpt above, students choose to ride the bike and at times chose modes of involvement including sitting at desks, sitting on physioballs, and even sitting on the floor. Harmine, a student who rode the bike on a regular basis also observed that students were making a variety of choices in terms of how they wanted to position their body within the classroom:

I think offering desks is, you know, good and letting them know that they can go back and forth; they don't have to pick one throughout the whole entire semester, they can go back and forth if they're feeling sick that day or if their just their bums are tired, they can switch

Students were making a variety of choices which was not something that was observed in a traditional classroom setting. The ability of students to make choices was something that seemed to be new to the students and the instructors, but was not seen as a negative attribute of the

environment, but rather a positive. The following is an excerpt from my observation field notes which illustrates this concept of student autonomy in the classroom:

One student who is also a softball athlete has been sitting on the floor for the past few weeks during class. However, today, she has chosen to ride the bike. When asked about changing back to the bike, she said she was riding because she was sore. During the first few weeks of the moving class, she chose to ride the bike, did become dehydrated in a subsequent practice, and slowly moving to the floor for most class periods.

What is interesting here is that she didn't choose to sit at the provided tables and chairs, but rather choose to sit on the floor as this choice was self-directed based on what the student felt was best for their own learning experience. She was not alone. As the course evolved over the course of each semester, students found a variety of ways to integrate themselves into the learning environment. Dr. Dailey also described the students embracing autonomy to choose how they would position themselves in the classroom, and that the choices students were making appeared to be productive in terms of student learning:

Yeah, I mean, again, I think they're just going with what's comfortable for them to hang out there for an hour, and you know, the ones – even the ones on the balls and the mats and things like that, they seem to be taking a lot of notes.

Although students did embrace this autonomy in terms of deciding where to situate themselves in the learning environment, students noted the importance of having the choice to participate in the moving classroom by riding on the stationary bicycle during class meetings. Students enjoyed the option of riding the bike for a variety of reasons. For John, the benefit seemed to be the learning experience as well as the opportunity for what he refers to as a “mini-workout”:

. . . the entire experience is obviously benefited by the fact that you're moving. I think that is awesome because it's, you know, I really don't know why but I kind of like the idea that it's... it's weird but it's like, your learning but like, if you're – even if it's like at a light pace, if it's like for an hour or so you get into fat burning mode by that time after – in a little while. So it's like, almost like you're getting a little mini-workout while you're going to class.

Like John, Nate too found it important to ride on the bicycle for both the learning benefits as well as in the spirit of increasing overall health. Here, the group was asked if they were given a choice of the same instructor's course in a moving classroom or within a traditional class, which would they chose and why? Nate's response below captures what students reported as enjoying the movement while learning.

Yeah, I like just to stay, like moving and stuff like that all at the same time while learning and stuff like that all at the same time while learning and stuff like that, because I mean, especially like studying, you get bored like looking at some stuff, just sitting still and stuff like that and if you can be like doing stuff and something like, and studying at the same time, I think it's like more better and it's healthier too so I mean, I enjoy that better.

Melissa reflects on her options within the moving classroom after she chose to lay on a yoga mat to take an exam in the moving classroom. For Melissa, having choices was a very important aspect of the moving classroom:

Yeah, I lay on the yoga mat. I don't know, I liked that. Um, sometimes on like my other classes I'll even put my head on the desk. I just like to really relax and everything when I take tests so I think I would prefer that over riding the bike but I definitely think it's a good experience and I would like to have it in another class but I just like that it's an

option because I know I wouldn't want to do it every day and there's always things that would affect whether or not I wanted to do it that day, like whether I had a meet that weekend, whether I had brought a lunch or whether I had brought my shoes because I would forget that sometimes, or if I was just tired and didn't want to do it, so it's nice to have that option.

Frank captured the essence of autonomy in his statement; he expressed that the single option to sit in a desk and chair was confining and being able to have choices was liberating and more independent. This made the environment more comfortable to him knowing that students had choices about how he and his peers could integrate themselves into the learning environment:

I feel like if I'm sitting at a desk I'm forced to, you know, try to suck in information but if I'm you know, residing on a ball or you know, on the ground, I'll feel more of my own, like, I guess to choose, you know, what I wanna take in which is gonna be most of it because you're relaxed. You feel more liberated than being confined in a little desk.

College students are a unique group with a lot of demands on them both in terms of schedule and physically especially with the student-athletes and those who were physically active outside of the classroom. Because of all that comes with these demands, and the very different needs of each student, it is important to have autonomy within the classroom to allow students choices of how they would like to be placed within the context of the learning environment. We do not typically see this type of autonomy in the traditional classroom, and appears to be an important finding of this study. Although not advertised as options, students embraced opportunities to sit on physioballs, sit on yoga mats on the floor, or ride on a stationary bike. Both instructors felt comfortable with this study autonomy, and did not perceive the

choices students were making to be distracting or inhibiting the learning experiences of their students.

Important to the moving classroom, students did desire to have the option to move/exercise in the classroom environment. In this study, the students felt having the option to ride the bicycle during class was an important option for them for a variety of reasons. Where John and Nate enjoyed the additional benefit of physical activity by riding on the bike, students such as John, Nate, Amanda, Frank and other students felt the option to ride the stationary bicycle in the learning environment had a positive impact on their learning experience.

Attention and focus. In alignment with the studies within the area of neuroplasticity, attention and focus improvements were a significant finding in this study. Students did share that their experience in the moving classroom, and specifically when riding on the stationary bicycle, enhanced the cognitive attributes of attention and focus. Specifically, this increase in ability to pay attention and focus appeared to be linked to the busy lifestyle of college students. Dr. O'Malley recognized that the students attended within this unique environment like she has never seen in her career of teaching:

The biggest upside to it was, even if there weren't necessarily attending to me and the lecture, I have all their attention, none of them were dozing, none of them were, ya know. It definitely was the first time in my whole career where I knew, shy of them being whiney about their buns, I knew that they were wide awake and their brains were highly function. You could just see it in the room, and I mean, Im, Im pretty impressed by that. And its mainly because maybe it not, I don't think it has anything to do with my lecture; I've given this lecture, I don't know how many years now. It had everything to do with the environment. I mean this kind of environment keeps them awake. You are not

falling asleep and falling off the bike; that's not even an option, so I think that had to be one of the biggest upsides I had ever seen was.

Dr. O'Malley summarized this phenomenon by simply stating: "Move their bodies makes the minds move." Not only did Dr. O'Malley and I notice this increase in attention and focus, but students such as Hermine noticed that her focus increased by riding on the bike by helping her stay awake despite being tired and sluggish:

oh yea, and I'm always, I'm always, I have the hardest time staying awake in class. You can ask Jerod from last semester, I just, I have a hard time, and so, being up there on the bike, I was just, I was mentally aware, I was all there, my brain was functioning perfectly instead of being all sluggish and trying to fight it. And Tuesday mornings are the worst; I don't know why Tuesday mornings are the worst, but for some reason Tuesdays are just, they drag me down.

For Amanda, the moving classroom and the ability to ride on the bicycles was important to help her feel awake and alert which had an impact on her attention, and ultimately her learning.

Um, I loved the moving classroom, and as we started riding the bike I felt more awake and, you know, ready for the day kinda like I do whenever I work out in the morning, but I wasn't working out, it just, you know it was nice; get the blood flowing. And um, I don't know if it made me understand the lectures any better, but I was definitely able to pay attention.

Hermine also provides a very specific instance where she felt exhausted coming into class, and much to her surprise, the riding on the bicycle helped gain her attention and focus by "releasing my happy endorphins":

I was really excited about it. I thought it was a great idea until that last day like I was so exhausted cuz I didn't sleep the night before at all, but then it ended up being a positive thing because it woke me up and released my happy endorphins

For Cookie Monster, the obstacle was not staying awake in class, but rather had to do with fidgeting and difficulty focusing during class. Here Cookie describes how riding the bicycle in the moving classroom helped to calm her and allow her to focus on the course instruction:

I'm pretty much tired and then I have political science at 11 and I will start talking and like, my feet will start like moving like crazy because it's just like, I don't know, like I'm not like ADHD or anything like that but it's just like, I need to move or something like that and so when I go to nutrition it's like everything's calm and I can finally like focus and I don't have to worry about my legs moving all over the place. I like it. I really do.

For Brad, the benefit was not necessarily that the bike kept him awake, but actually helped him to focus in more depth on the course content and note taking. In this way, Brad's focus has increased in the area of note taking which helped him remember and learn the information for the class quizzes more easily. For Brad, he noticed a positive difference when recalling the course content for testing purposes:

I felt like I like, remembered stuff easier. Like when we would take the quizzes, like, (inaudible) like I remember taking, like, learning about that, you know, instead of – like I feel like I don't have to study as much because like I'm focusing more on the note taking than in the class, just taking down notes because I actually had to like focus on writing it well.

Tests are very important to this particular group who are striving to earn a degree. Testing and test results do play a significant role in the overall course grade and progress towards a

degree. Similarly, Amanda has noticed an improvement in her ability to remember course content when she reflects back over the course units which were not taught in the traditional classroom setting:

except for I know that I can remember stuff from that unit a lot better than I could remember stuff from the other units, but I can't think of a specific example from. That I thought, "oh, I'm learning so much better now"; I just think I did because I can remember a lot of stuff from that unit and whenever I think about all the other units, I can't really remember anything.

In this way, Amanda, who rode the bicycle religiously, noticed an improvement in her ability to remember important concepts from the course content when she rode on the bicycle compared to the times when she was sitting at a desk. Collectively, there does appear to be an increase in overall attention of students from the instructor perspective, but the individual rationale for this occurring is slightly different. For Hermine, the bicycle riding helped her focus and pay attention because she was typically fatigued and tired when she came to class. For Cookie, the bike riding helped by calming her when she was fidgeting and allowed her to focus in on the course content. Conversely, for both Brad and Amanda, the bike riding seemed to help improve their memory and ability to recall course content for tests. Regardless of the mechanism, it is apparent that the moving classroom, specifically riding on the stationary bicycles during class did have an impact on cognitive functioning in ways that students describe as attention, focus, and memory. Therefore, specifically for the college student with a variety of demands, bike riding seemed to be a productive way to increase student attention and focus in the academic setting.

Novelty and adaptation. There are many elements of the moving classroom which were new to both instructors and students. Some of the elements mentioned above such as having choices and the movement on the bicycle positively impacting attention and focus seem to yield a positive learning experiences. Other aspects of the moving classroom were distracting because of the new and different experience. Specifically, the college students acclimated to specific aspects of their environment such as the overall newness and excitement of the experience.

Dr. O'Malley observed the attention of her students being very different than what she would typically see in the traditional classroom:

I could see that, um, at least for the first 10 minutes of the lecture they were very preoccupied with the environment not with the lecture. That I have yet to ever see in any traditional setting. I mean usually the first 10 minutes is when I think that they are actually paying attention the most and then I might lose em. It was very much the opposite only after probably ten minutes did I recognize then that they could stop paying attention to their feet and their bodies and start paying attention to the notes.

Here, Dr. O'Malley observed her students being distracted by the new environment at the beginning of class, but after this short acclimation time of about ten minutes occurs, students were paying attention and engaged in the learning environment. This seemed to be an obvious contrast to what takes place in the traditional classroom for Dr. O'Malley where she typically has the student's full attention for the first ten minutes of class, and then the student attention depreciates as the class continues.

Not only was the newness of the environment something that the students had to get used to, but there was tangible excitement at the implementation of the moving classroom especially during the first two semesters. This excitement included the students, instructors, myself, and

the greater community. Dr. O'Malley discusses her initial excitement once she saw the students getting their bikes set up for the first time:

really once the students got over to the room and I saw them setting up and they were very interested and it seemed like they were very , um . . . what am I trying to say. They were willing to listen and kinda get their bikes figured out. You know, they became more engaged then any other time, um, and then of course I heard a lots of little comments like “ man, I wish this was the entire semester”, “ this is so cool”, and things like that and I got really really excited.

There was so much excitement around the launching of this project that the media came to visit our classroom and write a story about what we were doing. This added to the excitement level, but also was a distraction for the first few classes. Hermine was a student in this first class and talks about the media distractions and initial excitement:

it was distracting with all the cameras and stuff, but you would have that after all the fuss of, you know, the research and everything. That was just like an initial stage; everyone's just like all excited about it.

