TEACHER KNOWLEDGE OF AND ATTITUDES REGARDING STUDENT CONCUSSION AND THE RETURN TO LEARN PROTOCOL

A Dissertation

by

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ABSTRACT

Concussion is a relatively frequent injury among youths which can impact various aspects of a youth's functioning including social, emotional, physical, and academic domains. While Return to Play has been addressed politically across all states, Return to Learn, or an individual's return to the school setting, is not as familiar. There is a significant lack of empirical research related to concussion and Return to Learn protocol. Efforts to distribute educational materials regarding concussion is without strategy and implementation can vary from school to school. Current research calls for further teacher trainings.

The purpose of the current study was to examine the association between concussion knowledge (CKI) and concussion attitudes (CAI) predicting variables of Return to Learn knowledge (RTL-KI) and adherence to Return to Learn (RTL-AI) protocols or practices within the school environment. Middle and high school teachers (grades 5^{th}-12^{th}) were asked to complete a survey composing of demographic information and questions asking about concussion and Return to Learn knowledge, their attitudes and beliefs as related to concussion, and their adherence to Return to Learn protocols or practices within their school. Fourteen demographic variables were selected in addressing eight research questions.

Results indicated that age was the only demographic variable to be found statistically significant as a stand-alone variable in predicting RTL-KI, and also as an interaction effect with CAI in predicting RTL-KI. Both independent variables, CKI and CAI were found to be statistically significant predictors of RTL-KI. All variables and moderation interactions suggest positive relationships between variables. Conclusions suggest intervention with young teacher populations as well as increased general trainings regarding concussion knowledge and concussion attitudes and beliefs.

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Contributors

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All work for the dissertation was completed independently by the student. Permission from authors to adapt previously published surveys was obtained and references are provided in appendix footnotes accordingly.

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TABLE OF CONTENTS

Table of Contents Continued

LIST OF FIGURES

LIST OF TABLES

List of Tables Continued

CHAPTER I

INTRODUCTION

The occurrence of concussions in sports is not novel. Concussions have been a part of contact sports since the initiation of sporting events. Medical definitions of concussion have been proposed since the 1600s, with a peak in societal and medical attention particularly surrounding the sport of football in the late 19th century; however, these concerns were dismissed as an effect of the inherent dangers of the contact sport (Harrison, 2014). Thus, it became an accepted part of sport. Martland (1928) investigated the anatomical effects of the concept of "punch drunk," acknowledged as the sluggish behaviors associated with boxers post-knockout hit. During the 20th century, attention to concussion fluctuated, though the beginning of the 21st century has recharged the notion of "The Concussion Crisis" as a major public health concern (Harrison, 2014, p. 823).

Specifically, concussions have been receiving more attention in recent decades through the academic literature and popular media due to research in regard to chronic traumatic encephalopathy (CTE). Research demonstrates that those athletes and military veterans who sustain multiple concussive or subconcussive brain traumas are more likely to be at risk of developing a neurodegenerative disease later in life, recognized as CTE (Baugh et al., 2012; Gavett, Stern, & McKee, 2011; McKee et al., 2009). CTE occurs due to the buildup of tau proteins, which are detrimental to brain cells, and can manifest symptoms in a time frame ranging from months to decades following trauma. Symptoms include memory loss, confusion, impulse control problems, depression, and ultimate progressive dementia (Baugh et al., 2012; Gavett et al., 2011; McKee et al., 2009). Autopsies of National Football League (NFL) athletes and professional boxers have highlighted the prevalence and subsequent concerns of CTE among athletes who sustain multiple concussions or blows to the head (Baugh et al., 2012; Gavett et al., 2011; McKee et al., 2009). Given the participation rates of youth involved in contact sports, preventative measures and educational resources regarding the potential long-term effects of concussions are necessary.

In addition to the media follow-up of CTE, short-term effects of concussions also warrant attention for youth. With a significant portion of the current youth population involved in organized sport, as well as concussion from falls, motor vehicle accidents and so on, concussion education is important (Merkel, 2013). Concussion implications can vary by individual case, but often there are social, academic, emotional, and neurological effects of concussion. Moser and Schatz (2002) found cognitive deficits as well as attention concerns in youth athletes who had sustained a concussion. Individuals who have had a concussion are found to have lower reported life satisfaction, more psychosocial concerns, and higher levels of stress and depressive behaviors following mild traumatic brain injuries, such as concussion (Stalnacke, 2007). Further, elements of the school environment such as lighting and noises may be detrimental to an individual recovering from a concussion (Mayo Clinic, 2016). Building upon the sensitivity to light, societal emphasis on “screen time” technologies (e.g., smart phone, computer) can be detrimental to a youth attempting to recover from concussion (Baker et al., 2014; Master et al., 2012). It is likely that individuals recovering from concussion will have difficulty with academic tasks (e.g., learning new tasks, remembering material) due to negative effects of concussion on neurological factors such as attention, concentration, and executive functioning (Howell, Osternig, Van Donkelaar, Mayr, & Chou, 2013). These implications must be considered in the youth’s everyday environments to decrease potential for exacerbating post-concussion symptoms, thus worsening the recovery trajectory.

Post-Concussion Return to Activities

Following concussion, all individuals must integrate back into everyday activities. For youths, particularly youth athletes, this often involves returning to athletic play and returning to day-to-day tasks, such as attending school and completing assignments. In the literature, returning to athletic play is formally recognized as Return to Play, whereas reintegrating back to the school environment is acknowledged as Return to Learn (Carson et al., 2014; McCrory et al., 2013). Specific guidelines are presented within each protocol to facilitate concussion recovery. Best practice recommendations and nationwide training programs are offered to multiple audiences including coaches, teachers, and parents to disseminate critical concussion prevention and intervention education (Williamson, 2008)

In helping youths recovering from concussion, it is important that the school environment provide any modifications or accommodations deemed necessary for appropriate recovery. According to results from a 2008 nationwide survey from the National Center for Education Statistics, an average of 6.22 hours to 7.17 hours per day is spent in school by youths, depending on the state (U.S. Department of Education, n.d.). Therefore, incorporating the school environment is vital to successful recovery from concussion for youths, given the significant percentage of their day spent in the school environment. In the Return to Learn model, teachers are a fundamental part of the transition back to the school environment for youths who suffered a concussion (Halstead et al., 2013). Still, studies report that teachers are largely underprepared regarding adequate concussion knowledge and further concussion training is warranted for this population (Dreer et al., 2017; Halstead et al., 2013; Heyer et al., 2015; Kuzma, 2015)

The Present Study

The purpose of the present study was to examine moderator variables to concussion knowledge, attitudes, and knowledge/adherence for Return to Learn protocols. Figure 1 depicts the relationships and moderator variables investigated in the current study. Middle and high school teachers were evaluated for concussion knowledge factors, as well as demographical variables. Demographical variables include sex, age, region of the country, level of education, years of teaching experience, current teaching grade, sport participation experience, whether the individual has completed formal concussion training or in-service, and personal experience with concussion. Determining whether the moderator variables influence concussion knowledge will assist researchers in future intervention and education regarding concussions.

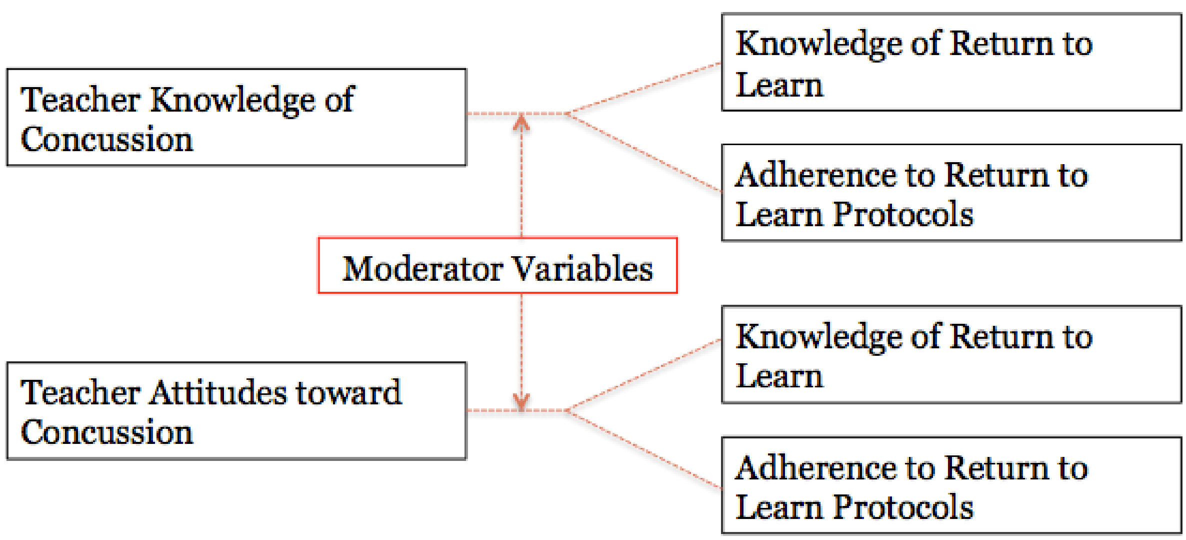

Figure 1. Variable model for the present study. This model illustrates the relationships and moderation that will be investigated in the current study.

Research Questions

The following research questions were addressed in this study. Given the significant lack of prior research related to this topic, the null hypothesis was applied to each research question.

1. Does teacher sex moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association with the moderator variable of teacher sex.
2. Does teacher age moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association in relation to the moderator variable of teacher age.
3. Does location or community size moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association in relation to moderator variables of location or community size.
4. Does teacher educational attainment moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association related to the moderator variable of teacher educational attainment.
5. Does teacher years of experience moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols?

It is hypothesized that there will be no statistically significant difference in the level of association relative to the moderator variable of teacher years of experience.

6. Does teacher grade or subject moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association relative to the moderator variables of teacher grade or subject.
7. Does teacher history of sport participation (participant or coach role) or history of concussion moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association relative to the moderator variables of teacher history of sport participation or teacher history of concussion.
8. Does teacher engagement in training or in-service about concussion or teacher experience working with student with concussion moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? It is hypothesized that there will be no statistically significant difference in the level of association relative to the moderator variable of teacher training or in-service about concussions or teacher experience with student concussion.

Clinical Significance

Concussion for an individual of any age is likely to have detrimental effects on several areas of functioning, including social, emotional, and academic functioning. For youth in the process of brain development, repetitive brain trauma can have particularly dire implications on cognitive functioning (Shrey, Griesbach, & Giza, 2011). While emphasis has been placed on

Return to Play protocols, researchers also must consider the significance of post-concussion effects on the individual within the learning environment. To do so, assessment of the teacher population, those individuals primarily exposed to students in post-concussion learning environments, is needed. Additional empirical literature would be beneficial in regard to Return to Learn protocols and attributing demographic variables to concussion knowledge and attitudes among the teacher population. Understanding demographic variables that influence factors associated with concussions and Return to Learn protocols will highlight future areas of intervention and education in the field to better serve concussed youth.

Definition of Terms

Concussion: A concussion is recognized as a mild traumatic brain injury (TBI) directly or indirectly resulting from an impact to the head, neck, or body (Kushner, 2001; McCrory et al., 2013). Symptoms of concussions and length of recovery vary from individual to individual. Concussions can affect physical, emotional, social, and cognitive functioning (CDC, 2015; Graff & Caperell, 2016; Kushner, 2001; McCrory et al., 2013).

Return to Play: Return to Play (RTP) is acknowledged as the reintroduction to athletic play for an individual following a concussion (Carson et al., 2014; Lovell, Collins, & Bradley, 2004; McCrory et al., 2013). Typically, this process is gradual and incorporates consultation from physicians, coaches, and parents. Guidelines for Return to Play protocols vary from state to state with different states enacting different laws regarding concussion in sports for youth and/or high school athletes. State laws differ in language dictating mandated concussion education and Return to Play criteria (American Psychological Association [APA], n.d.). In contrast, the National Collegiate Athletic Association (NCAA) provides a universal concussion Return to Play policy for collegiate athletes (National Collegiate Athletic Association [NCAA], n.d.).

Return to Learn: Return to Learn is acknowledged as the reintroduction to academic work for an individual following a concussion (Carson et al., 2014; Halstead et al., 2013; Master et al., 2012). As with Return to Play, Return to Learn protocols suggest gradual reintroduction to academic work until the individual is performing at pre-injury status. Often, additional activity restrictions also are implemented within the home and school environments to facilitate recovery (Halstead et al., 2013). Return to Learn protocols are not as common as Return to Play protocols across the United States.

Post-Concussion Syndrome: Post-Concussion Syndrome (PCS) encompasses the physical, cognitive, and emotional/behavioral symptoms that are typically associated with a concussion injury, occurring in the days, weeks, months, or years following a concussion (Ryan & Warden, 2003). Symptoms vary in severity and longevity, though common symptoms include headaches, dizziness, fatigue, memory/concentration difficulties, sensitivity to light and sound, and sleeping problems.

CHAPTER II

REVIEW OF CURRENT LITERATURE

Youth Involvement in Sport

As the importance of physical activity is stressed among all populations, sport participation is common among youth populations. Sabo and Veliz (2008) report that sport participation has increased in recent decades, specifically in youth populations. Overall, youth sport participation varies by reporter, though it can undoubtedly be concluded that a significant portion of the nation's youth participates in sports. An estimated 45 million children and adolescents participate in organized youth sports across the U.S., with 75% of U.S. families having at least one child participate in organized sports (Merkel, 2013). Younger generations are found to be more active, with inactivity increasing with age (Physical Activity Council, 2017). Within Generation Z, or those born since 2000, approximately 56.7% of the generation participated in team sports in 2016. Generation Z also leads among other generations in participation in individual sports, outdoor sports, and winter sports (Physical Activity Council, 2017).

Various factors can influence sport participation. Factors such as income, race, and location can contribute to significant effects on sex inequity among youth sport involvement (Women's Sports Foundation, 2008). Sport programs tend to favor boys' programs over girls' programs, particularly in low-income communities, where more resources are perceived to be allotted for boys sport programs. Further, when considering racial differences, particularly among African American and Hispanics, there is reported to be more support for boys' sports programs. Finally, location, specifically urban versus rural settings, is associated with favorable gender gap for males sport participation (Women's Sports Foundation, 2008).

Benefits to sport participation during youth development have been highlighted among society. Regarding health-related behaviors, sport participants were found more likely than non-sport participants to consume higher rates of fruits and vegetables and were less likely to engage in risk-taking behaviors (e.g., cigarettes, illegal drug use, sexual intercourse; Pate, Stewart, & Levin, 2000). Improved physical and mental health, social skills, and social behavior also are reported to be associated with youth sport participation (Bailey, 2006). Sabo and Veliz (2008) reported that organized sport participation among youths is associated with improved health and self-esteem, healthy body weights, and better-reported quality of life. Finally, positive associations are found between general physical activity involvement or sport involvement and academic achievement among middle and high school students (Fox, Barr-Anderson, Neumark-Sztainer, & Wall, 2010). The benefits of youth sport involvement cannot be understated.

Overall, among the most popular U.S. youth sports are basketball, baseball/softball, football, and soccer (DeMaria, 2015). These sports are recognized as high-contact sports and have increased incidences of concussions among participants, particularly high school athletes, paralleling the increase in participation among youth populations (Rosenthal, Foraker, Collins, & Comstock, 2014; Sabo & Veliz, 2008). Still, the type of sport activities has broadened in recent decades, introducing additional sports to the youth population (Women's Sports Foundation, 2008). While benefits of sport participation have been highlighted, given the significant number of youth involved in sports in the U.S., it is important to consider the potential of detrimental injuries, such as concussion.

