INFORMING LEADERSHIP PRACTICES: EXPLORING RELATIONSHIPS BETWEEN STUDENT ENGAGEMENT IN SCIENCE AND A FIELD EXPERIENCE AT THE HOUSTON ZOO

A Doctoral Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education
in Professional Leadership

by

Chance Alan Sanford

May 2013

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DEDICATION

For Mom, Dad, Denise, Dixie, and Daisy.

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Abstract

The science most adults in the United States learned was derived from informal science broadcast programming outside the classroom (Ogden et al., 2011; National Research Council, 2009; Falk et al., 2010). Evaluations over the last decade of organized informal science programs consistently show that such programs can raise student interest, confidence, and classroom achievement (Thomasian, 2012). This study focused on teachers' perceptions of their students' engagement in science in their classroom after attending a field experience at the Houston Zoo. Teachers were administered an online survey three weeks after the field experience. The study revealed that teachers noted a slight increase in positive learning behaviors, and three themes related to increased engagement in the classroom: 1) Excitement, 2) Connectedness, and 3) Science as a Career Option. Implications of this study impact both informal and formal educational leaders and increases awareness regarding the benefits of collaboration between formal and informal environments.

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CHAPTER I

INTRODUCTION

School principals, especially in decentralized districts, wear many hats around campus. Much of today's current research has categorized their roles as an instructional leader, organizer of the school community, manager of interpersonal relationships within the school community, and resource/maintenance manager (Anderson, 2008). With so much on their plate and so much at stake, principals, as a resource manager and a leader, need to know the student programs and experiences they support both inside and outside the classroom provide the best value possible to support students' overall success.

With the passing of the No Child Left Behind legislation, principals were forced to focus even more attention on their students' achievement. It has been reported that the achievement gap between students in the United States of America and those abroad, specifically in math and science, is widening (Fisher, Frey, & Lapp, 2011). In a recent publication by the National Governors Association it was reported, "Over half of the world's share of STEM (Science, Technology, Engineering, and Math) researchers live outside of the United States (Thomasian, 2012, p. 3)." If you couple this widening gap with students' lack of motivation for sciences as they progress through school, principals are up against enormous odds.

To fill the achievement gap and renew motivation towards science studies, some researchers have proposed focusing on student engagement in schools and classrooms, especially for academically at-risk students, as an important factor to making a positive impact (Ladd & Dinella, 2009; Dotterer & Lowe, 2011). Engagement has been described as students' positive perceptions and feelings about their schools, teachers, peers, and participation in extracurricular activities (Covell, 2010). Dewey, almost a century ago, proposed the value schools place on engagement will truly payoff and contribute to the students' success in life, as well as success in studies (Covell, 2010).

In her book *School, Family, and Community Partnerships: Your Handbook for Action*, Epstein (2009) describes the importance community partners play in engaging students in the sciences. She notes research that supports the belief that less affluent students are certainly at a disadvantage because of the lack of exposure they have to community partners, such as zoos and museums, while growing up. There is even more recent research indicating that the science most adults in the United States learned was derived from informal and science broadcast programming outside the classroom (Ogden, Boyle, & Atkins, 2011; National Research Council, 2009; Falk & Dierking, 2010).

In 2012, the National Governors Association (NGA) issued a brief on how they felt the role of informal science could assist states' educational missions as it pertained to helping STEM agendas move forward, thus engaging students in the sciences. The brief noted, "evaluations over the last decade of organized informal science programs consistently have shown that such programs (1) raise student interest, confidence, and classroom achievement in math and science, (2) generate student interest in pursuing STEM studies and careers" (Thomasian, 2012, p. 1). The NGA encouraged governors, who are making STEM a state educational strategy, to consider the following actions:

- Make informal science education as a state priority in regards to reaching STEM goals and objectives, and include representatives from informal science educational institutions on advisory panels.

- Support quality informal science education programs such as those offered by museums and science centers.
- Encourage districts to support more project-based STEM learning in afterschool environments.
- Encourage the governor’s STEM council or state education agency to oversee the creation of an on-line catalogue of informal science activities offered throughout the state and a compendium of program evaluations (Thomasian, 2012, pp. 1-2).

While making this information available to governors is important, it is ultimately the principal who will have to decide the value of such an informal science education field experience for their students. Orion and Hofstein (1994) noted, “The field trip is one of the most complex and expensive activities in the educational system. Therefore, it is important to achieve optimal educational results that will justify investment” (p. 1098) Field experiences do not come without their difficulties. For example, principals have to consider the logistical and liability concerns as a result of administrators and teachers being off campus with the students, district and state testing schedules, budgetary implications for the trip and transportation of the students, recruiting parental involvement for chaperoning the experience, and ultimately the loss of classroom instructional time. These challenges are not to be taken lightly, but as a 2009 report from the National Research Council documented, “there is mounting evidence that structured, non-school science programs can feed or stimulate the science-specific interests of adults and children, may positively influence academic achievement for students, and may expand participants’ sense of future science career options” (p. 15).

Statement of the Problem

As research in Chapter II of this study indicates, field experiences at informal science education institutions can have an impact on student interest and engagement in science. However, there is very little research that concentrates on the connections between field experiences at zoos and the formal learning environment (Randler, Kummer, & Wilhelm, 2012). This study focuses on teachers' perceptions of their students' engagement in science studies and activities in their classroom, and their engagement after having attended a field experience at the Houston Zoo. The differences associated with student engagement and socioeconomic status and gender will also be addressed.

As leaders, principals are often asked to make decisions without all information being readily available. In a climate in which budgetary cuts are prevalent, research is needed to ensure principals have the best information possible for making decisions to support meaningful out-of-school activities and experiences, which will provide the greatest value and impact on student achievement through student engagement.

Significance of the Study

This study has the capacity to contribute to the literature connecting informal science education at zoos to the formal learning environment. While there is a wide range of research on educational programs at zoos, there is very little discussing the connection between zoos and formal learning (Randler, et al., 2012). Most studies to date have focused on knowledge about and attitudes toward wildlife and conservation (Randler, Hollworth, & Schaal, 2007; Falk & Balling, 1982). However, research also supports that informal science education can impact student interest, confidence, and achievement, which are all important components of student engagement (Thomasian, 2012; National Research Council, 2009).

The results of this study will have implications for not only principals, but also for informal science education institutions, such as zoos. Principals will be forced to make difficult budgetary decisions as they continue to receive reduced funds. As the human population continues to grow exponentially, the world's wildlife and wild places continue to be in peril. As a result, zoos need to continue to strive to meet their mission of educating students in an effort to inspire a positive behavior change, translating to students making decisions and taking actions now and in the future that will help to protect and preserve animals and their habitats. If principals feel field experiences are not valuable, and subsequently less students visit informal science education institutions, then the world's wildlife and wild places could be in even greater trouble.

Purpose of the Study

The goal of this study is to determine if there is a relationship between students' engagement in science in their classroom and students' participation in a field experience at the Houston Zoo. This study will focus on teachers' perceptions of science engagement in the classroom, and whether or not there is a difference between students based on socioeconomic status and gender. The results of this study will expand the knowledge base on engagement in science in formal and informal educational settings, and the data gathered could support principals' decisions in determining the value of learning outside the classroom. This is timely in light of the recent budgetary restrictions placed on school districts in the State of Texas. Since many districts in the Greater Houston Area are decentralized, principals are tasked as the ultimate decision maker in how money is utilized for programming on their campus.

In this study, 58 teachers from participating schools in science classes at the Houston Zoo were surveyed. The participating schools were from public and private schools in the Greater Houston Area. A survey was administered to teachers three weeks after participating in a science class at the Zoo. In addition to surveying their perceptions regarding their students' engagement level in science as a result of participating in the Houston Zoo science class, demographic data on the students was also collected. The demographic information allows for exploration of the differences associated across ethnicities and gender.

Research Questions

The research questions designed for this study were created with the specific intention of investigating the possibility of change in the engagement of students in science class as influenced by science educational programs at the Houston Zoo.

1. Is there a relationship between teachers' perceptions of students' engagement in science in their classroom and participation in a field experience at the Houston Zoo?
2. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by gender?

3. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by socioeconomic status?

Definition of Terms

Conservation – "As a resource, conservation is an ethic of planned management of a natural resource or a particular ecosystem based on balancing resource production, use, allocation, and preservation to ensure the sustainability of the resource. As an object, conservation is maintenance and preservation of works of art, artifacts, or objects; their protection from future damage, deterioration, or neglect; and the repair or renovation of works that have deteriorated or been damaged" (National Association for Interpretation, 2006).

Student Engagement – Current research organizes engagement into three related areas: behavioral, emotional, and cognitive (Fredricks, Blumenfeld, & Paris, 2004). For the purpose of this study, student engagement is defined as how involved/interested students are in the learning occurring in their classroom, and how connected they are to the subject matter taught (Axelson & Flick, 2010).

Field Trip – "A trip arranged by school and undertaken for educational purposes in which students go to a place where the material of instruction may be observed and studied directly in their functional setting" (Orion, Hofstein, Tamir, & Giddings, 1997).

Formal Education – "The hierarchically structured, chronologically graded education system, running from primary school through the university and including, in addition to general academic studies, a variety of specialized programs and institutions for full-time technical and professional training" (National Association for Interpretation, 2006).

Informal Education – "The truly lifelong process whereby every individual acquires attitudes, values, skills, and knowledge from daily experience and the educative influences and resources in his or her environment -- from family and neighbors, from work and play, from the market place, the library, and the mass media" (National Association for Interpretation, 2006).

Program – "Any type of organized, topic-specific presentation or other delivery of information. An environmental education program is a program that aims to develop an environmentally literate citizen who has the skills, knowledge, and inclination to make well-informed choices as a member of a community" (National Association for Interpretation, 2006).

Title I – "Schools where at least 40 percent of the children in the school attendance area are from low-income families or at least 40 percent of the student enrollment are from low-income families are eligible to receive federal Title I funds. The proportion of low-income families is most frequently measured by the percent of students receiving free and reduced-price lunch" (Greatschools, 2012).

Zoo – "Places where non-domesticated animal species are kept for the purposes of conservation and protection from extinction, by strengthening wild populations whose genetic variability have been lost" (Kola-Olusanya, 2005).

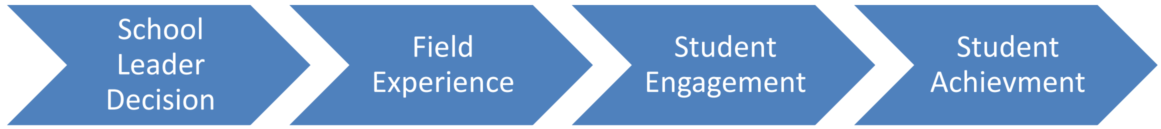
CHAPTER II

LITERATURE REVIEW

Introduction

School leaders must make decisions. In face of recent budget cuts and increasing emphasis placed on student achievement, specifically science, school leaders must have as much information as possible in which to draw upon in order to still be effective when confronted with choices for their students (Epstein, 2009). In order to bolster student achievement in science, some researchers have focused efforts toward students' engagement in schools and classrooms (Ladd & Dinella, 2009; Dotterer & Lowe, 2011). However, recent research has shown that a lot of what students learn can be contributed to learning in outside the classroom, informal learning environments (Ogden, et al., 2011; National Research Council, 2009; Falk & Dierking, 2010). One of the most time-honored traditions in students' out of school learning opportunities is the field trip. Yet, the field trip can be a very costly both monetarily and on school personnel resources (Orion & Hofstein, 1994). Therefore, the review of literature for this study will explore the relationships presented in Figure 2-1; student achievement can be linked to student engagement, student engagement can be linked to field experiences (a zoo in this instance), and these connections will help inform the decision making of school leaders.

Figure 2-1 School Leader Decision Making Model for Field Experiences



Student Engagement

Student engagement has recently seen increasing attention by researchers and practitioners as educators and administrators search to solutions for declining motivation and achievement (Ladd & Dinella, 2009; Finn, 1989). While the attention paid to the study of engagement has increased over the past few years, the history of research on this topic dates back much farther. In the 1930s, researcher Ralph Tyler conducted studies on how much time students spent on their work, and compared that to the impact it had on the learning process. Most educational historians agree Alexander Astin conducted the first true student engagement research in the 1980s. Astin suggested the quality and quantity of a student's energy invested in college produced learning directly related to that investment (Axelson & Flick, 2010).

A majority researchers focusing attention toward student engagement do so because they hypothesize in order for students to truly benefit from attending school, students must be engaged in the classroom in a variety of ways to promote their learning (Ladd & Dinella, 2009). In a meta-analysis on student engagement conducted by Fredricks, Blumenfeld, and Paris (2004), the researchers define the constructs of student engagement into three facets: behavioral engagement, emotional engagement, and cognitive engagement. The researchers define "behavioral engagement as participation in academic and social activities; emotional engagement as positive and negative reactions to teachers, classmates, academics and school; and cognitive engagement as the thoughtfulness and willingness to exert the effort necessary to learn complex constructs" (Fredricks et al., 2004, p. 60).

While there is still debate amongst researchers on how best to evaluate the impact of each of the constructs of student engagement, it has been shown both student achievement and drop out rates are significantly impacted with increasing engagement across the constructs (Ladd & Dinella, 2009; Fredricks et al., 2004). It is important to note there are many factors impacting engagement outcomes, and Fredericks et al. (2004) outlined those factors in the context of the school and classroom. The researchers found most of the school-level features were associated with behavioral engagement and included the following: "voluntary choice, clear and consistent goals, small size, student participation in school policy and management, opportunities for staff and students to be involved in cooperated endeavors, and academic work that allows for the development of products" (Fredricks et al., 2004, p. 73). In the context of the classroom, the following features were identified: "teacher support, relationships with peers, classroom structure, support for autonomy, task-oriented behaviors, and individuals' needs for relatedness, autonomy, and competence" (Fredricks et al., 2004, p. 74). Since there are many facets to the contexts of school and classroom, it can be difficult to discern student engagement from instructional practice, and therefore the need to focus on one or the other in studies arises (Jones, 2009).