Dr. O'Malley's first class really took the brunt of all the excitement and attention focused on this project, but Dr. O'Malley always was able to harness that positive energy into her class and make it a productive experience for students. The result of the media attention was a story printed in the local newspaper. Dr. O'Malley brought copies of the newspaper for the entire class:

Yeah, so I brought a pack of newspapers in and we took about, oh, probably ten or fifteen minutes to talk about the article itself. Kind of some of the things you and I had already talked about. Um, but it was super fun for them. You know, I said, I'm sure some of you

will recognize some familiar faces in these pictures and they were like, oh my gosh, and you know, some of them had already been told by friends and colleagues they were in the [Local Newspaper] So they were just thrilled.

Student participant Katie, from the third semester class with Dr. Daily, discusses that despite the excitement that comes with a new experience, the novelty of the environment could be distracting at times:

Still exciting and fun, it was just like, new and then kind of distracting. I couldn't like focus on taking notes.

Students like Carolyn echo this initial difficulty of being in a new environment, but also that there seems to be a period of adaption where students will acclimate and become comfortable with the environment. The novelty will be gone and the student will adapt:

It's good. Um, I really haven't had to – now that I'm getting like, on schedule like taking notes 'cause at first when I was having trouble dealing with the bike with the note taking, I didn't have like a system down with this class yet, but now that I do, I can pretty much – it's not that difficult.

Therefore, the excitement of doing something innovative and new in the classroom produced excitement in everyone involved, but this did distract from the goal of the environment which was to learn. Understanding that the novelty and excitement will dissipate and that acclimation to the environment will occur overtime is important for future implementation of the moving classroom. With the disappearance of the novelty, not only did the distraction of novelty and excitement decrease, but we also experienced attrition of students riding on the bicycle:

Dr. O'Malley: Um... I noticed that the newness was wearing off even after just a few lectures, um, to the point where I worried that it wouldn't be – because it wasn't new any longer, it wouldn't be received well

Participation did decrease in each class, but was the most significant during the third semester in Dr. Dailey's class. The participation declined so much that he considered moving back to the traditional classroom:

I don't know. I really don't. I think the big thing that comes up is, looking at the mass, majority of the students at this point, since they're kind of falling off the bike is, you know, looking at, OK, for the best interest of the class, is it in the best interest that the majority are not on it to do it? I don't know. Um, so I mean, that would be really difficult to say at this point and I mean, I think... you know, maybe if it were one of those things where the students have an option to do it – I mean, I know they have an option to do it, um, but in a traditional classroom setting where you could actually put them in the back or something like that, if they wanted to ride they could.

There were some unique circumstances of Dr. Dailey's class that were very different from Dr. O'Malley's class which added some additional challenges. These challenges are discussed later in this chapter. In terms of excitement, there seems to be a process of excitement and novelty to acclimation, and possible attrition. This may simply indicate something about the human condition which is that we are drawn to new and exciting things, but that once the excitement wears off, so to speak, we revert back to what we know and what is comfortable. However, there may be something unique here where the excitement and newness sparks student's interest in participating, and the distraction that comes with the novelty wears off where the student can continue to benefit from the experience.

Collaborative Learning Experiences. Both Dr. Daily and Dr. O'Malley put a great deal of emphasis on the interaction of students in the classroom environment. Dr. Daily naturally prefers to allow students to work in small groups, and describes his traditional teaching style as:

Um, I like to try to keep it pretty interactive. Um, you know, try and get students involved. Uh, you know, in conversation, dialogue, um, you know, try to get them engaged in some kind of discussion that's relevant to the topic, um, as well as you know, hands-on activities and group work and things of that nature, so...

In terms of the utilization of instruction through lecture, Dr. Daily shares that although there is a purpose for lecture, he prefers to use groups as an instructional technique over lecture:

I try to, yeah. I mean, there's – and there's some days where I go in and you know, the lecture or the content just doesn't lend itself well to anything other than straight lecture but I try to get away from it either as often as I can or try – if I'm doing a lecture to get them to participate in it a little bit versus me just, you know, sitting up there and talking, so –

On the other hand, Dr. O'Malley prefers student interaction through whole class discussion which is mixed in with the instructor lecture. My field notes from observing Dr. O'Malley in the traditional classroom setting describes her instructional style this way:

A few minutes after entering the room she began a traditional lecture on nutrition as she paced across the front of the room explaining each powerpoint slide in her presentation.

Although, Dr. O'Malley uses lecture predominately, she pulls students into the conversation through the use of examples (for this class the topic is nutrition). This is an example from my field notes of Dr. O'Malley's class in the traditional classroom setting using student's drinks and food packaging for nutritional examples.

The instructor, then picks up a water bottle from student A11 to use as an example and then picks up a wrapper from a bar that student A2 had sitting on the front table.

Dr. O'Malley describes the student interaction in her lecture courses as a continual Q&A or Mythbusters discussion:

um, I get a lot of "what about" questions. Like, what about eating this? What about doing this type of diet? Or, and "I heard". So some of the questions would be like "I heard". One of them yesterday was: "I heard that if you don't eat protein within thirty minutes of your workout, then you might as well not bother" for recovery. And I just, you know. So those are the kind of, it's. I almost feel like it's a "myths buster" Q&A most of the time. So, that's what we get. We get a lot of "what ifs" "I hears" and "is this correct" kinda questions.

Although Dr. Daily and Dr. O'Malley have slightly different instructional approaches in the classroom, student interaction and collaboration are important and central to both instructional styles. Dr. Daily prefers the use of small groups, and Dr. O'Malley prefers large class interaction about current issues and topics.

John, a student in Dr. O'Malley's course has difficulty describing the instructional difference between this class and others he has taken, but he does identify that it is so much more than simple delivery of information from the instructor to the students.

Oh, it's one I actually look forward to going to as opposed to some other classes because it is – well, that and it's information I want to know but it's information that's not just put across – it's not ju—I mean, it's got the PowerPoint but it's not just the PowerPoint, so to speak, as some – as some instructors kind of do or what have you.

Dr. O'Malley was able to maintain the interaction within her class with the bikes spread out across the room. However, we learned that the moving classroom has some obstacles for doing small group work within Dr. Daily's moving classroom. Dr. Daily states that group work is one of the biggest differences between the traditional classroom and the moving classroom:

I mean, honestly that's probably been the biggest one for me. I think the other one is trying to figure out how to keep that group work, um, environment, because I do like the students collaborating with one another and having time to – because, you know, it kind of goes back to the whole discussion thing is, if they're not comfortable talking about it in class, you know, give them some time to sit down and talk amongst themselves and get some (inaudible) and now maybe they're gonna be more willing to share and do that. So you know, I always like to do that, um, in my other classes so that's one thing and this one's a little bit more challenging just because of how it's structured. Um, but you know, [what I've told them] and I've noticed with the timer, like, it does shut down but there's a little bit of buffer time.

Dr. Daily is referring to the data on the bike screen such as distance, heart rate, and an estimation of calories expended being lost when the individual stops pedaling. Therefore, if students get off of the bike to move into groups, they may lose this data if they do not move quickly. Many students didn't want that screen to clear, so they could accurately measure how many miles and calories were expended during a single class.

Fredrick describes how moving the bicycles into groups had some limitations, but also if the class started out with group work, students were less likely to get a bike out for the class. In summary, moving the bikes to do group work was inconvenient and not as easy as moving chairs into group as we see in a traditional classroom setting.

Yeah, 'cause usually like, towards the last half of class they'll be like, oh, we're gonna do a group today so... move your bikes together or it'll just start off at the beginning of the class, like he'll say we're starting group work now and so none of us will get a bike out.

And then we might finish early so we all just sit there.

Fredrick recommend a solution to doing small group work in the moving classroom by planning group work in advance and having the stationary bicycles set up in groups at the beginning of the class, so that students come into the classroom and the bikes are already arranged in groups:

I think that like the best way it could be done is to have the room already set up to where the bikes are like in threes and fours, like close to each other so it's already in a group setting if you wanna do groups. If not you – I mean, you're just gonna be next to somebody but I think that would be the easiest way is to already have it set up like in the front, like how we already have it, it's just put two tables and chairs around it.

Regardless of the instructional techniques used, it is important for college student to have peer-to-peer and instructor-to-student interactions within the learning environment. Bicycles are more difficult to move into small groups during a class meeting, so instructors will need to be mindful that when teaching in a moving classroom, bicycles should be set up prior to the class starting time to meet the instructional and learning demands of the course content and instructional techniques that day.

Physical Activity, Exercise, and Physiological Characteristics. The college students in the moving classroom were interested in a variety of physical aspects of the moving classroom. This group of students was unique in that they were all majoring in kinesiology and were taking a nutrition course within the moving classroom, we may assume that this group of participants found the physical activity and exercise benefits more than other groups of students may. I

found that the student participants in this study were very interested in the physical benefits of the moving classroom. Moreover, both the students and the instructor found a variety of physical benefits to the moving classroom.

Students, like John were keenly aware that there was a physical health benefit from the moving classroom:

um, but it was beneficial to get exercise, even if it was just a little bit during the class and it definitely helped keep me on my toes, so to speak, a little bit more so than normal.

Moreover, Katie, who had difficulty finding time in the day to workout, felt that the moving classroom also served the benefit of exercise:

And it was more like, um, I don't really have time during the day to get any exercise in anyway so it's kind of like two in one.

Katie's insights are important because this is someone who is getting some physical activity in the moving classroom that normal would not due to a busy schedule. She is going to attend class, and so incorporating movement during class was a physical benefit to her. Carolyn also expresses how she has embraced the exercise benefit from the moving classroom:

I really don't notice the difference anymore. I'm just used to it. I'll like pick out the levels on the bike and just play around with it. Get some exercise.

John reported cycling as many as 28 miles during a single class:

I think the highest I've gotten is 27-28 and the lowest, like the average like low is probably 21, 22.

Brett reports riding 30 miles in a single class and not realizing or meaning to:

I get too into it and I start pedaling real fast. I'll notice that sometimes like I'll pedal like 30 miles during that class and I don't even mean to . . .

Conversely, student-athletes such as David were aware of the exercise associated with the moving classroom because it added physical activity to an already great deal of physical exertion in the sport participation:

Um, for me kind of like, (inaudible) worked out since I'm an athlete and workouts so that kind of makes me not want to ride some days. Um, besides that, I don't know, like, it's really hard to like, I guess motivate myself to do it.

Sanders, an female student-athlete reports also the increased physical activity that the moving classroom adds to an athlete's already physically demanding schedule.

Kind of the same thing he has, like we had workouts in the morning and stuff and then lately we've had a lot more harder practices because it's towards the end of our like fall season so I haven't like wanted to ride because I know like afterwards I'm gonna go out there and have to run a whole bunch more after, so...

Therefore, although the primary focus must be on learning, it is evident that there is a component of physical activity and exercise in the moving classroom that benefits most college students.

One group, the student-athletes did express that they preferred having some choices in the moving classroom as they could easily overexert themselves by adding the physical activity of the moving classroom to their already demanding workout schedules.

Awareness of Bodies is Important for Learning

The overall body position of students within the learning environment was an important finding in this study. Prior to beginning my observations in the moving classroom, I completed an observation of Dr. O'Malley and her class in the traditional classroom setting.

While students were sitting in chairs at desks, I observed: some students were leaning with their back against the back of the chair while others were leaning forward with their

arms on the desk, and fewer students were sitting upright with their lower back against the seat and the rest of their torso upright.

In the moving classroom, both instructors and students assumed a more upright posture on the bicycles with the custom fitted desk (see Figure 6).



Figure 6. Students in the moving classroom riding on stationary bicycles with an upright posture.

Autonomy for Students. Autonomy or self-governance was discussed in theme one in terms of students having the option or opportunity to select to ride on the stationary bicycle during class, or to integrate themselves into the learning environment in multiple ways including sitting on physioballs, on the floor, or at a table/desk. Within theme two: Awareness of Bodies is Important for Learning goes beyond choices merely presenting choices for students within the classroom such as stationary bicycles, physioballs, and yoga mats. This category within theme two represents how student's awareness of their body position led to their choices in the moving classroom.