School Belongingness

Bronfenbrenner's Ecological Systems Theory (1979) states that an individual is not an isolated entity but rather grows and develops largely based on factors and thereby influences of their environment. This theory is particularly relevant to children and their development. The theory's dimensional influences include the microsystem, or the immediate environment, the mesosystem, or connections between different elements of the individual's microsystems, the exosystem, or the indirect environment, the macrosystem, identified as social and cultural values, and the chronosystem, which represents changes over time (Bronfenbrenner, 1979). The microsystem, which can be identified as the individual's home and school environments, can have particularly significant effects on development given the proximity and consistency to the individual. Interestingly, Bowen and Bowen (1998) found school and teacher support to have a greater impact on protective factors as related to student achievement and affective investment in schooling than home status or home academic perception. Particularly given the amount of time a youth spends in the school setting daily, the belongingness that a youth feels to the school environment, which may be identified as relationship with other peers or teachers, can have significant impact on development and psychosocial adjustment (Bronfenbrenner, 1979; Allen, Vella-Brodrick, & Waters, 2016).

The self-determination theory suggests that there are three core components linking an individual's personality, motivation, and optimal functioning. These three components are identified as competence, autonomy, and relatedness or connection. Within this current study's body of research, a reasonable extrapolation may place weight on the factor of relatedness or connection, or the degree to which a youth feels a sense of belongingness in the school setting. Research suggests that a youth's sense of perceived belongingness in the school setting, particularly as related to teacher support, is significant in academic and psychological outcomes (Van Ryzin, Gravely, & Roseth, 2009). Further, Kennedy and Tuckman (2013) found a positive relationship between perceived school belonginess and decreased academic-related stress.

Belongingness has also been identified as a protective factor against concerns such as loneliness and potential depression (Baskin, Wampold, Quintana, & Enright, 2010). Research supports the notion that a supportive teacher-student relationship can be critical in outcomes of the student being engaged and connected to the school environment (Klem & Connell, 2004). Murray and Pianta (2009) identify the importance of teacher-student relationships, specifically the teacher's beliefs, actions, and attitudes, with adolescents with high incidence disabilities. Students with disabilities are identified to be at a heightened risk for social, emotional, and behavioral issues (Murray & Pianta, 2009). Student-teacher relationships and teacher responses in the moment of emotional or behavioral distress can affect the student's likelihood of reaching out to that teacher for help in the future (Sullivan, Sutherland, Lotze, Helms, Wright, & Ulmer, 2015). Based on the significant literature base related to student-teacher relationship and teacher support and subsequent student perceived belongingness, this current study assessing teacher's knowledge and attitudes toward concussion is vital. Students being aware that teachers care can be related to numerous student outcomes, including in the case of concussion.

Concussion

The definition of a concussion can vary based on the resource; however, often it is defined as a mild type of traumatic brain injury caused by a bump, blow, or jolt to the head or by a hit to the body, with or without loss of consciousness (Baugh et al., 2012; Gavett, Stern, & McKee, 2011; Kushner, 2001; McCrory et al., 2013; McKee et al., 2009). This impact causes the head and the brain to rapidly move back and forth, potentially resulting in stretching and damaging of brain cells and causing chemical changes in the brain (Centers for Disease Control and Prevention [CDC], 2015). Severity of concussion can range based on each individual case. Research predicts that between 1.6 and 3.8 million concussions occur each year, with approximately 5-10% of athletes experiencing a concussion in any given sport season (Sport Concussion Institute [SCI], 2015). Given this large population impacted, concussion intervention is necessary, especially considering that 47% of athletes do not report any concussion symptoms (SCI, 2015).

Demographically, girls are more susceptible to concussions due to biological and cultural factors (Covassin & Elbin, 2011; Gessel, Fields, Collins, Dick, & Comstock, 2007; SCI, 2015). For example, at a biological level, girls typically have weaker neck muscles, which may contribute to concussions or other injuries. Culturally, girls are typically perceived as the more vulnerable sex in comparison to boys. Thus, society is more likely to respond to an injury such as a concussion when a girl is affected, whereas the same injury for a boy may be overlooked or the youth may be told to or feel compelled to 'tough it out' (Covassin & Elbin, 2011; Gessel, Fields, Collins, Dick, & Comstock, 2007).

Concussion reporting rates have increased within the past decade (Rosenthal, Foraker, Collins, & Comstock, 2014). According to the CDC, the national concussion diagnosis rate for youth ages 10-19 in 2010 was 8.9 concussions per 1000 youths, while the national average for youth ages 10-19 in 2015 was 15.2 concussions per 1000 youths. These numbers highlight a significant change in reporting rates with an approximate 71% increase in concussion diagnoses over the period of five years. Researchers speculate that this change is likely due to the increased education and awareness of concussion, rather than solely an increase in incidences of concussion. Society overall is more aware of concussion signs and symptoms than in the past, as well as the potential side effects of not attending to a concussion, and thus exhibits an increased likelihood to report concussion occurrences (Rosenthal, Foraker, Collins, & Comstock, 2014).

Concussion education. Concussion education is key to societal awareness regarding concussion prevention and intervention. Effects of concussion can range across individual cases and can last anywhere from a few days to a few months, and even up to years post-concussion incident (Ryan & Warden, 2003). Particularly in the school environment, concussion education is important to assisting the student's academic functioning and success (Gioia, 2016; Halstead et al., 2013; Master et al., 2012). Proper education leads to more effective prevention and intervention strategies for youth with concussions. A specific study focusing on school psychologists suggested that individuals who gain more education and exposure to youth with traumatic brain injuries (TBI), with concussion often considered a mild TBI, perceived a greater perceived ability to perform across numerous job responsibilities (Glang, McCart, Moore, & Davies, 2017). While efforts are continuously made to increase concussion education, research focusing on concussion education in school environments suggests further education and training is warranted (Dreer, Crowley, Cash, O'Neil, & Cox, 2017; Gioia, 2016; Heyer et al., 2015). Lack of teacher education is identified as one of three core challenges to concussion implementation regulations (Howland et al., 2018). Formal national education programs and school accommodation plans offer various intervention strategies for concussion cases. The following programs and interventions have been implemented on a national scale to further educate and treat youth who have experienced a concussion.

Heads Up (2015). *Heads Up* is a formal concussion education program initiated by the CDC in 2003. Since it's inception, the program has been disseminated to a variety of audiences via websites, newsletters, fact sheets, events, public service announcements, conferences, and social media platforms to raise awareness for increased and improved prevention, recognition and response to concussion injuries (Sarmiento, Hoffman, Dmitrovsky, & Lee, 2014). The CDC has partnered their efforts driven by *Heads Up* with numerous organizations facilitating youth education such as schools, health and medical organizations, sport organizations, and government agencies (Covassin, Elbin, & Sarmiento, 2011). Studies have suggested a positive response to *Heads Up* in regard to increased confidence in identifying children with a concussion, provision of novel educational resources, and motivation to educate others in regard to concussion awareness, specifically among the youth coaching population (Covassin et al., 2011). Among physicians, *Heads Up* was found to have an influence on recommendations in regard to Return to Play participation; physicians who received the CDC *Heads Up* toolkit were less likely to recommend next day Return to Play (Chrisman, Schiff, & Rivara, 2011). CDC continues to disseminate resources associated with *Heads Up* as a main facilitator for educational resources for the youth population (Sarmiento, Hoffman, Dmitrovsky, & Lee, 2014).

ThinkFirst (2015). *ThinkFirst* is a nation-wide program supported by the National Injury Prevention Foundation, founded in 1986. Part of the organization's purpose is to enhance education and awareness of brain, spinal cord, and other traumatic injuries, such as concussions (Williamson et al., 2011). *ThinkFirst* is a program that fosters a Health Belief Model perspective, following the concept that individuals must believe that something serious may happen to them in order to change behavior (Williamson et al., 2011). *ThinkFirst* provides educational resources to school populations, largely in the form of presentations and public speakers, yet also stresses recognition and management of concussion injuries (Williamson et al., 2011). Program evaluation studies have found *ThinkFirst* to be making positive impacts on public education regarding concussions (Rosenberg, Zirkle, & Neuwelt, 2005).

Concussion Awareness & Prevention Program (CAPP; 2015). The Concussion Awareness and Prevention Program (CAPP) is supported by the New England Institute for

Neurology and Headache and provides resources for the formation of concussion protocol and management strategies for sports teams. In addition to resources, educational workshops, and consultation, the foundation also provides neurological cognitive baseline testing for pre-injury and post-injury individuals (New England Institute for Neurology & Headache, n.d.). The overall purpose of the foundation, specifically within CAPP, is to increase education and prevention of concussions, as well as to assist with interventions to concussions as needed.

Concussion helmet impact sensors. In recent years, the interest in impact sensors in football helmets has been growing and gaining traction with attention toward instantaneous monitoring of potential concussions (Jadischke, Viano, Dau, King, McCarthy, 2013; Schnebel, Gwin, Anderson, & Gatlin, 2007). Merrell and colleagues (2013) developed a flexible, portable smart foam sensor which would be placed inside a football player's helmet measuring force and acceleration and transmitting impact signals to a coach on the sideline monitoring hits. This technology, termed Head Impact Telemetry System and supported by Riddell helmets, is able to provide immediate feedback for concussion monitoring at the neurological level, ideally leading to improved decisions with regard to continuing impact play (Jadischke, Viano, Dau, King, McCarthy, 2013; Schnebel, Gwin, Anderson, & Gatlin, 2007). Researchers also have investigated the use of smartballs and headgear in sports such as soccer in order to track the impact of headers (National Research Council, Institute of Medicine, Board on Children, Youth, and Families, & Committee on Sports-Related Concussions in Youth, 2014). A review of head impact measurement devices during contact sport participation found a total of 24 products that can track head impact for either research or clinical purposes, with 10 of the products supported by empirical literature in regard to their effectiveness (Williams, Dowling, & O'Connor, 2016). Utilizing immediate feedback of head impacts with such technologies would provide concrete data for identification, as well as resources to respond to potential concussions experienced during play.

Neurocognitive concussion assessments. Neurocognitive baseline and post-injury concussion assessments is widely supported for sports teams, typically being utilized with university teams and professional play yet also recommended for high school teams. Numerous computerized assessments are available, such as ANAM, Axon Sports/Cogstate Sport, and ImPACT; yet studies suggest they have significant value in immediate response to possible concussions (i.e., within 24 hours of injury) rather than long-term symptom assessment (Nelson et al., 2016). Utilizing data with concussion assessment ideally leads to more informed decisions and interventions.

School environment interventions. The following education and intervention techniques are implemented in the school environment for youth who have experienced a concussion. While many other educational resources and intervention strategies support Return to Play decisions, interventions provided in the school environment emphasize the individual's Return to Learn modifications and accommodations.

Response to intervention (RTI). Response to Intervention, or RTI, is a common approach in schools with the purpose of identifying and supporting students struggling in the learning environment (Fletcher & Vaughn, 2009). It is a three-tiered approach with Tier 1 representing universal screening, Tier 2 representing targeted interventions for students considered to be "at risk", and Tier 3 representing intensive, comprehensive interventions targeting specific skill deficits. Regarding concussions, RTI may be implemented with the purpose of providing further support or to identify the student for more intensive intervention or assessment. Oftentimes, the

RTI support team at the school will help facilitate the student's return to school following post-concussion (Duff, 2009; Heyer et al., 2015; Sady, Vaughan, & Gioia, 2011).

504 plan. Should a student's skill deficits from concussion warrant an accommodation to the learning environment, a formal 504 Plan may be utilized. A 504 Plan is part of the Rehabilitation Act (1973) and the American with Disabilities Act (1990) and can be enacted for students not eligible for special education services, yet requiring accommodation in general education due to some deficit that affects a domain of life functioning, such as learning (Halstead et al., 2013; Kirkwood, Yeates, & Wilson, 2006). In order to receive 504 services, the concussion must impact a major life activity, such as walking, seeing, learning, writing, or other activity of daily living (Duff, 2009). The 504 Plan will provide an accommodation, not a modification, to instruction, and oftentimes will not be a permanent structure to the individual's learning environment.

Individualized education plan (IEP). In more severe cases of TBI, an Individualized Education Plan, or IEP, may be developed under the Individuals with Disabilities Education Act (Individuals with Disabilities Education Act [IDEA], 2004; Halstead et al., 2013). Utilization of an IEP is not typical practice for mild concussions where symptoms are expected to alleviate in a short manner of time, yet may be enacted if the individual has post-concussive syndrome and meets criteria for services under TBI (Halstead et al., 2013). An IEP would provide formal modifications, as well as accommodations, to educational instruction. Typically, RTI and 504 services would be attempted prior to formal multidisciplinary assessment, consideration for special education services, and development of an IEP (Duff, 2009).

Coaches and concussion. When dealing with concussion, coaches are concerned primarily with the Return to Play protocol, or the timeline of an athlete's return to impact play following a concussion injury (Carson et al., 2014; Lovell, Collins, & Bradley, 2004; McCrory et al., 2013). Washington was the first state to pass a Return to Play law in 2009, following legislation recognized as the Zackery Lystedt Law following the death of a 13-year-old athlete due to premature return to impact play (Adler & Herring, 2011). The Lystedt Law has served as foundation for similar laws enacting concussion intervention and management in all states across the U.S. (Bompadre, 2014). Concussion education is disseminated to coaches nationwide in multiple formats, including online training and education (Covassin, Elbin, & Sarmiento, 2012; Glang, Koester, Beaver, Clay, & McLaughlin, 2010). Still, misconceptions exist about concussion diagnosis and management. Benson and colleagues (2013) reported that education can be inconsistent and slow, and education programs are largely dependent upon individual schools/school districts or sports teams. Further, while coaches serve as instrumental personnel in intervening with athlete concussion, barriers exist, including parent and athlete discount of concussion severity, which can introduce complications to formal concussion management (Sarmiento, Mitchko, Klein, & Wong, 2010).

Concussion and cognition. The attention drawn toward concussions recently largely supports behavioral and structural brain changes as a result of concussions. Kneightley and colleagues (2014) found less activation specifically in areas of the brain such as the dorsal anterior cingulate cortex, left thalamus, left caudate nucleus, and bilateral dorsolateral prefrontal cortex following concussion. These areas of the brain correlate with functions commonly associated with working memory performance. On working memory tasks, youth athletes who suffered concussion demonstrate significantly worse performances in skills such as delayed recall and verbal fluency (Kneightley et. al, 2014). Other research, concluding that no two concussions have identical effects, found disruptions to visual systems of the brain, thereby affecting the balance of the athlete in addition to memory and concentration difficulties (Guskiewicz, Ross, & Marshall, 2001).

Further research has found that individuals who may not be exhibiting symptoms of post-concussions still may have brain damage to the dorsolateral prefrontal cortex. These physiological changes in the brain have been linked to head collisions to the top-front of the head. Identifying these injuries in individuals who exhibited no clinically diagnosed concussion, but demonstrated measurable cognitive deficits (e.g., neurocognitive, neurophysiological), further suggests the possibility that there are more athletes who sustained concussion than are being diagnosed (Talavage et. al, 2014). This presents significant danger to the individual, as they may continue to engage in high impact sports, leading to additional deficits and injuries.

A final piece of common research regarding neurology and sports-related concussions is chronic traumatic encephalopathy (CTE). CTE is a long-term effect, initially found in professional boxers, subject to repetitive minor TBIs, such as concussions, which can result in neurological atrophy (McKee et. al, 2009). With CTE, protein tangles are found throughout several parts of the brain associated with functioning in memory, behavior, personality, and gait, as well as neurological degeneration in areas such as the medial temporal lobe, thalamus, and brainstem, in addition to others (McKee et. al, 2009). Effects in these individuals beyond changes in memory and gait include depression and suicide. Further, research has suggested that blows to the head resulting in neurodegenerative effects such as CTE can be qualified as subconcussive, or traumas that do not meet clinical levels to be formally recognized as a concussion (Bailes, Petraglia, Omalu, Nauman, & Talavage, 2013). Thus, it is not the severity of the concussion that matters, but rather the frequency of blows to the head endured by the individual that may carry more weight in terms of the neurological effects.