The sections below cover recent research related to the dimensions of behavioral engagement related to the research for this doctoral thesis.

Student Engagement and Student Achievement

Interest in student engagement has increased most notably because of the connection researchers have found to student achievement, and therefore, the perceived malleability of the elements of student engagement (Finn, 1989). Bishop and Pflaum (2005) demonstrated the importance of the interconnectedness of student engagement elements through a qualitative study on 20 rural middle school students on the students' perception of social dimensions as influencers on their academic engagement. The site selection did not allow for them to be able to diversify the sample through ethnicity; however, their selection of study participants was equally distributed across gender, grade level, and socioeconomic status. In this study, the students produced drawings of situations in which they felt engaged in the learning, and then the researchers would interview the students about the circumstances surrounding the particular situation they illustrated. The results of the study indicated the students felt positively engaged in academic situations where the social situations in the classroom were positive, and conversely they were negatively influenced through peer judgment and distraction (Bishop & Pflaum, 2005).

Furthermore, in a 2007 study Gonida, Kiosseoglou, and Voulala examined student achievement goal orientations and engagement in the classroom from early to late adolescence with 139 students in Grade 7, 149 students in Grade 9, and 138 students in Grade 11. The study took place in Greece, so the ethnic diversity was 96.5% Greek, 2.6% Russian, and 0.9% Albanian. The researchers administered self-report questionnaires to the participants. Statistical analysis revealed there was not a significant difference between the grade level groups for gender. They did find their measures of student achievement (performance-approach goal orientation and performance-avoidance) were significantly correlated with classroom engagement at $p < .01$ (Gonida, Kiosseoglou, & Voulala, 2007).

Yet again, Ladd and Dinella (2009) conducted a longitudinal study on 383 children ages five and a half to thirteen and a half to determine the effects of early student engagement on student achievement. There were 189 boys and 194 girls in the study with an ethnicity make-up of 77.4% European American, 17.2% African American, 5.3% Hispanic or other, and majority of the students came from a low-income to middle income family. The parents reported their students' demographic data, while the students were administered the Peabody Picture Vocabulary Test-Revised during their fall semester of kindergarten, and followed up with the Wide Range Achievement Test in the spring of Grades one, two, and three. The teachers reported the students' engagement based on a survey consisting of such reporting measures as class participation, acts defiant, uses materials, breaks classroom rules, and responds promptly to teacher requests. The researchers found significant correlations across all grade levels for classroom engagement and achievement at $p < .05$. When they analyzed the results to see if engagement was a predictor of achievement, Ladd and Dinella found cooperative-resistant participation to be the strongest predictor of long-term achievement (Ladd & Dinella, 2009).

This connection between student engagement and student achievement continued to be studied in a 2009 report. Ponitz, Rimm-Kaufman, Grimm, and Curby (2009) conducted research on 171 low-income, rural kindergarteners to determine if there is a relationship between reading achievement and behavioral engagement. The sample consisted of an even distribution of gender, and 143 Caucasians, 23 African Americans, and five children of various ethnic groups. The researchers measured the children's reading achievement in the fall and spring of the school year, and observed engagement in the classroom three times over the course of the school year. The results indicate that engagement was significantly correlated to reading achievement in students in their spring semester with a value of 0.16 and $p < .05$ (Ponitz, Rimm-Kaufman, Grimm, & Curby, 2009).

Additionally, Iyer, Kochenderfer-Ladd, Eisenberg, and Thompson (2010) administered self-reported, peer-reported, and teacher-reported questionnaires to 390 children ages six to ten. The study sample had 212 males and 178 females with an ethnicity of 38.2% Latino and 46.7% Caucasian. To report on school engagement, teachers rated their students' independent and enthusiastic participation in class, and this was combined with the students' self-reporting school avoidant attitudes that were measured from the School Liking and Avoidance Questionnaire. The researchers measured student achievement by having the teachers report the students' grade point rating. The results indicated school engagement was positively associated with school achievement, yet negatively associated with school avoidance (Iyer, et al., 2010).

Yet again, in a 2011 study, Crumpton and Gregory administered surveys to 62 high school students at the end of their first and second years, and followed up afterwards with student interviews that were used for illustrative purposes. The participants in the longitudinal study were students identified as low achievers in Grade 9. In addition to responding to the survey instruments on engagement, grade point average was collected at the end of both years. The researchers found a significant relationship between self-reported classroom engagement and grade point average in the first year at $p < .05$.

Most recently this connection between student engagement and achievement was explored by Fisher, Frey, and Lapp (2011) in a case study focused on school engagement and achievement in which they conducted two intervention techniques. Their first intervention technique was to focus on school attendance, and the second was to focus on school engagement. The school employed techniques of sending personalized cards, making home visits, and celebrating attendance. As a result, there was approximately a 5% increase in attendance. When focusing on student engagement, the researchers first assessed the amount of teacher instruction in the classroom. They found that in the highest achieving classrooms, teachers were talking the least amount of time. Through professional development, which was teacher-led, the school was able to change the patterns in which they engaged students in the classroom. With both of these techniques combined, the school saw their overall passing rates increase over a three-year period at a higher rate than the state average.

Student Engagement and At-Risk Students, Gender, and Ethnicity

Evidenced by the research, student engagement was positively connected with student achievement; however, other factors must be considered when determining the impact engagement has on student success, including students' prior achievement, student gender, and student ethnicity (Fredricks, et al., 2004). When considering the connection between at-risk, or low-performing, students and student engagement, a good example is a 2011 study conducted by Dotterer and Lowe. The researchers conducted a study using data from the NICHD Study of Early Child Care and Youth Development to determine whether or not there was a relationship between school engagement and academic achievement in at-risk students in Grade 5. The students had previous achievement difficulties dating back to Grade 3. The study consisted of 1,014 students with an even distribution across gender, and with 77% of the sample being Caucasian and 23% were other ethnicities. They did not find a significant correlation with psychological and behavioral engagement and achievement for the at-risk students.

In consideration of the connection student engagement has with gender and ethnicity, the 2011 study by Crumpton and Gregory encompassed both aspects. The researchers administered surveys to 62 high school students at the end of their first and second years, and followed up afterwards with student interviews that were used for illustrative purposes. The participants in the longitudinal study were students identified as low achievers in Grade 9. Fifty percent of the participants were male and fifty percent were female. The participants self-reported gender. Additionally, district records were used to determine the following racial make-up of the sample: 68% black, 21% white, 2% Latino, and 9% other. The researchers did not find a significant relationship between self reported classroom engagement and gender or ethnicity.

Wiggan (2008) presented a qualitative study on student engagement and ethnicity on seven African American students attending a public, urban university to determine if there was a relationship between high achieving African American students' school engagement and achievement. He used a mixed method analysis from the data collection process of open coding, axial coding, and selective coding of the respondents answers to in-depth interviews. Wiggan's findings revealed there were three indicators the students reported as the main contributors to their success: 1) engagement; 2) participation in extracurricular activities; and 3) a state scholarship incentive. One respondent noted the importance the teacher placed on getting the students involved in the community, impacted his school experience significantly.

In yet another study focused between the connection between student engagement to ethnicity, Shernoff and Schmidt (2008) studied what others have coined as the "engagement-achievement paradox, in which white students demonstrate low engagement but high achievement, while some minority groups demonstrate high engagement but low achievement" (p. 565). The researchers analyzed classroom experiences and self-reported grades of 586 students from 13 high schools. Results indicated there was a significant difference in the engagement and achievement of Caucasian versus African American students. African American students reported a higher level of engagement and motivation, as well as a lower GPA relative to Caucasian students. One of the most notable positive factors leading to a disparity in engagement between Caucasian and African American students was being on-task while in the classroom.

Wright (2011) studied connections between ethnicity and student engagement through collating best practices in STEM teaching to African American students. One of the items of note he found was that when students participated in real world activities outside the classroom to supplement classroom studies, there were significant gains in achievement. In the information to which he was referring, a student learning Newton's laws of motion was much more engaged and successful when taken outside to see cars going down ramps while explaining this concept. Similarly, he reported when there was school and district-level support for diverse curriculum implementation (e.g. science fairs, clubs, community programs, etc.) the students' performance in science and math significantly improved.

Conversely, in 2008, Sciarra and Seirup conducted a multidimensional study across behavioral, cognitive, and emotional engagement and ethnicity. Using data from the Education Longitudinal Study in 2002 and 2004, the researchers utilized a multiple linear regression to analyze the responses of students to student engagement questions and the students' math achievement scores across five major ethnicities: American Indian, Asian, African American, Latino, and Caucasian. The results of the study indicated there was a significant relationship between the three types of student engagement and math achievement, and was a predictor of math achievement for all five ethnicities. This suggests student engagement is tied closely with academic achievement; the researchers for this study did not find ethnicity differed significantly amongst the types of student engagement. The researchers did indicate that of the three types of student engagement analyzed, emotional engagement had the least significant relationship to math achievement amongst all five ethnicities.

Student Engagement and Science

An additional consideration when looking into the dimensions of student engagement is the impact the subject matter could have on the students. Therefore, it was important to investigate the connection of student engagement to science. For example, in a 2007 study, Chang, Singh, and Mo assessed data from the National Education Longitudinal Study: 88. The study was to determine if there was a relationship between science engagement and science achievement in students in Grade 8, Grade 9, and Grade 12. The researchers collected data from 12,144 students, and the sample size was diverse across ethnicities, gender, and socioeconomic status. The researchers found a significant relationship between science engagement and science achievement at the growth rate, and a confidence interval of p <.01. This indicated students with higher science engagement scores increased their performance at a faster rate than students with low science engagement scores.

Likewise, Mant, Wilson and Coates (2007) conducted a study on the relationship between achievement and engagement in science class with children age eleven in 32 schools in England. Sixteen of the schools were control schools, and the remaining 16 were provided professional development for their teachers as part of a project know as "Conceptual Challenge in Primary Science." At the conclusion of the training, the teachers developed lessons focused on practical, versus theoretical, science. The researchers compared performance on a national science test before and after the teacher professional development for both groups. They found there was a 10% increase in performance at $p < .02$ by the students from the schools in which the teachers received the professional development. Through focus groups the researchers confirmed the students reported a higher level of engagement and motivation in the intervention schools.

Student engagement and science was furthered studied by Hassan and Rahman (2010) through an investigation of the overall fit and significant relationships of a model of science teachers' support of psychological basic needs on student engagement. Four hundred students participated in the survey-based study that examined relationships of autonomy, competence, and relatedness to student engagement. When analyzed against their model, the researchers found the only predictor to student engagement was competence support in the subject area. One of the key findings of this report noted competence support is critical in a constructivist-learning environment, which is the learning approach of the classrooms in which the students were surveyed.

As Figure 2-1 indicates, there is a connection between student engagement and student achievement. Through the review of literature, it is apparent there is a positive correlation between students' interest and motivation and their achievement (Fredricks, et al., 2004). Students' socioeconomic status, gender, ethnicity, and subject matter taught in the classroom should be accounted for when studying student engagement levels. Socioeconomic status and gender did not appear to have an impact on the engagement of students, whereas students' ethnicity and both the science as a subject matter and the method by which science was taught did have an impact on the students' level of engagement and achievement.

Figure 2-1 School Leader Decision Making Model for Field Experiences

The next connection to be explored is that of field experiences, specifically at zoos. To effectively review the connection of field experiences to student engagement, the following section covers the research associated with the history of zoos and education, the theoretical foundations and practical application of learning at zoos (known as informal science learning), and field experience preparations and field experience connections to student engagement and student achievement.

Zoos and Education

In the mid-1950s, Heidi Hediger commented on the state of the organization of education at zoos as a “shameful and regrettable fact that most zoological gardens are still not as yet well organized as they should be for educational work with schools and with the people who are looking for spare time activities" (p. 1). It is for this reason she mentioned that education at zoos and aquariums started out of necessity and usefulness. Zoo visitors who encountered the early zoos had questions, and desired answers from those who knew the animals best – the keepers. However, at this time, keepers were elusive, and most visitors did not take the opportunity to visit a local library later on to pursue answers to their questions. At the same time, teachers viewed the zoo as an opportunity for an extended classroom, and wanted to be able to conduct science-based lessons with live plant and animal species as the backdrop (Carr, 1998).

As zoos started to evolve, so did education. By the 1970s most zoos were establishing a department devoted solely to education. However, since there was not much knowledge in educating informally, and most individuals hired by the zoos were former formally trained educators, the programming focused mostly on groups of school children and was typical of the time’s formal classroom instruction model. In addition to the formal education, education departments took on the role of developing graphics to provide additional information to visitors on the natural history of the animals they were viewing. It was thought that through exposure, and hopefully retention, of the factual information, there would be an increase in their desire to assist the world around them (Association of Zoos & Aquariums, 2010).

The world was changing, and there started to be an increased emphasis placed on the conservation and preservation of the world's species and habitats. This placed a large importance on zoo educators in connecting the visitors of the zoos to the animals that called the zoos home (Carr, 1998). More research was indicating knowledge alone would not lead to a positive change in behavior toward the natural world. Ham (1992) wrote, "in order for people to make behavior changes, they have to have an experience and experience something on an emotional level" (p. 19). It is through this transition that zoos now engage their guests through a variety of interpretative elements, presentations, programs, and more to foster emotional connections with the animals.

By the late 1990s the Association of Zoos and Aquariums (AZA) dictated an institution must have a paid staff member focused solely on education as a requirement of accreditation. This brought about a focus in expanding programming in the informal education arena as education departments were not just focused on educating guests to the zoo, but also in driving their own attendance and revenue through innovation. This legitimizing of the field of education in zoos also produced the need for more collaboration and formalized training, and bringing about the development of a committee known as the Conservation Education Committee, which offers both of those elements to support the role of education in AZA accredited facilities (Association of Zoos & Aquariums, 2010).