As mentioned earlier, students generally had an upright posture when seated on the bicycle. My field notes indicate the same general observation repeatedly: "All students on the bikes and the balls are sitting upright or leaning forward." Popeye indicated his choice to ride on the stationary bike was related to his posture:

I don't know, I think the spin bike's just good overall 'cause I mean, beside the seat because it helps you – it makes you keep your posture instead of slouching forward and things like that.

Additionally, Bob had been sick and noticed that he felt better sitting on the bike with a more upright posture compared to sitting slumping in a desk. Not only did he feel better overall, he also experienced better ability to breathe:

Yeah, and adding onto that, I mean, a few weeks ago I was kind of under the weather and I noticed in stats class I was just kinda like, just slouching and just worrying about my cough and stuff like that and then when I would come to nutrition I would still be on the bikes and I felt a lot different like I was... I would breathe through my nose a lot better than before and it just, it lets you focus more on the lecture than previous classes before.

Participants chose slightly different posturing positions while on the bike, but did have some slight modifications based on preference and comfort level (Figure 7 shows some variations in the postures of students).



Figure 7. Variations in upright posturing on bicycle (upright hands on hips, leaning forward on desk, leaning forward on handlebars).

The finding that students became aware of their body positioning in this environment is important. Even though students had multiple options and choices, they become more aware of their body positioning and were allowed the autonomy to choose what body positioning worked best for their own learning experience.

Attention and Focus. Not only movement, but also body position seemed to play a role in the student's ability to attend to the course delivery and focus on the course content. Meagan explains that sitting on the bike and specifically the posture helps her to stay alert and focused:

But it's a lot easier to focus in this class because when you're sitting in the other chairs, in the other lecture halls, like you can slouch and have bad posture, you can get comfortable and you start daydreaming and wandering off, but when you're up there and you're a little more uncomfortable and sitting up and everything it's a lot easier to focus. It keeps you awake and focused and everything whereas everything else you're sitting and just being comfortable.

Cookie Monster compared the choice to sit in a chair with that of sitting on a stationary bicycle. She, feels that the posture or position the body is in on the bicycle compared to that of sitting in a chair makes a positive difference in her ability to focus:

The comfortable ones you'll still like, slouch a little bit and you're in more of a relaxed position so you're gonna get – I mean, you're still gonna get like drowsy and everything even if your feet are moving. This one just kind of makes you like stay focused and upright and attentive.

Cookie's observations are important because we learn that not only is the movement of the legs peddling creating a change in the body and potentially the cognitive activities such as attention, focus, and memory, but the way that an individual must sit in an upright position on the bicycle is very different than sitting in a chair. Chelsea shared her experience with the posture required to sit on the stationary bike stating: "Makes you stay alert . . . versus sleeping." Overall, the posture in sitting upright on the bike is very different than sitting in a chair, and student's experienced that this upright posture assisting with their ability to focus in class.

Novelty and Adaptation. Not only was the novelty of the environment something that participants had to acclimate to, but participants also experience discomfort with the bike seat as many of them were not accustom to riding a bicycle for extended periods of time. Moreover, the particular bike seat on the spinning bikes is designed like a racing bike seat which many students had not experienced in the past. It was clear from the observations, interviews, and photos that the bike seat discomfort was a significant distraction within the learning environment. My field notes are riddled with comments about the apparent discomfort of the bike seats: "two students in front of me have stopped cycling, appear to be in uncomfortable", and in another entry "pain

in the bottom is an issue for most students.” Dr. O’Malley also observed that the seat discomfort was a distraction at first:

We would get far enough into the actual lectures, time-wise, and I could see them very fidgety because their bottoms were hurting and I worried that they would have to keep redirecting their focus to their discomfort

In order to assist with the acclimation process regarding the seat pain, Dr. O’Malley made a point to have the whole class take a break early in the semester and encouraged students to take breaks as needed. Hermine felt this was important to allow students to feel comfortable taking breaks as they acclimated to the seats:

I think something that would help. I think, I wanna say the second or third day, she made us more aware like “hey, you can get off the bike for a few seconds, it’s not gonna hurt. Like I was kinda afraid the first day to move, and then after she said that I was like, I gonna get off for a second and chill. Like I think if she would have said that the first day, I think maybe make everyone feel like they could a little bit more. It would have been better, cuz I was kinda afraid to hop off that first day and I don’t remember if it was the second or third day, she was like “you guys can get off if you need to”.

Although the bike seat was too uncomfortable for a few to continue, many did experience the initial discomfort and noticed that their body did acclimate to where they became accustomed to the bike seat. Popeye explains his interaction with another students in the class who stopped riding the bike due to the bike seat discomfort:

I know, one of the guys there, he got on the spin bike the first day we were on it and then after that he hasn’t gotten on it and then I had asked him, I go, you’re not riding the bike?

And he's like, no, it hurts too much, you know. I focus more on the pain than I do on class so I'd rather just sit down. So I mean, he's been sitting down ever since.

For Popeye himself, despite having initial discomfort, he began to acclimate to the seat:

I've noticed that my (inaudible)'s improved since day one but uh, it's kinda hard to – at first it was kinda hard to ride and uh, bike at the same time but it's gotten – it's gotten better and the tolerance for the – for the pain is, once you pay attention more to the lecture you kinda forget about it.

Bailey was able to accommodate to a point of comfort in the classroom and describes that the gel bike seats that we provided were helpful for the bike seat comfort:

I feel better I think now, like I can go like the whole class without being uncomfortable but like the actual cushion seat actually helps a lot now because I don't think I noticed it but I don't think I was just used to riding a bike.

However, many students chose not to utilize the gel bike seat which was provided because, for them, it either didn't make a positive difference or they didn't like the idea of using a gel seat.

The image below (Figure 8) demonstrates only one of the various cushions students found in the environment to assist with bike seat pain. Students used towels like that in the photo as well as yoga mats, and even brought their own pillows to sit on.



Figure 8. Student use a folded towel over seat to help with bike seat discomfort.

In terms of body awareness, most students were very aware of the seat discomfort; however, the participants that continued to ride on the bike (even with taking breaks periodically) were able to acclimate to the bike seat.

Collaborative Learning Environment. In a collaborative learning environment it is likely that students and instructors will need to move about the classroom to interact with others. One important finding from the moving classroom was that even though participants were moving their bodies on stationary bicycles, it was not as easy for them to move about the room to interact with others as it was in the traditional classroom.

Amanda describes how being on the stationary bicycles in the moving classroom limited the typical teaching style of Dr. O'Malley to moving around the classroom, and how although everyone was 'moving' on the bicycles, they were also 'stationary':

Also, with her being on a bike she couldn't, usually in her regular classroom she moves around, so if for a few seconds she's in the way of the slides, she'll move out of the way.

But, I had a real hard time one day cuz she was just right there in the way of the notes, so I had a hard time one day. It's not like she can move

Dr. O'Malley discusses her inability to move around the room contradicting her typical instructional style and ability to interact with students when she was on the stationary bicycle:

I guess change in my teaching style is, I've always moved across the classroom. I've made it a point from my first semester that I've ever taught – really post-doctorate cognitive classes, is to always try to incorporate the entire room and I've always done it by geography. So I'll go over to that side of the room if a student has a question and I will try to answer it on that side of the room, and then I try to just kind of filter back and forth. That was the hardest thing for me. I tried to do it with just visually, like skating

the room, or even turning my shoulders to try to engage, but that felt confining. And that was the biggest thing for me, is I worried that I wouldn't get the interaction that I had enjoyed in a traditional style classroom.

Dr. Daily was able to implemented small group work into the moving classroom, but he would have liked to have the groups become more diverse. His experience is that asking the students to move themselves and the bike a further distance within the moving classroom would have created more chaos:

Yeah, I mean, I'll usually tell them, OK, take a minute, we're gonna break into groups of about four or five. Try and find somebody that's close to you. Yeah, and they're already sitting by people that they wanna be in groups with anyway. Now, the thing that I have not done that I will do a lot is try and mix the groups up. Um, I think at this point in time it would just be too chaotic, um, so I'm not even gonna go there at this point. Um, but you know, I think again, just giving them the opportunity to work together in little pods, if you will, kind of helps.

As an instructor, Dr. Daily did notice that being confined to the stationary bicycle had some pros and cons to it. Like Dr. O'Malley, Dr. Daily had a difficult time being confined to a single position on the stationary bicycle, but also did like the ability to have his notes right in front of him all throughout class.

For me, that's probably one of the hardest things is sitting down the whole time because I am up all the time. When I'm in a classroom usually I'm all over it. I mean, I'm up and down the aisles, in the front of the room, the back of the room, I mean, all over. So for me, you know, being locked in –To one spot, yeah. Is – it's – that part is very different for me as well. Now, there's some things I like about it. Um, because I'm really able to

sit there and I can, you know, review my notes, you know, as I go, um, which usually I'll just go. Um, so you know, that part's been good. Um, you know, but for those students who are like me who don't sit well for a long period of time then you know, for them it's – it might be (inaudible) that they're actually having something to do while they're – they're doing it.

Overall, the intention of the moving classroom was to increase physical movement among participants, and although those who rode on the stationary bicycles did increase their body movement, participants were limited to moving on a stationary bicycle. Stationary bikes can be moved around the room to allow for interactions in small groups. However, less movement around the classroom did seem to limit interaction among members of the class. Thus, this is a challenge of teaching and learning in the moving classroom.

Physical Activity, Exercise, and Physiological Characteristics. Participants measured and kept track of their physical activity in the moving classroom in a variety of ways. For some participants, both students and instructors, the increased metabolism from the moving classroom was evident by the number of calories expended or by the need to take in more calories. For Meagan, she was tracking the number of calories expended during the moving classroom:

Kind of the same thing he has, like we had workouts in the morning and stuff and then lately we've had a lot more harder practices because it's towards the end of our like fall season so I haven't like wanted to ride because I know like afterwards I'm gonna go out there and have to run a whole bunch more after, so...

David also was aware of the caloric expenditure that was occurring while riding the bike in the moving classroom noting that he was burning an estimated 300-400 more calories each day he was participating in the moving classroom:

I noticed I burned a lot more. I mean, I looked at what it said on the little monitor thing. Who knows if that's accurate but says like, 3-400 calories if not more in one sitting so I mean, we're burning a lot more than I'm used to.

Sanders, a student athlete, notices that she must take in more calories due to the increased activity level, but also noticed the need to take in more fluids due to the extra physical activity.

I've noticed I have to eat more because I get more hungry and then uh, actually the first week we started biking, I didn't really have a Gatorade with me and I got dehydrated in practice.

Dr. O'Malley also noticed that although she did not feel physical exertion following the class in the moving classroom, she did require an increase in caloric and fluid intake:

One of my students came to me or told me the next class cuz I had him in that class and then the very next class. And he said. I said "guys I'm so sorry, I've never done this before, but I need to eat. I have some apple slices with me. I've never lectured and ate at the same time and I know it's a little unusual and a bit rude, but I still have to. I just taught on a spinning bike and I can't get to the next class." And so, I literally lectured while eating apple slices.

What was interesting is that many of us didn't realize how many calories we were expending or amount of fluid lost. Dr. O'Malley did have an episode of dehydration and muscle cramping following one class although many of us were not visibly sweating.

The take away message here is that there is tremendous potential to increase the physical activity among college students through implementation of the moving classroom. However, students must be informed about this increase in physical activity and how it will affect their bodies because many participants will not realize they are expending the number of calories that

they actually are, or realize the potential fluid loss. Therefore, I highly recommend that participants have something healthy to eat prior to coming to the moving classroom (don't skip meals prior to class), and everyone should bring water with them to class.

The Purpose of Movement Must be Clear for Effective Teaching and Learning

Each class had a moving classroom orientation day where the informed consent process was covered, questions were answered, and students were taught how to move and set up their bike to meet their specific height and comfort. Additionally, during each orientation meeting I made a very diligent effort to explain to all participants that each student could decide their own pace to ride on the bikes, and that we wanted them to ride in such a way that allowed them to pay attention to the course presentation and content primarily. Therefore, the message was that exercise benefits should be secondary to learning; "This is not an exercise class." Despite these instructions, and perhaps do to the kinesiology mindset of the participants, this was not something that was realized immediately for all participants, but rather realized over time. Dr. O'Malley, the first instructor participant had her own experience in realizing this which made her more comfortable as an instructor in the moving classroom:

Once it actually came to the study and I felt like we as a research team had made it very clear that this is not a workout. This is just simply moving your body. I think once I got my own head around that I was never worried about the workout or the act itself.