Connecting neurology to cognitive deficits, recent research has focused on the effects of concussions on working memory (Jonides, Lacey, & Nee, 2005; Shrey, Griesbach, & Giza, 2011; Tapper, Gonzalez, Roy, & Niechwiej-Szwedo, 2017). Working memory, often referred to as the "search engine of the mind," is responsible for various cognitive functions including manipulating information, utilizing information, delegating tasks to take action on, staying focused, blocking out distractions, and maintaining awareness of one's setting, as well as other executive functioning tasks (Jonides, Lacey, & Nee, 2005; Pearson, 2016, p. 1). Thus, working memory can have implications in academic, professional, and social settings. Further, working memory demands can change from grade level to grade level. For elementary school students, tasks may include mental arithmetic or appropriate peer interactions; middle school tasks may include independently completing homework and planning for an activity; high school tasks may include understanding social cues and writing reports; college tasks may include sustaining focus throughout lectures and creating and adhering to study plans (Pearson, 2016).

Assessments completed with athletes who sustained a concussion suggest several neurocognitive impairments as a result of the concussion. Individuals with recent concussions perform significantly worse on measures of attention and concentration, and furthermore, these students are more likely to have lower grade point averages as a result (Moser, Schatz, & Jordan, 2005). Other executive functions, as well as attention and concentration, have been recognized as impaired following concussions, and long-term effects can have detrimental effects on educational outcome (Howell, Osternig, Van Donkelaar, Mayr, & Chou, 2013). Additionally, memory impairments are noted as more prevalent for individuals during post-concussion assessments (Lovell et al., 2003). Still, following prescribed cognitive and physical rest, participants exhibit improved performance overall on assessments, highlighting the significance of post-concussion intervention and treatment (Moser, Glatts, & Schatz, 2012). The combination of both cognitive and physical rest is vital to recovery. Finally, Belanger and Vanderploeg (2005) acknowledged that history of prior head injury inflates effect sizes associated with cognitive post-concussion symptoms. This emphasizes the potential of accumulating detrimental effects for individuals with multiple concussions and highlights an additional vulnerability factor regarding cognitive outcomes for individuals with a concussion.

Return to Learn

When considering concussion recovery, it is common to refer to Return to Play protocols for athletes, which dictate medical recommendations regarding when the individual is safe to return to contact play (Lovell, Collins, & Bradley, 2004, McCrory et al., 2013). Both national and statewide organizations provide guidelines for this transition from rest to returning to full participation in the sport. In the past, these protocols have primarily emphasized the need for physical rest and recuperation following concussion.

In recent years, more attention has been directed to the effects of classroom environments on students who have experienced concussions, referred to as Return to Learn protocols (Gioia, 2016; Halstead et al., 2012; Master, Gioia, Leddy, & Grady, 2012). Master and colleagues (2012) emphasized the significance of both physical and cognitive rest following concussions for appropriate recuperation. In following a cohort of individuals who experienced a concussion and evaluating their cognitive activity, Master and colleagues concluded that individuals who engaged in higher levels of cognitive activity sooner took longer for concussion symptomology to diminish. Additional research supports the association between engaging in high-intensity activities during post-concussion periods and increased difficulties with cognitive recovery (Majerske et al., 2008). Poor neurocognitive functioning was observed in areas such as verbal memory, visual memory, visual motor speed, and reaction time. While the research base is limited, the emphasis on cognitive rest is highlighted during post-concussion periods for appropriate recovery.

For youth athletes, emphasis on cognitive rest is most applicable to the school environment. The CDC (2015) reported that most youth require academic adjustments following concussion, with informal and formal support services in the school environment. Ransom and colleagues (2015) supported the conclusion that students who have not fully recovered from concussion symptoms report adverse academic effects. Services are variable by school district and state and differ based on the needs of the individual. As noted above, this may be through a 504 Plan, Response to Intervention Protocol (RTI), or an Individualized Education Plan (IEP) if special education services are warranted. Research suggests that, overall, school officials and personnel either often fail to recognize the need for or exhibit variability in compliance with academic and environmental adjustments for individuals following concussions due to lack of knowledge or lack of confidence in adhering to concussion management. As such, this area warrants further study to determine appropriate populations to target for concussion education dissemination (Halstead et al., 2013; Olympia, Ritter, Brady, & Bramley, 2016).

The concussion symptomology experienced by youths with concussion within a school environment can vary based on the individual. Most often, concussion results in headaches, dizziness/lightheadedness, visual symptoms, noise sensitivity, difficulty concentrating/remembering, and sleep disturbances (Mayo Clinic, 2016). RTI-type activities can assist in monitoring the students' responses to such stimuli, and thus create more effective intervention strategies that may help the student. In the classroom environment this may mean that lighting and noise may be detrimental to an individual recovering from a concussion.

Individuals may have frequent headaches during class or difficulty remembering the process in solving recently learned math equations. Additionally, due to sleep disturbances, the student may not be adequately rested for the school day (Baker et al., 2014).

Youth who sustained a concussion can struggle with a variety of day-to-day tasks in the classroom as a result. Given the detrimental effects on attention and executive functioning following concussion, it is likely that youth will have difficulty with classroom tasks, such as learning new tasks and remembering material (Howell, Osternig, Van Donkelaar, Mayr, & Chou, 2013). It is likely that youth initially will prioritize the need for rest, identified by shorter days or brief periods of reading and limited screen time prior to moving on to more significant accommodations or modifications (Baker et al., 2014; Master et al., 2012). Adapting the academic requirements and making environmental adjustments will assist the youth in recovery from a concussion.

Within the school environment, a focused team of school personnel ideally would serve as the gold standard for a Return to Learn team, determining appropriate services and accommodations for the individual on a case-by-case basis. These protocols can vary by school district and by state. No single comprehensive protocol has been enacted nationwide in response to concussion management in the school environment. Gioia and colleagues (2015) have suggested five key components of a Return to Learn policy, including the formation of an interdisciplinary team with documented expertise in brain injuries, professional development of all school-based personnel, screening/identification, assessment and developmental surveillance, accommodations and interventions, and medical-school communication (Newlin & Hooper, 2015). Further, the Ohio Return to Learn: Concussion Team Model, supported by the University of Dayton and Ohio Department of Health, necessitates collaboration between school personnel and parents to facilitate concussion recovery specific to the school environment (Davies, 2016). Frequent re-assessment of needs is required due to the fluctuation of concussion effects, with concussion symptomology continuing for one week to more than a year (Mayo Clinic, 2016). Much research focuses on the gold standard recommendations for returning to the classroom environment, though empirical data is lacking. Nonetheless, the significance of the potential need for accommodations for individuals with concussion in the school environment is evident.

Currently, research is sparse regarding empirical data of knowledge of concussions and Return to Learn protocols. Very few studies address the topic, despite the recent attention given to concussions and Return to Learn significance. A recent study by Dreer and colleagues (2017) examined teacher knowledge and classroom management for students with concussion. The results suggested that a majority of participants were able to identify the common concussion symptoms (e.g., headaches, trouble concentrating) and reported modifying classroom strategies, yet lacked confidence in concussion knowledge. Participants voiced requests for additional formal concussion training as less than half reported concussion training as a component of their job (Dreer et al., 2017).

Romm and colleagues (2018) evaluated differences in teacher versus administrator perceptions of concussion management and Return to Learn implementation. Qualitative data was collected via semi-structured interviews with a small sample of sixteen teachers and six administrators. Results suggested that personal experiences, such as a history of coaching or history of concussion, mediate perceptions about concussion. Still, there is a discrepancy in Return to Learn implementation in that teachers feel ill-equipped to implement recommendations and request further education, whereas administrators reported no awareness of any challenges with Return to Learn implementation. The study expressed the importance of a team-based approach to concussion management (Romm et al., 2018).

Further, Heyer and colleagues (2015) assessed high school principals' resources, knowledge, and practices regarding students returning to the school environment following a concussion. Overall, the study highlighted how approaches and resources vary by school, yet stressed the significance for further concussion training. While the study suggested further training, there is no clear strategy to address the need for further education for specific teacher populations (Heyer et al., 2015). Similarly, Hildenbrand, Richards, and Wright (2018) assessed physical education teachers regarding awareness and understanding of concussions and policies and protocols. Conclusions underscored that physical education teachers are not generally required to participate in concussion training or management. Teachers included in the study reported being aware of concussion policies and procedures; however, the researchers noted that there was minimal influence on their teaching methods. Further, concussion facts were more commonly known than concussion symptomology (Hildenbrand et al., 2018).

A final study highlighted educational professionals' concussion knowledge and the Return to Learn implementation practice (Kuzma, 2015). Data presented primarily utilized descriptive statistics, or percentages. While demographic data were collected, moderating relationships between variables were not investigated. Kuzma (2015) concluded there was variability in regards to concussion knowledge/awareness in the teaching population, lack of confidence in providing appropriate concussion management in the classroom, and the need for further concussion training for this population.

While Return to Play laws are enacted nationwide in all U.S. states, Return to Learn laws are not as pervasive. Thompson and colleagues (2016) reported that scarce, vague legal guidelines exist in regards to youths with concussion returning to the school environment, with only eight states regulating reintegration to the school environment. Best practices recommendations for the Return to Learn protocol have limited empirical bases (Halstead et al., 2013). Master et al. (2012) suggested gradual reintroduction to resuming full cognitive workload with a six-stage process: "1) No activity, 2) Gradual reintroduction of cognitive activity, 3) Homework at home before school work at school, 4) School re-entry, 5) Gradual reintegration into school, and 6) Resumption of full cognitive workload" (p. 3). Even in Washington State, where legal attention was first garnered for the Lystedt Law regarding Return to Play practices, students' needs are unmet (Lyons et al., 2017). Survey participants, including parents, teachers, nurses, and school administrators, voiced concerns about further teacher training regarding concussions, the need for a universal, formal Return to Learn protocol/policy, and further collaboration with medical professionals, due to lack of knowledge and awareness of appropriate concussion management (Lyons et al., 2017).

In addition to maintaining this timeline to reintegration to the school environment, cognitive activity and post-concussion symptomology need to be monitored via charts and checklists (Halstead et al., 2013; Master et al., 2012). Further, the 2012 Zurich Consensus Statement suggested strategies such as gradual increase of cognitive activity and environmental stimulation, pacing activities below symptom threshold, adjustment of academic demands and expectations, and a team-based support approach (Baker et al., 2014). Specific Return to Learn accommodations include frequent breaks in a quiet location, additional time for assignments, and no testing prior to full reintegration to cognitive workload, and, even then, untimed testing (CDC, 2015; Master et al., 2012). There is a lack of evidence in the empirical literature regarding implementation and effectiveness of such Return to Learn strategies and protocol as the few existing studies focus on general concussion knowledge. Currently, there are variable conclusions, warranting further concussion knowledge and management education, though gold standard recommendations are pervasive (Carson et al., 2017; Dreer et al., 2017; Gioia, 2016; Graff & Caperell, 2016; Halstead et al., 2013; Heyer et al., 2015; Kuzma, 2015; Lyons et al., 2017; Master et al., 2012).

Gaps in Literature

Overall, the focus on concussions is relatively recent, particularly within the past few decades, with significant emphasis on professional sports players rather than youth populations. Much of the literature discusses general knowledge and awareness of concussions. Still, limited literature addresses teacher knowledge of concussions, yet this awareness is especially important to the Return to Learn process. Further, while programs to train school administration and staff are addressed, there are limitations in targeting specific populations for concussion education. There is no identified strategy in targeting specific populations for Return to Learn concussion education. In addition, there is very sparse empirical literature regarding Return to Learn protocols within school environments. There is no formal consensus on how to disseminate concussion education materials (Williamson et al., 2014). Further, there is no identified strategy to target specific populations regarding Return to Learn concussion education. The mass dissemination of concussion materials is left up to the discretion of school districts regarding importance and emphasis placed on training and knowledge.

CHAPTER III

METHODS

The study used a quantitative cross-sectional design to examine correlational relationships between concussion-related variables, as well as the implication of moderator demographic variables on such correlations. All data were collected via survey methods. A power analysis was conducted via G*Power 3.1 to determine the number of completed surveys needed for the study, and for an effect size of 0.15 and alpha of 0.05, it was determined that a minimum of 89 completed surveys were needed. This chapter outlines the procedures that were followed and discusses the measures used in the study. Additionally, the chapter describes the recruitment methods utilized for this study, compensation strategies for participation, and participant characteristics.

Procedure

Participants were recruited through three different approaches: (a) contacting national teaching organizations, (b) utilizing social media outlets geared toward teaching populations, and (c) recruiting participants from specific school districts across the US via public access email addresses as approved by the Institutional Review Board (IRB). After obtaining IRB approval from Texas A&M University, a survey link via Qualtrics was sent out to middle and high school teachers requesting participation. The Qualtrics link was distributed via public email addresses, social media networking, and Amazon MTurk. Surveys included an information sheet documenting all the elements of consent and agreement to participate. If they agreed, they were directed to the demographic questionnaire, as well as the measure including concussion-based information to evaluate their concussion knowledge, attitudes, and Return to Learn knowledge/adherence of teachers. If they disagreed, they were directed to the end of the survey thanking them for consideration of participation. The survey participation was anonymous.

Measure review. Given that the Return to Learn (RTL) survey, further described in the Measures section below, was created for this current study, a panel of personnel external to the research committee reviewed the measures. Approximately eight individuals were asked to review the questions for readability and comprehension. These individuals were either engaged in or familiar with the educational environment so as to give a valid interpretation of the typical teacher population. Based on the feedback from this panel, small changes were made, largely as related to the diction or rewording of some items. No concerns or indications of confusion were reported by the participants throughout the data collection process.

Measures

Study participants completed a demographic questionnaire as well as a Concussion Questionnaire and Return to Learn Questionnaire. The Concussion Questionnaire assessed knowledge about and attitudes toward concussion. The Return to Learn Questionnaire assessed Return to Learn knowledge and adherence in the school environment. In total, the survey was estimated to take participants approximately 25 minutes to complete.

Demographic questionnaire. Participants completed a demographic survey with a series of quantitative open-ended or multiple-choice questions to gather information about potential moderator variables (e.g., age, sex, years of teaching experience, subject, prior participation in concussion education program, sports participation). The demographic form was adopted from Kuzma (2015) and additional demographic questions were added as appropriate to investigate additional variables for the current study. In total, the demographic questionnaire consisted of 20 questions, with six questions querying for further quantitative information in cases of affirmative responses (e.g., "If yes, how many clinic/in-services/classes have you attended on concussion recognition or intervention?") The demographic questionnaire is attached as Appendix A.

Concussion questionnaire. The second survey consisted of questions to evaluate the respondent's knowledge about and attitude toward concussions. This survey was adapted from the Rosenbaum Concussion Knowledge and Attitudes Survey – Student Version (Rosenbaum & Arnett, 2010), with word changes to better direct questions toward teachers. For example, instead of "Most athletes would feel…", this was replaced with "Most teachers would feel…". Face validity is not believed to be impacted by these changes. Some questions also were added to further evaluate knowledge and attitudes regarding concussion. Otherwise, the survey remained the same.

Rosenbaum and Arnett (2010) found the RoCKAS-ST to be a psychometrically strong measure with valid and reliable interpretation of concussion knowledge and attitudes. Williams (2013) found the questionnaire to have a Cronbach's alpha of 0.83, indicating good internal consistency. In total, the adapted RoCKAS consists of 55 questions divided into five sections. Sections 1, 2, and 5 load onto a Concussion Knowledge Index (CKI), while sections 3 and 4 load onto a Concussion Attitude Index (CAI). A validity scale is present in the measure, with the validity score ranging from 0-4, where completed surveys with validity score of 0 or 1 should be considered invalid. The adapted RoCKAS-ST utilized for this study is attached as Appendix B.

