

PERCEPTIONS OF UNDERGRADUATE RESEARCH IN
EXERCISE AND SPORTS SCIENCE AT TEXAS STATE UNIVERSITY

by

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A thesis submitted to the Graduate Council of
Texas State University in partial fulfillment
of the requirements for the degree of
Master of Science
with a Major in Exercise Science
May 2020

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ACKNOWLEDGEMENTS

This thesis project would not have been possible without the unwavering support of my committee, family, and friends.

Thank you to Dr. Ting Liu for the hundreds of hours put into this project from the very beginning. Your guidance led me to produce a piece of work I am incredibly proud of, and I could not have done this without you.

Thank you to Dr. Jennifer Ahrens and Dr. Ron Haas for being fantastic mentors over the last six years at Texas State. You have always believed in me and pushed me to pursue my dreams. I have been so incredibly blessed to also have you both as my mentors. I can never repay you for all of the advice, opportunities, and support you've given me.

Thank you to my family. You gave me every chance to succeed, and I am incredibly grateful each and every one of you.

Lastly, I want to give a special thank you to my friend Marcus Case for pushing me to be my best and for helping me get this project off the ground.

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LIST OF ABBREVIATIONS

| Abbreviation | Description |
|---------------------|---|
| ESS | Exercise and Sports Science |
| HHP | Health and Human Performance |
| BESS | Bachelor of Exercise and Sports Science |
| HFM | Health and Fitness Management |
| ALPE | All-Level Physical Education |
| PRS | Pre-Rehabilitation Science |
| QEP | Quality Enhancement Plan |
| CES | Clinical Exercise Science |
| CRE | Current Research Experience |
| FRE | Future Research Experience |
| RC | Research Competence |
| RA | Research Attitudes |

Chapter I

Introduction

As a continuously growing subsection of Kinesiology, the field of Exercise and Sports Science (ESS) is influenced by a wide variety of academic disciplines. Many undergraduate programs in ESS include courses in the fields of psychology, physics, biology, chemistry, and communication among others in their general education core (Elder, Pujol, & Barnes, 2003). These courses are used to set the foundation of knowledge for the study of exercise science in Kinesiology and its impact on health, society, and quality of life (American Kinesiology Association, 2019). However, specific curricula are determined by adherence to standards set by professional organizations such as the American College of Sports Medicine (ACSM) and the National Association for Sport and Physical Education (NAS-PE; Elder et al., 2003). These national organizations consider courses in exercise physiology, biomechanics, physical education, sports nutrition, motor learning, resistance training and sports psychology as necessary components for an exercise science curriculum (Elder et al., 2003). Dependent upon the department affiliation with a particular national organization, undergraduate ESS programs are designed to prepare students for careers as rehabilitation specialists, teachers in elementary and secondary schools, exercise physiologist, fitness instructors, and coaches (American Kinesiology Association, 2019)

In addition to the ESS curricula, it is recommended that research in ESS programs need to be diverse and multidisciplinary (Williams & Wragg, 2004). The three key sub-disciplines in ESS research are biomechanics, physiology and psychology (Williams & Wragg, 2004). Prominent research in most recent years from these fields has focused on

aerobic fitness, motivation and the impact of cognition on physical activity, dietary influence on skeletal muscle structure, and skeletal muscle function in the aging population (Enoka, 2019). While research in exercise science is not exclusive to these topics, there is a narrow focus for programs that affiliate with certain national organizations. For example, for programs that base their curriculum on ACSM guidelines, the knowledge, skills, and abilities listed for certifications only include few concepts beyond preparatory material covered in anatomy and physiology courses (Ives & Knudson, 2007). Narrow, surface-level focus on so few subdisciplines within ESS are translate to fewer program courses such as motor learning, exercise physiology, and biomechanics that are required to develop students' understanding beyond basic science (Elder et al., 2003).

It is commonly found that, regardless of professional affiliation, undergraduate ESS programs face the challenge of engaging undergraduate students in research. With a potentially wide range of disciplines in ESS for undergraduate students to pursue research in, it becomes imperative that these students are given the tools for necessary for successful practice in research in their respective fields (Ives & Knudson, 2007). A stronger focus on creating more applied research opportunities and teaching undergraduate students' evidence-based practices may improve the quality and reliability of the research in Kinesiology. However, despite the trend in expanding research exposure, undergraduate students perceive various barriers to their engagement in research (Myers, Sawyer, Dredger, Barnes, & Wilson, 2018).

As a prime example of diverse ESS undergraduate program, the Department of Health and Human Performance (HHP) at Texas State University also experiences the

challenge of engaging undergraduate students in research. The HHP department houses the Bachelor of Exercise and Sports Science (BESS), which contains the Exercise and Sports Science (ESS) and Health and Fitness Management (HFM) majors. The major in ESS undergraduate program has three concentrations: All-Level Physical Education (ALPE), Pre-Rehabilitation Science (PRS), and Clinical Exercise Science (CES). Courses in both majors include fitness programming, exercise physiology, biomechanics, motor learning, physical education, and sports psychology (Texas State University Catalog, 2019). Undergraduate students in HHP are also exposed to internship and student-teaching courses to prepare them to acquire the academic and clinical qualifications, earn professional certifications (e.g., ACSM, NCSA), and for entrance to graduate schools in Kinesiology and allied health. While these courses engage students in professional practice, there are limited research-based courses in the curricula. Students are not required to take a research methods course or capstone research course as a part of their degree requirements.

Considering this current lack of research-based courses, the department's Strategic Plan for 2017-2023 states that the mission of HHP is to create and disseminate knowledge promoting evidence-based practice in health promotion, exercise science, and recreation professions (HHP, 2019). As a portion of this mission, the department also highlights a goal to expand interdisciplinary research through the creation of new spaces and support for teaching and research. These goals are in line with the university's Quality Enhancement Plan (QEP) 2020, whose theme is centered on supporting student learning, enhancing the role of undergraduate research, and accomplishing the university mission through research experience. The QEP is a mandate from the Southern

Association of Colleges and Schools Commission on Colleges (SACSCOC) and is set to be finalized in 2020 (Quality Enhancement Plan 2020, 2019). The QEP defines undergraduate research as a process framed within the four broad stages of problem resolution: (a) Identification of the problem/need, (b) information gathering (e.g., data collection, systematic methods as appropriate to discipline), (c) analysis, and (d) proposed solution. Undergraduate research may occur in the context of: (a) faculty driven projects and/or (b) student driven projects (Quality Enhancement Plan 2020, 2019). The QEP task force has determined six learning outcomes to enhance and assess the growth of undergraduate research practices at Texas State University. These six learning outcomes for students include: 1) recognizing the utility of research or inquiry appropriate to their discipline, 2) differentiating ethical aspects of research or inquiry appropriate to their discipline, 3) evaluating a body of research, inquiry, or creative expression appropriate to their discipline, 4) synthesizing a body of research, inquiry, or creative expression appropriate to their discipline, 5) designing a research, inquiry, or creative expression appropriate to their discipline; and 6) implementing a research, inquiry, or creative expression appropriate to their discipline (QEP, 2020, 2019).

As the HHP department and university at large strive to promote undergraduate research in the future, it is important to understand the current state of undergraduate research at Texas State University. According to the National Survey of Student Engagement (NSSE) for Texas State University, the percentage of students who have participated in at least one high-impact practice was 53% for first-year students and 81% for seniors (Office of Institutional Research, 2018). High impact practices are service learning, learning community, research with faculty, study abroad, and culminating

senior experiences (Office of Institutional Research, 2018). Undergraduate research is currently handled by separate entities within the university. Each academic department maintains their own support on undergraduate research with various courses in research methods, statistics, and capstone courses. For example, there are programs dedicated to specific majors such as the STEM Undergraduate Research Experience (SURE) in the College of Science and Engineering (Office of Strategic Initiatives, 2019) and Honors College with three outlets for undergraduate research: Honors Thesis, Texas State Undergraduate Research Journal (TXSTUR), and Undergraduate Research.

The Honors College at Texas State University has been a staple in undergraduate research for the university since 1967 (Honors College, 2019). As an additional requirement to graduate in the Honors College, students have the opportunity to take a research methods class: HON 4390A, and Senior Seminar that focuses on research and learning research techniques appropriate for an honors thesis. It provides students with the foundation to develop their thesis, find an appropriate thesis supervisor, and build a foundation of their topic to complete their Honors Thesis (Honors College, 2019).

Students also have an opportunity to present their thesis at one of two events depending on the semester of their graduation. The Honors College also houses the Texas State Undergraduate Research Journal (TXSTUR). The student-edited publication takes submissions from all disciplines and publishes during the Spring semesters. The creation of TXSTUR stemmed from an Honors Thesis project completed by Rachel Barnett in Spring 2013 (Barnett, 2013). The Honors College also houses and maintains portions of the Undergraduate Research Initiative. The initiative, in conjunction with other departments on campus supports the Undergraduate Research Fellowship (URF)

(Undergraduate Research, 2019). URF funds are used to support undergraduate research and creative projects at Texas State University. Funds of up to \$1000 are awarded for projects such as Honors theses and independent studies as well as for capstone projects or for original work done under the umbrella of faculty-directed research. Undergraduates of all majors are eligible. As a whole, the Honors College at Texas State provides a wealth of opportunities for students from across campus. With a membership of around 2,500 students (Honors College, 2019) out of the nearly 35,000 student population, it is a small, but effective outlet for undergraduate students to engage in research.