Meagan explained her experience with this process of understanding the purpose of the moving classroom noting that in the beginning the moving class was really seen as a dual purpose of exercises during class:

I think we got overzealous. We were like, oh my gosh, this is awesome, two birds one stone, calories, bikes, and we were all overexcited about it so we were all going a lot

further. I think, I don't know if you've been going through the sheets on a regular basis but I think if I had to guess most people would be going down in mileage which is weird because before we started class I would say that people would be getting more in shape and more comfortable on the bike and less butt hurting and so it would go up but actually I think it's going the other way.

Autonomy for Students. In addition to selecting what works best for the individual, there is also a sort of modeling that was occurring in the moving classroom where students were looking to instructors as an example or a model. John discusses how he was watching Dr. O'Malley cycle and how he felt that he could not meet what she was modeling in terms of pedaling rate:

Because she normally like kind of paces during class, back and forth, but like, I coulda swore she was like, tch-tch-tch, like doing a spin class that first day because she was flying like constantly, legs were like moving like non-stop and I felt – because I noticed it because I'm like, well, I'm not going anywhere near as fast as that. I'm like, either I'm like, doing something wrong or something, or she's got like the... or I've got the resistance up too high or, I was thinking like something I'm – I've done something that's not the same but then I found out later that she had a resistance lower than mine and then I noticed it like, I guess that hers – by the time she had gotten to her last classroom, I guess what she said is, she had started to slow down just I guess naturally and then kind of got into the rhythm of things.

Once John was able to talk to Dr. O'Malley about her pace he no longer felt that he was doing something wrong or not measuring up.

During the third moving classroom semester, a sense of competition about the riding speed developed among the participants. The instructor Dr. Daily initially found the pace of course delivery as well as pace on the bike was too fast for the learning environment, and was able to adjust the pace once this was acknowledged:

So I kind of felt the need to increase the rate of delivery just because it looked like they were ready for more and they didn't want to get involved so like, all right, we're gonna cover the material then, and uh, based on the fact the I'm on a bike, honestly respiration rate is gonna be higher anyway so I'm hammering the lecture and I'm on, you know, the bike so all of a sudden cognition was not there. I mean, I was out the door.

The students in Dr. Daily's class started to model his pace, and subsequently a competitive environment was created. Moreover, Dr. Daily has a background in sport conditioning and fitness, and began asking students about their bike speed and mileage during class. Although, the instructor had a good understanding of the purpose of the bicycle and riding speeds needing to allow for student learning, the students started to lose sight of the purpose. Maria describes her experience as a member of this competitive group of students:

Just, I really like it but I think the biggest thing is, like, a lot of us like, we're a competitive class and so we started off, like, trying to get – let's go as many miles as we can, let's go – I'll beat you, dadadadada, and I think that's where we started going kind of in a bad direction.

Frank also discussed the influence of the instructor on the competitive nature of the bike riding:

It just, I think all of us started out competitive because Dr. Daily started, well, how many miles do you have so far? . . . And he started the competition

Fredrick also indicated that there was this competitive atmosphere that developed and the class lost sight of the purpose of the moving classroom:

Everybody was like just – everyone went up from there, like oh, I did this many, oh, I did this many. Oh, I did this many on this speed.

Dr. Daily's class which started out competing for mileage acknowledged that that was not in line with the purpose of the course and adjusted accordingly. Frank describes the change in mindset moving from a competitive mindset to a non-competitive learning mindset: "Now I don't really care about competition. I'm just like, ladada." Maria explains the competition dissipating by describing: "It's kind of chilled out." After the acknowledgement by both the instructor and students that the environment was becoming too competitive to be conducive to learning, the members of the class adapted and adjusted.

Attention and Focus. Related to riding speeds, it was important for participants to choose speed and resistance measures on the bike that worked best for that individual's needs. From my field notes from day three of the first class, I noted: "Students are riding at varied speeds." Dr. O'Malley talked about her conversation with a student participant regarding her pedaling speed during course instruction:

[lol] so anyway, and he said, "you were going really fast." I said, "I was?". I had no idea what I was doing on. You know, and that's what's, what I thought was interesting, I don't really know what my body was doing because I was focused so much on the materials. So, maybe there is a point when you move from worrying about your body, although your body is moving and clearly you have to use the brain power to move your body, but you can hyperfocus on, and you know and there's learning theories about this all over the place, but you can hyperfocus on one topic and give, you know, most of your

attention to that topic while these other things are going on kinda in your back brain. It was; I had no idea. I don't know what speed I had, I don't know anything about that; about and when he said "you were going really fast", I had no idea.

Although the students may have perceived the rate to be fast, for Dr. O'Malley it was a perfect pace for her which allowed her to focus her attention on the course delivery. The rate or pace of cycling was not in her conscious. In this way, the purpose of the moving classroom was achieved, the instructor was able to achieve a cycling pace which allowed her to focus on the primary task of course delivery.

Like Dr. O'Malley, Brett also pedaled at a fast rate naturally, and did not notice it until he realizes how much he is sweating and looks around to compare his speed to others in the class:

I get too into it and I start pedaling real fast. I'll notice that sometimes like I'll pedal like 30 miles during that class and I don't even mean to, like I'll be soaking with sweat but I think it's just like, I'm sitting there and I'm listening, and I just start pedaling faster and faster and so I'm taking notes and I'm just like, you know.

What we learned from this datum is that each individual has an optimal speed of pedaling with the appropriate resistance which allows them to attend to the class and course content. As mentioned above, some students can become distracting by trying to pedal at a particular pace, and it seems to be most important that each individual chooses a pace which allows the pedaling to almost become unconscious.

Novelty and Adaptation. The purpose found in riding a stationary bicycle for most individuals is for the purpose of exercise and fitness. Instructors and students alike had a difficult time adjusting to and discovering the purpose of riding the bike in a way that allowed

for the primary focus to be in the course content. As Dr. Daily found, there was so much new in this unique environment that it does take some time to acclimate:

Yeah, one of the things – as I’m getting more used to it, it’s not – it’s not as bad because like, again, there’s definitely things about being on the bike and being right there in front of, you know, the notes and things like that that I like. Um, but you know, again, it’s hard for me to say just because like, I get up and move so much that that’s more my style. I don’t think it’s just a bad thing, I think it’s an acclimation thing at this point.

Given some time, Katie was able to acclimate to the moving classroom in terms of being able to turn her attention away from riding the bicycle and to the course content:

I mean, I get to the point where like, if you start, you know, telling a story I’ll just be like, OK, and then pay attention.

Meagan, like other students, started out the course by riding viciously, but was able to adjust her rigor to meet her specific needs:

I did that at the beginning. I was like, OK, higher resistance, more miles, and then lately I guess because I’ve also been training on my own I’ve been trying to conserve maybe more energy or just getting lazy, I’ve been doing half the amount of miles and and the resistance.

Popeye also made an adjustment by noting his mileage at the beginning of the class and how he was able to adjust that mileage overtime:

I think I’ve been like, the first couple weeks when we first started doing it I was like at 25, 26 miles and now I’m probably like at 20. . . I think it’s just focusing more on the notes rather than just pedaling.

Regardless of the reason or trigger, participants (both instructors and students) across all three classes had a difficult time grasping a full understanding of the use of bikes within the learning environment. Across all classes, students started out the class with a fast pace which was not the ideal pace for learning, but as the course went on, students acclimated to realize the purpose of the movement and adjusted their speed accordingly.

Collaborative Learning Experiences. As mentioned above, the primary purpose of the moving classroom is learning. Although, there is certainly an aspect of this environment which includes caloric expenditure, this should be a secondary or unconscious focus of the environment as to not distract from the learning environment. Because learning is the primary focus, it is important to consider how students learn best, and implement instructional methods which are most conducive to learning.

As mentioned earlier, student-to-student interaction as well as instructor-student interaction were important aspects of learning across all three moving classes. John describes how the interaction within Dr. O'Malley's class is important for his enjoyment of learning:

I guess it's just like a – it's a lighter mood, it's – information that's like easy to like intake so to speak so it's... it's um, Dr. [O'Malley] makes uh, puts things across everything, it's kind of simple and easy to learn. It's – there's lots of joke telling and stuff.

Maria discusses how Dr. Daily includes small group work each class. The students do seem to feel that the collaborative nature of this group work is important, but it is difficult within the moving classroom to collaborate in small groups.

I've ridden every day but I haven't ridden the whole class. Like there's been a couple classes where it's like, I'll be like, OK, I don't want to keep going so I'll stop like, after

30 minutes or something. Because like if we have group proj—groups – group work, it's hard to like, do group work on the bike and that's what [Dr. Daily] is all about.

Fredrick explains that student get off of their bikes to do the group work in Dr. Daily's class:

We just get off and if someone – If someone really wants to stay on their bike we pretty much – we just all shift over there to that bike.

Therefore, one major consideration of teaching in a moving classroom is to ensure that the method of movement is not interfering with learning. The major barrier to collaborative learning in terms of doing small groups is setting up the bikes ahead of time with the purpose of how the students were going to engage in learning that day. Maria recommends:

I think if there was like a cycling classroom that was like half desks, half bikes, or all bikes and a couple chairs, like, I think that would work good because I mean, if you go into the classroom, the bike's already set up. All you have to do is sit down and get on and you know, you have the option, the bike or chair, straight up. You don't have to be like, OK, let me go make sure the closet's open, pull the bike out and then we have to climb on top of a bike to get our desk and now we have to set our desk up, let's lift it up, then we get our stuff out.

Like Maria, Fredrick suggests having the bikes set up prior to the class, but Fredrick feels that the moving class should always be set up into collaborative small groups:

I think that like the best way it could be done is to have the room already set up to where the bikes are like in threes and fours, like close to each other so it's already in a group setting if you wanna do groups. If not you – I mean, you're just gonna be next to somebody but I think that would be the easiest way is to already have it set up like in the front, like how we already have it, it's just put two tables and chairs around it.

Although, Dr. O'Malley prefers each participant setting up their own bike for interaction in the classroom to meet specific student needs, she does indicate that the bike placement needs to be purposeful:

This is better because you know how you've sat in a group environment and you kinda have to like lean over to the side to get the vantage point you need; whether it's the board or your, you know lecture or whoever, and letting them set up their own bikes ended up better because they could see where I was eventually going to end up, of course, I ended up moving it, which I can now set up appropriately the next time and they could see the board. So, they could set up the bike to have those two vantage points. And when I did move, I did end up, I did end up blocking one a student in the back from a student in the front. But, it didn't start out that way, he had chosen his space wisely with that in mind and then I shifted over to my left and it blocked our view. His view and my view of him, but um, but I actually think that worked out a lot better.

Therefore, the conclusions here are multilayered. First, the primary objective must be on student learning. Collaboration and interaction are central to student learning, but each instructor may facilitate this collaboration in a variety of ways, and could vary depending on the course content. Therefore, regardless of who sets up the moving classroom (individuals for each class or preset by instructor), the classroom should be set up with the first goal of effective learning in mind. Part of that is considering how students will interact in the classroom, and having the set up meet the collaboration needs of the class.

Physical Activity, Exercise, and Physiological Characteristics. As mentioned earlier, it was important for both instructors and student participants to have the primary goal of learning within the moving classroom. Although it was easy for some participants to become distracted

with goals of physical activity and exercise, attending to this exercise as a primary objective became distractive to learning. This is not to say, however, that physical activity is should not be a motivating factor or secondary goal. This is only to say that attending to the physical activity or exercise can be a distraction to the learning. Therefore, the goal is that the movement becomes something done unconsciously.

Chelsea discusses how her focus shifted somewhat after the first exam in the class, and how her focus on exercise was detrimental to the learning experience:

It can kinda be for me if I'm in a really good working out mood because I'm try and make it more of a workout than a class, but um – I think more educationally after a test. Like Chelsea, John became aware of the ability to become distracted by over focusing on the exercise benefits of the moving classroom. For John, he took the instructions we gave about the goal being primarily to learn to heart. John was able to select a resistance and pace that worked well for him; what he describes as a steady slow pace.

Just, that first one I initially got I thought was pretty good because I remember I was told I guess initially that it shouldn't technically be like a workout or like, or anything like that that. It should just be like movement so I think I got mine up to like, I just kept it on four and just kind of stayed within it and it was just like a steady I guess slow pace or what have you. It wasn't super-fast but it was enough to where, like, I remember she asked me when I had mine on like I (inaudible) 10 to 12 or 13 miles when we're all said and done but I guess it was at a decent pace.