Concussion knowledge index. As noted above, Sections 1, 2 and 5 tap concussion knowledge. Sections 1 and 2 have True/False response options; in Section 5, respondents must indicate concussion symptoms from a checklist. Section 1 consists of 18 True/False statements, with correct answers supported by clinical data and empirical literature. Four of the 18 True/False statements load onto the validity scale. The responses to the validity questions were evaluated, though not calculated in the total index score. Section 2 consists of five questions utilizing applied sport scenarios, where respondents must select True/False responses. Section 5 consists of 16 symptoms, where the respondent must select all possible symptoms relevant to an individual following sustaining a concussion. The current researchers added an additional part to Section 5. A second copy of the list of 16 symptoms was provided. For the first list, participants were asked to identify symptoms relevant within one hour after a concussion; for the second list, participants were asked to identify symptoms an individual may experience for up to one week following a concussion. This question was adapted to gather further information regarding the participant's knowledge of symptoms related to recovery time following a concussion. Correctly answered items receive 1 point, and incorrectly answered items receive 0 points. Total CKI is determined by summing scores from sections 1, 2, and 5. The range of CKI score is 0-35, with higher scores indicating a greater knowledge of concussion.

Concussion attitude index. Of the survey questions pertinent to the Concussion Attitude Index (CAI), Sections 3 and 4 are formatted in 5-point Likert-scale responses. The CAI is comprised of a total of 30 items. The response options include "strongly disagree", "disagree", "neutral", "neither agree nor disagree", and "strongly agree." Items include opinion questions, as well as applied scenarios. Items are scored from 1 to 5 points based on the safety of responses. Participants receive 1 point for very unsafe responses and 5 points for very safe responses. The total CAI is calculated by summing the points from sections 3 and 4, with a total possible CAI range of 30-150. A higher CAI indicates safer attitudes regarding concussion.

Return to Learn questionnaire. The Return to Learn Questionnaire consists of 30 questions. It was anticipated that questions from this survey would load to two main factors: Return to Learn Knowledge Index (RTL-KI) and Return to Learn Adherence Index (RTL-AI).

The Return to Learn Questionnaire is attached as Appendix C. The survey is adapted from Kuzma (2015) and additional resources regarding Return to Learn symptomology concerns (CDC, n.d.; Halstead et al., 2013; Master, Gioia, Leddy, & Grady, 2012).

Return to Learn knowledge index. Of the survey questions pertinent to the Return to Learn Knowledge Index (RTL-KI), Section 1 is formatted in 5-point Likert scale responses. The RTL-KI is comprised of a total of 20 items. The response options include "strongly disagree", "disagree", "neither agree nor disagree", "agree", and "strongly agree". Questions center on a student's experience in returning to the classroom following concussion, particularly regarding cognitive rest, post-concussion syndrome symptomology, environmental stimuli, and typical recovery concerns. Items are scored from 1 to 5 based on the safety of responses. Participants receive 1 point for very unsafe responses and 5 points for very safe responses. Some items are reverse-scored. The total RTL-KI is calculated by summing the points from Section 1, with a total possible RTL-KI range of 20-100. A higher RTL-KI score indicates a greater knowledge of Return to Learn protocols following concussion.

Return to Learn adherence index. Of the survey questions pertinent to the Return to Learn Adherence Index (RTL-AI), Section 2 is formatted in 5-point Likert scale responses. The RTL-AI is comprised of a total of 10 items. The response options include "strongly disagree", "disagree", "neither agree nor disagree", "agree", and "strongly agree." Questions center on the teacher's interpreted value and implementation of Return to Learn protocols as well as adherence to responding to post-concussive symptoms. Items are scored from 1 to 5 based on adherence or value of the statement. Participants received 1 point for very low adherence/value responses and 5 points for very high adherence/value responses. Some items are reverse-scored. The total

RTL-AI is calculated by summing the points from Section 2, with a total possible RTL-AI range of 10-50. A higher RTL-AI score indicates higher adherence to Return to Learn protocols.

A Variable X Measure Matrix was created for this study and is attached as Figure 5 in Appendix J to identify the information that will be interpreted from each measure and specific measure items. Variable categories present in the table include sex, race/ethnicity, and age, school context and years of experience, sport context and experience, concussion knowledge, concussion attitude, Return to Learn knowledge, and Return to Learn adherence. The three measures identified are the demographic questionnaire, the Concussion Questionnaire (CQ), and the Return to Learn Questionnaire (RTLQ). Figure 2 denotes the specific classification of each moderator variable in the study.

		Variable Classification			
Moderator Variables		Qualitative Variable	Quantitative Variable	Categorical Variable	Continuous Variable
	Sex	●		● (Dichotomous)	
	Age		●		●
	Location	●		●	
	Community Size		●	●	
	Educational Attainment	●		●	
	Years of Experience		●		●
	Grade	●		●	

Figure 2 Continued

		Qualitative Variable	Quantitative Variable	Categorical Variable	Continuous Variable
	Subject	●		●	
	History of Sport Participation (Participant)	●		● (Dichotomous)	
	History of Sport Participation (Coach)	●		● (Dichotomous)	
	History of Sport Participation (Trainer)	●		● (Dichotomous)	
	History of Concussion	●		● (Dichotomous)	
	Training/In-service	●		● (Dichotomous)	
	Experience working with student with concussion	●		● (Dichotomous)	

Figure 2. Teacher moderator variables for the present study. This figure illustrates the classification of each moderator variable in the current study.

Participants

Recruitment. Recruited participants included in the study were teachers who are currently employed in a school-based setting. Teachers were recruited to represent a national sample from middle and high school teachers. Given the engagement of middle school and high school youth in sports, this teacher population was hypothesized to be the most likely to encounter students with concussions in the school environment. Participants were recruited via email through national teaching organizations and online social media outlets. Additionally, specific school district personnel nationwide with public email contact information were contacted in order to recruit participants. Attempts also were made to recruit participants through Amazon MTurk. Within the Amazon MTurk system, settings were put in place to ensure that participants were associated with the educational setting (e.g., teachers). The Amazon MTurk survey was "live" for several months; however, no participants were successfully recruited from this source, likely due to the stringent requirement of participants being employed as teachers within an educational setting. Inclusionary criteria included currently employed education teachers, including special service teachers (speech teacher, foreign language teacher, physical education teacher, and so on) in any public or private school setting.

The focus of the study was based on teachers due to the critical role teachers play in the Return to Learn process and the adjustment of the student back to the classroom environment following a concussion. Teachers have the potential to directly work with youth following a concussion, thus evaluating their knowledge and understanding of concussion was determined to be significant to highlight the need for more effective dissemination of concussion education. Demographic factors were included in the final analyses as moderator variables.

Compensation for participation. Study investigators obtained financial support through Texas A&M University to compensate participants. Due to the various ways in which participants were recruited for the current study, two survey links were created via Qualtrics based on differing compensatory methods. Participants recruited via social media, email contacts, and teaching organizations were offered an opportunity to enter a Rafflecopter drawing for one of five $50 Amazon gift cards. At the end of the anonymous survey, participants were provided a link to the Rafflecopter drawing as well as a passcode to enter their information. Personal data (e.g., name, valid email address) for the Rafflecopter were kept confidential and were in no way associated with survey responses. Following the Rafflecopter drawing, email addresses were deleted to further maintain participant anonymity. Participants were not required to enter the Rafflecopter; survey data for those who chose not to enter the Rafflecopter were still included in study analyses. Planned compensatory methods for participants participating through Amazon MTurk were to compensate $1.40 per completed survey. An additional amount was required by Amazon MTurk to be included due to the specification of participants limited to an association with the educational setting.

Participant characteristics. In total, there were six significant sections of the survey: (a) Participant Consent, (b) Demographics, (c) Concussion Knowledge Index, (d) Concussion Attitude Index, (e) Return to Learn Knowledge Index, and (f) Return to Learn Adherence Index. These elements are further elaborated in the Measures section of this paper. Ultimately, a total of one-hundred and sixty-five participants agreed to participate in the study. Of those, 27 stopped after the initial consent questions, so these individuals were eliminated from the final participant count. Of the 138 participants who continued, seven stopped at varying points during the demographic questions. Three additional individuals stopped prior to initiating the concussion section of the questionnaire. Due to the lack of data contributed by these ten individuals, they were also eliminated from the study. Two additional individuals were also eliminated due to their job role in the school (e.g., school psychologist, chemical dependency counselor). Principals were included as they had history of teaching experience and may work directly with the students with concussion. This resulted in a total of 126 individuals who contributed input to the concussion and Return to Learn components of the survey. Of the 126 individuals, 15 stopped the survey at various points during the concussion component of the survey and an additional 18 stopped the survey during the Return to Learn component. In total, 93 individuals completed the entire survey.

It should be noted that all 18 individuals who stopped during the Return to Learn component stopped at the same question. It is hypothesized that these participants stopped the survey prematurely due to testing fatigue, as the stopping point corresponded with the last set of directions. This limitation is further discussed in Chapter V. The 33 individuals who stopped during the concussion and Return to Learn survey components were not eliminated from the study. The following tables further describe the sample population characteristics and question response rates. The sample sizes for the question response rates may vary between 93 to 126 based on where individual participants prematurely ended the survey.

Sex. Participants were queried regarding their sex. Participants were given the option of male, female, or choose not to respond. Of the 126 individuals who provided a response, 28 individuals selected male (22.22%) and 98 (77.78%) individuals selected female. No individuals chose "choose not to respond" as their answer choice. This variable breakdown is depicted in table-format in Table 1.

Table 1

Participant demographic characteristics: Sex

Variable	n	%
Sex (N=126)		
Male	28	22.22
Female	98	77.78
Choose not to respond	0	0.00

Age. Participants manually entered their age in years in an open-response textbox. One hundred and twenty-five individuals responded to the question; one individual did not provide an age. In total, the range of ages reported spanned from 22 years to 73 years old with a mean age of 40.98 (11.50). The age groups were divided into ten-year age spans. The highest age group representation in the study was ages 40-49 with 41 individuals composing 32.80% of the participant sample. The least representation was from the 60+ age group, with 5 individuals, or 4% of the participant sample. The other age groups ranged from 22 individuals (17.60% of the sample) to 31 individuals (24.80% of the sample). The mode of the sample was 43 years of age (9 individuals), followed by 27 years of age (8 individuals). According to a 2011-2012 survey from the National Center for Education Statistics, the age representation in the sample is roughly congruent to what would be expected of a represented sample of public-school teacher ages in the United States (U.S. Department of Education, n.d.). Further breakdown of this variable statistic is depicted in Table 2.

Table 2

Participant demographic characteristics: Age

Variable	n	%	M(SD)
Age (in years) (*N*=125)			40.98(11.50)
20-29	26	20.80	
30-39	31	24.80	
40-49	41	32.80	
50-59	22	17.60	
60+	5	4.00	

Notes. One person chose not to respond.

Race/ethnicity. Participants were asked to select their identified race/ethnicity. A majority of the 126 individuals (*N*=104, 82.54%) identified as White (Non-Hispanic). The representation from other races/ethnicities was small, with seven (%) identifying as Black/African American, six (%) as Hispanic/Latino, two (%) as Asian/Pacific Islander, and one (%) as Native American/American Indian. Six individuals (%) selected "Other" as their identifying race/ethnicity. The variable breakdown is depicted in Table 3.

Table 3

Participant demographic characteristics: Race/Ethnicity

Variable	n	%
Race/ethnicity (N=126)		
White (Non-Hispanic)	104	82.54
Hispanic/Latino	6	4.76
Black/African American	7	5.56
Native American/American Indian	1	0.79
Asian/Pacific Islander	2	1.59
Other	6	4.76

State/regional representation. Participants were asked to identify what state they currently live in. All 126 participants responded, representing 18 states or territories (e.g., District of Columbia). The greatest representation was from Texas with 40 participants. For this study, the major regions of the United States were used to categorize regional locations. The U.S. Census Bureau identifies four regions of the country: Northeast, Midwest, South, and West. Of the participant sample of the current study, the following states fall within the Northeast region: Massachusetts, New Jersey, and Rhode Island. The following states fall within the

Midwest region: Illinois, Missouri, Nebraska, and Wisconsin. The following states fall within the South region: District of Columbia (D.C.), Florida, North Carolina, Texas, Virginia, and West Virginia. The majority of participants (52.38%) in this study were from the South region. The following states fall within the West region: Alaska, California, New Mexico, Washington, and Wyoming. The variable breakdown is depicted in Table 4.

Table 4

Participant demographic characteristics: State/regional representation

Variable	n	%
State (N=126)		
Texas	40	31.75
Nebraska	15	11.90
Florida	11	8.73
Washington	9	7.14
North Carolina	9	7.14
California	8	6.35
Wyoming	8	6.35
New Mexico	6	4.76
Virginia	4	3.17
Alaska	3	2.38
Missouri	3	2.38
Rhode Island	3	2.38
Illinois	2	1.59
District of Columbia (D.C.)	1	0.79
Massachusetts	1	0.79
New Jersey	1	0.79
West Virginia	1	0.79
Wisconsin	1	0.79

Table 4 Continued

Variable	n	%
Regional Representation (N=126)		
Northeast	5	3.97
Midwest	21	16.67
South	66	52.38
West	34	26.98

School setting. Participants were asked about the school setting in which they teach. Of the participants, 114 (98.48%) indicated public school settings, 3 (2.38%) indicated private school settings, and 9 (7.14%) indicated charter school settings. As expected, a majority of individuals who completed the survey teach in the public-school setting. The variable breakdown is depicted in Table 5.

Table 5

Participant demographic characteristics: School setting

Variable	n	%
School setting (N=126)		
Public school	114	90.48
Private school	3	2.38
Charter school	9	7.14

Population size of geographic area. One hundred and twenty-five individuals answered an item regarding the population size of the geographic area in which they live; one participant chose not to respond. Most participants (%) live in an area with a population size less than 25,000 people. More than three-quarters of the participant sample reported living in areas smaller than 100,000 people. Only two participants per category live in regions with populations ranging from 250,000-500,000 and 500,000-750,000. The variable breakdown is depicted in Table 6.

Table 6

Participant demographic characteristics: Population size of geographic area

Variable	*n*	%
Population size (*N*=125)		
<25,000	53	42.40
25,000-100,000	44	35.20
100,000-250,000	17	13.60
250,000-500,000	2	1.60
500,000-750,000	2	1.60
750,000-1,000,000	4	3.20
>1,000,000	3	2.40

Notes. One person chose not to respond.

Level of education. Of the 126 individuals who answered an item regarding educational attainment, a majority reported having either their Bachelor's degree (57 individuals; 45.24% of the sample) or Master's/Professional degree (61 individuals; 48.41% of the sample). Only one individual reported having their Associate's degree, and seven individuals reported having their PhD/EdD, or equivalent. These educational statistics are comparable as to what would be expected from a representative teacher population (citation please). The variable breakdown is depicted in Table 7.

Table 7

Participant demographic characteristics: Level of education

Variable	n	%
Level of education (N=126)		
Associate's degree	1	0.79
Bachelor's degree	57	45.24
Master's/Professional degree	61	48.41
PhD/EdD, or equivalent	7	5.56
Other	0	0.00

Teacher certification. Of the 126 respondents, 121 (96.03%) reported being a certified teacher. Approximately one-quarter of respondents (31 participants; 24.60%) reported getting certified for teaching through alternative means. Only five respondents (3.97%) reported not having their teaching certificate. The variable breakdown is depicted in Table 8.

Table 8

Participant demographic characteristics: Teacher certification

Variable	n	%
Certified teacher (N=126)		
Yes	121	96.03
No	5	3.97
Alternative certification (N=126)		
Yes	31	24.60
No	95	75.40

Class population. Participants were assessed for information regarding their class population. Of the 126 individuals who responded to the item, 12 (9.52%) reported teaching only special education classes, 96 (76.19%) reported teaching only general education classes, and 18 (14.29%) reported teaching both class populations. The variable breakdown is depicted in Table 9.