Now, education is not only a focal point of modern zoos, but also more closely linked with conservation than ever before. If conservation and preservation of wildlife and wild places is the ultimate goal, then focusing on the education of visitors to zoos, and the communities in which the imperiled wildlife live, is integral to the success of the conservation programs (Barney, Mintzes & Yen, 2005). Conservation education is now centered on changing attitudes, knowledge, and behavior of millions of people each year, and is increasingly becoming a topic of research around the world.

For example, de White and Jacobson (1994) conducted research on an environmental education program in Cali, Columbia for students in Grade 4 from 26 randomly selected schools, totaling 1,015 students. The students were given an achievement test and an attitude scale. The researchers applied four treatments to the students, and they were given the previously mentioned test and scale before and after each treatment. The four treatments were "a zoo workshop directed toward their regular teachers and followed by a class visit to the zoo, a zoo visit preceded by an audiovisual show, a zoo visit only, and a control." The researchers found a significant difference in scores of wildlife-related knowledge and shifts in a positive direction for wildlife conservation, at $p > .05$, in the students that had a workshop given to their teachers prior to their visit. The remaining groups did not show a significant difference.

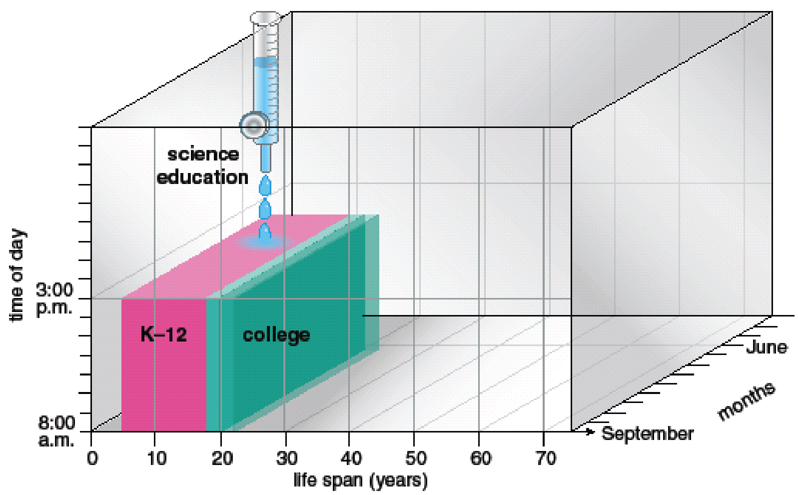
In another study focused on environmental attitude and knowledge change, Leeming, Porter, Dwyer, Cobern, and Oliver (1997) administered the Children's Environmental Attitude and Knowledge Scale to 16 elementary schools (853 students) prior to and at the conclusion of participating in the Caretaker Classroom Program. In addition to the 16 participating schools, there were 19 schools in a control group. The Caretaker Classroom Program consisted of eight activities meant to "develop awareness, build knowledge, and/or take action for the environment" (p. 33). The researchers found a significant difference in attitude toward the environment; however, they did not show a significant difference in knowledge. Parents were also surveyed, and it was reported their responses indicated participation in the Caretaker program significantly increased their student's performance of pro-environmental behaviors.

Informal Science Learning

Education in zoos and aquariums is now part of a larger field of study commonly referred to as informal science learning. Throughout their daily lives, most individuals of all ages, ethnicities, and backgrounds engage in informal science learning (National Research Council, 2009). "Informal environments can stimulate science interest, build learners' scientific knowledge and skill, and—perhaps most importantly—help people learn to be more comfortable and confident in their relationship with science" (National Research Council, 2009, p. 291). Informal science learning can include everyday experiences; experiences in designed settings, such as museums, zoos, nature and environmental programs, and other science-rich cultural institutions; experiences in structured out-of-school-time (OST) programs, such as after-school youth programs, clubs, and citizen science; and experiences through science media, such as gaming, television, radio, and the internet (National Science Teachers Association, 2012).

While research supports most science knowledge is learned in informal environments, most attention to trying to bolster science knowledge has been paid toward the formal classroom (Ogden et al., 2011; National Research Council, 2009; Falk et al., 2010; Randler et al., 2012). Falk & Dierking (2010) depict in Figure 2-2 that currently very little time is being spent on science instruction in the approximately 5% of an individual's life during which they are in school. They suggest an alternative solution for increasing science aptitude would be to focus attention toward the 95% of time in which individuals are not in the classroom (Falk & Dierking, 2010).

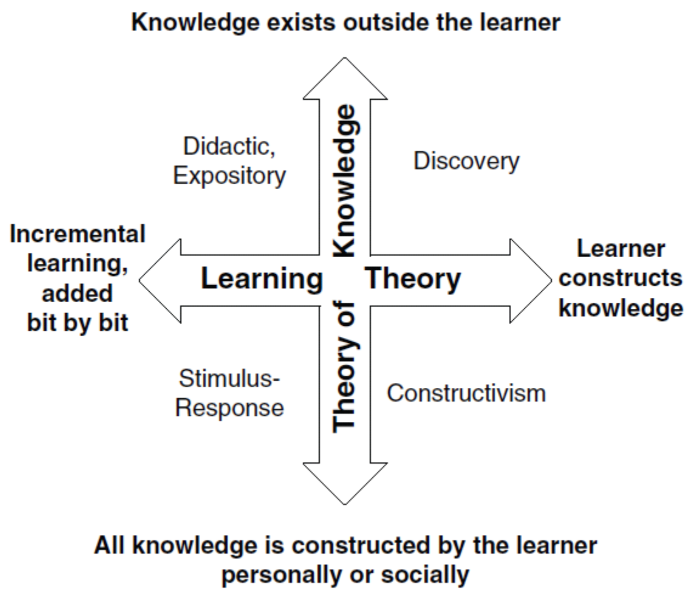
Figure 2-2 Illustration of Amount of Science Education During an Individual's Life



(Falk & Dierking, 2010)

As the push to increase more attention to informal science learning increases, it is important to understand the theoretical foundations of informal learning and the way in which people learn in informal environments (Patrick & Tunnicliffe, 2013). In a 2009 publication, the National Research Council proposed the following learning perspectives encompass most of the theory surrounding informal science learning: didactic/expository, discovery or free-choice learning, constructivism, and stimulus-response. In a didactic learning environment, individuals assume the information presented is factual, and an instructor should push them through the information, rather than reflecting on the information and asking questions (National Research Council, 2009). In a discovery or free-choice environment, learners come to their own meaning of concepts and knowledge through self-initiated discovery and interest (Dierking & Falk, 2003). A constructivist approach focuses on the learner building upon preexisting knowledge to make sense of new concepts they learn, and this knowledge can be constructed individually or as part of a social effort in which the group helps one another construct meanings to the new information (Phillips & Soltis, 2009). Finally, the behaviorist, stimulus-response approach occurs as learners master segments of knowledge as they build a larger base (Hein, 1998). Figure 2-3 portrays these learning perspectives along a spectrum from knowledge accumulation over time to learner-constructed knowledge.

Figure 2-3 Learning Perspectives of Informal Science Education



(National Research Council, 2009)

Ultimately, these learning perspectives and instructional methods are used to shape both informal learning environments and informal programming. In a 2009 report by the National Research Council, the following recommendations were made of program and exhibit development in informal environments: “1) be designed with specific learning goals in mind, 2) be interactive, 3) provide multiple ways for learners to engage with concepts, practices, and phenomena within a particular setting, 4) facilitate science learning across multiple settings, 5) prompt and support participants to interpret their learning experiences in light of relevant prior knowledge, experiences, and interests, 6) support and encourage learners to extend their learning over time" (National Research Council, 2009, p. 19) In order to effectively plan for these learning experiences in informal environments during student field experiences, it is necessary for this planning to not take place just within either the formal environment or the informal environment. Yet, if the learner is the center of the planning, then informal and formal educators must partner together for continuity and effectiveness of learning (Patrick & Tunnicliffe, 2013).

Field Experiences

In a formal classroom setting, science learning has been taken out of nature and moved to an artificial environment – the classroom (Zoldosova & Prokop, 2006). However, the field experience provides opportunities to expose students to learn, explore, investigate, and observe things in the natural world, as well as connect to learning in the classroom (Kisiel, 2005). Therefore, the more connections that can be made between field experiences and the formal classroom environment, the greater the chance of increasing student success (Kisiel, 2006).

In order to build on these connections between formal and informal environments, research has revealed the following information surrounding successful field experiences: planning, visit to where the field trip will take place, making sure the experience is fun, and combining both student-led and teacher-led learning opportunities (Patrick, Mathews, & Tunnicliffe, 2011). When planning a field experience, educators often focus a majority of their time on the logistical aspects of a successful trip, and forego the learning objectives. It is important for formal educators to discuss in advance the learning possibilities that exist with the facility's informal educators to make sure there is an understanding of each other's learning objectives. This partnership will pay off not only in the planning phase of a field experience, but also in the students' learning back in the classroom (Kisiel, 2010). After appropriately planning, educators should take the initiative to visit the facility of the field experience prior to their visit with students. By visiting in advance, educators can prepare both students and chaperones with some of the locations important procedural and safety information, as well as determining what knowledge of the location should be shared with students in advance in order to negate some of the novelty of the space (Patrick & Tunnicliffe, 2013). Novelty has been shown to be a distractor in learning during a field experience (Tunnicliffe, 1999). It is also important to make sure elements of the field experience are fun. Hamilton-Ekeke (2007) described the field experience as an opportunity for students to engage socially as they learn together, and create a fun link to the content being presented in the classroom. Finally, combining both opportunities for student- and teacher-led learning can often lead to increasing student achievement (Davidson, Passmore, & Anderson, 2010). In Texas, the Texas Education Agency (2002) made the following recommendations for increasing student success related to field trips:

- The field experience should have clearly stated instructional goals based on the TEKS.

- The field experience should have three components: pre-visit, on-site, and post-visit TEKS-based instructional activities that are clearly developed in lesson plans.
- The field experience should include formative and summative assessments of student expectations.
- Field experiences should occur during the time that concepts are presented and developed in the classroom (p. 1).

Taking all of the elements described above into account, students' engagement in science can increase during a field experience. For example, in a 2006 study Zodosova & Prokop directed a study to explore the informal science learning through a field experience at The Science Field Centre in Slovakia. The research participants were students (*N* = 153) from seven different elementary schools and comprised of 70 boys and 83 girls, while the control participants were students (*N* = 363) from the same seven elementary schools and comprised of 165 boys and 198 girls. The field experience sessions at the Centre were five days in length, and each session introduced the students to the Centre freely, avoiding conducting field trips during inclement weather, and kept the trips relatively short in length. These methods were put in place to combat the novelty of the space inhibiting learning, as well as to limit the students' tiredness. The method for the study was two-fold: 1) students were asked to select 5 books out of 45 books based on their interest in the title, and 2) the students drew their ideal science learning environment. The results of the study indicated the students significantly preferred titles of books related to studies at the Centre, and students that participated in the field experience drew significantly more elements of their ideal science-learning environment than the students who did not participate in the field experiences. The researchers noted there were no significant differences in either part of the study based on gender. The researchers concluded that field experiences are an effective method to both increase students' interest in science, as well as intrinsic motivation to study science.

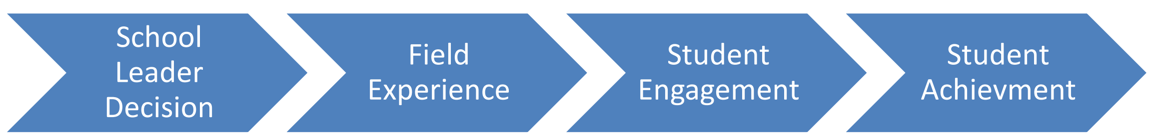
In yet another example, Hamilton-Ekeke (2007) conducted a study in the Niger Delta region of Nigeria. The study participants were 20 males and 20 females spilt into three groups, and were administered the Ecology Achievement Test both before and after the treatment. The first group, A, was taught ecology by taking a field trip to a nearby farm, stream, and pond. The second group, B, was taught ecology via the traditional formal classroom teaching style, while the third group, C, was not taught ecology at all. The treatment, or teaching, occurred twice a week over a period of three weeks. At the conclusion of the study the researchers found a significant difference in the post-test scores of group A compared to those in groups B & C at $p < .05$, indicating students attending a field trip out performed those who did not.

Similarly, Randler, Kummer, and Wilhelm (2012) conducted a study aimed at determining the knowledge retention and learning gained as a result of a field trip to a zoological garden in Germany. The researchers used a BACI, before-after/control-impact design, and administered a post-test both immediately after the visit, and then again six weeks later. Eight hundred forty-five students in Grades 5 and 6, evenly distributed by gender, were divided into four groups, and three of the groups received a structured program during their visit to the zoo. Results indicated a very high effect size in post-test results, both immediately following the program and six weeks later, for those groups receiving a structured program.

Zoos can play an important role in providing experiences for increasing science learning and engagement for learners of all ages. These informal science learning experiences can add depth to science which is not able to be to achieved in a formal learning environment (National Science Teachers Association, 2012). However, in order to achieve this success, these experiences must be appropriately planned, include pre-, during and post-visit activities, and include open communication between the formal and informal educators about learning objectives (Patrick & Tunnicliffe, 2013).

While the review of literature has shown the connection of field experiences to student engagement to student achievement, the decision to use field experiences as a resource to engage students is the decision of school leaders. As Figure 2-1 depicts, the next section will explore the leadership practices related to the decision-making process of leaders deciding to have students at their campus participate in a field experience.

Figure 2-1 School Leader Decision Making Model for Field Experiences



Leadership Practices

The role of a principal in today's schools is complex and involves many different elements of leadership. Principals not only lead the school, but also serve as the link to the community and district on school initiatives. Much of today's current research has categorized their roles as an instructional leader, organizer of the school community, manager of interpersonal relationships within the school community, and resource/maintenance manager (Anderson, 2008).