Bob started out in the moving classroom at a faster pace on the bike, and made an adjustment so he could focus more on note taking and course content:

Yeah, I started hard at first but now it's, I've slowed down because I kind of take more notes. I keep my legs moving but I don't go at a constant pace like I used to.

As mentioned earlier, Dr. Daily's class became created a competitive environment concerning physical outcomes which distracted from the learning environment:

Maria: I really like the bikes. Like, it's a good idea and it's like, I think it's helpful. I think the problem is just trying to get in the right state of mind. Getting into the class is the hard part.

Fedrick: Not being competitive.

Maria: Yeah. Like realizing it's a cla—it's an academic class, not an exercise class.

For most participants in the moving classroom it took some time and experience to find a work rate or pace that worked best for learning even though they may not have been exercising or physically exerting themselves as much. It is clear that there is some physical benefit of moving on the bike during class even if this is done at individualized rates and not the primary reason for cycling. I believe it is best to think of the physical benefits of the moving classroom as secondary to learning. This is not to say that the physical benefits are less important than the learning, but what we found is that students who were overly concerned with the physical outcomes did not have a good learning experience, and even reported low test scores over course content.

Identified Challenges

Over the course of three semesters in this novel environment, there were many lessons and challenges about ways that a moving classroom can be improved for the future. Although some challenges were more significant than others, the instructors and majority of participants

saw a greater benefit from the moving classroom than cost. I will discuss some of the many challenges we faced, and offer my suggestions for future implementation.

Instructor Experience

As discussed earlier in chapter 4, Dr. O'Malley and Dr. Daily entered into teaching in the moving classroom with very different background and experiences. Dr. O'Malley was very comfortable with the course and teaching college students. She had more than four years of teaching experience at Cambiar University teaching this nutrition course. Dr. Daily, however, was a new professor and this nutrition course was one of many new courses that Dr. Dailey had to prepare during the semester in which his course participated in the moving classroom:

Just trying to figure it out. Well, and kind of as we talked about before, this is a new [prep] for me as well. . . So that throws another dynamic into it. I never taught this class in a traditional classroom setting. . . You know, so basically it's all kind of new at this point.

Both instructors teach with high energy, and the students connect with both instructors. Maria explains that Dr. Daily genuinely cares about students and their learning:

I think honestly just [Dailys'] personality. He's just got.. the way he goes into situations when he talks about stuff is conducive but with like, the size of the room, it's really big and having people like, everywhere and having group work, like sometimes I just get super distracted and it's hard to pay attention so I think [Dr. Daily] helps a lot and just like having someone there that like, really wants to teach you. If there's someone in there that was like, not into it, like, I wouldn't learn anything.

Valerie also explains that Dr. Daily's teaching is important and valuable:

OK, because like, Mr.[Daily] he says extra things that are really useful, you know.

Dr. O'Malley also is also an effective teacher and well-liked by students. Ben describes his experiences in having Dr. O'Malley as an instructor as enthusiastic and valuable:

Ms. [O'Malley] is really enthusiastic and I kind of, I'm always attentive to what she's saying . . .

Nate also echos Ben's sentiments that Dr. O'Malley is high energy and that it is fun having her as a teacher:

She's so energetic so she pretty much walks around the classroom the whole time anyway and she knows [her course content] too so it's fun having her as a teacher and everything like that 'cause she knows [her stuff] but she teaches and she gets into it.

Overall, both instructors as very energetic and effective in terms of teaching and student learning. Student report liking both of these instructors, and I never heard anything negative about them or their teaching while in the field. The primary difference between Dr. O'Malley and Dr. Daily from an instructional standpoint was experience. I would not recommend teaching in a moving classroom for a new professor that already has a lot of things that they are acclimating to. The moving classroom added another stressor to a new professor who was already trying to balance several new course preparations as well as getting used to the role of faculty at the university level. One very important thing we learning about the moving classroom is that it should be reserved for instructors who have already taught the course previously because it may be overwhelming to teach new content in this new environment.

Class Schedules

Another challenge that imerged over the three semesters in the moving classroom is that the first two semesters were taught on a Tuesday and Thursday course schedule which meant that the course met for one hour and fifteen minutes two days a week. However, during the third

semester the course was taught on a Monday, Wednesday, and Friday schedule which meant that the course met three days a week for only fifty minutes. This shorter class meeting time added some additional stress in terms of getting the classroom set up, and have students riding on the bicycles learning for the entire fifty minute course. This was also further complicated by an aerobics class which was using the room prior to the class. I will discuss challenges with the facility below. The length of the course meeting time was an important factor. Dr. Daily describes how starting the course late to allow for students to set up their bikes and getting ready for the course was creating a loss of time to cover needed course material:

Yeah, I'm losing time, like I'm losing usually at least five on a front and five to ten on the back end, so I mean, we're talking about you know, really 35 to 45 minute class depending on what day it is. Um, so I mean, that's a little bit of a challenge, but you know, right now what I'm trying to do is, it's a new prep as well so trying to get (inaudible) OK, here's all the things I've got to get through at this point. Um, like originally I had planned on giving them an exam for Monday. I moved it. We're doing it on, um, uh, the following Monday and we're not even gonna cover all the materials I plan on covering.

Therefore, due to the investment in time on the part of the instructor and students to set up their bikes and get acclimated to riding on the bike, and getting prepared to learn, I would recommend that the moving classroom is utilized for courses which are longer than fifty minutes especially if set up is required. However, I also would not recommend the moving classroom for a class lasting longer than 1.5 hours as bike seat discomfort started to become a distraction for many students. Bob describes his experience with the bike seat starting to become a distraction after 50 minutes of riding the bike continuously:

It was real close to the end, probably around like 50 minutes. Like 120[pm or 50 minutes] for the time, like I'll feel numb like fidgety just trying to find a position

Also, using the moving classroom for courses beyond 1.5 hours in length could have significant impacts on caloric expenditure and dehydration as discussed earlier in this chapter. Therefore, fifty minute classes may be too short if set up time is required on the part of the instructor and student, but riding the bike beyond 1.25-1.5 hours could also have negative consequences in terms of seat discomfort, caloric expenditure, and dehydration concerns.

Recreational Sports Exercise Room

For the study, a Recreational Sports exercise room was utilized. This space was chosen for this study primarily for the purpose of access to thirty stationary spinning bikes that were typically used for spinning classes offered by the Recreational Sports department on campus. Although this space did provide easy access to the bikes, there were many elements of the environment which were not conducive to a classroom learning environment.

Lighting. The lighting in the exercise room was was not able to dim in the appropriate area to allow for clear vision of the projector screen and PowerPoint notes. Instructors adjusted background color of PowerPoint slides to compensate for this. Because the primary purpose of the exercise room was for fitness courses, and not for academic courses, lighting for projector use was not considered. Amanda describes the lightening as annoying: "Oh, and it was annoying the lights in that room we were in because I could hardly see the slides." John echos the problems seeing the notes on the projected PowerPoint notes:

Just the – well, the initial day and um, let's see, 'cause the lights didn't help in one sense because, I guess because it was, the projector

Frank, along with other students, recommended changing the background color on the PowerPoint slides to allow for better visibility:

The background should be black, the letters should be white. It'll be easier than white background, black letters.

Fredrick explains the problem could easily be solved if the lights were able to be dimmed:

Yeah. And then something, I also think, if we could dim the lights, like in the front, it would probably help but if you turn off the lights in that room all the lights go out.

When teaching within a moving classroom instructors should consider the purpose of the room being utilized, and particularly lighting in the room should be considered especially if notes or presentation material will be delivered via a projector. Although an exercise room or facility may allow greater access to equipment which will allow students to move, it is important to also consider access to instructional technologies and the effective use of those within the classroom for effective course delivery.

Mirrors. It is not uncommon for an exercise room to have mirrors everywhere. In the room we utilized, a full wall was completely covered with mirrors. Although the instructors and I minfully designed the classroom to face away from the mirrors as much as possible, these were unavoidable. A description of the classroom from my field notes helps to paint the picture:

As you enter the multipurpose room/aerobic room in the [Wellness Center]. There is a full wall of mirrors. In the font and approximate center of the room is a portable screen and a cart containing a laptop with projector. The instructor is riding on a stationary bike just to the right of the cart and her bike is angled at approximately 45 degrees facing slightly to the left of the room.

Portable Classroom. Because this room was not a room dedicated for academic courses, there was no technology permanently installed in the room for instructional purposes. Therefore, a workorder with the campus Information Technology department. This was an additional department which had to coordinate efforts to set up the laptop, projector, and projector screen before each and every class meeting. Although the task of having all needed equipment set up for each and every class takes into consideration a collaborative effort with a variety of equipments, the set up was further compounded with Dr. Daily's class as we only had a 5-10 minute window between the end of a scheduled aerobics course and our nutrition in the moving classroom. The result was that the classroom was not often fully equipped by the beginning of class time. Dr. Daily explains his frustration with the set up of the moving classroom:

Um, with this one, and that's been a challenge, is um, just because of, you know, delivery of the materials, getting the materials like AV equipment, things like that, um, you know, trying to get the tables set up, chairs set up, bikes set up, you know, running cords from here to there, you know, getting heart rates, getting all that stuff together. That's been a little bit of a challenge because normally, I mean, if I were doing it in a normal circumstance I have everything set out, you know, and everything would be on the tables ready to go but we can't do that based on what we've got.

For future implementation of the moving classroom, technology and instructional equipment needs to be readily accessible within the moving classroom. It was evident that the frustration of the faculty and the students with the setting up of all of the equipment became a burden and a stressor. The burden of setting up the classroom for each class became a barrier to both effective teaching and learning to some degree.

The burden of classroom set up was certainly not limited to the technology, but also included setting up the bikes. Amanda describes that having the bikes set up ahead of time and permanently would have reduced a barrier to participate in riding the bike:

okay, one more thing. Another good thing about having the bikes pre-setup. If someone is on the cusp of going to class today, I'll just be like 10 min late. Like if you have the bikes set up they can kinda walk in and just sit on a bike. Like if I'm gonna be late to class, I'll walk in and just sit in the back row, but if the moving classroom didn't have the bikes set up and I knew I was going to be 10 min late and everyone was going to be pedaling and I had to go the back and get the bike out and cause all that commotion

Exercise Classes. As is typical with the facility that we were utilizing, a variety of group fitness courses were meeting prior to, after, and during our class meeting. To major distractions to the learning environment developed as a result. First, as mentioned previously, having an aerobic class that met prior to our class, and often did not exit the room on time limited the amount of time available for setting up the moving classroom. Set up of the room was very rushed and induced frustration for the instructor, but also acted as a barrier for students being motivated to take out a bike and use it for class. In a reflective interview with Dr. Daily more than one year after teaching in the moving classroom, he points out that the set up was one of the most significant obstacles to the moving classroom, and especially having the aerobics class in the room prior had a significant impact on the ability to set up the room in time for class:

Oh, man. Um, I think looking back, the biggest – probably the biggest challenge was just the set-up and the location. Not having a dedicated classroom to it because I think, you know, what would happen is we had the, uh, aerobics class that would come in right before that and typically if they're a little bit late and we weren't able to get our

equipment out – and so consequently what happened is, you know, each day that would delay the process of actually getting started by, you know, 5-10 minutes depending on kind of what the situation was, and then of course you’ve gotta shut down 5-10 minutes early to make sure that everything gets put back in place and things of that nature. So I just noticed that, you know, within about two, three weeks, you know, when given the option to either be on the bike or not, but a lot of them were going no.

Dr. O’Malley also had an issue with a Zumba exercise class which met directly next door to the moving classroom. On several occasions, we had to ask the Zumba instructor to turn down the volume of the music and/or the microphone she was using for the class as it was distracting both the student and the instructor. Some students were able to block out this additional noise, but overall, it was a distraction. Although Ben perceived the movement on the bike to be beneficial to his attention and focus, he did note that the Zumba class was a distraction in the environment:

I enjoyed it. I definitely enjoy moving more than sitting still. I feel like it’s beneficial to me in pretty much every aspect, especially (inaudible 18:30) if I’m in a classroom where you’re just sitting, listening to a professor talk, if there’s an outside distraction that pretty much captures all my attention but we had that Zumba class next to us and we were on the bikes, I felt like I could focus more on the lecture instead of letting that take my attention away. I think it was beneficial overall.