Table 9

Participant demographic characteristics: Class population

Variable	n	%
Class population (N=126)		
Special Education	12	9.52
General Education	96	76.19
Both	18	14.29

Years of teaching experience. Individuals ranged from less than one year of teaching to 39 years of teaching with a mean of 13.41 (10.39). Years of teaching experience was tri-modal with nine individuals reporting one, two, or three years of experience. Individuals who reported half year (e.g., 13.5 years) was rounded up. When grouped by five-year increments, a majority (36 individuals; 28.57%) reported five years or less of teaching experience. The variable breakdown is depicted in Table 10.

Table 10

Participant demographic characteristics: Years of teaching experience

Variable	n	%	M(SD)
Years of teaching experience (N=126)			13.41(10.39)
<1-5 years	36	28.57	
6-10 years	25	19.84	
11-15 years	19	15.08	
16-20 years	14	11.11	
21-25 years	13	10.32	
26-30 years	9	7.14	
31+ years	10	7.94	

Roles. Participants were asked about their roles in the school environment. A total of 125 individuals responded to this item; one individual chose not to respond. Approximately 63.20% of respondents (79 individuals) reported their sole role in the school environment as being a teacher; however, 27.20% (34 individuals) reported being a teacher and coach. Ten individuals, or 8% of the sample, reported being "Other," and two individuals (1.6%) reported being a teacher and a coach outside of the school setting. No participants were both a teacher and athletic trainer. The variable breakdown is depicted in Table 11.

Table 11

Participant demographic characteristics: Roles

Variable	n	%
Roles (N=125)		
Teacher	79	63.20
Teacher/Coach	34	27.20

Table 11 Continued

Variable	n	%
Teacher/Athletic Trainer	0	0.00
Teacher/Coach outside of school setting	2	1.60
Other	10	8.00

Notes. One person chose not to respond.

Student demographics. Participants were asked about their student demographics, specifically what grades and classes/subjects they teach. For grades, a total of 122 participant responses were coded as to whether they taught one grade, more than one grade, or all grades. These categories were further delineated by breakdown between grades 5^{th}-8^{th} and 9^{th}-12^{th}. For grades 5^{th}-8^{th}, 32 individuals (26.23% of sample) teach one grade and 32 individuals (26.23%) teach more than one grade. For grades 9^{th}-12^{th}, 7 individuals (5.74%) teach one grade and 35 (28.69%) teach more than one grade. Ten participants (8.20%) reported teaching more than one grade, with at least one from each grade category (5^{th}-8^{th}; 9^{th}-12^{th}); these participants may have reported teaching grades 8^{th} and 9^{th}. Six participants (4.92%) reported teaching all grades included in the study.

As related to classes/subjects, a total of 116 participant responses were coded based on academic classes, special topics classes, or a combination. Academic classes included science, social studies, history, English-language arts, and math. Special topics classes included physical education, foreign languages, college preparatory classes, theatre, and leadership. Seventy-three participants (62.93%) reported only teaching academic classes, 30 (25.86%) reported teaching only special topics classes, and 13 (11.21%) reported teaching a combination of academic and special topics classes (see Table 12).

Table 12

Participant demographic characteristics: Student demographics

Variable	n	%
Grade (N=122)		
One grade (5^{th}-8^{th})	32	26.23
More than one grade (5^{th}-8^{th})	32	26.23
One grade (9^{th}-12^{th})	7	5.74
More than one grade (9^{th}-12^{th})	35	28.69
More than one grade combination levels (5^{th}-8^{th}; 9^{th}-12^{th})	10	8.20
All grades	6	4.92
Class(es)/Subject area(s) (N=116)		
Academics	73	62.93
Special topics	30	25.86
Combination	13	11.21

Exposure to concussion. Various items were included to assess the participant's overall exposure to concussion information. Items were specific to participant attendance at a clinic/in-service related to youth concussion, whether the teacher has worked with one or more students with concussion, and whether the participant themselves or a family member has a history of concussion. Of the 126 individuals who responded to the item about a clinic/in-service, 52 individuals (41.27%) confirmed attendance, 74 individuals (58.73%) indicated they did not attend. Of the 126 who responded to the item related to working with a student with concussion, approximately three-quarters (72.22%) of the respondent pool confirmed such experience, while approximately one-quarter (27.78%) indicated no experience. Finally, as related to the participant themselves or a family member having a history of concussion, a little over half of the sample (56.45%) of 124 individuals reported affirmatively. If individuals answered "many" or “several” to the number questions, their data was not included in the mean and standard deviation calculations. Additionally, if the participant did not include answers to both components of the question, their data were not included. If separate years were provided, the totals were additive. The variable breakdown is depicted in Table 13.

Table 13

Participant Characteristics: Exposure to concussion

Variable	n	%	M(SD)
Clinic/in-service attendance (N=126)			
Yes	52	41.27	
No	74	58.73	
Number of clinics/in-services (N=49)			5.00(6.28)
Worked with student with concussion(s) (N=126)			
Yes	91	72.22	
No	35	27.78	
Number of students with concussion(s) (N=77)			5.26(6.71)
Self or family member experienced concussion(s) (N=124)			
Yes	70	56.45	
No	54	43.55	
Number of individuals known with concussion (including self) (N=66)			1.35(0.67)
Number of concussions (others and self) (N=66)			1.78(1.18)

Notes. Two people chose not to respond to the item regarding self or family member experienced concussion(s).

Sport participation. Participants were queried as to whether they had a history of engaging in sport as a participant, coach, or athletic trainer. Of the 126 respondents, 104 (%) confirmed a history of sport participation. One hundred and twenty-four participants answered the item regarding history of coaching sports, to which responses were roughly equal. A total of 60 participants (48.39%) reported that they had engaged in sport as a coach and 64 participants (51.61%) reported not having done so. Very few individuals (4 participants total) reported engaging in sport as an athletic trainer. If individuals answered “many” or “several” to the number questions, their data were not included in the mean and standard deviation calculations. Additionally, if the participant did not include answers to both components of the question, their data were not included. The variable breakdown is depicted in Table 14.

Table 14

Participant demographic characteristics: Sport participation

Variable	n	%	M(SD)
Participant (N=126)			
Yes	104	82.54	
No	22	17.46	
Number of sports (participant) (N=72)			1.89(1.06)
Number of years (participant) (N=72)			13.01(11.85)
Coach (N=124)			
Yes	60	48.39	
No	64	51.61	
Number of sports (coach) (N=43)			1.93(1.24)
Number of years (coach) (N=43)			12.65(17.61)
Athletic Trainer (N=126)			
Yes	4	3.17	
No	122	96.83	
Number of sports (athletic trainer) (N=3)			3.00(1.73)
Number of years (athletic trainer) (N=3)			6.00(3.61)

Notes. Two people chose not to respond to the item regarding history of coaching.

CHAPTER IV

RESULTS

Analytic Strategy

Descriptive statistics were run for the moderator variables in the study, which are encompassed in Chapter III. Chapter IV also includes descriptive statistics of the item responses for the variable indices, Concussion Knowledge Index (CKI), Concussion Attitudes Index (CAI), Return to Learn-Knowledge Index (RTL-KI), and Return to Learn-Adherence Index (RTL-AI). Excel and SPSS were used to calculate descriptive statistics. Based on number of groups within each variable, t-tests or Analysis of Variance (ANOVA) statistics were run. For the analytic model, assumptions for multiple regression analyses were tested. Internal consistency was measured to examine index reliability. A main effects model evaluating the predictor variables and outcomes variables was run. For predictors that were found to be statistically significant within the main effects model, a second multiple regression model was run to evaluate moderation interaction.

Descriptive Statistics

In considering the data available, descriptive analyses by item was completed for all variables. Tables 15 and 16 show the descriptive statistics from the Concussion knowledge component of the survey. Overall, participants responded correctly 26.98% to 100% of the time. Taken individually, participant accuracy across items ranged from 65.22% to 95.65%. These percentages were based off number of responded items for each participant. No participant answered all items correctly. All participants were aware that symptoms of a concussion can last for several weeks. Additionally, all participants recognized that one concussion does not have a negative impact on an individual's intelligence. Items related to medical testing, future well-being, and likelihood of later concussions were the most likely incorrect.

Table 15

Item responses: Concussion knowledge (True/False)

Item	n	% Correct
There is possible risk of death if a second concussion occurs before the first one has healed.	126	94.44
Running everyday does little to improve cardiovascular health. (N=126)	126	89.68
People who have had one concussion are more likely to have another concussion.	126	77.78
Cleats help athletes' feet grip the playing surface.	125	94.40
In order to be diagnosed with a concussion, you have to be knocked out.	126	99.21
A concussion can only occur if there is a direct hit to the head.	125	84.80
Being knocked unconscious always causes permanent damage to the brain.	126	85.71
Symptoms of a concussion can last for several weeks.	125	100.00
Sometimes a second concussion can help a person remember things that were forgotten after the first concussion.	126	80.16
Weightlifting helps to tone and/or build muscle.	126	100.00
After a concussion occurs, brain imaging (e.g., CAT Scan, MRI, X-Ray, etc.) typically shows visible physical damage (e.g., bruise, blood clot) to the brain.	126	37.30
If you receive one concussion and you have never had a concussion before, you will become less intelligent.	126	100.00
After 10 days, symptoms of a concussion are usually completely gone.	126	27.78
After a concussion, people can forget who they are and not recognize others but be perfect in every other way.	126	26.98
High school freshmen and college freshmen tend to be the same age.	126	97.62
Concussions can sometimes lead to emotional disruptions.	126	99.21
An athlete who gets knocked out after getting a concussion is experiencing a coma.	126	88.10
There is rarely a risk to long-term health and well-being from multiple concussions.	126	92.06
It is likely that Player Q's concussion will affect his long-term health and well-being.	124	70.97
It is likely that Player X's concussion will affect his long-term health and well-being.	124	91.94
It is likely that Player X's prior concussions will lead him/her to be more likely to sustain a concussion in his/her future.	124	79.84
Even though Player F is still experiencing the effects of the concussion, his/her athletic performance will be the same as it would be had s/he not suffered a concussion.	121	94.21
Even if Player F sustained a concussion, there is no reason for him/her to not continue to play.	121	94.21

Participants were asked to indicate symptoms associated with concussion. Only 111 individuals answered each question about concussion signs and symptoms over two different time periods. The least frequent endorsed signs/symptoms present within one hour of concussion included hives (0.00%), arthritis (0.00%), and weight gain (0.90%). The most frequently endorsed signs/symptoms within one hour included headaches (100.00%), difficulty concentrating (96.40%), and dizziness (95.50%). The most frequent, incorrectly endorsed item one hour post-concussion included difficulty speaking (76.58%). Headaches (100.00%) was the most frequent, correctly endorsed item one hour post-concussion. The least frequent endorsed signs/symptoms present up to one week following concussion included excessive studying, arthritis, and hives. The most frequently endorsed signs/symptoms present up to one week following concussion included headaches (98.20%), difficulty concentrating (94.59%), and difficulty remembering (81.08%). The most frequent correctly (headaches; 98.20%) and incorrectly (difficulty speaking; 45.05%) endorsed items up to one week post-concussion mirrored responses immediately following concussion, though at a reduced frequency per sign/symptom. In total, 1,818 signs and symptoms were endorsed by the 111 participants. Response rates are provided in Table 16.

Table 16

Item responses: Concussion knowledge – Endorsed concussion signs/symptoms

Signs/symptoms (N=111)	*n*	%	*n*	%
	Within one hour of concussion:		Up to one week following concussion:	
Hives	0	0.00	3	2.70
Headaches	111	100.00	109	98.20

Table 16 Continued

Signs/symptoms (N=111)	*n*	%	*n*	%
	Within one hour of concussion:		Up to one week following concussion:	
Difficulty speaking	85	76.58	50	45.05
Arthritis	0	0.00	2	1.80
Sensitivity to light	105	94.59	88	79.28
Difficulty remembering	103	92.79	90	81.08
Panic attacks	19	17.12	33	29.73
Drowsiness	93	83.78	73	65.76
Feeling in a fog	105	94.59	85	76.58
Weight gain	1	0.90	5	4.50
Feeling slowed down	93	83.78	88	79.28
Reduced breathing rate	39	35.14	26	23.42
Excessive studying	2	1.80	1	0.90
Difficulty concentrating	107	96.40	105	94.59
Dizziness	106	95.50	85	76.58
Hair loss	2	1.80	4	3.60

Statistics were also evaluated for correctly endorsed concussion signs/symptoms by individual study participants. These statistics can be found in Table 17. It should be noted when considering response accuracy that individuals could endorse more than the eight correct items and still classifying within the group "Correctly endorsed 8 items". To further elaborate, item response endorsements per individual ranged from 3 signs/symptoms to 12 within one hours of concussion and one sign/symptom to 14 up to one week following concussion. Overall, within one hour of concussion, a majority (67.57%) of respondents endorsed all eight sign/symptoms. The least number of correctly endorsed items was three, accounting for 2.70% of participants. When considering concussion signs/symptoms up to one week following concussion, 42.34% of participants correctly endorsed eight concussion items. One individual only correctly endorsed one sign/symptom. Comparison across time frames was generally comparable, though participants were less likely to correctly endorse signs/symptoms up to one week following concussion as compared to within one hour of concussion.

Table 17

Item responses: Individual accuracy percentages – Endorsed concussion signs/symptoms

Item endorsement (N=111)	*n*	%	*n*	%
	Within one hour of concussion:		Up to one week following concussion:	
Correctly endorsed 8 items	75	67.57	47	42.34
Correctly endorsed 7 items	21	18.92	24	21.62
Correctly endorsed 6 items	8	7.21	9	8.11
Correctly endorsed 5 items	3	2.70	16	14.41
Correctly endorsed 4 items	1	0.90	4	3.60
Correctly endorsed 3 items	3	2.70	8	7.21
Correctly endorsed 2 items	0	0.00	2	1.80
Correctly endorsed 1 item	0	0.00	1	0.90
Correctly endorsed 0 items	0	0.00	0	0.00

Descriptive statistics for concussion attitudes are provided in Table 18. These were on a Likert-type scale with possible item responses ranging from 1=Strongly disagree to 5=Strongly agree. Greatest agreement (smallest range of responses 1-3 or 3-5) was evident in determining whether a student who loses consciousness should be transported to the emergency room, whether concussion should be considered as important as other injuries, and whether the individual or teachers would have Student M return to play following a concussion. Mean and standard deviation statistics suggested greatest response consistency across participants in favor of strongly agreeing that even after sustaining a mild concussion, parents of athletes should be informed in order to monitor symptoms (M=4.90; SD=0.44). The greatest discrepancy in response consistency was reflected in whether the participant would continue playing a sport while having a headache from a minor concussion (SD=1.22).