ESS HFM majors make up a small population of the Honors College. In the history of the Honors College, there have been a total of 1241 Honors Thesis as of Fall 2019 (Honors College, 2019) and 18 Honors Thesis (1.5% of the total) written by students in the Department of Health and Human Performance for the past years. Topics range from physical education, public health, physical therapy, and athletic training to literature, philosophy and psychology (Honors College, 2019). Although they are Honors Theses from students in HHP, not all of the projects are centered in ESS research.

Outside of the Honors College, the Department of HHP sponsors several laboratories and events for students in ESS. The labs include the Community-Engaged-Scholarship lab, Biomechanics/Sports Medicine lab, Translational Neuromuscular Physiology Laboratory, Human Performance lab, and the Metabolic Applied Physiology Lab. These labs are supervised by faculty in the HHP department and used for faculty, graduate and undergraduate student research.

With these resources available to students, the question becomes whether students are actually engaging and interested in research. According to the NESS Snapshot from

2018, only 23% of seniors in the College of Education (32% of seniors in the total population of Texas State) have planned to or completed a research project with a faculty member (Office of Institutional Research, 2018). These data are representative of the entire college and not of the HHP department specifically. Currently, there is no specific data on the state of engagement of ESS or HFM students in undergraduate research at Texas State University.

As a whole, undergraduate research is beneficial to the undergraduate experience of students at Texas State as it creates awareness and develops strong research practices regardless of discipline (QEP, 2019). With the current lack of data specific to ESS student's engagement in undergraduate research, a separate inquiry into their involvement is appropriate. Determining the current state of research engagement in HHP requires understanding how and why students may or may not pursue undergraduate research opportunities. A better understanding of students' current research experiences, desire to engage in future research, research competence, and research attitudes may more clearly quantify student engagement in undergraduate research. These themes are informed by the QEP, HHP strategic plan, and literature discussed in depth in the next section.

Chapter II

Review of Literature

Understanding what makes up the undergraduate research experience or what can even be considered undergraduate research has evolved over the history of higher education. Several milestone reports have shaped the state of undergraduate research. The Carnegie Foundation's *College: The Undergraduate Experience in America* (Boyer, 1987) and the Boyer Commission's *Reinventing Undergraduate Education: A Blueprint for America's Research Universities* in 1998 serve as a powerful force in reshaping the undergraduate research experience in the United States.

The Carnegie Foundation report concluded that undergraduates at large research universities experiences less satisfaction with their college experiences than peers at other kinds of institutions (Grassmuck, 1990). Following this report, Boyer (1990), posed a challenge to research universities in the United States to move away from the teaching versus research debate and define scholarship in more creative ways. Boyer's *Scholarship Reconsidered* proposed that universities strengthen research, integration, application, and teaching to reform undergraduate education (Boyer, 1990).

The influence to revamp the undergraduate experience for students in American universities strengthened with the Boyer Commission Report *Reinventing Undergraduate Education: A Blueprint for America's Research Universities* (1998). The report highlighted the lack of progress in the reinvigoration of undergraduate education. In order to address deficiencies in the state of the undergraduate education, the commission prescribed ten specific recommendations. These recommendations are as follows: 1) make research-based learning the standard; 2) construct an inquiry-based freshman year;

3) build on the freshman foundation; 4) remove barriers to interdisciplinary education; 5) link communication skills and course work; 6) use information technology creatively; 7) culminate with a capstone experience; 8) educate graduate students as apprentice teachers; 9) change faculty reward systems; 10) cultivate a sense of community (Boyer Commission, 1998).

Responses to the Boyer Commission report were that the recommendations and demands on faculty and the diverse populations of research universities were impractical, expensive, and unrealistic in the complex culture of a research (Katkin, 2003). In response to the negative reactions to the report, the Boyer Commission surveyed 123 research universities to determine the extent to which the recommendations were being implemented (Boyer Commission, 2002). The findings of the survey and subsequent follow up revealed a lack of available data for institutions to determine to what extent undergraduate research had been enriched (Katkin, 2003). According to Katkin (2003), responses were based primarily on educated estimates and anecdotes, suggesting a need for administrative efforts in promoting clear institutional change.

Beyond the Boyer Commission

With the foundation for undergraduate education laid down by the Boyer Commission, several national organizations have formed in the effort to shape the understanding of undergraduate research in the United States. The Association of American College and Universities and the Council on Undergraduate Research (CUR), are two of the most respected organizations.

With the advent of the findings from the Boyer Commission, universities were tasked with exploring methods of improving and expanding the richness of the

undergraduate experience. Nearly two decades after the Boyer Commission report, the Association of American Colleges and Universities published *High-Impact Educational Practices* by George Kuh (2008). Like the Boyer Commission report (1998), Kuh suggests ten “high-impact practices” to improve the undergraduate experience. High-impact practice seven centers around undergraduate research, stating that colleges and universities are now providing research experiences for students in all disciplines. The goal in this high-impact practice remains to involve students with actively contested questions, empirical observations, cutting-edge technologies, and the sense of excitement that comes from working to answer important questions (Kuh, 2008). However, most of these experiences have been experienced most prominently by students in science disciplines (Kuh, 2008).

This skew in the understanding of undergraduate research is further supported by Joyce Kinkead, a former Fellow for the American Council on Education. According to Kinkead, this is due in part to the efforts by the National Research Council and National Science Foundation, whose reports on the state of science, technology, engineering, and mathematics, (STEM) in the United States. With a heavy influence of STEM education programs in the university structure, students are inclined to relate undergraduate research with scientific inquiry (Kinkead, 2003). In fact, much of the literature on undergraduate research is centered on STEM undergraduate research experiences (Gentile, 2017).

Efforts have been made by national organizations to create a more clear, all-encompassing definition in order to avoid a narrow focus and definition of undergraduate research. The Council on Undergraduate Research (CUR) emerged as a one of these

national voices in support of diversified undergraduate research. CUR was founded by a small group of chemistry faculty in 1978 (Doyle, 1991). CUR first appeared as a newsletter that identified research funding opportunities and provided models for undergraduate research activity (Doyle, 1991). As the state of undergraduate research evolved in the 1980s with the Carnegie Foundation and the Boyer Commission, CUR grew and evolved in both mission and scope. It invited new science disciplines including physics, astronomy, biology, and geology to join the council throughout the 1980s and social sciences, such as psychology and sociology, in the 1990s (Doyle, 1991).

According to *Characteristics of Excellence in Undergraduate Research*, the CUR's mission is to support and promote high quality undergraduate collaborative research and scholarship (Council on Undergraduate Research, 2012). In a chapter written by Rowlett, Blockus, and Larson (2012) titled *Characteristics of Excellence in Undergraduate Research (COEUR)*, a summary of the best practices that support and sustain highly effective undergraduate research environments is laid out for typical college campuses. These include 12 general areas, 64 characteristics, and 203 assessable outcomes that can be used to evaluate institutional undergraduate research programs (Council on Undergraduate Research, 2012).

Institutions have used these characteristics to shape their undergraduate research programs (Webster & Kerpinsky, 2015). Using COUER as an assessment tool for undergraduate research uncovered important perspectives on faculty, administrative and student focus in undergraduate research practices (Webster & Kerpinsky, 2015). According to Webster and Kerpinsky (2015), timing is seen as the greatest barrier to research across all disciplines. Therefore, curricular and institutional restructuring efforts

must recognize the high value and impact of undergraduate research and make sure that time for faculty members and students to do it well is incorporated into new initiatives (Webster & Kerpinsky, 2015).

As a whole, CUR and the COUER have provided a blueprint for undergraduate research that extends beyond that which was presented by the Boyer Commission in the 1990's. With an understanding of undergraduate research as a high-impact practice, understanding methods of implementing undergraduate research at the university and college level is crucial.

Undergraduate Research Implementation

As interest has swelled and universities have adapted to allow students to better engage in research, several methods of offering opportunities for undergraduate researchers have emerged. Methods vary based on discipline and adaptability of the curriculum (Brew, 2013). According to Brew (2013), there is a need for a holistic conceptual framework which can encompass the wide variety of ways in which research can be experienced and can contribute to student learning. Existing frameworks have challenged academics to increase the circumstances in which teaching, and research have occasion to meet, as engaging students in research and inquiry-based learning are the best ways of strengthening the links between research and teaching (Elsen, Visser-Wijnveen, van der Rijst, & van Driel, 2009; Hattie & Marsh, 1996; Spronken-Smith & Walker, 2010). Healey and Jenkins (2009) proposed a framework in which supports these links. In their proposed framework, Healey and Jenkins suppose that research and inquiry are seen in two dimensions. Students interact either as participants or as an audience based

on the emphasis on research content, process or problems. Healey and Jenkins (2009) argue that

students should engage in research at all levels regardless of whether they are engaging in research in their courses or outside the curriculum by participating in events, seminars and special undergraduate research programs. While it is clear that this framework is helpful for explaining aspects of research and inquiry-based learning, there are some limitations. It is difficult to see how students can be developing research and inquiry skills when they are an audience versus a participant for research (Brew, 2013).

Considering this limitation, understanding specific curriculum-based integration models may be beneficial.