The following excerpt from my field notes explains how I had to go and ask the Zumba instructor to adjust her volume due to the distracting nature of the volume of the music and instructor voice:

Zumba class next door is distracting to professor. She has spent several minutes speaking about Zumba class next door rather than the lecture. Additionally, I got off of my bike initially to go and speak to one of the facility administrators and grab a towel to put at the bottom of the door adjoining our rooms.

Despite the efforts to buffer the noise and ask the instructor to lower the volume, we were no on our turf which made reducing this distraction very difficult.

Overall, the facility itself presented several obstacles that impacted teaching and learning within a moving classroom. Hermine, a student in the first semester class, recognized not having a dedicated classroom for movement was a potential obstacle:

That like, but I think part of it is that room, that room really designed for that either. Like maybe if you're going to moving classroom, maybe there's a designated classroom and the bikes wouldn't even have to be put away; they could just stay out and there could be a place marked on the floor and this is where this one goes and that one goes

A dedicated classroom with effective teaching and learning in mind would be critical for future teaching endeavors utilizing a moving classroom. Utilization of an exercise room did afford us the opportunity to study this unique concept, and for that I am grateful, but moving forward with any future moving classroom implementation, I highly recommend a dedicated space.

Media Attention

As I have discussed throughout this chapter, the implementation of the moving classroom created quite a bit of excitement among students, faculty, and the community. There was so much excitement about this project that the local newspaper visited our unique class to write a story about it. At the time, the instructor and I were so excited about the opportunity that we did not realize the distraction that would be created by photographers being in the room taking

pictures for their story. Luckily, their visit was short lived and lasted less than one hour. Hermine describes her experience with this media attention and the “fuss“:

. . . and it was distracting with all the cameras and stuff, but you would have that after all the fuss of, you know, the research and everything.

Amanda agreed that the media were a distraction, and possibly even more of a distraction than the bike seat discomfort:

I agree, the cameras were, um, a worse distraction to the lecture than the comfort of the bike seat

After this initial experience with the first course, no other media were invited to the classroom. Although it was a good opportunity for the faculty, the University, and I to have some positive media coverage of this research, it distracted the learning environment.

Bike Seat Discomfort

Bike seat discomfort, as discussed earlier in this chapter was very important challenge to the moving classroom as a learning environment. Although it did seem to be something that students could acclimate to over time, it was a distraction, and in some cases a barrier to bike riding participation. This was not only something that the students reported as a distraction, but it was also apparent to the instructors and myself via observation and through out own experience with the bike seat. Dr. O’Malley discusses her observation of the bike seat discomfort after thirty minutes into the class:

Um, but after gosh, after maybe thirty minutes or so you could see their bottoms startin to hurt. They were being very fidgety. Even mine was so I could appreciate that, and I tried to as the lecture progressed give them little ideas to relieve some of the discomfort, but you could see that that’s gonna be an ongoing problem until they can acclimate to the

seat. Which we all know your bodies will adjust. Um, and then you know in subsequent semesters were just gonna have to do something about it. Whether it's mandatory bike shorts or something like that because what I could see is I couldn't get them at the beginning of the lecture because they were so interested in the environment, and then toward the end of the lecture I lost em because they were so interested in their bums hurting.

Although many students in the focus groups continued riding despite the discomfort, it was easy for David to see why a student would choose not to ride because of the bike seat pain:

I think it's hard to do it because people aren't motivated. I mean, like if you had someone – if you have an option of sitting or riding and you notice that your butt hurts when you ride, I feel like people are gonna take the... sitting down versus their butt hurting all day.

For the students that continued riding on the bikes during class, they did report acclimating to the seat and getting more comfortable with it overtime. Carolyn describes her experience with the bike seat as an obstacle:

Well, I would say obstacle. I mean, it didn't take me like three weeks to get used to it.

Well, of course once our butts stopped hurting.

Although I am not sure of a solution for the bike seat pain, I can offer some suggestions based on my own experience and the interaction with the participants. First, I think it is a good idea that students choose to sign up for a moving classroom. Perhaps this could be a special designation in the course schedule. I believe that students who are informed about the environment will be more motivated to continue riding and less likely to stop. Also, for students may be able to prepare for this by riding a stationary bike prior to the beginning of the course. For students who

were accustomed to bike riding, the seat was not a challenge. Sanders commented that she was accustomed to the seat because she used to bike race:

Oh, I was gonna say, like, I'm used to – like I used to bike race and stuff so I'm used to like the littler bike seats, not the big bike seats.

Not only do I recommend informing students on what the moving classroom entails when they sign up and encourage them to do some cycling on a similar bike prior to the class, but I also recommend giving deliberate breaks early on in the course just as Dr. O'Malley did:

I think something that would help. I think, I wanna say the second or third day, she made us more aware like “hey, you can get off the bike for a few seconds, it's not gonna hurt. Like I was kinda afraid the first day to move, and then after she said that I was like, I gonna get off for a second and chill. Like I think if she would have said that the first day, I think maybe make everyone feel like they could a little bit more. It would have been better, cuz I was kinda afraid to hop off that first day and I don't remember if it was the second or third day, she was like “you guys can get off if you need to”.

By encouraging and allowing breaks, students feel more comfortable listening to their own body when it is time to take a break. Overall, the more comfortable students are, the more likely they will continue cycling in the moving classroom.

Note Taking

Another challenge for some students was the ability to take notes while peddelling on the bicycle. Chelsea was one of the student who struggled to take notes that were legible:

At the beginning it was really bad. It made it really hard to study because I couldn't read half the things I was writing.

For Fredrick, he acknowledged that taking good notes on the bike was not going to happen for him, but riding the bike was more important:

But like with me it's really hard because not only do I have a learning disability but it's hard to ride notes on the bike, period. I mean, you can't write good notes on the bike anyway and so with me also being competitive it's kind of like, well, what do I want to do? Do I want to ride the bike or do I want to take notes? And personally I'd rather ride a bike.

Not all students would make the choice that Fredrick did. Many considered note taking very important to them and a major challenge while riding on the bike. However, Hermine found a positive in this struggle with note taking by rewriting her notes after each class. This helped her correct the note taking problem, but also facilitated her learning:

I found that my handwriting as my butt started hurting more, got awful, but in the end I had to go back and rewrite it so it kinda made me like relook at my notes and rethink about it all, so I wouldn't say that's a bad thing

Not all students will embrace this challenge like Hermine did. The majority of student who had no problems at all with note taking were using a laptop to take notes as opposed to hand written notes. Using a laptop or tablet would be a suggestion I would recommend to any future student in a moving classroom environment.

There were several challenges that both instructors and students experiences in the moving classroom environment; however, I believe there are solutions found within these experiences. I believe with some modifications, the benefits of the moving classroom will certainly outweigh any challenges. This research was important in order to identify such obstacles and learn ways of overcoming them in the future.

Chapter Summary

In summary, this qualitative case study involved three semesters in the field at a participant-observer. Participation involved three undergraduate nutrition courses which included two instructor participants and a total of 76 student participants. I was able to observe and record field notes on a regular basis along with learning from participants through instructor interviews and student focus groups. The information provided by the two instructor participants and 23 students who agreed to participate in the interview process was invaluable. The raw data was coded, and codes were organized into five categories. Three themes were identified which included all five categories. The major themes of the study are:

1. College Students Learn, Stay Awake, and Engage in the Moving Classroom
2. Awareness of Bodies is Important for Learning
3. The Purpose of the Movement Must be Clear for Effective Teaching and Learning

CHAPTER 5: DISCUSSION AND IMPLEMENTATION

As an educator and a student, I have first-hand experience of the demands of the learning environment, and the time students spend sitting in traditional educational settings. My interest in the health of students in the learning environment, along with findings from the area of neuroplasticity, and the increasing knowledge of exercise effects on the human brain has contributed to my interest in the moving classroom concept; the idea of combining movement into a classroom. My subjectivities, including my dual roles of educator and student along with my own health struggles, have led to my invested interest in exploring creative interventions to increase health of students in educational settings.

This study was grounded in constructionism which accepts that multiple realities and meanings exist (Merriam, 1998). Specifically, the aim of the interpretivism framework is to make meaning of multiple experiences and to understand those lived-experiences (Crotty, 2004; Merriam, 2009). Therefore, in this case study, instructor interviews, student focus groups, and researcher observations were analyzed to gain understanding of the experiences of participants engaged in moving classroom. The purpose of this study was to identify how a moving classroom informs teaching practices as well as learning experiences of students in an undergraduate kinesiology course. The following research questions guided this qualitative case study:

1. How do instructors reflect on their experiences of teaching in a moving classroom?
2. How do students reflect on their experiences of being part of a moving classroom?
3. What do instructors and students identify as challenges while teaching and learning in a moving classroom?

In chapter four, I presented the experiences of two teachers and 78 students, 23 of whom participated in focus groups, concerning their engagement in the moving classroom learning environment. Analysis of data yielded five categories across three themes.

Connections to Neuroplasticity

As discussed in chapter two, brain neuroplasticity is a change in the brain that results in a subsequent change in brain functioning (Shaw & McEachern, 2001). Specifically, for the purposes of this study, knowledge of how exercise creates changes in the brain that subsequently create positive cognitive changes substantively frame this study. Although knowledge gained about the physical and chemical changes within the brain as a result of exercise is largely studied in animal models (Berchtold et al., 2010; Kramer et al., 2006; Radak, et al. 2001; Van Praag, 1999), human studies are emerging in support of neuroplastic changes with exercise that improve memory and cognition (Chaddock et al., 2010; Dishman et al., 2006; Rasmussen et al., 2009). Brain Derived Neurotropic Factor (BDNF) is of central importance in both animal and human studies as it is likely BDNF which is released in the brain which stimulates the creation of new nerve cells (neurogenesis), improves resistance to chronic brain diseases, and improves mental performance (Cotman & Berchtold, 2002; Kramer et al., 2006; Ratey, 2008).

The effects of exercise on the brain's ability to perform cognitively is an emerging niche in the study of neuroplasticity. Investing in exercise and neuroplasticity are taken up by researchers in the areas such as Neuroscience and Biological Psychology. Positive changes in brain functioning after exercise interventions have been recorded in neurodegenerative diseased populations (e.g. dementia, Alzheimer's, and Parkinson's disease) (Colcombe & Kramer, 2003; Colcombe et al., 2004; Gordon et al., 2008; Laurin et al., 2001; Podewils et al., 2005).

Although my review of the literature yielded no empirical studies from the discipline of Education with a neuroplasticity framework, however, practitioners in Education are integrating the neuroplasticity framework into the school setting (Kilbourne, 2009; Ratey, 2008; Reilly et al., 2012), and in work with special populations of students such as those who have been diagnosed with ADHD (Mulrine et al., 2008).

This current study utilized a qualitative framework to gain an in-depth understanding of instructors' and students' experiences of teaching in learning in a moving classroom. An important finding from this case study is that participants within the moving classroom did experience increased attention and focus by moving their bodies on the stationary bicycles. Although cause and effect cannot be claimed in this particular study, the findings from the moving classroom do represent the experiences and realities of the participants in a real-context learning environment. Further work in the area of neuroscience and neuroplasticity is needed to understand the specific processes and mechanisms from a neurocognitive standpoint; however, the findings from the moving classroom regarding focus and attention are important because these are documented experiences of students who implemented movement within a learning environment. This study adds to the body of knowledge in unique ways by using participants in natural learning environments which involve movement of the body. In this way, this qualitative case study helps us understand how findings from the area of neuroplasticity and brain science can be implemented into practical real-life educational scenarios.