Table 18

Item responses: Concussion attitudes

Item	n	M	SD	Med	Mode	Min	Max
I would continue playing a sport while also having a headache that resulted from a minor concussion.	118	1.80	1.22	1.00	1.00	1.00	5.00
I believe that coaches need to be extremely cautious when determining whether an athlete should return to play.	117	4.76	0.71	5.00	5.00	1.00	5.00
I believe that mouthguards protect teeth from being damaged or knocked out.	118	4.20	0.76	4.00	4.00	1.00	5.00
I believe that professional athletes are more skilled at their sport than high-school athletes.	117	4.32	0.89	5.00	5.00	1.00	5.00
I believe that concussions are less important than other injuries.	118	1.27	0.50	1.00	1.00	1.00	3.00
I believe that an athlete has a responsibility to return to a game even if it means playing while still experiencing symptoms of a concussion.	117	1.14	0.52	1.00	1.00	1.00	5.00
I believe that an athlete who sustains a concussion should be taken to the emergency room.	118	3.96	0.92	4.00	4.00	1.00	5.00
I believe that an athlete who is knocked unconscious should be taken to the emergency room.	118	4.68	0.54	5.00	5.00	3.00	5.00
Even if a mild concussion, I believe that if an athlete experiences a concussion, parents should be notified so they can watch for symptoms.	118	4.90	0.44	5.00	5.00	1.00	5.00
I believe that most high-school athletes will play professional sports in the future.	118	1.45	0.72	1.00	1.00	1.00	4.00
I believe that Coach A made the right decision to keep Player R out of the game.	117	4.79	0.65	5.00	5.00	1.00	5.00
Most teachers would believe that Coach A made the right decision to keep Player R out of the game.	117	4.31	0.85	4.00	5.00	1.00	5.00
I believe that Player R’s teammates will understand why he was pulled out of the game.	117	3.78	1.07	4.00	4.00	1.00	5.00
Most teachers will believe that Player R’s teammates will understand why he was pulled out of the game.	117	3.68	1.12	4.00	4.00	1.00	5.00
I believe that Athlete M should have returned to play during the first game of the season.	116	1.23	0.46	1.00	1.00	1.00	3.00
Most teachers would believe that Athlete M should have returned to play during the first game of the season.	115	1.65	0.85	1.00	1.00	1.00	3.00
I believe that Athlete M should have been reevaluated for concussion symptoms prior to returning to play.	114	4.77	0.50	5.00	5.00	2.00	5.00
Most teachers would believe that Athlete M should have been reevaluated for concussion symptoms prior to returning to play.	116	4.41	0.83	5.00	5.00	1.00	5.00
I believe that Athlete O should have returned to play during the semifinal playoff game.	116	1.35	0.73	1.00	1.00	1.00	5.00
Most teachers believe that Athlete O should have returned to play during the semifinal playoff game.	116	1.84	0.96	2.00	1.00	1.00	5.00
I believe that Athlete O should have been reevaluated for concussion symptoms prior to returning to play.	116	4.76	0.60	5.00	5.00	1.00	5.00

Table 18 Continued

Item	n	M	SD	Med	Mode	Min	Max
Most teachers would believe that Athlete O should have been reevaluated for concussion symptoms prior to returning to play.	116	4.34	0.81	4.00	5.00	1.00	5.00
I believe that the athletic trainer, rather than Athlete B, should make the decision about returning Athlete B to play.	111	4.35	1.02	5.00	5.00	1.00	5.00
Most teachers would believe that the athletic trainer, rather than Athlete B, should make the decision about returning Athlete B to play.	111	4.15	0.96	4.00	4.00	1.00	5.00
I believe that the coach and athletic trainer will likely agree on the decision about Athlete B returning to play.	112	3.26	1.07	3.00	3.00	1.00	5.00
Most teacher would believe that the coach and athletic trainer will likely agree on the decision about Athlete B returning to play.	112	3.29	0.94	3.00	3.00	1.00	5.00
I feel that Athlete H should tell his/her coach about the symptoms.	111	4.79	0.63	5.00	5.00	1.00	5.00
Most teachers would feel that Athlete H should tell his/her coach about the symptoms.	111	4.47	0.80	5.00	5.00	1.00	5.00
I believe that Athlete H should tell his/her parents about the symptoms.	111	4.78	0.59	5.00	5.00	1.00	5.00
Most teachers would believe that Athlete H should tell his/her parents about the symptoms.	111	4.57	0.72	5.00	5.00	1.00	5.00

Notes. SD=Standard deviation; Med=Median; Min=Minimum; Max=Maximum.

Descriptive statistics for Return to Learn knowledge is presented in Table 19. As with responses related to concussion attitudes, these items were also scored on a Likert-type scale with possible item responses ranging from 1=Strongly disagree to 5=Strongly agree. All items reflected similar ranges. There is one response with a bimodal distribution; the item pertains to the environmental stimuli of the classroom negatively affecting student performance. The item with the highest mean (M=4.63) suggested most participants strongly agreed that concussion can affect academic performance. The lowest mean (M=1.84) reflected that most participants strongly disagreed that a student recovering from concussion should be able to pay attention and concentrate at the same rate as peers. Standard deviation suggested the greatest response consistency in an item defining cognitive processes (SD=0.66). The greatest response discrepancy among participants was reflected in an item addressing memory of events prior to the concussion and learning post-concussion (SD=1.18).

Table 19

Item responses: Return to Learn knowledge

Item	n	M	SD	Med	Mode	Min	Max
Recovery from a concussion is complete when the individual is asymptomatic.	111	2.92	1.15	3.00	2.00	1.00	5.00
Concussion can affect academic performance.	111	4.63	0.76	5.00	5.00	1.00	5.00
Cognitive rest is important for recovery from a concussion.	111	4.44	0.84	5.00	5.00	1.00	5.00
'Cognitive' refers to thinking processes such as memory, attention, and learning.	111	4.57	0.66	5.00	5.00	1.00	5.00
Concussed students should be eligible for accommodations such as specialized instruction or other educational accommodations.	111	4.22	0.86	4.00	5.00	1.00	5.00
Long-term cognitive deficits only occur when the individual sustains multiple concussions.	111	3.63	1.15	4.00	4.00	1.00	5.00
A repeated concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems.	110	4.46	0.74	5.00	5.00	1.00	5.00
A concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things.	111	2.60	1.18	2.00	2.00	1.00	5.00
Symptoms of a concussion can last for several weeks.	110	4.50	0.70	5.00	5.00	1.00	5.00
Once a person recovering from a concussion feels 'back to normal', the recovery process is complete.	111	2.11	0.94	2.00	2.00	1.00	5.00
Environmental stimuli in the classroom (e.g., loud noises, bright lighting) can negatively affect a student's academic performance when recovering from concussion.	111	4.37	0.74	4.00	4.00; 5.00	1.00	5.00
A student recovering from a concussion may become fatigued more easily than peers.	110	4.35	0.67	4.00	4.00	1.00	5.00
A student recovering from concussion should be able to pay attention and concentrate at the same rate as peers.	111	1.84	0.87	2.00	2.00	1.00	5.00
A student recovering from concussion may need longer time to complete tasks or assignments.	111	4.33	0.69	4.00	4.00	1.00	5.00
A student recovering from concussion will have no difficulty organizing or shifting between tasks.	111	1.92	0.98	2.00	2.00	1.00	5.00
It is common for persons to experience changes in behavior (e.g., irritability, emotional) after a concussion.	110	4.17	0.74	4.00	4.00	1.00	5.00
It is uncommon for an individual to experience physical symptoms (e.g., headache, nausea, dizziness) following concussion.	111	1.86	1.08	2.00	2.00	1.00	5.00

Table 19 Continued

Item	n	M	SD	Med	Mode	Min	Max
It is typical for adverse academic effects to occur as a result of concussion.	111	3.93	0.79	4.00	4.00	1.00	5.00
It is atypical for adverse social/emotional effects to occur as a result of concussion.	111	2.46	1.09	2.00	2.00	1.00	5.00
Tolerance for cognitive activity is variable for each student recovering from concussion.	111	3.99	0.74	4.00	4.00	1.00	5.00

Notes. Item responses ranged from 1=Strongly disagree to 5=Strongly agree. SD=Standard deviation; Med=Median; Min=Minimum; Max=Maximum.

Descriptive statistics for Return to Learn adherence is presented in Table 20. As with responses related to concussion attitudes and Return to Learn knowledge, these items were also scored on a Likert-type scale with possible item responses ranging from 1=Strongly disagree to 5=Strongly agree. All items reflected similar ranges. The item with the highest mean (M=4.26) suggested most participants strongly agreed that consistent monitoring is necessary for students recovering from concussion. The lowest mean (M=2.04) reflected that most participants strongly disagreed that Return to Learn intervention does not have educational relevance. Standard deviation suggested the greatest response consistency in participants self-reporting history of or intention to seek out accommodation assistance for students who demonstrate concussion symptoms in the classroom (SD=0.78). The greatest response discrepancy among participants was reflected in an item addressing a team approach for concussion management (SD=1.41).

Table 20

Item responses: Return to Learn adherence

Item	n	M	SD	Med	Mode	Min	Max
Intervening with students who demonstrate post-concussive syndrome symptoms is the responsibility of the teacher.	93	3.59	0.90	4.00	4.00	1.00	5.00

Table 20 Continued

Item	n	M	SD	Med	Mode	Min	Max
I have or will seek accommodation assistance for students who demonstrate symptoms of a concussion in the classroom.	93	4.23	0.78	4.00	4.00	1.00	5.00
Consistent monitoring is necessary for students who are recovering from a concussion.	92	4.26	0.82	4.00	4.00	1.00	5.00
A team approach is unnecessary for management of students with a concussion.	93	2.30	1.41	2.00	1.00	1.00	5.00
Accommodations/modifications are useful in management of return to learn students.	93	4.16	0.80	4.00	4.00	1.00	5.00
I always implement accommodations/modifications for return to learn students in my classroom.	93	4.04	0.83	4.00	4.00	1.00	5.00
I feel confident in my ability to provide, manage, or handle concussed students within the classroom.	93	3.76	1.08	4.00	4.00	1.00	5.00
I do not believe that return to learn intervention has educational relevance.	92	2.04	1.04	2.00	2.00	1.00	5.00
I think my colleagues believe that return to learn intervention has educational relevance.	93	3.59	0.91	4.00	4.00	1.00	5.00
I think my school's administration believe that return to learn intervention has educational relevance.	93	3.81	0.90	4.00	4.00	1.00	5.00

Notes. Item responses ranged from 1=Strongly disagree to 5=Strongly agree. SD=Standard deviation; Med=Median; Min=Minimum; Max=Maximum.

Item response rate. The graphs below present the item response rates for the concussion and Return to Learn components of the survey. Overall, respondent rate decreased as the survey progressed.

Item response rate: Concussion. Figure 3 presents a graph of the response rate by participants for the concussion component of the study survey. The concussion component was 55 questions in total. Response rate varied from 111 responses to 126 responses per item. Overall, there is a decline in response rate as the survey progresses (i.e., over time) suggesting presence of respondent fatigue.

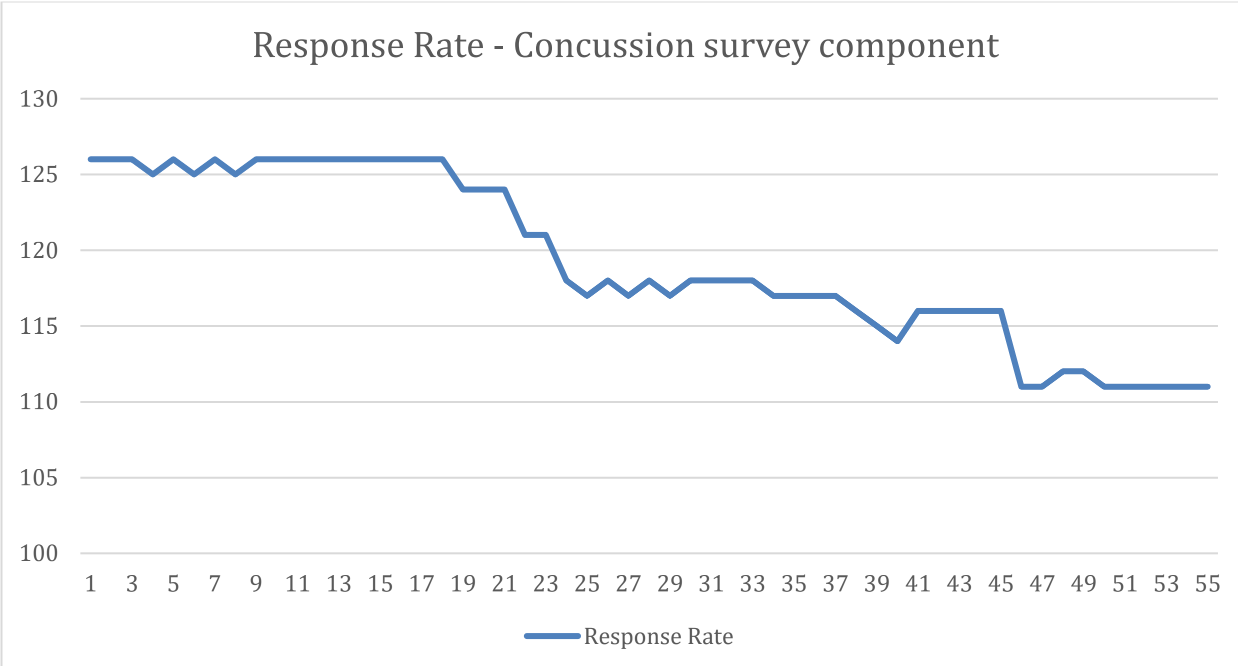

Figure 3. Item response rate for Concussion component of study survey. This graph depicts overall participant response rate by question. See Appendix B for item questions.

Item response rate: Return to Learn. Figure 4 present a graph of the response rate by participants for the Return to Learn component of the study survey. The Return to Learn component consisted of 30 items in total. Response rate varied from 93 responses to 111 responses per item. As seen in Figure 4, there is a significant drop in response rate after question 20. Starting with question 21 on the survey, there was a new directions template. It is hypothesized that participants experienced peak testing fatigue when viewing the new set of directions and consequently prematurely ended the survey.

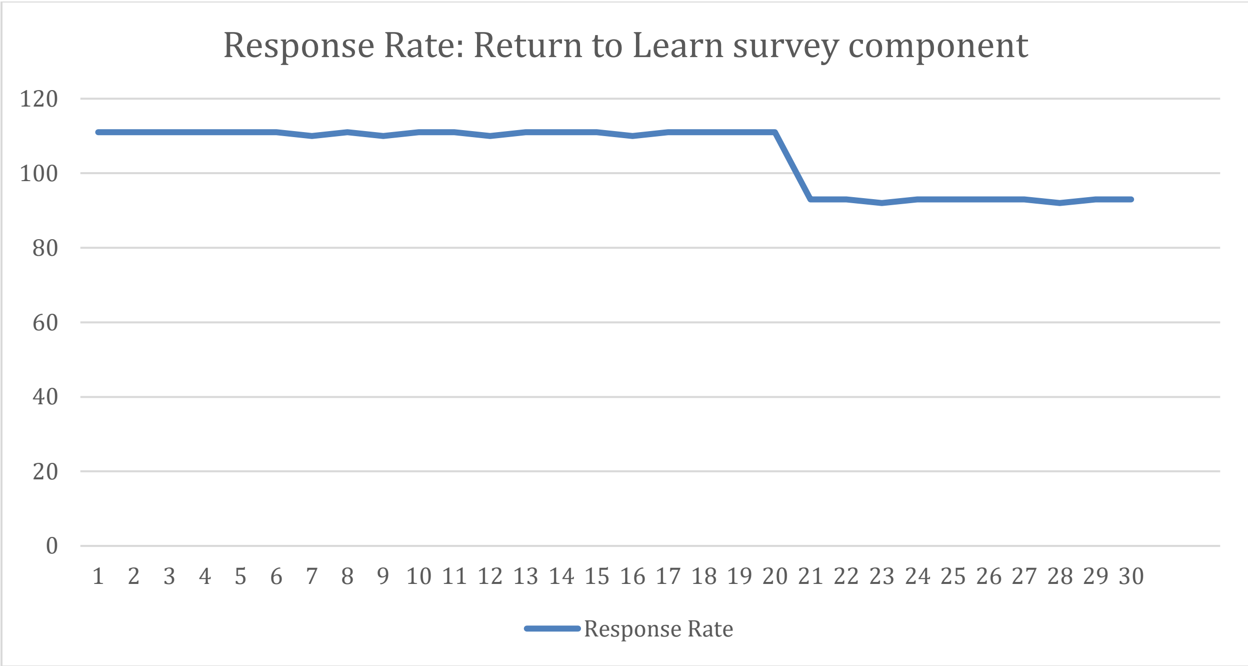

Figure 4. Item response rate for Return to Learn component of study survey. This graph depicts overall participant response rate by question. See Appendix C for item questions.