Curriculum integration. Curriculum integration is one of the most prominent ways universities have introduced undergraduate students to research. There are numerous studies on the benefits and implementation of research into curriculum for undergraduate students (Brew & Mantai, 2017; Harris, Babkoo, Gu, & Kremer, 2016; Karukstis & Elgren, 2007; McLaughlin, Patel, Johnson, & de la Rosa, 2018; Mendoza & Martone, 2019, Mordacq, Drane, Swarat, & Lo, 2017; Willison, 2012). While the frameworks in these works vary based on academic discipline, regional origin, and implementation, they all center on similar benefits of curriculum-based research for students. Harris et al., (2016) most effectively summarizes these benefits in stating that course-based undergraduate research experiences (CUREs). According to their review of over 40 pieces of literature on CUREs, students are more experienced in real research in their discipline, were given opportunities to network, develop scientific skills, learn new material and clarify graduate school requirements (Harris et al., 2016). More specific

benefits of CUREs include increased sense of teamwork, critical thinking ability, communication skills, research skills and confidence in research (Harris et al., 2016). These benefits are in line with the Boyer Commission and CUR guidelines for improvement of undergraduate research. However, CUREs are not immune to challenges of integration. According to Harris et al. (2016), time constraints, resources, authenticity of research projects, and balancing of mentorship styles were seen as barriers for students and faculty members.

Further research in curriculum integration is seen in the work of Zimbardi and Myatt (2014). In their cross-sectional study, they observed various methods of curriculum-integration of undergraduate research and reported that the model of undergraduate research used by specific disciplines varied. For hard sciences, apprenticeships, methods courses and mixed models which combined methods courses with inquiry projects were most popular. The focus of these methods lies the use of undergraduate research experiences to help students understand the processes of knowledge development of their discipline. Zimbardi and Myatt (2014) further assert that although certain types of disciplines might favor certain methods, examples of undergraduate research activities across disciplines can be used when designing or refining curricula. However, successful development of holistic cross-disciplinary methods has yet to be explored in the literature.

Summer Undergraduate Research Experience (SURE). One of the other most popular iterations of the incorporation of undergraduate research into curriculum and instruction for undergraduate students is the Summer Undergraduate Research Experience (SURE). Research on SURE programs is incredibly vast, with many benefits,

applications, and outcomes clearly documented in the literature. Lopatto (2010) suggests that SUREs are the epitome of the undergraduate experience. Generally formatted in ten-week long experiences, the structure and project focus are determined by the discipline under which the students are studying. SURE programs in STEM and psychology are most prominent, with many universities offering some sort of SURE program in these fields. SURE programs are evaluated using a SURE survey before the program begins and after the program ends (Lopatto, 2010). Gains in understanding of research design, information or data collection and analysis, information literacy, and communication are analyzed by the survey (Lopatto, 2004). For students who have positive experiences with SURE programs, many reported that they felt that better able to think independently, were more intrinsically motivated to learn, and had become more active learners (Lopatto, 2010).

Further research on the impacts and opportunities seen in undergraduate research experiences (UREs) have shown similar results as those reported by Lopatto. It is presented in a review paper that evidence for the benefit of UREs has been established in over 60 articles (Linn, Palmer, Baranger, Gerard, & Stone, 2015). However, URE programs generally only engage students in experimental design rather than interpretation (Linn et al., 2015). In order to remedy this, Linn et al. (2015) suggest the use of a knowledge integration framework to interpret the findings and increase the presence of mentors to help explain and concepts of the lab so that students can fully benefit from the URE. Again, there is a need for a generalized framework that will allow students to benefit from the participation in these URE programs as seen in the curriculum-integration literature.

Benefits of Undergraduate Research

The benefits of engaging students in undergraduate research have been well explored in the literature. As a partial fulfillment of some of the recommendations by the Boyer Commission (1998) and CUR (2012), student's perceived benefits are increasingly important in the assessment of undergraduate research programs. Benefits cited in the literature include but are not limited to advancing cognitive and intellectual growth, gains in knowledge and skills, academic achievement and educational attainment, fostering professional growth and advancement, and promoting personal growth (Osborn & Karukstis, 2009).

Impact of demographic background on research participation. Further research on the benefits of undergraduate research have examined impact of socioeconomic, cultural, and other demographic backgrounds in relation to the availability, engagement, and perceptions of undergraduate research. These studies (Davis, Jacobsen, & Ryan, 2015; Grineski, Daniels, Collins, Morales, Frederick, & Garcia, 2018; Martinez, Boucaud, Casadevall, & August, 2018; Rodríguez Amaya, Betancourt, Collins, Hinojosa, & Corona, 2018) have primarily explored the impact of gender, cultural background, and status as a first-generation student.

Many of these studies, are on the disparities for STEM students (Grineski et al., 2018; Rodríguez Amaya et al., 2018; Martinez et al., 2018). In each of the studies, the impact of increasing understanding, confidence, and awareness of how to conduct a research project, help clarified STEM student's career interests. However, there was not a significant increase in research involvement amongst minority students despite positive perceptions of undergraduate research (Rodríguez Amaya et al., 2018). Rather, minority

students ranked the experience of mentorship as being an important component of participation in research (Martinez et al., 2018). First-generation students were also less likely to publish, accrue research confidence, and work more with faculty mentors (Grineski et al., 2018). This suggests a greater need for targeted efforts not only to minority students, but also to first-generation students who are less likely to engage in research when compared to their peers.

The influence of race and gender has been explored in the pairings of students with faculty mentors. Davis et al. (2015) examined faculty-student matching to determine whether students of certain race and gender would be paired with mentors of their same gender or race. They reported that gender of a student is a poor predictor of whether they will be mentored by someone of their same gender. Race and rank of the faculty mentor was more telling as to what kind of mentor a student would receive. Students that were non-white had a lower chance of having a mentor of their same race. Women also had a lower chance of having a mentor of their same gender across academic departments. This is likely due to the homogeneity of many academic departments and the larger diversity of the student body (Davis et al., 2015). Therefore, special care should be given to departments in which women and non-whites are in the minority.

Student Perceptions of Undergraduate Research

As a method of understanding the impact of undergraduate research, student perceptions have proved to be a valuable tool in the literature (Alsuhaibani, Alkharbi, Inam, Almro, & Saqr, 2019; Bage, 2019; Imafuku, Saiki, Kawakami, & Suzuki, 2015; Jenkins, Blackman, Lindsay, & Patton-Salzberg, 1998; Manarin, McGrath, & Carey,

2016; Ozay, 2013; Salsman, Dulaney, Chinta, Zacavage, & Joshi, 2013, Spronken-Smith, Miroso, & Darrou, 2014; Vereijken, van der Rijst, de Beaufort, van Driel, & Dekker, 2016; Vieyra, Carlson, Leaver, & Timmerman, 2013). While this list is not exhaustive, the scope of these studies covers an extremely wide range of disciplines and methodologies. A common theme seen in these articles are the benefits of participation in research in regard to student understanding of research, mentorship, improved problem solving and critical thinking, and reflective learning.

The most common way of obtaining student perceptions in the studies mentioned above was through the use of surveys. Whether using pre-established surveys (such as SURE) or independently developed surveys, authors of studies on student perceptions of undergraduate research have found promising results.

Several studies on the generation of a self-report survey instrument (Bovijn, Kajee, Esterhuizen, & Van Schalkwyk, 2017; Maltese, Harsh, & Jung, 2017; Rawson et al., 2018) have been used to gauge research interest, perceptions of undergraduate research and student gains following UREs. The Bovijn et al. (2017) study surveyed undergraduate students in a health sciences department. These students, ranging from physical therapy to pre-dental majors, were given a two-and-a-half-page questionnaire containing questions about their current, previous, and future research endeavors and self-perceived research competence as a part of their programs. As a way of quantifying research experiences, the study utilized three primary categories: 1) Voluntary research involvement, 2) Self-perceived re- search competence and 3) Future research participation. Further questions used in questionnaire developed in this study determined research attitudes among student surveys. The results of the study revealed that students

in allied health majors were more likely to engage in voluntary research projects, have higher research competence, and a greater propensity to get involved in research in the future (Bovijn et al., 2017). Bovijn et al. attributed these outcomes to the structured nature of the undergraduate research curricula in their respective programs. The authors also further inferred that by identifying and nurturing students who may participate in future research outside of the curriculum will in turn increase their research interests and academic development. These results are also in line the Boyer Commission and CUR guidelines for undergraduate research as a high-impact practice in that the design of the curricula and support given to these students has produced positive effects for students in this study.

Further research into the development of self-report tools have produced similar positive results for students who participated in an URE. Maltese et al. (2017), provides an exceptionally thorough description of the processes necessary for the development of an entirely new self-report tool for the evaluation of undergraduate research experiences. The tool created from this study is the USMORE-SS tool. , In comparison with other tools intended only for a single post-experience administration, the USMORE-SS tool was developed to provide both pre- and post-measures to establish baseline information and monitor self-reported changes in students' skills over multiple research experiences (Matlese et al., 2017). The USMORE-SS provides better estimates of student skill trajectories when compared to existing surveys such as URSSA survey due to its longitudinal qualities in pre- and post-experience measures. The influence of pre- and post-assessment tools is further developed in McDevitt, Patel, Rose, and Ellison's (2016) study on the programmatic goals of the Harvard Forest Summer Research Program in

Ecology. By using pre- and post-assessments, student learning gains were better tracked although student goals in STEM were not significantly different. Being that an outcome goal of URE and SURE programs is to increase understanding of research design, information or data collection and analysis, information literacy, and communication, the ability to track these gains is vital.

Undergraduate Research in Exercise Science

With the background, methods, and previous research on general undergraduate education considered, current literature in Exercise Science will now be discussed. The nature and popularity of the field of Exercise Science has continuously changed over the past few decades. Due to the changes and growth seen in the discipline, the importance of undergraduate research in Exercise Science must be explored (Petrella & Jung, 2008).

Research methods for Exercise Science has been explained in works such as Williams and Wragg's *Data Analysis and Research for Sport and Exercise Science: A Student Guide* (2004). Concepts covered in each chapter of the text are similar to those covered in a research methods or statistics course. These concepts range from literature review and experimental design to various types of statistical analysis methods. For students who are not well versed in research methods or have not had the ability to take a research methods course, this book serves as an adequate base of information from which to pursue research in Exercise Science.