As an instructional leader, a principal needs to focus on what students are learning versus what teachers are teaching (Anderson, 2008). This can be achieved through various leadership styles, but a style shown to be effective is transformational leadership (Leech & Fulton, 2008). Northouse (2007) describes transformational leaders as those concerned with leadership as a process emphasizing intrinsic motivation and follower development. He goes on to mention that transformational leaders value “emotions, ethics, standards, and long-term goals and include assessing followers’ motives, satisfying their needs, and treating them as full human beings” (p. 175).

When considering the principal’s role as a resource/maintenance manager, one must consider the differences between management and leadership. Northouse (2007) identified those differences as seen in Figure 2-4. Management is focusing on activities and routines, while leadership is focusing on influencing others.

Figure 2-4 Functions of Management and Leadership

Leadership
Produces change and movement

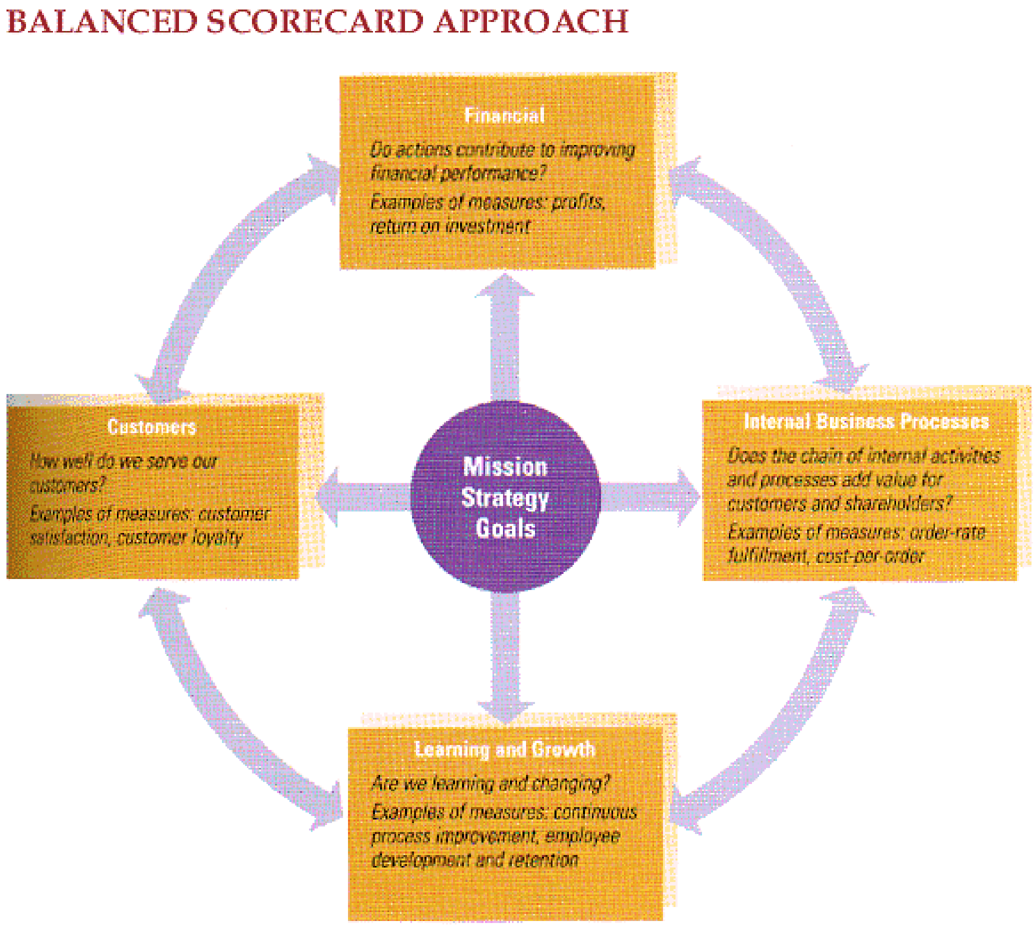
1. Establishes direction
   - Creates a vision
   - Clarifies the big picture
   - Sets strategies
2. Aligns people
   - Communicates goals
   - Seeks commitment
   - Builds teams, coalitions and alliances
3. Motivates and inspires
   - Energizes
   - Empowers subordinates & colleagues
   - Satisfies unmet needs

Management
Produces order and consistency

1. Planning and budgeting
   - Establishes agendas
   - Sets timetable
   - Allocates resources
2. Organizing and staffing
   - Provide structure
   - Make job placements
   - Establish rules and procedures
3. Controlling and problem solving
   - Develop incentives
   - Generate creative solutions
   - Take corrective action

While student achievement is the ultimate measure of success for a school and its leadership, as evidenced above, administrators, as resource managers, have multiple responsibilities which all can contribute to the overall performance of the school. To this end, one approach to measure organizational performance is the balanced scorecard approach. Daft (2007) presents the balanced scorecard approach, Figure 2-5, as a way to measure performance from four areas: financial perspective, internal business processes, customer perspective, and learning and growth. First, the financial perspective indicates concern with the overall financial performance of the institution. The internal business processes perspective aims to determine whether the processes of the institution add value for shareholders. The learning and growth perspective measures the management of human capital and development for the future. Finally, the customer perspective evaluates how customers value the institution.

Figure 2-5 Major Perspectives of the Balanced Scorecard



While the balanced scorecard approach is not unique to business, its application in the educational sector has not been well documented (Karathanos & Karathanos, 2005). In their research, Karathanos and Karathanos, align the Baldridge National Quality Award for Education’s criteria with that of the balanced scorecard approach. The factors they included are student learning results, student-and-stakeholder-focused results, budgetary results, faculty and staff results, organizational effectiveness results, and governance and social responsibility results. Just as in the case of the business model balanced scorecard approach, the educational implementation factors all align with the institutions mission and vision. This allows for administrators to not only monitor student performance and achievement, but also to adjust implementation of strategies and acquire resources that could improve overall institutional success.

In order to utilize the balanced scorecard approach, or any overall institutional performance measure and strategy, administrators must make evidenced-based decisions. Leech and Fulton (2008) note the current trends that have led to this increased importance placed on principals in the area of decision making as consisting of four specific areas, "(1) enhanced decision-making authority given to schools, (2) greater principal accountability for school decisions, (3) increased need for participation of school staff in decision making, and (4) enhanced need to function as both school manager and instructional leader" (p. 635).

There are many models for decision-making; Daft (2007) describes the decision-making models that can be used based on the certainty of knowledge of the solution and the certainty of a consensus on the problem. When there is a certainty for both a consensus of the problem and knowledge of the solution, Daft suggests organizations use an approach of making data-based decisions and make any changes based on analysis and calculations. When there is certainty on the knowledge of the solution, but an uncertainty on a consensus of the problem, then Daft suggests using discussion and alliance building in which to make a decision. If there is uncertainty on the knowledge of solution, yet certainty amongst a consensus on the problem, then Daft's suggested decision-making approach is one of trial and error. This allows for small steps, analysis, and changes to be made if needed. If there is uncertainty on both the solution and consensus on the problem, then the approach utilized might be that of the garbage can model. The garbage can model is a model in which there is no linear sequence for problems and solutions.

Instead, sometimes problems present themselves, and sometimes solutions precede problems, but then can be linked with problems later.

Summary

The field experience is one of the most complex and expensive activities in the educational system (Orion & Hofstein, 1994). With the stress this activity can place on the balanced scorecard for the school, from budgets to academic performance, administrators must make evidenced-based decisions, with support from faculty, staff, parents, and students. Evidence has been presented in this chapter that student engagement can increase student academic performance and is not impacted by students' gender or socioeconomic status, but can be impacted by the way in which a subject matter is taught. One way in which science can impact student engagement is through field experiences. Field experiences are effective as long as there is planning, activities before, during, and after, and communication between the formal and informal educators discussing the learning objectives for the experience.

CHAPTER III

METHODOLOGY

The emphasis of this chapter is to provide the framework for the procedures that were followed to explore the relationships between student engagement in science and a field experience at the Houston Zoo. Included in this chapter are the description for research design, the research questions, the description of the research setting, subjects and procedures, as well as the instruments that were used to conduct the study and any foreseen study limitations.

Description of the Research Design

The design of this research study is a mixed-methods research design. According to Frankel, Wallen, and Hyun (2012), mixed methods research has three strengths, "clarifying and explaining relationships found to exist between variables, exploring relationships between variables, and confirm or cross-validate relationships discovered between variables." Using a triangulation design, wherein both the quantitative and qualitative pieces of the study have equal priority, the researcher administered an online survey to teachers whose classes participated in a field experience at the Houston Zoo. Through this method and the purposive sampling, the researcher was able to gather more detail related to each of the variables versus doing the study from strictly a quantitative or qualitative approach.

The survey instrument used, a modified version of the preexisting Student Participation Questionnaire, asked teachers to use a retrospective approach to rating or discussing their perceived changes in student behavior in science before and after participating in a field experience at the Houston Zoo (Finn, Pannozzo, & Voelkl, 1995). The Student Participation Questionnaire was used in portions or its entirety to evaluate teachers' perceptions of behavioral engagement in the classroom previously. Finn, Pannozzo, and Voelkl (1995) used the questionnaire to determine teachers' perceptions of students' behavioral engagement over a two to three-month period. In this study, teachers were also asked to recall students' behavior in the classroom, but only over a three-week period. The original version of the Student Participation Questionnaire asked teachers to rate their perceptions of students' behavior in four different areas: effort, initiative, disruptiveness, and inattentiveness.

For this study, the retrospective approach was used to help minimize response shift bias (Howard & Dailey, 1979). This allows for the survey respondents to establish their own standard by which to respond and minimizes their potential to artificially inflate answers due to having just participated in an activity. This response shift bias is seen more prevalently in traditional pre/post survey methodology (Davis, 2003).

Research Questions

1. Is there a relationship between teachers' perceptions of students' engagement in science in their classroom and participation in a field experience at the Houston Zoo?
2. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by gender?

3. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by socioeconomic status?

Setting

Participants in the study attended a science-based class taught at the Houston Zoo. The Houston Zoo, a 501(c)3 non-profit organization, is a 55-acre zoological institution, home to nearly 6,000 animals, situated in the Museum District of Houston, TX. Founded in 1922, the Houston Zoo has been operating as an independent non-profit, governed by a volunteer board of directors, since it privatized from the City of Houston in 2002. Houston Zoo, Inc. now maintains a 50-year lease with the City of Houston to manage the facilities, animal collection, and daily Zoo operations. The Education Department of the Houston Zoo, the organizational umbrella under which the program in this study falls, is part of the management of daily Zoo operations. These programs are taught at the George R. Brown Education Center.

While the educational, science-based programs portion of this study was conducted at the Houston Zoo, the participants in the study are teachers from schools and districts in the Greater Houston Area. The schools vary by geographic location, demographic information, student population, and Texas Education Agency's state accountability ratings. The programs at the Houston Zoo are 45-minute long, Texas Essential Knowledge and Skills aligned, interactive presentations that include the use of animal artifacts (skins, skulls, etc.) and live animals. Schools have the option of selecting a curriculum topic that has been differentiated by grade level. In 2012, the Houston Zoo reported these programs reached 98 schools through 248 classes, and impacted 6,753 students (personal communication, March 13, 2013). Those curriculum topics by grade level with accompanying descriptions are found below:

- Habitats (Grades K-3, 5) – "During this class we will examine what living organisms need to survive such as food, water, shelter and space, determine how the physical characteristics of a species and an environment are related to where the animal lives and what it eats, and describe how animals survive in a specific ecosystem" (Houston Zoo, Inc., 2012b).
- Survival Gear (Grades 2-5) – "During this class we will compare how behavioral and physical characteristics help animals survive in the wild, and discover how animals inherit unique characteristics from their parents while others learn behaviors to help them survive" (Houston Zoo, Inc., 2012e).
- Texas Animals (Grades K-5) – "During this class we will examine what living organisms need to survive such as food, water, shelter and space, and determine how the physical characteristics and behaviors of animals are related to where the animal lives" (Houston Zoo, Inc., 2012f).
- King Phillip's Class (Grades 6-7, 9-12) – "During this class we will discuss taxonomic classification of living organisms, categorize animals using taxonomic classification, compare characteristics of taxonomic groups, and use dichotomous keys to identify animals" (Houston Zoo, Inc., 2012c).
- Master Survivalists (Grades 7-12) – "During this class we will discuss variations and adaptations of organisms in different ecosystems, investigate how animals have internal structures that enable them to perform specific functions, examine

how animals depend on and may compete for biotic and abiotic factors, interpret relationships among organisms, and analyze how natural selection produces change in populations as well as diversity in and among species" (Houston Zoo, Inc., 2012d).

- Chomping Through the Food Chain (Grades 6-12) – "During this class we will explore the levels of organization within ecosystems, learn about relationship that can occur between organisms in food webs and the competition that arises within different ecosystems, analyze the way in which energy flows through ecosystems, and discover the interactions between organisms and their environment" (Houston Zoo, Inc., 2012a).

Subjects

The participants in this study were 58 educators whose students participated in a class at the Houston Zoo. The educators' schools vary by geographic location, demographic information, student population, and Texas Education Agency's state accountability ratings. The districts and schools represented in the study include public school districts in the Southeastern region of Texas, as well as private schools in the same region. Tables 3-2 – 3-8 depict the districts' Texas Education Agency's state accountability rating, enrollment, and demographical information from the 2010-2011 District Profiles, and their names have been replaced with sequential letters for anonymity (Texas Education Agency, 2012). Accountability ratings in the State of Texas are labeled lowest to highest: Academically Unacceptable, Academically Acceptable, Recognized, and Exemplary. Table 3-1 depicts the criteria for accountability system in Texas.