Validity Items

The survey included four validity questions to address attentiveness to the survey. These questions were included in the concussion survey component. Questions were considered to address general public knowledge and not related specifically to concussion. Participants earned a score of 0-4 based on number of correct answers; scores of 0-1 were considered unacceptable and responses were further evaluated to consider exclusion from the study. One individual did not answer item 4 and could therefore not be given a validity score. This respondent's data were further evaluated and considered valid. Descriptive statistics regarding the validity items are presented in Table 21 and Table 22.

Table 21

Validity questions and response percentages

Question	% True	% False
2. Running everyday does little to improve cardiovascular health.	10.32	89.68
4. Cleats help athletes' feet grip the playing surface.	94.40	5.60
10. Weightlifting helps to tone and/or build muscle.	100.00	0.00
15. High school freshman and college freshman tend to be the same age.	2.38	97.62

Notes. One hundred and twenty-six participants answered items 2, 10, and 15. One hundred and twenty-five participants answered item 4.

Table 22

Validity questions and respondent accuracy scores by percentage

Scores (N=125)	%
Validity score of 4	83.20
Validity score of 3	15.20
Validity score of 2	1.60
Validity score of 1	0.00
Validity score of 0	0.00

Preliminary Statistical Testing

Based upon number of groups within each variable, t-tests or Analysis of Variance (ANOVA) statistics were run in order to investigate whether there was a statistical difference between groups when predicting dependent variables. T-tests were utilized for variables with two groups; ANOVAs were utilized for variables with three or more groups. Analyses are further described according to the two dependent variables of the study.

Knowledge of Return to Learn.

Sex. An independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by male and female participants. There was no significant difference in the knowledge of Return to Learn scores for male and female participants, $t(38)=-0.19$, $p=0.85$.

Age. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by participant age. Five age groups were identified among participant data. No significant difference was found when considering scores of differing age categories, $F(4,100)=2.19$, $p=0.08$.

Location. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by participant location. Regional representation (e.g., Northeast, Midwest, South, West) was considered to identify four participant groups. No significant difference was found among groups based on location and scores of knowledge of Return to Learn, $F(3,103)=0.88$, $p=0.45$.

Community size. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by participant community size. Seven groups were identified. No significant difference was found, $F(6,96)=0.53$, $p=0.78$.

Educational attainment. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by participant educational attainment. Participants were categorized based on four groups. No significant difference was found as related to groups and scores on knowledge of Return to Learn, $F(3,103)=1.77$, $p=0.16$.

Years of experience. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by participant years of experience. Participants were categorized into seven groups ranging from <1-5 years to 31+ years. No significant difference was found between groups, $F(6,97)=1.11$, $p=0.36$.

Grade. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by grade(s) taught by the survey participants. Six groups were created based on participant responses. No significant difference was found with consideration of grouping among the grade variable, $F(5,95)=0.51$, $p=0.77$.

Subject. A one-way ANOVA was conducted to compare the knowledge of Return to Learn as reported by subject(s) taught by the survey participants. Three groups were created. There was no significant difference found as related to groups and knowledge of Return to Learn, $F(2,97)=0.35$, $p=.70$.

History of sport participation. Three independent-samples t-tests were run according to this variable due to distinction between history as a participant, coach, and trainer. The first independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals and their endorsement of history of sport participation as a participant. The second independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals and their endorsement of history of sport participation as a coach. The third independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals and their endorsement of history of sport participation as a trainer. Two groups were created for each t-test, as dichotomous (e.g., yes or no) responses were provided by participants regarding history of sport participation. No significant difference was found in the groups across any of the variable roles (participant, coach, trainer). History of sport participation as a participant yielded $t(23)=0.81$, $p=0.42$; history of sport participation as a coach yielded $t(96)=0.32$, $p=0.75$; history of sport participation as a trainer yielded $t(1)=2.42$, $p=0.25$.

History of concussion. An independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals who endorsed or did not endorse history of concussion. There was a significant difference found in the two groups regarding endorsement of history of concussion versus no endorsement of history of concussion as related to knowledge of Return to Learn, t(88)=2.86, p=<0.01.

Engagement in training/in-service. An independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals who endorsed or did not endorse history of engagement in training/in-service. No significant difference was found between groups who reported training versus reported no training as related to the dependent variable, knowledge of Return to Learn, t(105)=1.87, p=0.06.

Experience working with student with concussion. An independent-samples t-test was conducted to compare knowledge of Return to Learn as reported by individuals who endorsed or did not endorse experience working with student with concussion. No significant different was found between the two groups as related to knowledge of Return to Learn scores, t(39)=1.83, p=0.08.

Adherence to Return to Learn protocols.

Sex. An independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by male and female participants. There was no significant difference in the adherence to Return to Learn protocols scores for male and female participants, t(25)=1.26, p=0.22.

Age. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by participant age. Five age groups were identified among participant data: 20-29 years old, 30-39 years old, 40-49 years old, 50-59 years old, and 60 years and older. No significant difference was found when evaluating scores of differing age categories related to adherence to Return to Learn protocols, F(4,82)=0.73, p=0.58.

Location. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by participant location. Regional representation (e.g., Northeast, Midwest, South, West) was considered to identify four participant groups. There was a significant difference found when considering groups and scores on adherence to Return to Learn protocols, $F(3,85)=5.18$, $p=<0.01$. This suggests that a teacher's regional location may have a role in varying adherence to Return to Learn protocol.

Community size. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by participant community size. Seven groups were identified. No significant difference was found, $F(5,81)=0.79$, $p=0.56$.

Educational attainment. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by participant educational attainment. Participants were categorized based on four groups: Associate's degree, Bachelor's degree, Master's/Professional degree, and PhD/EdD, or equivalent. No significant difference was found between groups as related to groups and scores on adherence to Return to Learn protocols, $F(3,85)=1.72$, $p=0.17$.

Years of experience. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by participant years of experience. Participants were categorized into seven groups ranging from <1-5 years to 31+ years. No significant difference was found with consideration of years of experience groups, $F(6,79)=1.94$, $p=0.09$.

Grade. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by grade(s) taught by the survey participants. Six groups were created based on participant responses. No significant difference was found with consideration of grouping of the grade variable, $F(5,77)=0.88$, $p=0.50$.

Subject. A one-way ANOVA was conducted to compare the adherence to Return to Learn protocols as reported by subject(s) taught by the survey participants. Three groups were created: Academics, Special topics, and Combination. There was no significant difference found as related to groups and adherence to Return to Learn protocols scores, $F(2,79)=1.11$, $p=.33$.

History of sport participation. Three independent-samples t-tests were run according to this variable due to distinction between history as a participant, coach, and trainer. The first independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals and their endorsement of history of sport participation as a participant. The second independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals and their endorsement of history of sport participation as a coach. The third independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals and their endorsement of history of sport participation as a trainer. Two groups were created for each t-test based on dichotomous (e.g., yes or no) responses were provided by participants regarding history of sport participation. No significant difference was found in the groups across any of the variable roles (participant, coach, trainer). History of sport participation as a participant yielded $t(20)=0.45$, $p=0.66$.; history of sport participation as a coach yielded $t(86)=1.84$, $p=0.07$; history of sport participation as a trainer yielded $t(2)=3.41$, $p=0.08$.

History of concussion. An independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals who endorsed or did not endorse history of concussion (self, family member, or friend). There was no significant difference in the two groups when considering adherence to Return to Learn protocols, $t(79)=1.96$, $p=0.05$.

Engagement in training/in-service. An independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals who endorsed or did not endorse history of engagement in training/in-service. A significance difference was found in the two groups related to scores regarding adherence to Return to Learn protocols, $t(85)=2.70$, $p=<0.01$.

Experience working with student with concussion. An independent-samples t-test was conducted to compare adherence to Return to Learn protocols as reported by individuals who endorsed or did not endorse experience working with student with concussion. No significant difference was found between the two groups as related to scores regarding adherence to Return to Learn protocols, $t(30)=1.68$, $p=0.10$.

Assumptions of the Model

Assumptions of multiple linear regression include (a) linear relationship, (b) multivariate normality, (c) no multicollinearity, and (d) homoscedasticity. These assumptions were evaluated with the data set prior to running multiple regression analyses. For all models, Durbin-Watson statistics and collinearity statistics were considered to fall within appropriate ranges. In testing normality, residuals suggested minimal concern regarding multivariate normality and linear relationship of the models. Data, specifically dependent variables, suggested slight skewness to the right, though this can be expected given limitations of self-report bias. Skewness was determined to not be significant enough to warrant transformation of the data.

Reliability Statistics

Cronbach's alpha was calculated to test for internal consistency among item responses. Alpha values were determined for each of the four indices evaluating true/false and Likert-style responses. One question was not included in the calculations due to the multi-selection nature of the question. Cronbach's alpha values can be seen in Table 23. Overall, alpha values were poor to moderate. In the analyses it was noted that some items were not computed in the alpha calculation due to determinant of the covariance matrix being at or close to zero. When evaluating the items that could have been removed, alpha values would not have significantly differed even with item changes.

Table 23

Cronbach's alpha values for index scores

Index	Cronbach's Alpha value	Cronbach's Alpha (Standardized Items)
Concussion Knowledge Index (CKI)	.435	.388
Concussion Attitudes Index (CAI)	.583	.599
Return to Learn Knowledge Index (RTL-KI)	.623	.664
Return to Learn Adherence Index (RTL-AI)	.567	.649

Analyses & Research Questions

Eight research questions were identified for this current study. Through the eight research questions, fourteen demographic variables were highlighted. Four relationship models were examined for each of the hypothesized moderator variables, for a total possibility of 56 specific relationships to be analyzed.

A main effect model was first run to determine the relationship between predictors and criterion variables. Secondly, a model with both predictors and moderator variables was run based on statistically significant items from the first model. Individual models for each dependent variable, Return to Learn Knowledge Index and Return to Learn Adherence Index, were conducted. Taken together, approximately 80.1% of the variance of the dependent variable, Return to Learn Knowledge Index, is explained by the predictor variables (see Table 24). Further, the regression model was found to be statistically significant [$F(16,92)=28.215$, $p<.001$; see Table 25]. Found in Appendix K, Table 31 depicts the coefficients of the main effect model for dependent variable, RTL-KI.

Table 24

Model summary of main effect model for dependent variable Return to Learn Knowledge Index

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.911	.831	.801	11.62728

Table 25

ANOVA table of main effect model for dependent variable Return to Learn Knowledge Index

Model	Sum of Squares	df	Mean Square	F	Significance
Regression	61032.377	16	3814.524	28.215	<.001***
Residual	12437.806	92	135.194		
Total	73470.183	108			

Notes. ANOVA= Analysis of Variance; df= degrees of freedom; *p<.05, **p<.01, ***p<.001

The regression model with consideration of interaction effect between independent variables can explain approximately 42.8% of the variance of the dependent variable, RTL-KI (see Table 26). Table 27 reflects statistical significance within the model [F(2,122)=47.486, p<.001]. Results of statistically moderator analyses is embedded within the research question for the moderator variable, age (see Table 30).

Table 26

Moderator regression model summary of statistically significant values from main effect model (RTL-KI)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.662	.438	.428	20.99119

Table 27

Moderator regression ANOVA of statistically significant values from main effect model (RTL-KI)

Model	Sum of Squares	df	Mean Square	F	Significance
Regression	41847.837	2	20923.919	47.486	<.001***
Residual	53756.851	122	440.630		
Total	95604.688	124			

Notes. ANOVA= Analysis of Variance; df= degrees of freedom; *p<.05, **p<.01, ***p<.001

As with Return to Learn Knowledge, Table 28 suggests that 26.7% of the variance can be explained by the model with all predictors included. The ANOVA summary as seen in Table 29 supports the notion of a statistically significant multiple regression model [F(16,92)=3.458, p<.001]. Found in Appendix L, Table 32 depicts the coefficients of the main effect model for dependent variable, RTL-AI.

Table 28

Model summary of main effect model for dependent variable Return to Learn Adherence Index

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	.613	.376	.267	15.04077

Table 29

ANOVA table of main effect model for dependent variable Return to Learn Adherence Index

Model	Sum of Squares	df	Mean Square	F	Significance
Regression	12515.927	16	782.245	3.458	.<001***
Residual	20812.679	92	226.225		
Total	33328.606	108			

Notes. ANOVA= Analysis of Variance; df= degrees of freedom; *p<.05, **p<.01, ***p<.001

Research question 1: Sex. Does teacher sex moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher sex. Teacher sex was classified as a qualitative, categorical (dichotomous) variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining sex as a predictor of Return to Learn Knowledge, sex was not found to be statistically significant. While the overall model was found to be statistically significant, sex did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.07).

Return to Learn adherence index model (see Table 32). As with the prior model, the overall regression was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Teacher sex was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (p=.45).

Research question 2: Age. Does teacher age moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher age. Teacher age was classified as a quantitative, continuous variable.

Return to Learn knowledge index model (see Tables 30, 31). Within the main effects model evaluating the predictor variables on dependent variable Return to Learn Knowledge Index, age was found to be a statistically significant predictor variable (p=.04). For every one increased unit of change in age (years), the outcome variable, Return to Learn Knowledge Index, increases by 0.35. Additionally, the independent variables, Concussion Knowledge Index (CKI) and Concussion Attitude Index (CAI) were both found to be statistically significant to the model at p<.001 (see Table 31). For each one increased unit of change in CKI and CAI, participant knowledge about Return to Learn increased by 2.95 and 0.37, respectively. To investigate if age has a role as a moderator variable on CKI and CAI, a second regression was conducted with two products: CKI and age, and CAI and age (see Table 30). This model also was determined to be statistically significant. Age was determined to have a statistically significant interaction with CAI, though the unit change, or unstandardized beta, did not differ significantly from the unstandardized beta of the main effect model.

Table 30

Moderator regression coefficient table of statistically significant values from main effect model (RTL-KI)

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	T	Significance	Confidence Interval (95%)	
						Lower Bound	Upper Bound
(Constant)	30.762	5.665		5.430	.000	19.548	41.976
CKI*Age	-.011	.011	.154	-1.000	.319	-.032	.010
CAI*Age	.013	.003	.796	5.167	<.001***	.008	.018

Notes. *p<.05, **p<.01, ***p<.001

Return to Learn adherence index model (See Table 32). The overall regression model was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Despite the model significance, teacher age was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (*p*=.87).

Research question 3: Location, community size. These variables are broken down into two specific research questions. The first question addresses the variable, location, and the second question addresses the variable, community size.

Teacher location. Does teacher location moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher location. Teacher location was classified as a qualitative, categorical variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining location as a predictor of Return to Learn Knowledge, teacher location was not found to be statistically significant. While the overall model was found to be statistically significant, location, or geographical region, did not represent a statistically significant predictor of the dependent variable, RTL-KI (*p*=.90).

Return to Learn adherence index model (see Table 32). Teacher geographical region, or location, was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable. While the overall regression model was found to be statistically significant, teacher geographical region was not found to be a statistically significant predictor variable (*p*=.36)

Teacher community size. Does teacher community size moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher community size. Teacher community size was classified as a quantitative, categorical variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining community size as a predictor of Return to Learn Knowledge, teacher community size was not found to be statistically significant. While the overall model was found to be statistically significant, community size, or community population, did not represent a statistically significant predictor of the dependent variable, RTL-KI (*p*=.99).

Return to Learn adherence index model (see Table 32). Community population size was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable.

While the overall regression model was found to be statistically significant, community population size was not found to be a statistically significant predictor variable (p=.05). Limitations will be discussed further in Chapter V, though the small sample size may have been a factor in this variable.

Research question 4: Teacher educational attainment. Does teacher educational attainment moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher educational attainment. Teacher educational attainment was classified as a qualitative, categorical variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining educational attainment as a predictor of Return to Learn Knowledge, teacher educational attainment was not found to be statistically significant. While the overall model was found to be statistically significant, educational attainment did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.79).