Research exists in each of the disciplines contained within the larger body of Exercise Science. Students may pursue research in biomechanics, exercise physiology, motor learning, coaching, teaching, rehabilitation, and sports psychology. As previously discussed, the extent to which a department engages in research in any of these fields is

partially dependent upon the affiliation or alignment with national organizations (Ives & Knudson, 2007).

Methods of Pursuing Undergraduate Research in Exercise Science

Due to the vast nature of the field, there are no comprehensive reviews of all the different kinds of research within Exercise Science. However, there are several reports on the range of ways undergraduate Exercise Science programs have included undergraduate research into their curricula. One of the more holistic views into the current structures of research and service-learning experiences in Exercise Science departments is presented by Carson, Petrella, Yingling, Marshall, and Sherwood (2018). According to Carson et al. (2018), service-learning programs and department-required undergraduate research are two common methods of integrating undergraduate research into the undergraduate Exercise Science experience.

Service-learning in Exercise Science. Considering the vastness of the various sub-disciplines under Exercise Science, students may be left with fragmented, inadequate or incomplete descriptions of concepts learned throughout the curriculum (Carson et al., 2018). Experiences outside of the classroom can create a more clear and complete picture of concepts in exercise science. These experiences, such as a service learning or field work, provide students with an opportunity to apply their knowledge of concepts learned throughout the curricula (Carson et al., 2018; Miller, 2015; O, Sherwood & Nygaard, 2018).

Promising examples from the California State University East Bay Kinesiology department have demonstrated the benefits and obstacles faced by service-learning programs (Carson et al., 2018; O, Sherwood & Nygaard, 2018). The department utilizes

two programs to engage students outside of the classroom. The first is the named the Kinesiology Research Group (KRG) and the other is the Get Fit! Stay Fit! Group (GFSF) (O et al., 2018). The program utilizes two of the high-impact practices outlined by George Kuh (2008); effective mentoring and frequent and substantive feedback from students.

The structure of the KRG program follows a weekly, two-hour long meeting that is comprised of a “work” period where students have discussions within smaller student (O et al., 2018). During these smaller student discussions, students mentor one another to develop research and professional skills as well as challenge students to engage in critical thinking. These interactions are also guided by faculty mentors who provide only general guidelines for most tasks and discussions and allow students to select their own specific research questions or research methods. The goal of the program is to develop future kinesiology experts and to allow students to understand the important of developing expertise in kinesiology.

The GSFS program is a service-learning course where students are assigned to work with faculty/staff members at the university in assisting them with meeting their personal health goals (O et al., 2018). In the GFSF program, students integrate knowledge across the breadth of their courses, including the kinesiology subdisciplines of psychology, physiology, biomechanics, and sociology, to design a program for, to motivate, and to educate their participants on evidenced-based health practices. As they would in a professional setting, students also have their participants relay personal health-related goals. Students are then tasked to test and assess cardiovascular fitness, muscular strength and endurance, body composition and movement analysis, and nutritional

assessments from a three-day diet recall. Outside of the applied work with participants, students are also required to meet as a group for approximately two and a half hours each week to receive additional training and reflect on their experiences during the week. Students are mentored by faculty, staff and peer leaders during these meetings to enhance the experience and growth throughout the program.

Students in both of these programs were required to complete a survey (either SURE or PLACE) and a reflection following the completion of their programs.

According to O et al. (2018), 100 students participated in at least one of the programs (15% of the total student population). These students presented positive perceptions of the programs stating that they gained confidence in their readiness for more demanding research, learning to work independently, tolerance for obstacles faced in the research process, and becoming part of a learning community. However, the role of mentorship was most impactful in the generation and growth of skills pertinent to the field of kinesiology. This suggests that while service-learning programs are beneficial to some capacity, the inclusion of mentorship opportunities is necessary to impact students.

Curriculum adaptation in Exercise Science. Integration of research into the existing curricula for Exercise Science programs is another way of introducing students to research. While there are anecdotal accounts of implementing research into an existing course (Allen, 2016), the most common form of curriculum adaptation is the integration of a senior seminar course based in undergraduate research (Allyn, 2013; Carson et al., 2018). For programs utilizing a senior seminar course, the course is a required part of the students' curricula. Allyn (2013) describes the course used at the University of Wisconsin-River Falls as a seminar course in which undergraduate students are gradually

introduced to research and introduced to the steps of conducting a small-group research project. The students' work is then displayed in a campus-wide presentation at the end of the course. This structure is different from that which is used at Samford University. The Samford University Kinesiology department utilizes a three-course system to integrate research into the curricula (Carson et al, 2018). These courses are: Foundations of Scientific Inquiry, Research Methods and Senior Seminar. The sequence of classes is meant to build a foundation of knowledge for students in order for successful completion of an independent project mentored by a faculty member. Outcomes in this program have been determined using a modified version of the Self-Efficacy in Research Measure (Carson et al., 2018). Results from this tool have demonstrated increased confidence in research skills by the end of the curriculum. Statements of student and alumni perspectives have also revealed an increase in learning outcomes, and increased preparedness for graduate school (Carson et al., 2018).

Further research on the integration of undergraduate research in an Exercise Science curriculum have explored faculty-driven (Culp & Urtel, 2013) undergraduate research experiences. Culp and Urtel's (2013) description of enhancing the undergraduate research experience for Physical Education Teacher Education (PETE) students centers around faculty mentorship as a method of engaging students in research. According to Culp & Urtel (2013), it was nearly impossible for the Department of Kinesiology at Indiana University Purdue University, Indianapolis to include a research methods or senior seminar style class into the existing curricula for PETE students. The program developed by the department allows students to work under a faculty mentor in their respective area of study. The process involves "hiring" a student to be a mentee for a

faculty member, the creation of mutually agreed upon standards and expectations, and application for internal or external funding (Culp & Urtel, 2013).

Faculty mentors in this relationship not only guide students through the research process, they help advocate for students and become instrumental in their growth as future professionals. While this program structure is dependent on the availability and compatibility of the faculty member, there is a mutually beneficial transaction between mentor and mentee. Culp and Urtel (2013) did not discuss student perceptions, however, so it is not easily evident that students perceive this structure to be productive or beneficial. Further research on student perceptions in this kind of dynamic are necessary to assess the impact of this type of faculty-centered design.

Perceptions of Undergraduate Research in Exercise Science

Most accounts of research in the Exercise Science curriculum or service-learning projects include the use of student perceptions to evaluate the effectiveness of their programs. Along with the literature mentioned above (with the exception of Allen, 2016 and Culp & Urtel, 2013) several other studies on engaging undergraduate Exercise Science students have explored student perceptions as a means of assessment.

In a study on undergraduate student perceptions of an applied research experience, Pearson, Crandall, Dispennette, and Maples (2017) thoroughly explore the benefits and implementation of research for undergraduate students. The study involved an existing course titled *EXS 324 - Measurement and Evaluation in Kinesiology* (Pearson et al., 2017). The course involved understanding, calculating, evaluating validity, and introduction of practical inferential statistics for the physical activity and health professions. In the existing structure of the course, students were not given the

opportunity to apply what they were learning. As a remedy to this problem, an applied research experience was developed to challenge groups of students to create, implement, and assess outcomes of a research project based on what they had learned in class (Pearson et al., 2017). The group project culminated in a paper written as a formal report of the project that was then presented in a poster format at the end of the semester. “Hard” skills targeted by this design were scientific writing, critical analysis of literature, data collection and analysis, interpretation of results. “Soft” skills targeted by this design were interpersonal communication, teamwork and professional etiquette, conflict resolution and effective communication to an audience. Outcomes were evaluated using an adapted “Research Team Evaluation” form. On this form, students were asked to evaluate themselves and their teams based on eight evaluation criteria.

Further assessment of the impact of the inclusion of the applied research component of this study was accomplished using a fourteen-question online questionnaire. The results for the Likert scale questions revealed that the applied research experience was an effective learning tool and that it allowed students to develop a better understanding of the research process and improve skills related to the course. The open-ended responses revealed split perceptions of the benefit of the research experience. Students either found the experience to be “a great learning experience” or hindered by the quality of their group members (Pearson et al., 2017). The authors concluded that although there were perceived benefits of the implementation of an applied research project in the class, there were some challenges that may impact the overall quality of student perceptions. As a high-impact practice, applied research experience has potential for positively impacting students, but further research is required

to determine how to overcome perceived barriers and negative outcomes for student involvement in the research process.

A Gap in the Research on Exercise Science Studies

While there have been studies on perceptions of undergraduate research in certain subdisciplines of Exercise Science, there are no comprehensive reviews on student perceptions across subdisciplines within the same Exercise Science department. Existing studies, as previously mentioned focused on student perceptions on existing service-learning programs or curriculum adaptation as a means to measure their specific impact. For an ESS program like the one that currently exists at Texas State, there are limited curricular and extra-curricular support of undergraduate research. A holistic view of the existing resources in an ESS undergraduate program that does not already include a research methods course, senior seminar, SURE, or mentorship program may be beneficial to understanding student attitudes in programs like the one at Texas State.