Table 3-1 The Requirements for Each Educational Rating Category in the State of Texas

	Academically Acceptable	***Recognized***	***Exemplary***
Base Indicators			
TAKS (2010-11) (including TAKS (Acc), -Alt, and -M) All Students *and each student group meeting minimum size:* · African American · Hispanic · White · Econ. Disadvantaged	Meets each standard: · Reading/ELA....... **70%** · Writing................ **70%** · Social Studies ..... **70%** · Mathematics........ **65%** · Science .... **60%** **OR** Meets Required Improvement	Meets **80%** standard for each subject **OR** Meets **75%** floor and Required Improvement	Meets **90%** standard for each subject
ELL Progress Indicator (2010-11) TELPAS or TAKS All ELL Students ≥ 30	N/A	**60%** at or above criteria **OR** Meets Required Improvement	**60%** at or above criteria **OR** Meets Required Improvement
Commended Performance (2010-11) (including all TAKS) *if meets minimum size:* · All Students and · Econ. Disadvantaged	N/A	Meets **15%** standard for Reading/ELA and Mathematics	Meets **25%** standard for Reading/ELA and Mathematics
Completion Rate I (Class of 2010) *if meets minimum size:* · All Students · African American · Hispanic · White · Econ. Disadvantaged	Meets **75.0%** standard **OR** Meets Required Improvement	Meets **85.0%** standard **OR** Meets floor of **75.0%** and Required Improvement	Meets **95.0%** standard
Annual Dropout Rate (2009-10) *if meets minimum size* · All Students · African American · Hispanic · White · Econ. Disadvantaged	Meets **1.6%** standard **OR** Meets Required Improvement	Meets **1.6%** standard **OR** Meets Required Improvement	Meets **1.6%** standard **OR** Meets Required Improvement

(Texas Education Agency, 2011, p. 48)

The enrollment for the districts is noted by the “Total Students” category; the ethnic distribution is the total district enrollment by ethnicity and percent make up of the district by ethnicity. The category noted “Economically Disadvantaged” notes the total number of students in the district that participate in free or reduced meal plans. Free meal plans are available for students in which their families fall below 130% of the federal poverty level, and reduced meal plans are available for students whose families fall below 185% of the federal poverty level (Texas Education Agency, 2011). Information on the private school campuses was obtained from campus and realty websites. Demographic information was not available for five of the private school campuses.

Table 3-2 ABC ISD's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	Academically Acceptable	
Total Students	5,097	
Ethnic Distribution	Number of Students	Percent
African American	936	18.4%
Hispanic	1,401	27.5%
Caucasian	2,556	50.1%
American Indian	41	0.8%
Asian	17	0.3%
Pacific Islander	0	0.0%
Two or More Ethnicities	146	2.9%
Economically Disadvantaged	24,577	35.8%

Table 3-3 DEF ISD's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	Academically Acceptable	
Total Students	68,710	
Ethnic Distribution	Number of Students	Percent
African American	20,184	29.4%
Hispanic	17,793	25.9%
Caucasian	13,973	20.3%
American Indian	407	0.6%
Asian	14,688	21.4%
Pacific Islander	96	0.1%
Two or More Ethnicities	1,596	2.3%
Economically Disadvantaged	24,577	35.8%

Table 3-4 GHI ISD's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	Recognized	
Total Students	21,557	
Ethnic Distribution	Number of Students	Percent
African American	3,669	17.0%
Hispanic	16,177	75.0%
Caucasian	1,200	5.6%
American Indian	105	0.5%
Asian	209	1.0%
Pacific Islander	19	0.1%
Two or More Ethnicities	178	0.8%
Economically Disadvantaged	16,911	78.4%

Table 3-5 JKL ISD's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	Academically Acceptable	
Total Students	203,294	
Ethnic Distribution	Number of Students	Percent
African American	53,272	26.2%
Hispanic	125,807	61.9%
Caucasian	15,802	7.8%
American Indian	495	0.2%
Asian	6,254	3.1%
Pacific Islander	280	0.1%
Two or More Ethnicities	1,384	0.7%
Economically Disadvantaged	163,905	80.6%

Table 3-6 MNO ISD's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	Recognized	
Total Students	45,092	
Ethnic Distribution	Number of Students	Percent
African American	6,253	13.9%
Hispanic	16,174	35.9%
Caucasian	17,427	38.6%
American Indian	190	0.4%
Asian	3,762	8.3%
Pacific Islander	70	0.2%
Two or More Ethnicities	1,216	2.7%
Economically Disadvantaged	17,779	39.4%

Table 3-7 PQR Private School's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	N/A	
Total Students	730	
Ethnic Distribution	Number of Students	Percent
African American	17	2.26%
Hispanic	88	12.03%
Caucasian	610	83.46%
American Indian	N/A	N/A
Asian	15	2.0%
Pacific Islander	N/A	N/A
Two or More Ethnicities	N/A	N/A
Economically Disadvantaged	N/A	N/A

Table 3-8 STU Private School's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	N/A	
Total Students	1,430	
Ethnic Distribution	Number of Students	Percent
African American	186	13.0%
Hispanic	157	10.97%
Caucasian	915	63.96%
American Indian	29	2.03%
Asian	143	10.04%
Pacific Islander	N/A	N/A
Two or More Ethnicities	N/A	N/A
Economically Disadvantaged	N/A	N/A

Table 3-9 VWX Private School's State Accountability Rating, Enrollment, and Demographics

State Accountability Rating	N/A	
Total Students	1,314	
Ethnic Distribution	Number of Students	Percent
African American	93	7.0%
Hispanic	33	2.51%
Caucasian	1,136	86.45%
American Indian	6	0.46%
Asian	93	7.0%
Pacific Islander	N/A	N/A
Two or More Ethnicities	N/A	N/A
Economically Disadvantaged	N/A	N/A

Procedures

After receiving consent from the Houston Zoo, and from the University of Houston Committee for the Protection of Human Subjects (Appendix A) this study commenced. An online survey instrument was designed using both Likert scale-based questions and open-ended questions. The survey was designed and hosted on SurveyMonkey.com, an online survey system website.

The Houston Zoo provided email addresses for the teachers who participated in classes taught at the Houston Zoo through the end of December 2012. Utilizing a non-specific Houston Zoo email address (education@houstonzoo.org), a request was sent to the aforementioned educators. Upon their consent of the provided "Consent to Participate in Research" form (Appendix B), they were allowed to continue to participate in the online survey. In order to preserve anonymity, the teachers were not asked to disclose their name or the name of the school, but were asked to provide basic demographic information on their class. A copy of the survey instrument can be found in Appendix C.

Once the surveys were completed, the data was exported through a secure and encrypted process from SurveyMonkey.com to a Microsoft Excel spreadsheet for analysis. All data was password protected to limit access only to the researcher. Once the data was exported, the survey was then deleted from SurveyMonkey.com. Upon completion of the study, all data and consent documents were moved to a secure location in the University of Houston College of Education administration offices in Farish Hall Ste. 115 for three years. Results from the study will be shared with the Houston Zoo.

Statistical Analysis

Data collected from the surveys were analyzed in two phases, quantitatively and qualitatively. The Likert scale-based questions were analyzed through determining frequency and percentage per response, and were then summarized per question into two categories: effort scale and initiative-taking scale. In order to analyze the open-ended question portion of the study, the researcher conducted a horizonalization of the significant statements made by the teachers, and then grouped these statements into themes prior to writing a composite description of the phenomenology (Creswell, 2013). While the response rate was low, the researcher also looked at emerging themes, and compared the responses with that of the current research.

Instruments

The instrument used in this study has elements of both a Likert scale-based survey derived from a preexisting survey instrument, Student Participation Questionnaire, as well as open-ended questions generated by the researcher with assistance from the chairperson for this doctoral thesis (Finn, Pannozzo, & Voelkl, 1995). The instrument was designed through and delivered via SurveyMonkey.com, an online survey system. Participants were asked to consent to and participate in the survey through a follow up email after their program at the Houston Zoo.

For the purpose of this study, only questions that pertained to positive learning behaviors, the effort and initiative scales from the Student Participation Questionnaire, were chose to be utilized, so the researcher could study the relationship between participating in a class at the Houston Zoo and increased engagement in the classroom. The teachers were asked to respond to the following questions based on their perceptions of changes in students' behavioral engagement on a scale of 1-5 where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree, and the appropriate scale, either effort (E) or initiative (I):

1. Students' attention in science class has increased. (E)
2. Students have increased the amount of homework they complete on time. (E)
3. Students have increased their attempts to do their science class work thoroughly and well, rather than just trying to get by. (I)
4. Students' participation in class discussions about science has increased. (I)
5. Students' persistence when confronted with difficult science-based problems has increased. (E)
6. Students do more than just the assigned science class work. (I)
7. Students approach new science class assignments with increased effort. (E)
8. Students' amount of questions about science information has increased. (I)

9. Students have increased efforts to finish science class assignments even when they are difficult. (E)
10. Students have increased raising their hands to answer a science question or volunteer science information. (I)
11. Students have increased engaging their teacher in conversation about science before or after school, or outside of class. (I)

Additionally, the open-ended questions below were developed with the intent to further explore the relationship between students' engagement in science in their classroom and participating in a class at the Houston Zoo, as well as to inform leadership practices at both informal science institutions and schools. These questions were also used to determine any common themes that might emerge across gender, ethnicity, and overall impact as a result of a field experience at the Houston Zoo. The open-ended questions were as follows:

1. To what extent do you feel the field trip to the Houston Zoo impacted your students?
2. To what extent do you feel the Houston Zoo helped increase your students' engagement in science once back in the classroom?
3. To what extent do you feel the field trip to the Houston Zoo impacted economically disadvantaged students that might not otherwise have the opportunity to visit the Zoo?
4. To what extent do you feel the field trip to the Houston Zoo impacted males versus females in your class?

5. To what extent would you recommend to other teachers a similar trip to the Houston Zoo?

Finally, basic demographic information was collected in order to get an understanding of the make up of each teacher's class. A copy of the survey instrument can be found in Appendix C.

Limitations

Due to the variety of zoological institutional sizes and resources, as well as the complexity in the educational institutions participating in this study, there are several limitations to this research. First, educators participating in the study were only those who participated in a field experience at the Houston Zoo. Additionally, they self-reported the grade level they teach, the gender breakdown of their class, and estimated the ethnicity of their class when true numbers were not available. Also, it is possible teachers in the sample were from the same school, so there is the possibility study participants discussed their responses with one another prior to completing the survey.

The amount of time from when the program occurred at the Zoo until the survey instrument was administered may not have been enough time for teachers to observe a change in student engagement, and therefore, limited the results. Also of note, is this study is based on one trip to the Houston Zoo; students' engagement in science may be further enhanced with more exposure to field experiences at informal learning institutions. This study did not capture whether or not this was a student's first visit to the Zoo; so therefore, the novelty of the visit is also a limitation. Additionally, there was not a prior measure of engagement with the students, therefore the research of this study relied on teachers' perceptions of their students' engagement in class prior to and after the field experience at the Houston Zoo. Likewise, the nature of the survey questions and concept in which engagement was interpreted were broad in scope, which could limit the ability of the study to pinpoint a particular aspect of the experience which contributed the most to engagement in science in the classroom.

The Houston Zoo instructors and their instructional strategies in the classes at the Zoo are not the focus of this study, nor is the learning that occurs during the students' field trip to the Zoo. Similarly, the Houston Zoo instructors' experience level was not a focus of this study, however it could have impacted the students' experience during the class portion at the Zoo. One final limitation of note is the sample size and restrictions placed on study participation limit the ability to generalize the results to either the educational or zoological communities.

CHAPTER IV

RESULTS

The intent of this study was to explore the relationship between students' engagement in science in a formal classroom and having participated in a field experience at the Houston Zoo. In order to study this relationship, the researcher administered an online survey to teachers that had brought their class to a field experience at the Houston Zoo. The survey instrument presented teachers with questions intended to determine teachers' perceptions of their students' engagement in science in their classroom after a field experience at the Houston Zoo, and whether or not the engagement differed by gender, ethnicity, or socioeconomic status. Additionally, two questions intended to provide the researcher with insight into the overall impact of the program at the Houston Zoo. The results of the survey are presented in this chapter.

Subject Demographics

Fifty-eight teachers that brought their students to participate in a class during a field experience at the Houston Zoo between September and December of 2012 were administered an online survey by the researcher two weeks after having visited the Houston Zoo. Based on information from the Houston Zoo, the response rate of educators to a post-program survey is typically less than 10%. Of the 58 teachers sent the survey, 27 responded, and 26 agreed to participate in the research. This is a response rate of 46.6% with 96.3% respondents agreeing to participate.

Respondents self-reported the number of students in their classes that participated in the field experience at the Houston Zoo. Twenty teachers responded to the question, and reported a total number of students of N = 490. Of the 20 teachers, three (N = 3, 15%) reported a class size between 10-15 students, six (N = 6, 30%) reported a class size of 16-20 students, five (N = 5, 25%) reported a class size of 21-25 students, three (N = 3, 15%) reported a class size of 26-30 students, and three (N = 3, 15%) reported a class size in excess of 31 students. The data in Table 4-1 provide a summary of these ranges in class size.

Table 4-1 Frequency and Percentages of Participants' Responses by Number of Students (N = 490) in Class

Range of Number of Students in Class	*f*	% of Total
10-15	3	15%
16-20	6	30%
21-25	5	25%
26-30	3	15%
31+	3	15%
Total	20	100%

Additionally, the respondents self-reported gender of the students in their class. Twenty teachers responded to the question, and reported an average of 12 (N = 241, 50%) males, and an average of 12 (N = 249, 50%) females. The data in Table 4-2 summarizes this information.