Connections to the Literature

The large emphasis placed on academic outcomes and fear centralized around global competition has placed a high stake on students' performance on standardized exams and in core subjects such as math and science (Administration of Barack Obama, 2011; Education,

1983; Spring, 2005; Tamir, 2011). In isolation, striving to be successful in school seems like a positive initiative. However, the overemphasis of the standardized testing in core subjects has detracted from another important area which is the implementation of movement and exercise across and within educational settings. Recall that Burgeson et al. (2001) reported that the percentage of schools which require physical education is 50% at best with a dramatic decrease to only 5% by the senior year in high school. The inactivity that is seen in the K-12 school setting extends into the collegiate settings (Desai et al., 2008), into employment settings (Musich et al., 2006), and into society as a whole. This lack of activity is contributing to an increase in disease (Flegal et al., 2010; Freedman et al., 2001; Wang et al., 2005) , healthcare costs (U.S. Department of Health and Human Services, 2000; Wang et al., 2008) and other negative health consequences. Moreover, other findings indicate that movement and exercise likely benefit cognitive processes (Åberg et al., 2009; Gordon et al., 2008; Hillman et al., 2005; Podewils et al., 2005; Williamson et al., 2009). Therefore, this study intersects the literature at a variety of points across multiple disciplines. Given the findings from chapter four, the contributions to the literature will be discussed across three areas: Educational Decision Making, Health and Wellness, and Cognition. The findings from the moving classroom presented in chapter four intersect the literature in each of these areas.

Educational Decision Making

Decision making in educational settings occur at multiple levels which include public policy, administrators, and teachers. Policy emphasize data-based decision making where test scores play a significant role, but it is uncertain how data are or should be used for decision making (Spillane, 2012). An important finding from Spillane's (2012) work is that policy makers and school leaders do not design practice, but rather, these important decision makers

design *for* practice or create the medium in which practice takes place. This is an important aspect of policy development and implantation to consider. The process of policy implementation and decision making in education extends beyond outcomes data and test scores. The medium or stage is set largely by a political process which may include public opinion, pressure from interest groups, elections, distribution in congress, and changes in decision makers (Brownson et al., 2010). In the case of physical activity in schools, implementation of policy related to data-based decisions and global competition have indirectly influenced physical education and movement or exercise time in educational settings. Because of this, researchers are exploring new ways of implementing and encouraging the opportunities for movement and exercise in educational settings.

The moving classroom was a unique intervention in that the movement was embedded within the learning environment. Although the empirical studies are lacking which involve implementation of movement directly into the classroom, this study does add to findings such as those of Kilbourne (2009) who had positive feedback from students who integrated the use of physioballs within the classroom environment. Also, recall the work at Daisy Elementary School where “take ten” energy breaks are incorporated in the classroom setting (Reilly et al., 2012). Although no results have been published from Daisy Elementary School, the goal is to “improve learning and curb obesity” (p. 66). Naperville Central High School is another model which implemented an extensive physical education program aimed creating a community where exercise is valued both as an investment in educational outcomes as well as physical and health outcomes (Ratey, 2008). In this study, I have explored have looked to creative solutions to incorporate more movement and exercise in school and academic settings. Like these other examples, this study was a creative initiative to implement activity into an academic setting.

Recall that not only did the students in this study appreciate the autonomy of having more movement choices, such as riding the stationary bicycle, but they also experienced both physical changes in terms of increased energy and metabolism along with better success academically in terms of attention, focus, and in some cases retention of the course material. It is important for policy makers to consider how decisions establish the medium through which education is delivered. Also, it is the responsibility of all decision makers to make the most of the stage which has been set by policy. Creative ways to implement physical activities into schools requires decision makers across the policy process (including administrators and teachers) to incorporate innovative opportunities for physical activity within educational settings.

Health and Wellness

The health of the US population is significantly impacted by the growing prevalence of obesity which is near 30% in most age groups (Flegal et al., 2010), and the prevalence is increasing at alarming rates not only in the United States, but around the globe (World Health Organization, 2000). Many diseases accompany obesity which include hypertension, diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, and some types of cancer (U.S. Department of Health and Human Services, 2000). In the late 1990s, the total cost of obesity including health care costs as well as a loss in work productivity was estimated at \$99 billion (U.S. Department of Health and Human Services, 2000). Using prediction models, Wang et al. (2008) estimates that the U.S. will reach a rate of 86.3% overweight and obese individuals by 2030 which comes with an estimated price tag of 860.7-956.9 billion US dollars for health-care costs alone.

Interventions in the areas of health and wellness have largely been focused on prescribed exercise and/or diet programs, and more recently, behavioral weight management programs

(BWMP) which involved diet, exercise, and implementation of a behavior strategy (Johns, Hartmann-Boyce, Jebb, & Aveyard, 2014). Weight and body fat reduction strategies have been studied extensively within the fields of health, nutrition, and kinesiology. Johns et al. (2014) meta-analysis examining the effectiveness of diet, exercise, or BWMP programs in obese populations, found that a combination of interventions (BWMP) is most successful for short and long term weight loss. However, attrition in these programs continues to be a barrier to weight loss.

Perhaps just as important as interventions to treat overweight and obese populations, is the prevention of such conditions which should begin in early ages among children and young adult. Academic settings are traditionally quite sedentary environments where students sit for a large portion of the day. This time spent sitting interferes with energy expenditure in the form of Non-Exercise Activity Thermogenesis (NEAT) which is a natural energy expended with activities such as walking, standing, and performing activities of daily living (Levine, 2003). Increasing amounts of time sitting in general has effected NEAT expenditure, which in turn, has affected energy expenditure. As Tremblay et al. (2007) explain, the activities which contribute to NEAT may be small, but the cumulative effects of these movements across time, has a significant impact on energy expenditure.

In terms of academic achievement, obesity is associated with lower academic achievement (Crosnoe, 2007), fewer years of school (Gortmaker et al., 1999), and poorer school performance in terms of GPA (Mo-Suwan et al., 1999). Specifically, in the high concern areas of math and reading, Datar et al., (2004) discovered that overweight children had lower math and reading scores compared to non-overweight children. Recall also that overweight and obese women in particular enter college less often, and provide less financial income than their non-

overweight counterparts (Gortmaker et al., 1993). Because of the negative impacts of obesity on academic performance, this study is particularly important in informing practices that prevent obesity in academic settings.

This study involving the implementation of movement on a stationary bicycle within a classroom setting, decreases sedentary time and increases the potential for energy expenditure via NEAT. Although this should not be the only intervention required for individuals who are obese, it can assist a more comprehensive BWMP program. Perhaps more importantly, incorporating physical activity within the academic activities may contribute to prevention of obesity later in life, and greater academic performance. Recall from chapter four, the action of riding the stationary bicycle during class did result in students experiencing a perceived energy expenditure. Both student participants John and Brett recalled the mileage they individual rode on the bike during a single class setting as being 28 miles and 30 miles respectively. Although, they were not exerting themselves, the mileage that was achieved in each of these cases was enough to make a significant impact on energy expenditure. Additionally, students such as Katie, who was having a difficult time finding the time to work out, found that the moving classroom was providing a positive opportunity for activity in her busy schedule. Overall, the moving classroom does add to the literature in the areas of health and kinesiology by positive influencing energy expenditure via NEAT.

Cognition

As discussed previously, the connection between physical activity and the brain is an emerging area in neuroplasticity and the study of the brain. Although, this study does not directly contribute to the research done in neuroplasticity, the findings of this case study intersect in the area of cognition. Recall that Anderson (2010) defines cognition as thought, and how

thought is realized by the brain. Cognition is a term which includes subcategories such as attention, information processing, and perception (Anderson, 2010). Higher levels of physical fitness are associated with greater cognitive functioning and processing (Åberg et al., 2009; Hillman et al., 2005; Williamson et al., 2009). The category of attention and focus emerged in the findings presented in chapter four.

Findings of this moving classroom case study revealed that attention was notably enhanced in student participants who rode on the bike. Not only was this increased cognitive attention perceived by students like Hermine and Amanda, but Dr. O'Malley was also able to detect a marked increase in attention while students were riding on the stationary bike compared to the same class of students in the traditional classroom environment. Findings in this area indicate that this increase in cognitive attention was important in assisting the focus students such as Hermine and Amanda who were tired from their busy schedules, and found it difficult to stay awake and attend to the course in a typical classroom setting. The movement on the bike also increased attention in focus for another group of students such as Cookie who tended to be easily distracted in the traditional classroom setting and spent a significant amount of time fidgeting while sitting in a chair at a desk. A third finding in this area is that both Brad and Amanda discovered that riding the bicycle assisted in their recall of the course information on quizzes and exams. Therefore, this study is an important contribution to the area of cognition, attention, and memory.

Conclusions

The aim of this study was to gain an in-depth understanding of instructor's and students' experiences within the moving classroom, and to identify challenges they faced during their experience within the moving classroom. The purpose of this study was to identify how a

moving classroom informs the teaching practices of instructors and learning experiences of students in undergraduate kinesiology courses in South Texas.

In chapter four I discussed the findings of this study, and the experiences of participants who participated in the moving classroom and this study. The journeys of Dr. O'Malley and Dr. Daily teaching in the moving classroom has yielded some common experiences in teaching in a moving classroom as well as some unique experiences and struggles that each instructor encountered while navigating this new environment. Teaching strategies and preferences between these two instructors varied and likely framed the difference in their experiences. Both Dr. O'Malley and Dr. Daily were full time faculty teaching within the same university and degree program. Both instructors are dynamic instructors who use energy and genuine interest in their teaching area, nutrition, to engage students in the learning environment. Both instructor participants were used to walking around their classrooms to teach, and found that teaching from the stationary bicycle was confining to their natural delivery and interaction with students. One solution is that the instructor may not ride on a stationary bike should she choose to walk around the classroom during class, or another solution would be to accommodate an instructor with a bicycle in which they could move from walking to riding the stationary bicycle as they chose.

Dr. O'Malley's previous experience teaching in the collegiate setting, and specifically teaching this course several times previously was quite different than Dr. Daily who, although had been quite experienced at professional speaking, was in his first year as a full time faculty member in a university settings, and was preparing this specific course material for the first time. Moreover, Dr. O'Malley was quite comfortable starting class about five minutes into the class period, and Dr. Dailey preferred to begin promptly at the start of class time. This differences yielded two unique experiences in teaching within the moving classroom where Dr. O'Malley

was more resistant to adversity in terms of portable classroom set up delays, technology malfunctions, and environmental distractions. On the other hand, adversity in these areas frustrated Dr. Daily where teaching in the moving classroom became burdensome.

Another important uniqueness for the instructor participants was the teaching strategies. Where both instructors used a great deal of interaction with students in the learning environment, the way this interactions was executed was unique to each instructor. Where Dr. O'Malley preferred pulling in student participation during lecture, Dr. Daily desired to have students arrange themselves into groups for collaborative learning experiences. Dr. Daily used direct lecture followed by group work on several occasions. The classroom did limit Dr. Daily's utilization of group work as students were required to get off of the stationary bikes and move them into groups. Although the bicycles are equipped with small wheels at the front of the platform, it was a more burdensome process compared to moving chairs into groups within a traditional classroom arrangement. For this reason, it did take some extra time to arrange the bicycles into groups. In addition, when students stopped pedaling, the bike screen which recorded distance, heart rate, and an estimation of calories expended would clear. Because students enjoyed this feedback and knowing their total distance at the end of the class, students became reluctant to move into the group setting. This too was a limitation in teaching style for Dr. Daily which added another element of burden for Dr. Daily. The temporary and portable nature of the classroom situated within an exercise room added many of these limitations which could likely be resolved given a dedicated space to offer a moving classroom where the classroom could be prepared and arranged prior to the students arriving to the room. Regardless of these limitations, both instructors were engaging and interactive with their students. Students

enjoyed both instructors, and many stated that they would like to take future classes with their instructors.

Lastly, each instructor participant experienced a period of acclimation in getting accustomed to this new teaching and learning environment. For the instructor participants, realizing the purpose of the moving classroom and riding on the bicycles was an important aspect of the acclimation. This was not unique to instructors as students also experienced this. For Dr. Daily, the period of acclimation including realizing that his desire for students to expend energy on the bikes during class created a competitive environment where students were hyper-focused on how many miles they were riding during class rather than attending to the course information. Although, this competitive spirit was realized as distracting from the learning environment, it did contribute to some attrition in bicycle riding among students. For Dr. O'Malley, the period of acclimation was included two important aspects. First, Dr. O'Malley expressed being nervous to "exercise" in front of others, but once she was able to fully embrace that the purpose was primarily for learning rather than an exercise/workout environment, she became quite comfortable teaching from the bike. Second, Dr. O'Malley, following one episode of dehydration and cramping after class, learned that for her, she must eat and drink plenty of fluids prior to teaching in the moving classroom. The use of calories was obvious to her, and although not sweating as if she was exercising at the gym, there was clearly a need for increased fluid intake. Therefore, the teaching experiences of Dr. O'Malley and Dr. Daily shared their enthusiasm for the content as well as their desire to engage students in the learning process. However, how they expressed their enthusiasm and how they engaged students was unique.