Purpose of the Study

Existing research on undergraduate research perceptions does not accurately inform programs like the ESS program at Texas State. Therefore, the purposes of this study were to: 1) determine the current state of undergraduate research in the Department of Health and Human Performance at Texas State, 2) understand ESS student perceptions of undergraduate research and their research abilities, 3) determine which students were more likely to be interested in future research opportunities, 4) determine the differences in perceptions of undergraduate research among ESS students, and 5) understand what students believe would improve their undergraduate research experience. Students with ESS or HFM majors at Texas State are a valuable population to examine given the

diversity of the major. These students may or may not be aware of research opportunities due to a lack of curricular or extra-curricular support for undergraduate research. It was hypothesized that students would have limited current and future research experience and generally negative self-perceived research competence and research attitudes. It was also hypothesized that current research experiences, interest in future research experiences, research competence and research attitudes would be predicted by the demographic background of the students in ESS.

Chapter III

Methods

Study Design

This project utilized a cross-sectional study design, adapted from Bovijn et al., (2017). The survey used in this study (Appendix A) was modified from the survey used by Bovijn et al. (2017) and was electronically distributed over the course of three months during the Fall of 2019 at Texas State University. Participation in the study was voluntary and no compensation was given to students responding to the survey.

This study was approved by the Institutional Review Board at Texas State University. It was carried out in accordance with the Declaration of Helsinki, including, but not limited to the anonymity of participants being guaranteed and the informed consent of participants being obtained (Appendix B).

Participants

Participants were included in this study based on their standing as a student pursuing a bachelor of ESS at Texas State University in the Fall of 2019. This includes undergraduate students with a major in HFM or in ESS with a concentration in ALPE, PRS, or CES. Out of 2270 undergraduate students in ESS, 1940 students are pursuing a major in ESS and 332 students with a major in HFM.

Participants were included in the study regardless of demographic background, gender identity, status as a first-generation student, or year of study. Students were required to be at least 18 years old and have access to a computer with an internet connection in order to complete the survey. In order to be included in data analysis, the student's responses to the multiple-choice questions must have been fully completed.

Recruitment

Recruitment of the students in this study was achieved via email correspondence and short in-class visits to particular ESS courses during the Fall of 2019. In order to maintain anonymity of the students responding to the survey, no paper-copies of the survey were distributed. Emails of all ESS and HFM majors were obtained from an Academic Advisor II in the College of Education Advising Center at Texas State University. In-class visits were made to three ESS classes. Each class was chosen based on the number of students enrolled in the course, the number of students in each particular concentration (PRS, CES, and ALPE), and the availability of the course instructor. For the purpose of this study, one freshman-level (ESS 1100: Lifetime Fitness and Wellness), one sophomore-level (ESS 2320: Motor Development), and one junior-level course (3319: Introduction to Cardiopulmonary Exercise Physiology) were chosen in order to recruit students from across both the ESS and HFM major. These recruitment efforts were made in order to obtain at least 30 respondents from each of the ESS concentrations and from the HFM majors (totaling a minimum of 120 respondents). However, in order to achieve a response rate of at least 10% of the population, the minimum return deemed reliable for this study is 227 responses.

Survey Instrument

The instrument used in this investigation was adapted from the questionnaire used by Bovijn et al. (2017). Portions of this instrument were directly adapted from the Bovijn et al. (2017) instrument and some new questions were developed in order to better fit the participants of this study.

The survey was self-administered online via Qualtrics (Qualtrics XM) and consisted of 20 questions (45 total items; Appendix A). Five main sections were used in order to structure the survey: a demographics section, three sections exploring the main themes of this study (Current Research Experience, Future Research Experience, Research Competence and Research Attitudes), and an open-ended response section. The four main themes are in line with the student learning goals and outcomes proposed by Texas State University's QEP (QEP, 2019), the HHP strategic plan (HHP, 2019), and existing studies on undergraduate research perceptions in students (Bovijn et al., 2017; Maltese et al, 2017; Rawson et al., 2018.) Questions pertaining to Current Research Experience (CRE) required a yes or no response, while Future Research Experience (FRE), Research Competence (RC) and Research Attitudes (RA) were evaluated on a five-point Likert scale. CRE score was determined by six questions, making the maximum possible score 12. The lower the CRE score, the more often the response to the questions asked in the CRE section was no. FRE score was determined by the answers to 8 items, making the maximum possible score 40. The lower the FRE score, the less interest a respondent had to pursuing future research opportunities. RC score was determined by the answers to 8 items, making the maximum possible score 40. The lower the RC score, the more negative the individual's perceptions of their research competence. RA score was determined by the answers to 9 items, making the maximum possible score 45. The lower the RA score, the more negatively the respondent perceived research in general. Additional items in this survey were used in order to gauge student attitudes on undergraduate research, further demographic information, and Department of Health and Human Performance related questions.

Pilot Testing

A pilot study was conducted prior to the start of data collection phase of this study in order to assess ease of completion, comprehension, and appropriateness of the survey. Pilot testing spanned five weeks in the Spring of 2019. Five students, all of whom were ESS majors of all years of study and concentrations, participated in the pilot testing. Pilot testing included three trials and revisions of the survey. Students were not compensated for participating in pilot testing, and their time taking the survey and discussing the question modifications was volunteered. The student's response time to the survey averaged 15 minutes. Following a final debriefing session, no changes were made to the survey. Validity of the instrument was evaluated in the final debrief with each student.

Data Collection

The data in this study were collected using Qualtrics, an online survey distributor licensed by Texas State University. The survey questions were entered into Qualtrics and all responses were made anonymous to protect student privacy. The survey was distributed via a specialized link attached in email correspondence and included in the informed consent forms used for in-class visits. In order to maximize the response-rate, the survey remained active for three months between September 2019 and December 2019. Students were allowed to start and finish their responses within two weeks of starting the survey.

Statistical Analysis

Quantitative data from the survey were analyzed using Statistical Packages for Social Sciences (SPSS, version 24, IBM Corp.). Similar to Bovijn et al. (2017), three of

the major themes in this investigation FRE, RC, and RA had their respective items grouped in order to determine an overall score for each theme. Items pertaining to CRE were analyzed as a binary variable and scored.

Descriptive analyses were used to assess the demographic section of the survey and participants' perceptions in undergraduate research. Multiple linear regression analysis was also used in order to determine the relationships between variables including student's concentration/major, year of study, academic performance, membership in the Honors College, and status as a first-generation student with each of the three themes previously described. Results were considered significant at $p < .05$.

The five open-ended items in the survey indicated perceptions of the current state of undergraduate research for ESS students, barriers, and possible improvements. The responses to these open-ended questions were grouped and categorized. These data were then discussed in terms of which responses were seen most frequently.

Chapter IV

Results

Demographics

A total of 294 undergraduate students in the ESS majors responded to the survey from September 2019 to December 2019. Following exclusion criteria, 198 students' responses were used for data analysis. A majority of student respondents were in the 18-22-year-old age range (n = 171, 86.8%) and were mostly female (n = 127, 64.1%). Students self-reported as being mostly White/Caucasian (n = 80, 40.4%) or Latino/Hispanic (n = 81, 40.9%), and 58.6% of students reported as not being first-generation college students (n = 116).

Most of the 198 responses were sophomores (n = 67, 33.8%), PRS students (n = 132, 66.7%), and students that were not a member of the Honors College (n = 173, 87.4%). About 31% of students reported having a GPA between 3.0 and 3.49 (n = 62). A full breakdown of the participants' demographic characteristics is presented in Table 1.

Current Research Experience (CRE)

The average score for CRE across all participants was 6.96. The minimum score received was six, and the maximum score received was 11, with 76.8% of scores were at or below the average and 23.2% of scores were above the average. An average of 6.96 indicates that students generally responded no to all six questions in the CRE section. This result suggests that majority of ESS students have minimal experience with undergraduate research both in and out of the classroom.

Table 1

Participant Demographic Information

| | | HFM | ALPE | PRS | CES | Total |
|---|------------------------------------|------------|-------------|------------|------------|--------------|
| Gender | Male | 12 | 27 | 26 | 6 | 71 |
| | Female | 8 | 10 | 106 | 3 | 127 |
| Age | 18–22 | 12 | 28 | 126 | 5 | 171 |
| | 23–27 | 8 | 8 | 5 | 2 | 23 |
| | 28–32 | 0 | 1 | 0 | 1 | 2 |
| | >33 | 0 | 0 | 0 | 1 | 1 |
| | | | | | | |
| Ethnicity | White/ Caucasian | 9 | 17 | 50 | 4 | 80 |
| | Hispanic/ Latino | 8 | 13 | 57 | 3 | 81 |
| | African American/ Black | 3 | 3 | 16 | 0 | 22 |
| | Native Alaskan/ American Indian | 0 | 1 | 2 | 1 | 4 |
| | Asian | 0 | 2 | 7 | 0 | 9 |
| First Generation Status | Yes | 6 | 19 | 54 | 3 | 82 |
| | No | 14 | 18 | 78 | 6 | 116 |
| Classification | Freshman | 1 | 3 | 37 | 1 | 42 |
| | Sophomore | 2 | 18 | 46 | 1 | 67 |
| | Junior | 6 | 14 | 25 | 3 | 48 |
| | Senior | 11 | 2 | 24 | 4 | 41 |
| Number of Years Completed In ESS | 0 | 3 | 9 | 55 | 2 | 69 |
| | 1 | 6 | 14 | 34 | 1 | 55 |
| | 2 | 3 | 11 | 19 | 2 | 35 |
| | 3 | 4 | 1 | 18 | 1 | 24 |
| | 4 or more | 4 | 2 | 6 | 3 | 15 |
| Honors College Student | Yes | 0 | 1 | 20 | 0 | 21 |
| | No | 2 | 36 | 112 | 9 | 177 |
| GPA | 2.0–2.49 | 1 | 10 | 14 | 1 | 26 |
| | 2.5–2.99 | 11 | 14 | 22 | 8 | 55 |
| | 3.0–3.49 | 7 | 5 | 50 | 0 | 62 |
| | 3.5–4.0 | 1 | 8 | 44 | 0 | 53 |

Note: HFM = Health and Fitness Management Major, ALPE = All-Level Physical Education concentration, PRS = Pre-Rehabilitation Science concentration, and CES = Clinical Exercise Science concentration.