Table 4-2 Frequency, Average, and Percentages of Participants' Responses of Gender of Students (N = 490) in Class

Gender	Average Number of Students	*f*	% of Total
Male	12	241	50%
Female	12	249	50%
Total	24	490	100%

Respondents were also asked to self-report the ethnicities of the students in their class. If exact information was not available, teachers were asked to provide an accurate estimate of number of students by ethnicity. Eighteen teachers responded to the question, and reported an average of one (N = 12, 3.7%) American Indian/Alaskan Native student, two (N = 32, 7.4%) African American students, two (N = 30, 7.4%) Asian students, nine (N = 138, 33.3%) Hispanic students, zero (N = 0, 0%) Native Hawaiian/Other Islander students, one (N = 10, 3.7%) Two or More Ethnicities students, and 12 (N = 182, 44.5%) White students. The data in Table 4-3 provides a summary of the average number of students reported by ethnicity.

Table 4-3 Frequency, Percentages, and Average Number of Participants' Responses of Ethnicity of Students (N = 404) in Class

Ethnicity of Students	Average Number of Students	*f*	% of Total
American Indian/Alaskan Native	1	12	3.7%
African American	2	32	7.4%
Asian	2	30	7.4%
Hispanic	9	138	33.3%
Native Hawaiian/Other Islander	0	0	0.0%
Two or More Ethnicities	1	10	3.7%
Caucasian	12	182	44.5%
Total	27	404	100%

Finally, the respondents were asked to report on the number of students in their class that are economically disadvantaged, or receive free and reduced meal plans. As before, respondents were asked to estimate the total number of students if exact information was not available. Sixteen teachers responded to the question, and reported a total number of economically disadvantaged students of N = 115. Of the respondents, nine (N = 9, 56.3%) reported 0-5 students, three (N = 3, 18.8%) reported 6-10 students, two (N = 2, 12.5%) reported 11-15 students, one (N = 1, 6.2%) reported 16-20 students, and one (N = 1, 6.2%) reported greater than 20 students as economically disadvantaged or receiving free and reduced meal plans. This information is summarized in Table 4-4.

Table 4-4 Range of Number of Students, Average, Frequency, and Percentages of Participants' Responses of Economically Disadvantaged Students (N = 115) in Class

Range of Number of Economically Disadvantaged Students	Average Number of Students	*f*	% of Total
0-5	9	8	56.3%
6-10	3	27	18.8%
11-15	2	28	12.5%
16-20	1	20	6.2%
20+	1	32	6.2%
Total	16	115	100%

Research Question One

Is there a relationship between teachers' perceptions of students' engagement in science in their classroom and participation in a field experience at the Houston Zoo?

Participants in the online survey administered by the researcher two weeks after having participated in a class during a field experience at the Houston Zoo were asked a series of 11 Likert scale-based questions, to determine if the frequency of students exhibiting positive learning behaviors in science class at school increased as a result of the visit to the Houston Zoo. The results of this data is intended to inform the researcher of answers related to research question one. The 11 questions were derived from the Student Participation Questionnaire, and comprised of questions from two scales, students' effort and initiative taking (Finn et. al., 1995). Below are the questions administered, and E = effort and I = initiative:

1. Students' attention in science class has increased. (E)
2. Students have increased the amount of homework they complete on time. (E)
3. Students have increased their attempts to do their science class work thoroughly and well, rather than just trying to get by. (I)
4. Students' participation in class discussions about science has increased. (I)
5. Students' persistence when confronted with difficult science-based problems has increased. (E)
6. Students do more than just the assigned science class work. (I)
7. Students approach new science class assignments with increased effort. (E)
8. Students' amount of questions about science information has increased. (I)
9. Students have increased efforts to finish science class assignments even when they are difficult. (E)
10. Students have increased raising their hands to answer a science question or volunteer science information. (I)
11. Students have increased engaging their teacher in conversation about science before or after school, or outside of class. (I)

Teachers were asked to respond to the questions by rating their perspective of their students' change in behavior as a result of the visit to the Houston Zoo on a scale of 1-5 where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. Twenty (N = 20) teachers responded to the questions. In rating the questions related to students' effort, respondents reported students' attention in science class increased at an average rating of 3.61 or between Neutral and Agree, students increased the amount of homework they complete on time at an average rating of 3.09 or slightly above neutral, students' persistence when confronted with difficult science-based problems has increased at an average rating of 3.30 or between Neutral and Agree, students approach new science class assignments with increased effort at an average rating of 3.57 or between Neutral and Agree, and students have increased efforts to finish science class assignments even when they are difficult at an average rating of 3.35 or between Neutral and Agree. Table 4-5 lists the distribution and average ratings by question for the effort scale, as well as the percentage of total for each response category. Average ratings were calculated by summing the frequency multiplied by rating category, and dividing by the total frequency for that question.

Table 4-5 Distribution of Respondents' Rating by Question on the Effort Scale

Students' attention in science class has increased.			
	Rating	*f*	% of Total
	1	0	0.0%
	2	1	4.4%
	3	9	39.1%
	4	11	47.8%
	5	2	8.7%
	Total	23	100%
Average Rating			3.61
Students have increased the amount of homework they complete on time.			
	Rating	*f*	% of Total
	1	1	4.4%
	2	1	4.4%
	3	16	69.5%
	4	5	21.7%
	5	0	0.0%
	Total	23	100%
Average Rating			3.09

Table 4-5 (continued) Distribution of Respondents' Rating by Question on the Effort Scale

Students' persistence when confronted with difficult science-based problems has increased.

	Rating	*f*	% of Total
	1	0	0.0%
	2	2	8.7%
	3	12	52.2%
	4	9	39.1%
	5	0	0.0%
	Total	23	100%
Average Rating			3.30

Students approach new science class assignments with increased effort.

	Rating	*f*	% of Total
	1	0	0.0%
	2	2	8.7%
	3	8	34.8%
	4	11	47.8%
	5	2	8.7%
	Total	23	100%
Average Rating			3.57

Students have increased efforts to finish science class assignments even when they are difficult.

	Rating	*f*	% of Total
	1	0	0.0%
	2	2	8.7%
	3	12	52.2%
	4	8	34.7%
	5	1	4.4%
	Total	23	100%
Average Rating			3.35

In rating the questions related to students' initiative taking, participants reported students have increased their attempts to do their science class work thoroughly and well, rather than just trying to get by at an average rating of 3.52 or between Neutral and Agree, students' participation in class discussions about science has increased at an average rating of 3.91 or slightly below Agree, students do more than just the assigned science class work at an average rating of 3.3 or between Neutral and Agree, students' amount of questions about science information has increased at an average rating of 3.73 or slightly below Agree, students have increased raising their hands to answer a science question or volunteer science information at an average rating of 3.57 or between Neutral and Agree, and students have increased engaging their teacher in conversation about science before or after school, or outside of class at an average rating of 3.7 or between Neutral and Agree. Overall, the respondents rated the effort scale items at an average rating of 3.38, which was below the average rating of the initiative taking scale items at an average of 3.62. The data on Table 4-6 depicts the aforementioned ratings by initiative taking scale and question, as well as the percentage of total by response category.

Table 4-6 Distribution of Respondents' Rating by Question on the Initiative Taking Scale

Students have increased their attempts to do their science class work thoroughly and well, rather than just trying to get by.			
	Rating	*f*	% of Total
	1	0	0.0%
	2	0	0.0%
	3	13	56.6%
	4	8	34.7%
	5	2	8.7%
	Total	23	100%
Average Rating			3.52
Students' participation in class discussions about science has increased.			
	Rating	*f*	% of Total
	1	0	0.0%
	2	0	0.0%
	3	6	26.1%
	4	13	56.5%
	5	4	17.4%
	Total	23	100%
Average Rating			3.91

Table 4-6 (continued) Distribution of Respondents' Rating by Question on the Initiative Taking Scale

Students do more than just the assigned science class work.

	Rating	*f*	% of Total
	1	0	0.0%
	2	4	17.4%
	3	9	39.1%
	4	9	39.1%
	5	1	4.4%
	Total	23	100%
Average Rating			3.30

Students' amount of questions about science information has increased.

	Rating	*f*	% of Total
	1	0	0.0%
	2	0	0.0%
	3	7	31.8%
	4	14	63.7%
	5	1	4.5%
	Total	22	100%
Average Rating			3.73

Students have increased raising their hands to answer a science question or volunteer science information.

	Rating	*f*	% of Total
	1	0	0.0%
	2	1	4.4%
	3	9	39.1%
	4	12	52.1%
	5	1	4.4%
	Total	23	100%
Average Rating			3.57

Students have increased engaging their teacher in conversation about science before or after school, or outside of class.

	Rating	*f*	% of Total
	1	0	0.0%
	2	1	4.4%
	3	8	34.7%
	4	11	47.8%
	5	3	13.1%
	Total	23	100%
Average Rating			3.70

In addition to the Likert scale-based questions, the participants were asked to respond to an open-ended question to add depth to research question one. The question was, “To what extent do you feel that the Houston Zoo helped increase your students engagement in science once back in the classroom?” Seventeen (N = 17) teachers responded to the question, and common themes for the question are discussed below.

Theme One: Excitement about science

The most notable theme in how engagement in science back in the classroom had been impacted by the visit to the Houston Zoo was excitement about science. The teachers described the students as having increased their enthusiasm for the subject matter, noted how the visit brought science to life, and some commented on specific behaviors to which they connect with the idea of increased excitement.

- “I feel it supplemented my students' excitement about science.”
- “It became real to them, not just a book.”
- “The students at my school are very engaged already so I don’t think it developed them in that way but I think it has helped them to put science into everyday uses, which is often hard to do.”
- “All of them came back wanting to do animal reports on the animals that they saw.”
- “They had so much to say about their experience at the Houston Zoo they even wanted to write about it.”
- “They were excited to come back and learn after the zoo.”
- “I believe that the students ask more questions of their science teachers.”

- “As they wanted to know more, more and better questions were asked.”

Theme Two: Connectedness

Another common theme the teachers commented on was connections of the information covered in the field experience at the Houston Zoo to the instruction in the classroom. The teachers felt the experience at the Houston Zoo helped build connections for the students in science back in the classroom.

- “The vocabulary used helped them to expand their knowledge.”
- “We were able to discuss in full detail all of the regions of Texas and many more animals in these regions.”
- “Students are able to connect the information they learned at the zoo to new information in class.”
- “The students were able to make connections between things they saw and heard at the zoo and what we were studying.”
- “They've a better appreciation of what we try to teach them.”

Theme Three: Science as a career option

One final theme related to the engagement of students to science back in the classroom after the field experience at the Houston Zoo was that the teachers described how the students saw and related to real examples of science as a career.

- “They gained a broader idea of what they could be when they grow up one day.”
- “I think they were excited to see a person who chose science as their career.”

- "In AVID [Advancement Via Individual Determination] classes, they attempt to relate information to what they learned on the trip."

Research Question Two

How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by gender?

To assist in answering this question, an open-ended question was asked of the survey respondents. The question was, "To what extent do you feel that the field experience to the Houston Zoo impacted males versus females in your class?" Sixteen educators (N = 16) responded to the question. Most noted that either the impact was not able to be differentiated by gender, or that the impact was equal between males and females. Therefore, there are no significant themes that can be derived from the responses. Table 4-7 summarizes the responses of the teachers to the aforementioned question.

Table 4-7 Count of Participants' Responses by Common Response Related to Engagement Differences Between Gender

Response	*f*	% of Total
Equal	5	31.3%
No Difference	9	56.2%
N/A	2	12.5%
Total	16	100%

Research Question Three

How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by socioeconomic status?

To determine if there was a difference by which economically disadvantaged students' engagement in science class was impacted by the field experience to the Houston Zoo, an open-ended question that read, "To what extent do you feel that the field experience to the Houston Zoo impacted economically disadvantaged students that might not otherwise have the opportunity to visit the Zoo," was posed to the teachers. Seventeen (N = 17) teachers responded to the question, and one common theme resounded through their answers. That theme, as well as a couple of outlying themes is described below.

Theme One: Novelty

Many of the educators stated this was the first time their students had the opportunity to visit the Zoo and were appreciative of the opportunity, as well as excited about seeing and learning about the animals.

- "The majority of my students had never been to the zoo, nor would they probably ever get the chance to go."
- "It was many students first opportunity to experience the Houston Zoo."
- "All of our students were very appreciative and relished the opportunity to visit the Houston Zoo."
- "Many of our students come from homes in which both parents work long hours and seldom have time to take them to places such as the Zoo. Our visit gave them the opportunity to actually see animals and their habitats instead of just reading about them in class or seeing them on television. Furthermore, our visit to the Zoo also serves as an experience [in] which the students can later use in their writing."

- "This is something I was so glad they were able to experience, some for the very first time and may have been the only time. It's an experience they will not forget."
- "Some of my students have never been to the zoo before and would have never been able to have the hands-on experience that they had."

Outliers

While novelty certainly the highest response rate, there were three other responses that should be noted. First, since not all teachers were from Title I classified campuses, or campuses with students on free or reduced meal plans, six (N = 6) educators responded that this question was not applicable to their group. Another response of note, was one (N = 1) noted that a volunteer assisting in the teaching took the time to talk to the students about career opportunities at the Zoo, and otherwise this discussion might not have happened. Finally, one (N = 1) educator noted, "Many have mentioned asking their parents to visit together as a family." While this was only mentioned one time, the importance of intergenerational transfer should be noted as an element of differentiation for students that are economically disadvantaged.

Informing Leadership Practices

To provide the researcher with information applicable for making recommendations for implication to organizational leaders of both science institutions, as well as schools, two additional questions were asked.

1. To what extent do you feel the field experience to the Houston Zoo impacted your students?
2. To what extent would you recommend to other teachers a similar trip to the Houston Zoo?

Nineteen (N = 19) teachers responded to question one, and eighteen (N = 18) responded to question two. Common themes associated with each question are noted below. Implications and applications for leaders are discussed in Chapter 5.

To what extent do you feel the field experience to the Houston Zoo impacted your students?

Theme One: Motivation

Many of the educators responded that field experience to the Houston Zoo impacted the students through increasing motivation toward science studies, and actively participating in science class.