The challenges that the two instructor participants experienced largely were attributed to the physical classroom space. The room was not designed for a classroom setting, but rather for

exercise classes which presented unique distractions. Distractions included mirrors aligning the walls of the room, lighting that did to allow for clear viewing of the projector screen, and noise and music from adjoining exercise classes. One of the most significant challenges, was that the classroom was portable in that the bikes, laptop computer, projector, and screen had to be set up each day for class. This was a responsibility that I took on as the researcher, but required coordination of myself along with the Recreational Sports staff, and computer services. There were several times when the computer cart did not arrive on time, or the exercise class meeting before ours did not vacate the room on time. Many of these physical space issues could be resolved by having a dedicated room designed for teaching, learning, and moving.

In addition to the physical space, class schedules, workload, and instructor experience also were identified as challenges. Future moving classes should consider the amount of instructor experience teaching in the college setting, and teaching the specific course content. Both should be considered pre-requisites to teaching in this unique environment. The challenges that Dr. Daily faced in the moving classroom were compounded by the workload of having all new courses to prepare while also adjusting to the new working environment and expectations. Adding the newness of the moving classroom to all the other aspects that are new to a first year faculty member can be overwhelming. Last, the class schedule in terms of number of days per week and for what period time varied across the three semesters. Experiences from the instructors indicated that the longer blocks of time (one hour and fifteen minutes) two days a week worked better than shorter blocks of time (fifty minutes) three days a week.

The students' experiences of being part of a moving classroom were identified in chapter four, and like the instructor experiences, were reflected in five categories across three themes. Several students chose to discontinue riding the bikes at various points across a given semester.

Some students chose to discontinue indefinitely while others only chose to discontinue riding on chosen days. The reasons students stopped riding varied, but what was learned from this attrition is that students chose to engage in the learning environment in a variety of ways, and that their second choice was rarely to sit in a chair. Many students sat on objects available in the exercise room we were utilizing such as physioballs, yoga mats, aerobic steps, and in some cases the floor. This aspect of the students' behaviors were consistent across all three classes and semesters. While interviewing students in focus groups, I learned that there was more to this than simple attrition from the bike riding. Students appreciated the autonomy to choose how to position themselves in the learning environment, and benefited from having choices. For example, Melissa shared that she preferred the yoga mat. She could not pin point what it was that she preferred about the yoga mat, but she did relate this to experiences in other courses where, for her, putting her head down helped her relax and be able to learn and take tests more easily. For Frank, the ability to choose was liberating and allowed for a feeling of independence. Frank reflected on a typical class room was more forced, but the ability to sit on a ball or on the floor made him feel more dependent. Other students shared this feeling of autonomy within the moving classroom.

Another emergent finding was the shared experience of increased attention and focus. Not only did students who ride on the stationary bike during class share that they were able to focus and pay attention better in class, but the instructors also noticed this in their students. For students like Amanda who had busy schedules and were often tired and struggled to stay awake during most classes, the bike helped her to be more "mentally aware" during class. Like Amanda, Meagan stated that the bike helped her feel more alert and focused largely due to the forced upright posture on the bike. For Meagan, chairs found in traditional classrooms facilitated

slouching and other postures that distracted attention away from the course material, but the stationary bicycles required an upright and slightly forward leaning posture which facilitated staying awake and attentive. For other students like Cookie, the bike riding helped with attention and focus where she was usually fidgeting in class and easily distracted, the biked helped her focus on the course content and limited her distractions.

Like most new environments, the moving classroom also required some getting used to. Most students experienced a period of acclimation, much like that of the instructor participants. For students, there was a collective excitement shared among most students at the beginning of the semester. It was exciting for students to be in a new environment and be part of a research project. Also, many students shared in my excitement as a researcher because they were kinesiology students who had a desire for health, wellness, and movement of the body. Excitement shared among students, instructors, and myself did provide positive energy. However, the excitement was an initial distraction until participants acclimated to the new environment. Not only was the newness of the environment a distraction for students during this period of acclimation, but also the discomfort of the bicycle seat. Recall that students shared that the spinning bike seats were uncomfortable for most everyone with the exception of students who rode on bikes regularly and were accustomed to it. For some students, the bike seat pain was a barrier to continued participation, but for those who endured on the bike did acclimate to the bike seat, and the discomfort decreased over time. During the acclimation period, many students took short breaks off of the bike during class until they were able to sit on the bike for the entire class period.

As presented in the early discussion on the experience of Dr. Daily and Dr. O'Malley, both instructors were interactive and engaging. Although the way each instructor encouraged

this engagement and collaboration was different, both were successful in creating a collaborative learning environment. Similarly to the instructor participants, students also recognized barriers in the ability to move the stationary bicycles to provide for group work and other collaborative opportunities. For students, this was a challenge perceived, but students continued to feel engaged by both instructors largely due Dr. Daily's and Dr. O'Malley's high energy and enthusiasm for their content areas.

Finally, students and instructors both experienced physical benefits from cycling in the moving classroom. For students Carolyn and Katie, riding on the bicycle had an exercise benefit. Because of their busy schedules, and not much time for exercise, both of these students enjoyed having the opportunity to move on the bike during class as a form of physical activity. For Brett and John, they were impressed by the distances on the bike that they were able to achieve during a single class session. For Brett and John, the primary focus was on the course material, and the benefit of riding 28 to 30 miles came as a secondary benefit. While the mileage was meaningful for Brett and John, the caloric expenditure was what stood out to Meagan, David, and Sanders. All three students were keenly aware of the of the increased energy expenditure when riding on the bike. David shared that during a single class, he expended an estimated 300-400 calories. For Meagan and Sanders who were both competitive athletes, this increase in energy expenditure was carefully monitored which did mean that they chose not to participate from time to time. Not only did they realize the increase in caloric expenditure, but also the potential fluid loss that was occurring. For Meagan and Sanders, balancing out calories and fluids was meaningful. Therefore, for a variety of reasons, students were aware of the physical activity and subsequent caloric expenditure that occurred with cycling in the moving classroom.

The purpose of this case study was to identify how a moving classroom informs the teaching practices of instructors and learning experiences of students in an undergraduate kinesiology course in South Texas. Important findings about these experiences included the instructional approaches of Dr. O'Malley and Dr. Daily, as well as the various challenges that were realized by teaching in a new environment. For students, autonomy, attention, and physical activity were important in framing both unique and collective experiences. Like instructors, students also perceived the primary challenges to be in the adaptation to the new environment and limitations to moving about the room for collaborative experiences.

Implications

The moving classroom presents a unique environment that can inform future directions in educational settings. The educational policy process sets the stage for teaching and learning, but it is up to the administrators and educators to explore ways to implement physical activity and movement into academic settings across ages, disciplines, and geographical locations. The moving classroom serves as an example of unique ways in which movement can be integrated into learning environments. Some of what was learned in this case study may transfer to other educational settings, but where it does not, educators can and should continue to strive for increased physical activity and movement among people of all ages, but particularly in children and young adults. Movement initiatives in educational settings should be carried out with both physical health, cognitive processes, and academic success in mind. The literature referenced in this study identifies that movement and physical activity can benefit all three of these areas which aligns well with the purpose of education.

Related to the area of brain science, neuroplasticity, and cognition, much more research is needed in these fields regarding the effects that movement and physical activity have on the

brain and nervous system. The findings presented in this case study regarding attention of students adds to this area of research by understanding this phenomena from a real-life context. Findings presented here should be used to inform future research using both qualitative and quantitative methods to add to the understanding in this area of movement and brain process and function.

Future Direction of Research

Future research should explore the use of movement interventions across age groups and academic settings. This will allow understanding of experiences and how experiences may be similar or different across settings which include changes in social constructs, policy, and maturation. In terms of academic performance, many more empirical research studies are needed that investigate the influences of physical activity on academic performance, job performance, and the brain. Additionally, quantitative studies which measure changes in body composition, blood pressure, and cardiovascular fitness may add to areas in health and kinesiology by quantifying important health measures. Finally, longitudinal studies will be beneficial to determine if the impact of movement interventions established in academic settings has positive influences across a lifespan.

Chapter Summary

The focus of this case study has been to provide an in-depth understanding of instructor and student experiences of teaching and learning with a unique learning environment I have coined, the moving classroom where students and instructors had the opportunity to ride on stationary bicycles during an undergraduate kinesiology course in nutrition. In this chapter, I have described how findings presented in chapter four connect with research underway in neuroplasticity and brain science. Also, I have described how the findings from this study align

with research in the areas of educational decision making, health and wellness, and cognition. Further, I have provided a concluding thoughts regarding the findings of this case study and how they address the research questions. Finally, I have outlined some important implications and future directions for this study.

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APPENDIX A

Open-Ended Interview Protocol – Student Focus Group

1. Describe your typical day in the moving class (include events, feelings, etc.) (mini-tour question)

2. Describe your typical class experience with the content of KINE 2375. (descriptive question)

3. Tell me about one day you particularly remember or stands out to you within the moving classroom.(descriptive question)

4. Can you tell me about a time where the moving classroom enhanced your learning experience? (example question)

5. Can you tell me about a time when the moving classroom was detrimental to your learning experience. (falsification question)

Open-Ended Interview Protocol – Instructor Interview

1. Describe your typical class, start to finish, within the moving classroom (include events, feelings, etc.) (mini-tour question)

2. Describe your typical interaction and preparatory time for KINE 2375 while teaching in the moving classroom. (descriptive question)

3. Tell me about your one particular day that stands out to you while instructing your class within the moving classroom. (descriptive question)

4. Can you tell me about a time where the moving classroom enhanced classroom instruction? (example question)

5. Can you tell me about a time when the moving classroom was detrimental to your classroom instruction? (falsification question)

Consenting to this Study and Consent Form

Exploring Teaching and Learning within a Moving Classroom

You are being asked to participate in a study about your experiences within a moving classroom. This form provides you with information about the study and will also be used to record your consent to participate. The purpose of this case study is to identify the ways in which a “moving classroom” concept informs instructional practices, learning experiences and academic performances of students within a single undergraduate kinesiology course in South Texas. The following research questions inform the study:

1. How do instructors reflect on their experiences of teaching in a “moving classroom”?
2. How do students reflect on their experiences of being part of a “moving classroom”?
3. What do instructors and students identify as challenges while teaching and learning in a “moving classroom”?

Description: I understand that the purpose of the study is to gain my knowledge and understanding through reflections of my time engaged in the moving classroom environment.

If I volunteer to take part in this study, I will be asked to engage in the following activities:

- 1) Participate in 1 one-hour focus group or interview by sharing your experiences within the moving classroom.

I understand that:

- The researcher will audio record interviews and focus groups that occur between the myself and the interviewer.

Confidentiality: I understand that I will be participating in an interview or a focus group and that the questions and my responses to those questions will be audio-recorded. The information you share with the principal investigator will remain confidential and results of the study will not use identifiable information. I understand that I will be assigned a pseudonym for the principal investigator to utilize in place of my name during publication and/or presentation of the findings of this study. I also understand that the investigator will have access to the master list connecting my pseudonym to my name and that this list along with all data will be kept in a locked cabinet in the principal investigator’s office.

Compensation: I understand that participation in the study will not cost me anything and that I will not receive any money for my participation.

Risks and Benefits: I understand that the risk for participating in this study is minimal and that I can stop and/or withdraw my participation in the study at any time. I also understand that I have the right to withdraw any data source (interview or focus group) at any point during the study.

Right to Withdraw: I understand that I am free to withdraw my consent and stop participating in the study at any time without penalty. I also understand that throughout the study, the researchers will notify me of any new information that may become available which may affect my decision to remain in the study.

Voluntary Consent: I certify that I have been informed about the study's purpose, procedures, possible risks and benefits; that I have been given the opportunity to ask questions before I sign; and that I can ask questions at any time. Additionally, I know that if I have any questions about my rights as a research participant, I can contact Erin Sherman, Compliance Officer at Texas A&M University – Corpus Christi, at (361) 825-2497. I have received a copy of this form, and by signing it, I voluntarily agree to participate in the study.

Signature of Subject

Date

Printed Name of Subject

Signature of Principal Investigator

Date

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