The forward stepwise multiple linear regression revealed that CRE was significantly related to the number of years completed in the undergraduate ESS program. A simple linear regression was used to predict student's CRE score based on their number of years completed in the ESS undergraduate program, and a significant regression equation was found, $F(1,193)=12.125$, $p = .001$, with an R of 0.243. Students' predicted CRE score is equal to $6.729 + 0.165$ (years) when CRE score is measured in points. Student's average CRE scores increased 0.165 points for each year completed in the undergraduate ESS program, suggesting that students become more involved in research as they complete more years as an ESS or HFM major.

Future Research Experience (FRE)

The average score for FRE across all participants was 29.34. The minimum score received was 17, and the maximum score was 39. Of the FRE scores, 48.5% of scores were at or below the average, and 51.5% of scores were above the average. This result indicates that students generally displayed a positive interest in pursuing future research experiences.

The forward stepwise multiple linear regression suggested that FRE was significantly related to undergraduate major and concentration. A simple linear regression was calculated, predicting a student's FRE score based on their undergraduate major/concentration. A significant regression equation was found, $F(1,193)=8.353$, $p = .004$, with an R of .204. Students' predicted FRE score is equal to $25.443 + 1.435$ (major/concentration) when FRE score is measured in points. Students' average FRE scores increased 1.435 points for those with a PRS and CES concentration. This implies that students in PRS or CES concentrations are more likely to pursue research

opportunities in the future when compared to the HFM major and students in the ALPE concentration.

Research Competence (RC)

The average score for RC across all participants was 24.27. The minimum score received was eight, and the maximum score was 39 in which 53% of scores were at or below the average, and 47% of scores were above the average. The results for RC scores presented the lowest minimum score recorded out of the three Likert-scale response categories (FRE, RC, and RA), indicating that students mostly responded strongly disagree or disagree suggesting that students generally had negative perceptions of their research competence. No significant predication on RC was found using the forward stepwise multiple linear regression analysis when relating it to the demographics measured in this study. This suggests that students' demographic information cannot be used to predict their research competence.

Research Attitudes (RA)

The average score for RA across all participants was 31.94. The minimum score received was 14, and the maximum score was 43. Of the RA scores, 52.6% of scores were at or below the average, and 47.4% of scores were at or above the average. This suggests that students had more negative attitudes toward research. No significant predication on RA was found using the forward stepwise multiple linear regression analysis when relating it to the demographics measured in this study. This indicates that students' demographic information cannot be used to predict their research attitudes.

Open-ended Questions

Five open-ended questions on ESS students' overall experiences in undergraduate research were given at the end of the survey. Their responses to these open-ended questions were not included in the 100% completion exclusion criteria for data analysis; therefore, some questions had fewer or more than 198 responses recorded.

The first question had students recount how they became aware of research in HHP, and 46 students responded. The common responses were that they became aware of research through 1) in-class recruitment, 2) flyers and bulletin boards in Jowers, and 3) ESS graduate faculty or graduate assistants involved in research. This suggests that information on undergraduate research is available to ESS students. The extent to which they receive this information depends on if their course instructor informs them of research opportunities, whether they look at the bulletin boards in Jowers, and if they are taking a class with an instructor that is highly involved in research.

The following question asked which courses in the ESS curriculum helped them in research, and 97 students responded. Many of the responses stated that the following courses helped them in research: 1) AT 3311/3312: Clinical Assessment I and II (Athletic Training course for PRS students), 2) ESS 1310: Introduction to Teaching Physical Education, 3) ESS 2320/3329: Motor Development and Motor Learning, 4) ESS 3317: Exercise Physiology, 5) ESS 3320: Biomechanics, and 6) a non-ESS course, with most responses being a Biology or Psychology course. The most common response to this question being a course that is only offered to PRS students suggests that PRS curriculum provides exposure to undergraduate research. It also seems that ESS 1310 is a strong supporter of engaging students in undergraduate research for APLE students. This may

be due to the course targeting “familiarization with current trends and issues and professional literature” (Department of HHP, 2019) in teaching and physical education.

The next question asked students to describe their past experiences on a research project or if they had worked in a lab, and 57 students responded to this question. The most common responses were: 1) it was interesting and rewarding, but too time-consuming for not having been compensated, 2) they learned how to interact with participants, 3) they became more detail-oriented researchers, and 4) their research experience was not completed at Texas State. While most of the responses to this question were positive, there was an overarching theme of the high cost of participating in undergraduate research. This may be indicative of why CRE scores were low and RA scores were mostly negative.

Students were also asked to give their suggestions for making research more accessible to undergraduate students in HHP. There were 202 responses to this question. The most common responses to this question were: 1) making research a mandatory part of the curriculum, 2) offering a class that is research-based, 3) giving more information on research opportunities via emails or flyers, 4) increasing funding opportunities for undergraduate students to encourage research participation, and 5) offering a research seminar or presentation. These responses primarily focused on increasing curricular support of undergraduate research. Students seemed to have an overall interest in increasing undergraduate research exposure, regardless of format or methodology.

The final question allowed students to provide additional comments regarding their undergraduate research perceptions. Thirty-nine students responded to this question and presented the following ideas: 1) students need to be provided with resources on

research awareness and engagement, 2) class time should be allocated to do research, and 3) undergraduate students have a desire to be involved in research, but many of them do not know how to get involved. These responses are in support of the existing interest in undergraduate research across all concentrations of ESS and HFM majors. Students specifically seem to be interested in having their undergraduate research experience built into the curriculum.

Chapter V

Discussion

This study sought to understand the current state of undergraduate research and student perceptions of research in ESS at Texas State University. The cross-sectional design of this study provides a snapshot of ESS student's current and future research experiences, research competence, and research attitudes during the Fall 2019 semester. The results of this study present a student-driven overview of how undergraduate research is currently experienced in the Department of HHP at Texas State. We hypothesized that students pursuing a Bachelor in Exercise and Sports Science would have limited current and future research experience (CRE/FRE), and generally negative perceptions of research competence (RC) and research attitudes (RA). In addition, FRE, RC, and RA would be significantly predicted by the students' demographic breakdown. The results of this study partially supported both hypotheses. As hypothesized, CRE, RC, and RA were all generally negative across all 198 included responses. Scores reported for CRE were the lowest out of all three categories. With a maximum possible score of 12 and a minimum possible score of 6, an average of 6.96 suggests that students rarely participated in undergraduate research opportunities, regardless demographic background. Whether these low scores in CRE are related to low RC and RA scores is unclear. However, considering that ESS students have had limited research experience, it would be reasonable to infer that students have low competence and negative attitudes due to lack of experience in undergraduate research. Previous research on ESS undergraduate involvement in research has suggested positive outcomes for both research competence and research attitudes (Carson et al. 2018; Pearson et al. 2017; O et al.,

2018). Therefore, if students are either not given the opportunities to engage or choose to not engage in research, they are likely to have negative research attitudes and feel less competent in research practices. Further impacts of curricular and extra-curricular practices in ESS will be discussed in the later portion of this discussion.

The second hypothesis was also partially supported by the results of the multiple linear regressions run to compare CRE and FRE to the demographic background of the students surveyed. As hypothesized, CRE scores were significantly related to a student's number of years completed in the BESS. This finding suggests that students were more likely to get involved in research in the later stages of their degree and more opportunities for upperclassmen to participate in research in the department. While this is beneficial to those upperclassmen students, introducing students to inquiry-based practice in the form of research to build a "freshman-foundation" (Boyer Commission, 1998) has been cited as an important high-impact practice (Kuh, 2008) in early enhancement of the undergraduate research experience.

Students' FRE scores were significantly related to their major/concentration. This suggested that students in PRS and CES concentrations were more likely to be interested in future research opportunities. The BESS with a concentration in PRS is designed to prepare students for entrance to a graduate-level allied health programs (Texas State University Catalog, 2019). The BESS with a concentration in CES is designed to prepare students for graduate studies, such as a master's degree in Biomechanics or Exercise Physiology (Texas State University Catalog, 2019). Considering that a major goal of the design of these degree plans is to prepare students for graduate studies, it is not surprising that PRS and CES students are more likely to be interested in research opportunities that

may include graduate school. The HFM and ALPE degree does not specifically mention graduate studies as a major goal (Texas State University Catalog, 2019), suggesting the students in the HFM major or ALPE concentration would be less likely to pursue graduate studies following the completion of the BESS.

As a whole, the results of this study supported the hypothesis that students had limited research experience, competence, and attitudes. Further, some components of research engagement and interest could be predicted using the student's demographic background. However, positive FRE score did not support the hypothesis that students would have limited interest in future research opportunities, and RC and RA could not be predicted using the student's demographic background. While not all of the hypotheses are supported, it is still important to understand how the current state of undergraduate research has affected student's attitudes, engagement, perceived barriers, and differences among the various concentrations/majors.

Current State of Undergraduate Research in HHP

Regardless of concentration, major, or year of study, it is important to engage ESS students in undergraduate research. Ives and Knudson (2007) stated that undergraduate students should be given the tools for necessary and successful practice in research in their respective fields. Therefore, it is important to understand how the current state of undergraduate research at Texas State has impacted ESS students' research engagement, interest in research, research competence and attitudes.