- “They [the students] now are more motivated to pursue studies in science.”
- “The trip has motivated the students to ask more science questions in their AVID classes.”
- “Since I have a mulit-age classroom, it was great to see the different levels of ‘putting stuff together.’ Most of them have been to the zoo a lot. It was great to see the renewed interest in both the older children and the chaperones!”
- “More questions about the animals we saw in the science class.”
- “They wanted to learn more.”

Theme Two: Hands-on, Interactive Activities with Animals

The teachers commented the activities conducted during the field experience at the Houston Zoo were engaging and kept the students' interest. The live animals that were included in the instruction were mentioned not only as a highlight of the experience, but also as a strong connector to the instruction in science class at school.

- "My students loved the experience of seeing and hearing about new animals especially since the animals were not regular pets they would normally have contact with."
- "They enjoyed seeing and touching the animals in the adventure class."
- "Students could make personal connections. They learned about animals that they had never seen up close before."
- "Our visit focused on animals found in Texas. As fourth graders, our students focus on learning all about Texas including its natural regions and animals that inhabit each. Our visit coincided with our unit on the regions, so our visit to the zoo gave our students the opportunity to see the animals we studied about. It brought their learning to life."
- "They loved learning about all the animals at the Houston Zoo."
- "The students loved seeing the animals we had been studying come alive."
- "They really enjoyed the hands-on experience they received."
- "The students had a memorable, interactive learning experience. The impact was positive and lasting."

Theme Three: Instructor Excellence.

A couple of the teachers noted the instructor leading the class at the Houston Zoo exemplified elements of good instruction including classroom management and keeping student interest in the subject taught, which impacted the students in attendance.

- "The person in charge was amazing as far as classroom management and maintaining student interest."
- "My students loved the class. The instructor was phenomenal."

To what extent would you recommend to other teachers a similar trip to the Houston Zoo?

Eighteen (N = 18) teachers responded to this question as either recommending or highly recommending the field experience at the Houston Zoo to other teachers.

- "I definitely will tell other teachers to take the opportunity that the zoo provides and take their students there. It was an AWESOME experience both for the students and for me as a teacher"
- "I think a field experience visit to the zoo should be part of every child's learning."
- "I would definitely recommend both the class that we took and the animal scavenger hunts."

In addition to highly recommending the experience, there were two points teachers wanted to be taken into consideration to teachers in which they recommend the program. First, two teachers (N = 2) noted they would recommend the program, specifically if the instructors that conducted the class were the teachers for their program.

- "With the ladies that talked to our kids I would highly recommend it."
- "Highly recommend the zoo and the special animal presentations if they are given by someone as talented as our leader was."

The second point to note, was that one (N = 1) teacher commented about recommending not only the program, but also field trip procedures that might be of use. This particular teacher noted the importance of aligning material taught in the classroom with that of the field experience.

- "I would recommend that science teachers maximize on the trip by teaching lessons that align with the adventure classes before the trip."

Summary

Many themes were established through the horizontalization of the statements made by the teachers in response to the open-ended questions. Table 4-8 summarizes the themes generated by research question, and includes those themes that emerged from the questions pertaining to informing leadership practices.

Table 4-8 Response Themes by Research Question

Themes	Research Question #1	Research Question #2	Research Question #3	Informing Leadership Practices
Excitement About Science	X			
Connectedness	X			
Science as a Career Option	X		X	
Novelty			X	
Intergenerational Transfer			X	
Motivation				X
Hands-on, Interactive Activities with Animals				X
Instructor Excellence				X
Recommend to Others				X
Not Applicable		X	X	

CHAPTER V

CONCLUSIONS

Overview of Study

The purpose of this study was to determine if there is a relationship between students' engagement in science back in their classroom after having attended a field experience at the Houston Zoo. This study further explored whether teachers' perceptions of their students' engagement in science after a field experience at the Houston Zoo differed by gender or socioeconomic status. To conduct this research, an online survey was administered to teachers that participated in programs at the Houston Zoo during the fall of 2012. The survey instrument consisted of three parts: 1) a series of Likert scale-based questions derived from the Student Participation Questionnaire, 2) a series of open-ended questions focusing on teachers' perspectives of change in students' engagement, and 3) a series of basic demographic questions (Finn et al., 1995).

The review of the literature shows that science most adults learn comes from informal science and broadcast programming (Ogden, et. al., 2011; National Research Council, 2009; Falk & Dierking, 2010). A recent report by the National Governors Association documented that organized informal science programs have consistently shown such programs (1) raise student interest, confidence, and classroom achievement in math and science, (2) generate student interest in pursuing STEM studies and careers (Thomasian, 2012). However, the field experience is an expensive venture, and includes complex decisions from trip logistics to student liability (Orion & Hofstein, 1994). While field experiences at informal science education institutions can have an impact on student interest and engagement in science, as well as expand students' thoughts related to science careers, there is very little research that concentrates on the connections between field experiences at zoos and the formal learning environment (Randler, et. al., 2012).

This study aimed to add to the research exploring the connections mentioned above. Three research questions guided this study.

1. Is there a relationship between teachers' perceptions of students' engagement in science in their classroom and participation in a field experience at the Houston Zoo?
2. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by gender?
3. How do teachers' perceptions of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by socioeconomic status?

Discussion of Results

Is there a relationship between teachers' perception of students' engagement in science in their classroom and participation in a field experience at the Houston Zoo?

Evidence of engagement in science once back in the classroom after participating in a field experience at the Houston Zoo was seen both in the results of the Likert scale-based questions, and indicated by the responses of the open-ended questions received through the online survey. Finn, Pannozzo, and Voelkl (1995) associated positive learning behaviors with behaviors related to student engagement in the classroom and analyzed them on two scales, effort and initiative-taking. The average response rating for behaviors associated with the effort scale is 3.38, while the average rating for behaviors associated with the initiative-taking scale is 3.62. While the quantity of results do not allow for a statistical analysis to determine significance, observationally, this denotes the teachers saw a slight increase in positive learning behaviors, associated with effort and initiative, in science back in the classroom.

The results presented from the open-ended questions will help to explore this observational relationship in student engagement in science as a result of the Houston Zoo field experience. Axelson and Flick (2010) noted student engagement in the classroom could be associated with such characteristics as involvement and interest in the classroom instruction, and connections to the subject matter taught. Three themes emerged from the teachers responses related to impacting student engagement in science: 1) Excitement, 2) Connectedness, and 3) Science as Career Options.

In theme one, excitement, the teachers indicated the excitement in science the students exhibited upon returning from the field experience were tied to behaviors of increased connectedness to the subject matter through the desire to write about and do reports on animals, and the level of and quantity of questioning increasing. Slightly over 45% of the teachers that responded to this question identified specific behaviors or the word “excitement” as it related to the students’ engagement in science. These behaviors, coupled with the teachers’ observations, indicate the strength the field experience had on the students’ interest and involvement in the classroom.

The second most mentioned theme by the teachers was the increase students made in connecting with science to what they had learned while at the Houston Zoo. The teachers identified these connections to science through specifically mentioning the connections to the material taught, as well as an increase in the detail added to class discussions and the expansion of knowledge through use of science-specific vocabulary.

While not noted specifically in the research above as an identifiable characteristic of student engagement, three teachers made mention to aspects of science as a career when noting the extent of student engagement in science. Crumpton and Gregory (2011) described an aspect of student engagement termed *academic relevancy,* mostly applicable to low-achieving minority children. Academic relevancy is a student's connection of the material learned in class to their real life experiences and how it is personally meaningful. Therefore, the teachers that responded could have been from campuses serving low-achieving students, and observed this academic relevancy through the students' peaked interest in pursuing careers in science. Additionally, mentioning career options could have been indicative of a focus of a particular program in which the students are participating. One teacher noted the students were in an AVID program at school, and that particular program focuses more on career-oriented aspects when learning, so the teacher noting career options in science as having increased might have been a stronger indication of academic relevancy. Therefore, informal science institutions should look for opportunities to promote this connection to careers as a reason for bringing low-achieving students on field experiences.

How do teachers' perception of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by gender?

Recent studies have explored the relationship between gender and student engagement and have not found a significant difference amongst gender (Crumpton &

Gregory, 2011; Gonida, et al., 2007). Similarly, the teachers responded they did not perceive a difference or the amount of engagement was equal between males and females, and those that did not mention there was not a difference commented the question was not applicable to them.

How do teachers' perception of students' engagement in science in their classroom after attending a field experience at the Houston Zoo differ by socioeconomic status?

There has been very little research to date on the impact of socioeconomic status on student engagement in the classroom (Fredricks et al., 2004). Crumpton and Gregory (2011) suggest low-achieving, economically disadvantaged students interest in class increases as the students find the instructional material to be relevant to their future success. Additionally, research indicates that "environmental novelty" or the "novelty of the space" can inhibit the students' interest in a subject and their learning process (Orion, et al., 1994; Falk, 1983). Children's learning is focused on the setting instead of the relevant instructional material taught (Falk & Balling, 1982). A majority of the teachers that commented about the extent of impact of the field experience on economically disadvantaged students specifically identified that this experience was novel to many of them. Since the impact was more noticeable on the novelty of the setting, we can assume the students were more engaged in the experience of the trip to the Zoo versus the science instruction occurring back in the classroom surrounding the field experience. Also, embedded in the comments of novelty, is a sub-theme of appreciation for the opportunity. Appreciation could be interpreted to placing a high personal value on the experience, which, as noted earlier in this chapter, economically disadvantaged students that have meaningful experiences with material find it to be academically relevant, and academic relevancy has been connected to student engagement (Crumpton & Gregory, 2011).

Additionally, while only one teacher responded their students wanted to take their families back to experience the Houston Zoo, this desire for parental involvement in the learning process is worth noting. George and Kaplan (1998) found that when parents are more involved in taking their children to informal science institutions, the students' attitudes toward science was positively impacted. This desire the teachers' students expressed may help to perpetuate the impact the field experience had for a much longer time by linking the experience with their families.

Informing Leadership Practices

While not a specific research question, one of the intents of this study was to inform leadership practices related to field experiences and student engagement. Therefore, the study posed two additional questions to the teachers focused on impact of the overall field experience and the extent to which the teachers would recommend the program to another teacher. When describing the impact the field experience had on their students, educators described a truly motivating experience. The teachers commented that the students came away wanting to pursue careers in science, asking more science related questions in class, and wanted to learn more when they got back to the classroom. All of these positive learning behaviors and interest in classroom instructional information are reflective of elements of both behavioral and emotional student engagement (Fredricks et al., 2004). In fact, in a report named *Engaging Schools*, the authors state that motivation and engagement are synonymous terms, which brings more depth to the point that the experience the students received at the Houston Zoo manifested in engaging characteristics once back in the classroom (National Research Council & Institute of Medicine, 2004).

A second point the teachers described when referring to the impact the field experience had on their students was the focus on the hands-on, interactive activities conducted during the Houston Zoo program. The teachers described seeing and touching animals they otherwise would not have the opportunity to see and/or touch brought the learning to life and helped the students build personal connections to the material they were learning. It has long been the practice of informal science education institutions to incorporate discrepant events into their instructional practice to create and stimulate student interest (Abraham-Silver, 2006). The practice of utilizing live animals as part of the Houston Zoo field experience is a purposeful experience, and the outcomes are in line with previous research. These practices should be continued and built upon in order to continue to stimulate interest in science.

Lastly, a point indicated by the teachers as a point of impact with their students, as well as a reason for them to extend a recommendation of the field experience to another educator, was the instructional excellence provided by the Education Department staff at the Houston Zoo. The teachers commented specifically on their abilities of classroom management, engagement, and presentation skills. This is important for organizations to note the value the teachers placed on the instructional practice during the field experience. To this end, organizations should make it a practice to provide continual training related to good instructional strategies in order for the instructors at the informal science institutions to provide quality programming that educators will trust.

Implications for Organizational and School Leaders

Implications of this study impact both informal and formal educational leaders. One of the implications for informal science educational leaders is the professional preparation of their instructors. The teachers responding to the survey noted some of the best practices, classroom management, and engaging presentation style employed by the instructors at the Houston Zoo. These teachers associated their view of the instructors with the value of the program and their recommendation to others to participate in the same program. Therefore, informal science educational leaders would behoove themselves to focus on the professional development of their staff, and more specifically the instructional strategies that best engage learners of all ages. In fact, it is not just an implication of this study, but also a recommendation of the National Science Teachers Association (NSTA) (National Science Teachers Association, 2012). In a position statement on learning science in informal environments written by NSTA, they called for, "an increase of support for informal science educators so they are able to continually improve their professional practices by expanding opportunities for the own professional learning, including (but not limited to) how they can collaborate with schools and teachers to advance student engagement with and pursuit of science" (National Science Teachers Association, 2012, p. 3). So not only is it important for the connections to the formal classroom environment, but also the value teachers associate with good instruction in the classroom is important to continuing to be able to effectively market the programs to school leaders faced with the decision of field experience options.

Another implication for informal science educational leaders to consider is the wise use of their resources. The teachers in the study commented that one of the most impactful parts of the field experience were the hands-on, interactive activities, specifically surrounding the animals. Patrick and Tunnicliffe (2013) note some individuals may mention that visits to zoos are not necessary because of the amount of information and interaction possible via today's media; however, they fail to see the opportunities that in-person experiences can provide in provoking emotional responses. Informal educators should build on these opportunities through innovative curriculum and instructional strategies to continue to spark an interest in science that might be carried back into the classroom.

Still yet another implication is the need the for informal education leaders to facilitate collaboration with formal education leaders. As the results of this study showed, the field experience and class at the Houston Zoo was a motivational experience for the students, and their teachers reiterated this point through their comments on the impact it had on the students. Therefore, it is easy to see informal educators can step into a role where they view themselves as motivators; however, if value was placed on collaboration with the formal teachers, the extent to which student learning occurs could potentially increase (Patrick, Mathews, & Tunnicliffe, 2011). Leaders at informal science institutions must work with their staff, as well as in-service and pre-service teachers to develop resources, curriculum, and plans for conducting the filed experiences, so as to provide the most impact possible to student learning. The Texas Education Agency recognizes this need, and in their flyer entitled, *Guidelines for Instructional Field Experience*, they specifically note, "The field experience should have three components: pre-visit, on-site, and post-visit TEKS-based instructional activities that are clearly developed in lesson plans" (Texas Education Agency, 2002, p. 1). This collaboration between formal and informal is not just a good idea, but a guideline from a governing organization.

School leaders make choices. By whatever decision-making model they use, principals have to decide on how the dollars they are allocated would be best used for the students' learning and achievement in their schools (Epstein, 2009). As this study shows, field experiences are a way to generate a renewed interest in a topic, motivate the students to engage in science class through their work and questions, and expose students that might not otherwise have an opportunity to visit a zoo, to a novel environment in which they might learn about additional career options, specifically in the areas related to STEM. The Texas Essential Knowledge and Skills (TEKS) "require a minimum of 40% of the instructional time in secondary science be devoted to laboratory and field activities §74.3" (Texas Education Agency, 2002, p. 2). Therefore, school leaders should support research-based, high value, low cost educational experiences with community partners that truly can compliment and reinforce student learning.

However, this selection should come with a stipulation and suggestion; school leaders need to collaborate with informal science education institutions to design and deliver professional development and curriculum surrounding these field experiences. Epstein (2009) discusses this as shared leadership as she recommends, "In effective partnership programs, shared leadership means that all members on the team of teachers, administrators, parents, and community partners will take responsibility for developing, implementing, evaluating, and continually improving plans and practices of family and community involvement" (p. 37) The notion of collaboration should be an ongoing process and conversation with informal science organizational leaders. Conversations and plans should call for professional development and curriculum surrounding the field experience, so that the extent of student engagement once back on campus is that much greater.

Implications for Further Research

This study provided opportunities for further research. First and foremost, as identified in the National Science Teachers Association position statement on learning science in informal environments (2012), as well as National Governors Association Issue Brief on informal science, there is a need for more and better evaluation instruments for informal environments that shows the impact on students, in both engagement and achievement (Thomasian, 2012). For the purpose of this study, an existing student engagement instrument had to be modified for data collection, and as such presented a limiting factor in ability of the research to be generalized to a larger constituency. As national organizations call for the support of informal science learning, it will be important that common measurements are available, and research is conducted to measure these links between the formal and informal environments so funding and resources can be allocated appropriately.

As informal science institutions continue to look for opportunities to conduct evaluation, it will be important to develop procedures supportive of appropriate data collection. While the representative student sample of 490 students for this study is somewhat strong, the overall response rate from participating teachers was only slightly over 45%, and limited the scope of this study. Researchers should consider incentivizing the teachers to respond, specifically if conducting a study that asks the teachers to provide feedback after having left the study site. Another alternative would be to conduct pre- and post-visits to schools participating in field experiences to measure engagement of students over time so the researcher was not relying specifically on the teachers' retrospective responses. Additionally, this method of prior to and after the field experience measure of engagement could lead to more specific results as a unit of measure over time for engagement could be established.

As has been mentioned in the research, as well as by one of the teachers in this study, there continues to be a need for research supporting the alignment of materials and instruction in the classroom to the instruction during a field experience, both before and after visits to an informal science institution. A limiting factor of this study was that there measuring the experience of the instructors at the Houston Zoo and the impact that might have had on the engagement of the students was not taken into account. Future research might want to consider adding that dimension to a study. Additionally, there was a broad interpretation of science engagement in this study, so future research might want to consider focusing on one particular unit of science and the impact that might have on student engagement. Overall, for the collaboration between formal and informal environments to continue to improve, it will be critical that the support provided to both be closely aligned and research based.

Conclusion

With the passing of the No Child Left Behind legislation, principals were forced to focus even more attention on their students' achievement. It has been reported the achievement gap between students in the United States of America and those abroad, specifically in math and science, is widening (Fisher, et al., 2011). Student engagement has seen increasing attention and research as of late because of the possibility it holds as a remedy to the widening achievement gap and decreasing student motivation, due to the perceived malleability of its components (Fredricks et al., 2004). Additionally, there are recent reports touting the role that informal science education can play in raising student interest, confidence, achievement, and career aspirations toward math and science. However, the field experience to an informal science institution can be one of the most complex and expensive elements of the educational system (Orion & Hofstein, 1994). Therefore, with budget deficits and an increasing demand on accountability, school leaders are faced with difficult decisions that require they place emphasis on information rooted in research, so they have the information needed to determine the financial and personnel allocation necessary for the greatest student impact (Epstein, 2009).

These difficult decisions faced by educational leaders will more than likely be evaluated on the basis how much student achievement can be accomplished as a result of the financial and personnel investment. However, it is a stretch to say an informal science education program or experience could positively impact student achievement on standardized tests. But as this study indicates, there are certain links to field experiences at informal science education institutions to student engagement, and as mentioned previously, student engagement has been positively correlated with increasing student achievement and interest. The need to build upon connections between formal education and informal education environments is critical to providing the organizational leaders the information necessary to continue to strive toward narrowing the achievement gap.

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APPENDIX A

APPROVAL FROM THE UNIVERSITY OF HOUSTON HUMAN SUBJECT RESEARCH COMMITTEE

UNIVERSITY of HOUSTON
DIVISION OF RESEARCH

December 7, 2012

Chance Sanford
c/o Ms. Rayyan Amine
Curriculum and Instruction

Dear Chance Sanford,

Based upon your request for exempt status, an administrative review of your research proposal entitled "INFORMING LEADERSHIP PRACTICES: EXPLORING RELATIONSHIPS BETWEEN STUDENT ENGAGEMENT IN SCIENCE AND A FIELD EXPERIENCE AT THE HOUSTON ZOO" was conducted on November 7, 2012.

At that time, your request for exemption under **Category 2** was approved pending modification of your proposed procedures/documents.

The changes you have made adequately respond to the identified contingencies. As long as you continue using procedures described in this project, you do not have to reapply for review. * Any modification of this approved protocol will require review and further approval. Please contact me to ascertain the appropriate mechanism.

If you have any questions, please contact Nettie Martinez at 713-743-9204.
Sincerely yours,

Kirstin Rochford, MPH, CIP, CPIA
Director, Research Compliance

*Approvals for exempt protocols will be valid for 5 years beyond the approval date. Approval for this project will expire **November 1, 2017.** If the project is completed prior to this date, a final report should be filed to close the protocol. If the project will continue after this date, you will need to reapply for approval if you wish to avoid an interruption of your data collection.

Protocol Number: 13118-EX

316 E. Cullen Building Houston, TX 77204-2015 (713) 743-9204 Fax: (713) 743-9577
COMMITTEES FOR THE PROTECTION OF HUMAN SUBJECTS

APPENDIX B

UNIVERSITY OF HOUSTON CONSENT TO PARTICIPATE IN RESEARCH FORM

UNIVERSITY OF HOUSTON
CONSENT TO PARTICIPATE IN RESEARCH

INFORMING LEADERSHIP PRACTICES: EXPLORING RELATIONSHIPS BETWEEN STUDENT ENGAGEMENT IN SCIENCE AND A FIELD EXPERIENCE AT THE HOUSTON ZOO

You are being invited to participate in a research project conducted by Chance Sanford as part of the completion of a doctoral dissertation at the University of Houston under the supervision of Dr. Rayyan Amine.

NON-PARTICIPATION STATEMENT

Your participation is voluntary and you may refuse to participate or withdraw at any time without penalty or loss of benefits to which you are otherwise entitled. You may also refuse to answer any question.

PURPOSE OF THE STUDY

The goal of this study is to determine if there is a relationship between students' engagement in science in their classroom and students' participation in a field experience at the Houston Zoo. This study will focus on teachers' perceptions of science engagement in the classroom, and whether or not there is a significant difference between students based on grade level, gender, and ethnicity. This study will conclude in April of 2013.

PROCEDURES

You will be one of approximately 58 subjects to be asked to participate in this project. You will receive a link to an online survey, hosted at SurveyMonkey.com, three weeks after having participated in a field experience at the Houston Zoo. Completion of the survey should take no more than 15 minutes of your time.

CONFIDENTIALITY

Your participation in this project is anonymous. Please do not write your name on any of the research materials to be returned to the principal investigator.

RISKS/DISCOMFORTS

There are no foreseeable risks associated with participation in this study.

BENEFITS

While you will not directly benefit from participation, your participation may help investigators better understand teachers' perceptions of student engagement in a science class as a result of participating in a field experience at the Houston Zoo.

ALTERNATIVES

Participation in this project is voluntary and the only alternative to this project is non-participation.

PUBLICATION STATEMENT

The results of this study may be published in professional and/or scientific journals. It may also be used for educational purposes or for professional presentations. However, no individual subject will be identified.

SUBJECT RIGHTS

1. I understand that informed consent is required of all persons participating in this project.

2. All procedures have been explained to me and all my questions have been answered to my satisfaction.

3. Any risks and/or discomforts have been explained to me.
4. Any benefits have been explained to me.

5. I understand that, if I have any questions, I may contact Chance Sanford at 713-533-6571. I may also contact Dr. Rayyan Amine, faculty sponsor, at 713-743-4965.

6. I have been told that I may refuse to participate or to stop my participation in this project at any time before or during the project. I may also refuse to answer any question.

7. ANY QUESTIONS REGARDING MY RIGHTS AS A RESEARCH SUBJECT MAY BE ADDRESSED TO THE UNIVERSITY OF HOUSTON COMMITTEE FOR THE PROTECTION OF HUMAN SUBJECTS (713-743-9204). ALL RESEARCH PROJECTS THAT ARE CARRIED OUT BY INVESTIGATORS AT THE UNIVERSITY OF HOUSTON ARE GOVERNED BY REQUIREMENTS OF THE UNIVERSITY AND THE FEDERAL GOVERNMENT.

8. All information that is obtained in connection with this project and that can be identified with me will remain confidential as far as possible within legal limits. Information gained from this study that can be identified with me may be released to no one other than the principal investigator and his faculty sponsor. The results may be

published in scientific journals, professional publications, or educational presentations without identifying me by name.

I HAVE READ (OR HAVE HAD READ TO ME) THE CONTENTS OF THIS CONSENT FORM AND HAVE BEEN ENCOURAGED TO ASK QUESTIONS. I HAVE RECEIVED ANSWERS TO MY QUESTIONS. I GIVE MY CONSENT TO PARTICIPATE IN THIS STUDY. I HAVE RECEIVED (OR WILL RECEIVE) A COPY OF THIS FORM FOR MY RECORDS AND FUTURE REFERENCE.

Study Subject (print name):

Signature of Study Subject:

Date:

I HAVE READ THIS FORM TO THE SUBJECT AND/OR THE SUBJECT HAS READ THIS FORM. AN EXPLANATION OF THE RESEARCH WAS GIVEN AND QUESTIONS FROM THE SUBJECT WERE SOLICITED AND ANSWERED TO THE SUBJECT'S SATISFACTION. IN MY JUDGMENT, THE SUBJECT HAS DEMONSTRATED COMPREHENSION OF THE INFORMATION.

Principal Investigator (print name and title):

Signature of Principal Investigator:

Date:

APPENDIX C

SURVEY INSTRUMENT

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I HAVE READ (OR HAVE HAD READ TO ME) THE CONTENTS OF THIS CONSENT FORM AND HAVE BEEN ENCOURAGED TO ASK QUESTIONS. I HAVE RECEIVED ANSWERS TO MY QUESTIONS. I GIVE MY CONSENT TO PARTICIPATE IN THIS STUDY. I HAVE RECEIVED (OR WILL RECEIVE) A COPY OF THIS FORM FOR MY RECORDS AND FUTURE REFERENCE.

○ I agree ○ I do not want to participate

2. Below are items that describe students' behavior in class. Please consider the behavior of the students in your class since you have returned from your field experience at the Houston Zoo, and rate your response on the scale of 1-5 (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Students' attention in science class has increased.	◯	◯	◯	◯	◯
Students have increased the amount of homework they complete on time.	◯	◯	◯	◯	◯
Students have increased their attempts to do their science class work thoroughly and well, rather than just trying to get by.	◯	◯	◯	◯	◯
Students' participation in class discussions about science has increased.	◯	◯	◯	◯	◯
Students' persistence when confronted with difficult science-based problems has increased.	◯	◯	◯	◯	◯
Students do more than just the assigned science class work.	◯	◯	◯	◯	◯
Students approach new science class assignments with increased effort.	◯	◯	◯	◯	◯
Students amount of questions about science information has increased.	◯	◯	◯	◯	◯
Students' have increased efforts to finish science class assignments even when they are difficult.	◯	◯	◯	◯	◯
Students have increased raising their hands to answer a science question or volunteer science information.	◯	◯	◯	◯	◯
Students have increased engaging their teacher in conversation about science before or after school, or outside of class.	◯	◯	◯	◯	◯

Please answer the following questions as you consider your students' behavior before, during, and after your visit to the Houston Zoo.

3. To what extent do you feel the field experience to the Houston Zoo impacted your students?

4. To what extent do you feel that the Houston Zoo helped increase your students engagement in science once back in the classroom?

5. To what extent do you feel that the field experience to the Houston Zoo impacted economically disadvantaged students that might not otherwise have the opportunity to visit the Zoo?

6. To what extent do you feel that the field experience to the Houston Zoo impacted males versus females in your class?

7. To what extent would you recommend to other teachers a similar trip to the Houston Zoo?

Please provide the following demographical information. If the actual numbers are not available, please estimate.

8. How many total students are in your class?

Number of Students

9. How many males and females do you have in your class?

Males

Females

10. How many students of each of the following ethnicities do you have in your class?

American Indian/Alaskan Native

African-American

Asian

Hispanic

Native Hawaiian/Other Islander

Two or more

White

11. How many students are economically disadvantaged (e.g., on free/reduced meal plans) in your class?

Number of Students

12. How many students are economically disadvantaged (e.g., on free/reduced meal plans) in your class?

Number of Students