CRE, FRE, RC, and RA. As previously discussed, Healey and Jenkins (2009) argued that students should engage in research at all levels regardless of whether they are engaging in research in their courses or outside the curriculum by participating in events,

seminars, and special undergraduate research programs. Considering the outcomes of CRE, FRE, RC, and RA scores, improving the undergraduate research experience for ESS students at Texas State University may be guided by existing literature on curricular and extra-curricular programs in Kinesiology.

The Department of HHP currently does not offer specific undergraduate research courses for either the ESS or HFM majors. This may contribute to the significantly low CRE scores seen across all the respondents of the survey. With the resources available to students (i.e., research labs and the Honors College), the lack of engagement in undergraduate research may indicate a need for specified courses in research techniques. Students often suggested the addition of a research course or seminar when asked how undergraduate research could be made more accessible in the department. Therefore, there seems to be a disconnect between the resources available to students and the extent to which they are able to utilize them. Also, considering the fact that CRE scores increased as students progressed through the major, with an increase of 0.165 points per year completed in the BESS, students were not engaging in research until later in the degree. As a whole, the findings of the 198 students responded to the study supported the hypothesis that ESS/HFM students had limited CRE.

The results of the CRE scores of this study may provide insight into why RA and RC scores reflected more negative perceptions of undergraduate research in ESS. The balance of resources available to students and perceived barriers to getting involved in research may make it difficult for students to gain experience. Studies in STEM undergraduate research have referenced increased confidence, awareness and increased career interests for inexperienced or disadvantaged students given the opportunities to

engage in research (Grineski et al., 2018; Rodriguez Amaya et al., 2018; Martinez et al., 2018). Remedies for making research worth the time and effort required require further studies into how ESS students perceive their research experiences.

While CRE scores were generally very low, FRE scores were higher for PRS and CES students. PRS and CES students are in two concentrations that are more geared toward future graduate level studies, which was covered in several questions included in the FRE theme. The ALPE and HFM concentrations are more-so prepared for entrance into the workforce as teachers, coaches, and personal trainers (Department of Health and Human Performance, 2019). Student teaching and internship are the necessary components in the curriculum for the ALPE and HFM students in the department of HHP which makes engaging in research more difficult for students in this major/concentration. This finding is consistent with the major-related limitations that ALPE students' rigorous curriculum does not allow for undergraduate research to be readily integrated (Culp & Urtel, 2013). As a result, ALPE and HFM students having lower FRE scores was in line with the literature on undergraduate research in ESS. Further, the positive results seen in FRE scores of this study may also provide insight into why RA and RC scores were negative. The rigidity of the curricular structure for ALPE and HFM students may make pursuing research harder for these students and create negative perceptions of research.

The results of this study suggest an imbalance between resources, perceived barriers, and curricular design in ESS. Providing beneficial experiences that are accessible for all students across the ESS majors and concentrations may involve several different approaches to maximize research opportunities. Current literature on undergraduate research ESS involve targeted curricular and extracurricular programs that

allow students to get involved in a form that best suits their degree plans and availability. These studies provide insight for engaging undergraduate ESS students in research in various methods that may be beneficial for all concentrations and majors in ESS at Texas State.

Curricular and Extra-Curricular Adaptations to Promote Undergraduate Research

Examples of curricular support of undergraduate research follow two general curricular designs: 1) a course progression including a research methods and research capstone project (Carson et al., 2018), and 2) applied research projects being integrated into an existing course (Pearson et al., 2017). Carson et al. (2018) highlighted the benefits of having a three-course progression of the following courses: Foundations of Scientific Inquiry, Research Methods, and Senior Seminar. The combination of these courses guided students from foundational to applied research, ending with the generation of a senior project, ensuring a solid support for undergraduate students to engage in research. Students increased competence in research skills, interpersonal skills, and academic confidence, making this progression of courses a solid support for undergraduate research. Carson et al. (2018) further reported that alumni perspectives of this program also revealed an increase in learning outcomes, and increased preparedness for graduate school, which relates to FRE scores in this current study. In addition, Pearson et al. (2017) recommended targeted curricular adaptation with an existing course. By adding a group project culminated in a formal report and then presented in a poster format at the end of the semester, students combined the concepts learned in the course with a practice of undergraduate research. Pearson et al. (2017) reported that students either found applied research project experience either to be “a great learning experience”

or “hindered by the quality of their group members.” Considering this variability in research attitudes, applied research experiences have the potential to positively impact students, but further research is needed to determine how to overcome perceived barriers and negative outcomes for student’s involvement in the research process.

While there are some courses that enhanced ESS student’s experiences with research, a common suggestion for increasing access to undergraduate research was the inclusion mandatory research projects or courses. Students also cited positive experiences with research outside of the curriculum but did not believe it was worth the time commitment, which negatively impacted CRE, RC and RA scores. Therefore, students may benefit from either of the curricular designs laid out by Pearson et al. (2017) or Carson et al. (2018). By offering a culminating research project in exist courses or set of courses that allow students to enhance their undergraduate research experiences (RC and CRE) while not having to take time outside of class, the likelihood that students engage in research would possibly increase and it may create more positive research attitudes (RA). Students may also, as described by Carson et al. (2018), be more inclined and prepared for graduate programs in ESS, leading to higher FRE scores.

However, curricular adaptations may not be appropriate for all ESS/HFM majors, as suggested by lower FRE scores seen for HFM and ALPE students, so extra-curricular opportunities may be beneficial for engaging students in research. Experiences outside of the classroom may create a more clear and complete picture of concepts in ESS. Examples of positive experiences with extra-curricular research in ESS were best detailed in O, Sherwood & Nygaard’s (2018) with the Kinesiology Research Group (KRG) and the Get Fit! Stay Fit! Group (GFSF) at California State University East Bay. The

structure of the KRG program allowed student discussions, mentorship and research, and professional skill development. The GSFS program allowed students integrate knowledge across the breadth of their courses, design programing, motivate, and educate their participants on evidenced-based health practices. An extra-curricular program may be beneficial for students that already have an interest in research, like PRS and CES students. By providing opportunities outside of the curriculums that support research and future graduate level work, students could further enhance their undergraduate research experience.

Further benefits for extra-curricular integration of research for ESS students was presented by Culp and Urtel (2013). They focused exclusively on ALPE students who have limited capacity in their curriculum to integrate a separate research course. The program developed by the department allows students to work under a faculty mentor in their respective area of study. For students in ALPE or HFM, many of responses to the last open-ended question in the survey mentioned that they would like to be engaged in research but were unsure how to get engaged. Introducing students to faculty mentors could create a pathway for engagement that does not interfere with the rigid curriculum design of their major or concentration. Further, mentorship has been established as a beneficial tool for enhancing the undergraduate experience as a whole (Kuh, 2008).

These two variations of extra-curricular adaptation may benefit ESS students at Texas State to engage in research without the burden of additional mandatory courses. Extra-curricular programs such as those described by O et al. (2018) and Culp and Urtel (2017), allow students to gain confidence in their readiness for more demanding research, learning to work independently, tolerance for obstacles faced in the research process, and

becoming part of a learning community. Students may become involved in extra-curricular programs at any time in their undergraduate career, which may remedy the gap in CRE scores seen between students who have completed fewer years in the BESS. Further, encouraging extra-curricular adaptation for the concentrations and majors with fixed curriculum may better engage undergraduate students in research in the future and closing the gap between majors/concentrations FRE scores.

Overall, CRE, FRE, RC, and RA scores provided insight into how perceived benefits to research and limited curricular and extra-curricular activities could impact student's ability to engage in undergraduate research in ESS. For students to increase research engagement both as an undergraduate student and in the future, the Department of HHP could integrate curricular designs and extra-curricular adaptations such as those presented by Carson et al. (2018), Culp and Urtel (2017), O et al. (2018), and Pearson et al. (2017). The introduction of these kinds of programs are in line with the goals of the QEP, Department of HHP strategic plan, and seem to be supported by open-ended responses to enhancing the undergraduate research experience for ESS students.

Implications for Future Research

The findings of current study added new information of undergraduate student research perceptions to the currently limited research. As a result of the opportunities to engage in research, students display inadequate research engagement, negative perceptions of research, and low research competence, which may impact their desire to pursue graduate level degrees or field work involving research. These sentiments spanned all majors and concentrations, regardless of demographic background or academic standing. Considering the idea that undergraduate students perceive various

barriers to their engagement in research (Myers et al., 2018), empowering students to be more readily engaged in research must address these perceived barriers.

Determining specific methods of enhancing the engagement of ESS students in a department that do not currently have an established undergraduate research program requires further studies into specific curricular or extra-curricular program integration in a department like HHP. As the undergraduate research presence is increased across the country, further investigation on best practices for enhancing undergraduate research in ESS may be powerful in guiding future research. More holistic accounts of the development of undergraduate research programs in ESS and the inclusion of student perceptions of the current state of research in their department may also continue to provide insight into the most beneficial programs for ESS students.

Limitations

There were some limitations to the design of this study. Firstly, this study utilized a cross-sectional design that consisted of only one semester of data collection which may have provided a limited view of student perceptions. Continuing data collection throughout the academic year beyond Fall 2019 may have allowed more students to respond to the survey, which may have decreased the number of excluded responses. Secondly, this study utilized an adapted survey to collect data, which may have also limited quality data return. The addition of a student focus-group or round-table session may have enriched the qualitative, perceptual data collected by the survey. Lastly, while there were 294 respondents to the survey, only 198 students' responses were included in the data analysis, which may have influenced the findings.

While these limitations were present, steps were taken to remedy some of the impact on data analyzed in this study. For the duration of the data collection period, multiple in class and email recruitment efforts were made to maximize data collection. Further, students were not compensated for their participation in this study, so extending the data collection period may not be beneficial. As for not implementing focus group or round table sessions, this study was adapted from Bovijn et al. (2017), who used a survey as the only means of data collection and reported significant results. Therefore, the design of this study mirrors that of Bovijn et al. (2017) and was sufficient to report significant information for this population ESS students. Lastly, the exclusion criteria for this study was developed to maximize return of qualitative questions for statistical analysis. Short-answer questions were included from all 294 responses, making the exclusion criteria beneficial for statistical analysis while not negatively affecting qualitative information gained. Future research on this or similar departments at Texas State would benefit from the addition of more qualitative data, however this study accomplished what it sought to achieve using the appropriate methodological design.

Conclusion

The BESS at Texas State University is a degree that encompasses a wide variety of subdisciplines of Kinesiology. Within the ESS and HFM major, there is a large area of variability in students' desire to engage in undergraduate research. Due to this variability, there is currently a lack of consistent curricular and extra-curricular support of research practices for all ESS students. This is reflected by student's lack of research experience, limited research competence, and negative research attitudes. While students

are interested in engaging in research, as suggested by higher FRE scores, there is a perceived lack of resources and opportunities to readily participate.

As a means of remedying student reported grievances with the current state of undergraduate research, a holistic approach to curricular or extra-curricular program adaptations to promote undergraduate research in ESS may be beneficial (Carson et al., 2018; Miller, 2015; O, Sherwood & Nygaard, 2018). Considerations of students' year of study and major/concentration are necessary, as upperclassmen and PRS and CES students are already more readily engaging in undergraduate research. PRS and CES students may more readily participate in a curricular undergraduate research experience as presented by Carson et al. (2018). ALPE and HFM students having a less research friendly curricula may benefit more from extra-curricular research experiences such as those presented by O et al. (2018) and Culp and Urtel (2017).

The findings of this study provide insightful information into how the department of HHP may approach enhancement of the undergraduate research experience for ESS students. While this study was somewhat limited in scope and data gathering methodology, significant findings in student reported perceptions of research help to fill a gap in the existing research on undergraduate research in ESS. Future studies incorporating holistic views of academic departments will benefit from utilizing student perceptions to inform best practices in engaging undergraduate students in research.

APPENDIX SECTION

Appendix A – Survey Instrument

ESS Undergraduate Research Perception Survey

Demographics:

1. Are you an Exercise and Sports Science major?
 - a. Yes
 - b. No
2. What is your undergraduate major/concentration?
 - a. Health and Fitness Management (HFM)
 - b. All-Level Physical Education Certification (ALPE)
 - c. Pre-Rehabilitation Science (PRS)
 - d. Health and Wellness Promotion for Clinical Population (HCP)
 - e. Other
3. Are you a current or previous Honors College member?
 - a. Yes, current
 - b. Yes, previous
 - c. No
4. What is your year of study?
 - a. Freshman
 - b. Sophomore
 - c. Junior
 - d. Senior
5. What is your current Texas State GPA?
 - a. 2.0 - 2.49
 - b. 2.5 - 2.99
 - c. 3.0 - 3.49
 - d. 3.5 - 4.0
6. Years completed in the Bachelor in Exercise and Sports Science/HFM major:
 - a. 0
 - b. 1
 - c. 2
 - d. 3
 - e. 4 or more
7. What is your age?
 - a. 18-22
 - b. 23-27
 - c. 28-32
 - d. > 32
8. What is your gender?
 - a. Male
 - b. Female
 - c. Non-binary
 - d. Prefer not to say

9. What is your ethnicity?
 - a. White or Caucasian
 - b. Hispanic or Latino
 - c. Black or African American
 - d. American Indian or Alaska Native
 - e. Asian
 - f. Native Hawaiian or Pacific Islander
 - g. Other (please specify)
10. Number of parents in health care/exercise science professions:
 - a. 0
 - b. 1
 - c. 2
11. Number of parents in medical or non-medical research settings (e.g., hospital, laboratory, university, field research):
 - a. 0
 - b. 1
 - c. 2
12. Are you a first-generation college student?
 - a. Yes
 - b. No

Questions:

1. What does “research” mean to you?
2. How do you generally feel about clinical/laboratory/education-based research?
 - a. Very Negative
 - b. Negative
 - c. Neutral
 - d. Positive
 - e. Very Positive
3. Have you previously completed a research project as part of the curriculum (e.g., a class project, presentation)?
 - a. Yes
 - b. No
4. Are you currently working on a voluntary research project? (I.e. not as part of the curriculum or class assignment)?
 - a. Yes
 - b. No
5. Have you previously completed a research project of your interest? (i.e. not as part of the curriculum or class assignment)?
 - a. Yes
 - b. No
6. Have you previously presented your research at a conference or a poster presentation?
 - a. Yes
 - b. No
7. Have you previously published your research in an academic journal?

- a. Yes
 - b. No
8. Have you attended a presentation sponsored by the Health and Human Performance Department? (i.e., Brennan Smith Lectures, HHP Poster Presentations)?
- a. Yes
 - b. No
9. How often do you search the literature and read research articles in your field?
- a. Daily
 - b. Weekly
 - c. Monthly
 - d. Almost Never
10. Are you aware of any research opportunities available in the department of Health and Human Performance?
- a. Very aware
 - b. Somewhat aware
 - c. Mostly unaware
 - d. Totally unaware
11. If you are aware, please give an example of research opportunity available and how did you find out?
12. Please rate the following statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)
- a. I am currently interested in pursuing a research project.
 - b. I am likely to get involved (i.e. observing, research assistant, creating a research project) with research before graduating.
 - c. I am likely to pursue a career that involves conducting research.
 - d. I am likely to pursue a Master's or doctoral degree in the future.
 - e. I am likely to never get involved with any research activities.
 - f. I am likely to pursue a teaching/training certification (e.g., teaching certification, TACSM/NASM).
13. Please rate the following statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)
- a. Research projects should be made required for all education/health science students.
 - b. Participating in research will be necessary to achieve my career goals (e.g., physical/occupational therapist, chiropractor, teacher, trainer).
 - c. Participating in research is an important part of my education.
 - d. Research is too challenging.
 - e. Research is interesting.
14. Please rate the following statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree)
- a. There is adequate time in the current curriculum to pursue research.
 - b. There should be time set aside in the curriculum for pursuing research interests.

- c. There is adequate training in the ESS curriculum for undergraduates on how to conduct research
 - d. There is adequate training for undergraduates in searching and reviewing literature.
 - e. It is difficult as an undergraduate to attain adequate research funding.
 - f. I know how to find a suitable research supervisor/mentor in ESS.
 - g. I know how to get involved with research and start my own research project.
 - h. It is difficult to present research (e.g., at a conference) as an undergraduate student.
 - i. It is difficult to publish research (e.g., in a journal) as an undergraduate student.
15. Please rate the following statements (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree) I am competent in the following:
- a. Searching the literature
 - b. Understanding and interpreting literature
 - c. Designing a research study
 - d. Conducting a research study
 - e. Analyzing and interpreting data from a research study
 - f. Writing a research paper/article
16. Please list courses in ESS curriculum that helped you in research. If there is no class currently offered for undergraduate research, please make recommendations of the courses that need to be offered to better prepare undergraduates in research.
17. If you have previously completed a research project, please share some of your experiences:
18. Please give us your suggestions for making research more accessible to students:
19. Please share any additional comments regarding undergraduate research.
20. Do you think this survey was easy to understand and complete? If not, please include any suggestions.

Appendix B – IRB Approval



The rising STAR of Texas

In future correspondence please refer to 6613

July 29, 2019

Isabel Valdez
Texas State University
601 University Drive
San Marcos, TX 78666

Dear Isabel:

Your IRB application titled "Perceptions of Undergraduate Research in Exercise and Sports Science at Texas State University" was reviewed and approved by the Texas State University IRB. It has been determined that risks to subjects are: (1) minimized and reasonable; and that (2) research procedures are consistent with a sound research design and do not expose the subjects to unnecessary risk. Reviewers determined that: (1) benefits to subjects are considered along with the importance of the topic and that outcomes are reasonable; (2) selection of subjects is equitable; and (3) the purposes of the research and the research setting is amenable to subjects' welfare and producing desired outcomes; that indications of coercion or prejudice are absent, and that participation is clearly voluntary.

1. In addition, the IRB found that you need to orient participants as follows: (1) signed informed consent is required as participation implies consent; (2) Provision is made for collecting, using and storing data in a manner that protects the safety and privacy of the subjects and the confidentiality of the data; (3) Appropriate safeguards are included to protect the rights and welfare of the subjects. (4) Compensation is not provided for participation.

**This project is therefore approved at the Exempt Review Level
Category 2 Surveys, Interviews, or Public observation**

2. Please note that the institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use other instruments, please re-apply. Copies of your request for human subjects review, your application, and this approval, are maintained in the Office of Research Integrity and Compliance.

Report any changes to this approved protocol to this office. All unanticipated events and adverse events are to be reported to the IRB within 3 days.

Sincerely,

Monica Gonzales
IRB Specialist
Office of Research Integrity and Compliance

CC: Dr. Ting Liu
Dr. Jennifer Ahens

OFFICE OF THE ASSOCIATE VICE PRESIDENT FOR RESEARCH

601 University Drive | JCK #489 | San Marcos, Texas 78666-4616

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This letter is an electronic communication from Texas State University-San Marcos, a member of The Texas State University System.

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