Return to Learn adherence index model (See Table 32). As with the prior model, the overall regression was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Teacher educational attainment was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (p=.44).

Research question 5: Teacher experience. Does teacher years of experience moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher years of experience. Teacher years of experience was classified as a quantitative, continuous variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining teacher years of experience as a predictor of Return to Learn Knowledge, years of experience was not found to be statistically significant. While the overall model was found to be statistically significant, teacher years of experience did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.21).

Return to Learn adherence index model (see Table 32). Teacher years of teaching experience was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable. While the overall regression model was found to be statistically significant, teacher years of experience was not found to be a statistically significant predictor variable (p=.53)

Research question 6: Teacher grade, subject. These variables are broken down into two specific research questions. The first question addresses the variable, teacher grade, and the second question addresses the variable, teacher subject.

Teacher grade. Does teacher grade moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher grade. Teacher grade was classified as a qualitative, categorical variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining grade as a predictor of Return to Learn Knowledge, teacher grade was not found to be statistically significant. While the overall model was found to be statistically significant, teacher grade did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.43).

Return to Learn adherence index model (see Table 32). The overall main effect model was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Despite this regression significance, teacher grade was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (p=.68).

Teacher subject. Does teacher subject moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher subject. Teacher subject was classified as a qualitative, categorical variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining subject as a predictor of Return to Learn Knowledge, teacher subject was not found to be statistically significant. While the overall model was found to be statistically significant, teacher subject/classes taught did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.84).

Return to Learn adherence index model (see Table 32). Teacher subject was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable. While the overall regression model was found to be statistically significant, teacher subject/classes was not found to be a statistically significant predictor variable (p=.96)

Research question 7: Teacher history of sport participation, concussion. These variables are broken down into two specific research questions. Both variable center on the context of teacher history. The first question addresses the variable, teacher history of sport participation, and the second question addresses the variable, teacher history of concussion.

Teacher history of sport participation. Does teacher history of sport participation moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher history of sport participation. Teacher history of sport participation was classified as a qualitative, categorical (dichotomous) variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining teacher history of sport participation as a predictor of Return to Learn Knowledge, teacher history of sport participation as participant, coach, or trainer was not found to be statistically significant. While the overall model was found to be statistically significant, teacher history of sport participation did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.46, p=.37, p=.60 respectively).

Return to Learn adherence index model (see Table 32). As with the prior model, the overall regression was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Teacher history of sport engagement as a participant, coach, or trainer was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (p=.39, p=.16, p=.76 respectively).

Teacher history of concussion. Does teacher history of concussion moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher history of concussion. History of concussion was defined as either the respondent personally experiencing a concussion or family or friend. Teacher history of concussion was classified as a qualitative, categorical (dichotomous) variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining teacher history of concussion as a predictor of Return to Learn Knowledge, teacher history of concussion was not found to be statistically significant. While the overall model was found to be statistically significant, history of concussion did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.17).

Return to Learn adherence index model (see Table 32). Teacher history of concussion was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable. While the overall regression model was found to be statistically significant, report of concussion by the respondent or a family member or friend was not found to be a statistically significant predictor variable (p=.22).

Research question 8: Teacher engagement in concussion training/in-service, working with student with concussion. These variables are broken down into two specific research questions. Both variable center on the context of teacher experience. The first question addresses teacher engagement/attendance in concussion training or in-service, and the second question addresses the variable, teacher experience working with student with concussion.

Teacher attendance of concussion training/in-service. Does teacher engagement in training or in-service about concussion moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher history of training or in-service about concussion. Reporting of teacher training or in-service about concussion was classified as a qualitative, categorical (dichotomous) variable.

Return to Learn knowledge index model (See Table 31). Within the main effect model examining reporting of teacher training/in-service about concussion as a predictor of Return to Learn Knowledge, the predictor was not found to be statistically significant. While the overall model was found to be statistically significant, teacher engagement in concussion training/in-service did not represent a statistically significant predictor of the dependent variable, RTL-KI (p=.30).

Return to Learn adherence index model (See Table 32). Teacher engagement in concussion training/in-service was examined as a predictor in the main effect model of regression on the dependent variable, Return to Learn Adherence Index to determine significance and possible role as a moderator variable. While the overall regression model was found to be statistically significant, teacher training/in-service on concussion was not found to be a statistically significant predictor variable (*p*=.65)

Teacher experience working with student with concussion. Does teacher experience in working with a student with concussion moderate the association between teacher concussion knowledge and attitudes, and knowledge of and adherence to Return to Learn protocols? Based on the lack of prior research regarding this topic, the null hypothesis was applied. Therefore, it was hypothesized that there would be no statistically significant difference in the association, even with the implication of the moderator variable of teacher experience in working with a student with concussion. Teacher experience with student concussion was classified as a qualitative, categorical (dichotomous) variable.

Return to Learn knowledge index model (see Table 31). Within the main effect model examining teacher experience with student with concussion as a predictor of Return to Learn Knowledge, the predictor was not found to be statistically significant. While the overall model was found to be statistically significant, teacher experience with student concussion did not represent a statistically significant predictor of the dependent variable, RTL-KI (*p*=.75).

Return to Learn adherence index model (see Table 32). As with the prior model, the overall model was found to be statistically significant in predicting variance of the dependent variable, Return to Learn Adherence Index. Teacher experience with student concussion was not found to be statistically significant as a predictor of dependent variable and was thus not considered as a moderator variable (*p*=.63).

CHAPTER V

SUMMARY

The goal of this current study was to examine current teachers' knowledge and attitudes as related to youth concussion and Return to Learn protocols. Further, investigators wanted to evaluate whether potential moderator variables (e.g., demographic variables) were related to a change in association between independent and dependent variables. There is very minimal empirical literature within the field assessing teachers' knowledge of and attitudes regarding these topics. Those studies that have been done indicate the need for further training for teachers in these areas.

An independent-samples t-test or one-way ANOVA was run with each moderator variable as related to each dependent variable. Results suggested a significant difference with three analyses. A significant difference was found as related to history of concussion and scores of knowledge of Return to Learn, suggesting a difference in scores among individuals who reported a history of concussion versus individuals who reported no history of concussion. A one-way ANOVA conducted to compare the adherence to Return to Learn protocols as reported by participant location suggested a significant difference. Finally, a significant difference was found in an independent-samples t-test comparing groups who have history teacher in-service/training versus no history of in-service/training as related to adherence to Return to Learn protocols.

When evaluating independent and dependent variables, Concussion Knowledge Index (CKI) and Concussion Attitudes Index (CAI) were found to have statistically significant representation in predicting RTL-KI. This suggests that with increased CKI and CAI, teachers are more likely to report higher levels of knowledge as related to Return to Learn. Targeting overall concussion trainings emphasizing concussion knowledge and concussion attitudes or beliefs may increase general knowledge of Return to Learn within the school environment.

Of the demographic variables included in the study, age was the only variable that had a significant effect as a moderator variable. The relationship suggests that as age increases, individuals are more likely to have an increased knowledge of the concept of Return to Learn. Further, age was found to have a statistically significant interaction effect with CAI in predicting RTL-KI. Given these results, it is suggested that a teacher's increased age in years is beneficial when considering knowledge of Return to Learn students in their classrooms. No other variables were found to have a significant association with RTL-KI, and no variables were found to have a significant association with RTL-AI.

Implications

Given the association with increased age in years and increased association with knowledge of Return to Learn, it would be beneficial to target young teachers, or teachers who recently completed their training programs. Implementing concussion knowledge and awareness lessons within teacher preparation programs at colleges and universities may be an ideal direction. While it is encouraging to know that older teachers have increased knowledge regarding students who may be returning to the classroom with the RTL protocol in place, researchers believe that the knowledge must be consistent across all teachers for optimum benefit to the students.

Limitations

While efforts were made to minimize limitations within the current study, biases are present that may affect validity factors. These suspected limitations include sample size, convenience sampling, volunteer, bias, and social desirability bias. Additionally, researchers hypothesize that the length of the survey may have negatively affected participant attrition regarding completion of the survey in its entirety.

Sampling. A significant limitation to this current research study is the sample size. While numerous different methods were attempted to recruit participants at various time points, a relatively small participant size was obtained for the study. This limitation should be considered when evaluating generalizability of results. Given the social media avenue of participant recruitment involved in the current study, it is likely that a convenience sampling bias may be present within the data set. The researcher presented the Qualtrics link to contacts via social media to an easily accessible participant pool. Additionally, regarding recruitment efforts via public email addresses, there was a convenience component introduced as to whether or not emails were made public. Recruitment emails were sent to all public email addresses found by the researcher.

Due to the recruitment methods involved in this study, there should be a reasonable expectation of volunteer bias introduced to the sample. This volunteer bias is inherent within the convenience sampling aspect of the study. Participants were not required to participate and could cease continuation of the study at any time without penalty. Given that participants were gathered on a volunteer basis, individuals who chose to participate in the study may have specific interests in, exposure to, or experience with concussion. Therefore, participants may not be representative of the typical population.

Social desirability bias. Social desirability is recognized as "the tendency of some respondents to report an answer in a way they deem to be more socially acceptable than would be their 'true' answer" as it "project[s] a favorable image of themselves" to others (Callegaro, 2011, p. 826). It is reasonable to assume that social desirability may be present within the responses. Individuals within any job aspect likely do not want to admit gaps in knowledge or negative perspectives. Given that teachers likely interact with students with concussion, they may have responded in a way that suggests a more positive attitude as related to concussion and concussion protocol. Additionally, in reflecting on their co-workers and administration in response to concussion, participants may have responded in a more positive manner.

Respondent fatigue. Prior research suggests that longer surveys often obtain less participants due to testing, or respondent, fatigue (Rolstad, Adler, & Ryden, 2011). In total, the survey component of the current study consisted of between 105 to 111 total questions depending on the individual's experience (e.g., those who responded "yes" to a specific demographic question were queried further as to specific numbers and experiences). Efforts were made to shorten the length of the survey; however, it was the researchers' intention to utilize the data for additional purposes in the future beyond the current study. Therefore, more data were collected. In distributing the survey, participants were informed that completion of the survey would take approximately 25 minutes. In evaluating the data, it is likely that individuals experienced respondent fatigue, as many individuals stopped the survey at the last question block. For those participants who completed the study, respondent fatigue may have affected their responses, particularly toward the end of the survey. In attempt to counter this concern, questions were implemented throughout the survey to ensure participant attention to responses.

Power. Based on power analyses, the current study necessitated 89 completed surveys to ensure appropriate generalizability across the population; however, given the number of moderating variables to the study, this number is likely severely underestimated. Ideally, the survey would have been completed by several hundred participants in order to obtain appropriate statistical power within the study. This limitation hinders the validity of results obtained through the current study.

Future Directions

Prior research suggested a significant lack of empirical literature related to concussion and return to learn among the teacher population. Many articles pertaining to the topic propose ideal treatment and service when working with youth affected by concussion, however, data collection is sparse. This study took an initial step in addressing this gap in the literature, which will continue to warrant further attention. Youths will undoubtedly continue to sustain concussions, and consequently effects of such concussions will likely affect their school functioning to variable degrees dependent on the individual. A future study with expansive data collection would be ideal in better understanding common teacher knowledge and awareness. Separately addressing study variables regarding concussion versus return to learn protocol also may be applicable. Further, honing in on specific demographic populations, such as young teachers, may be useful, particularly as related to intervention possibilities. Statistically, future studies may re-evaluate alternative hypotheses. The current study utilized the null hypotheses due to lack of prior research specifically within concussion and Return to Learn literature. Alternative hypotheses presented by overarching theoretical premises would be favorable for publication purposes. Overall, the topic warrants significant advancement within the empirical literature.

Conclusions

Glang, McCart, Moore, and Davies (2017) supported the notion that individuals who are better educated or exposed to a specific population or concern are more likely to report higher levels of perceived abilities across all job tasks. While one of the purposes of this current study was to highlight the importance of concussion education, an increased self-efficacy across all job tasks through psychoeducation on a sole topic is invaluable. Throughout review of the literature for this current study, it was suggested that teachers are eager for further education as related to concussion. While barriers certainly exist in the school environment, knowledge and training in this area is vital to student functioning in the educational setting. This study suggests that age acts as both a direct variable in predicting RTL-KI, as well as a moderating interaction with CAI in predicting RTL-KI. As teacher age increases in years, there is an increase in overall teacher knowledge of Return to Learn regarding students with concussion. Additionally, higher CKI and CAI were found to predict increased knowledge of RTL. No variables were found to have individual nor interaction effects in predicting teacher adherence to Return to Learn protocols in the school environment. Future research should focus on large teacher data sets related to the topics of concussion and Return to Learn. Additionally, intervention efforts may target pre-service teachers or teaching curriculums within colleges and universities in order to better equip young teachers with appropriate knowledge of concussion and Return to Learn prior to entering the classroom.

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APPENDIX A

DEMOGRAPHICS QUESTIONNAIRE

General:

1. What is your sex? Male Female Choose not to respond
2. What is your age (in years)? ________________
3. What is your race/ethnicity?

   White (Non-Hispanic) Hispanic or Latino Black or African American

   Native American or American Indian Asian/Pacific Islander Other
4. What state do you currently teach in? ___________________
5. What school setting do you currently teach in?

   Public school Private school Charter school
6. What population size best describes the geographic area that you teach in?

   <25,000 25,000-100,000 100,000-250,000 250,000-500,000

   500,000-750,000 750,000-1,000,000 >1,000,000
7. What is your highest level of education completed?

   Associate's degree Bachelor's degree Master's/Professional degree

   PhD/EdD, or equivalent Other______________

School Context and Experience:

8. Are you a certified teacher? Yes No
9. Did you get certified through alternative procedures? Yes No
10. Do you teach Special Education classes or General Education classes?

    Special Education General Education Both
11. How many years of teaching experience do you have? _____________________

12. Which of the following roles do you have within the school environment?

    Teacher   Teacher/Coach   Teacher/Athletic Trainer

    Teacher/Coach outside of the school setting   Other

13. Select what grade(s) you are currently teaching.

    5th   6th   7th   8th

    9th   10th   11th   12th

14. What class(es) or subject area(s) are you currently teaching? ______________________

15. Have you ever attended a clinic/in-service or taken a class on concussion recognition/intervention?

    Yes   No

    If Yes, how many? ______________

16. Have you worked with in a school setting with a student who has had a concussion?

    Yes   No

    If Yes, how many? ______________

Sport Context and Experience:

17. Have you ever engaged in sports as a participant?

    Yes   No

    If Yes, what sport(s) and for approximately how many years? (Note: 6 months is equivalent to 0.5 years.)

    ____

18. Have you ever engaged in sports as a coach?

    Yes   No

If Yes, what sport(s) and for approximately how many years? (Note: 6 months is equivalent to 0.5 years.)

____

19. Have you ever engaged in sports as an athletic trainer?

Yes No

If Yes, what sport(s) and for approximately how many years? (Note: 6 months is equivalent to 0.5 years.)

____

20. Have you or any of your family/friends ever been diagnosed with a concussion?

Yes No

If Yes, how many an what relationship was this person to you? _____________

APPENDIX B

CONCUSSION QUESTIONNAIRE*
(Adapted from Rosenbaum, 2010 [RoCKAS-ST])

NOTE: The phrase "Return to play/competition" refers to being cleared to play in both practice and games.

Section 1:

Directions: Please read the following statements and select TRUE or FALSE for each question.

1. There is possible risk of death if a second concussion occurs before the first one has healed. T F
2. Running everyday does little to improve cardiovascular health. T F
3. People who have had one concussion are more likely to have another concussion. T F
4. Cleats help athletes' feet grip the playing surface. T F
5. In order to be diagnosed with a concussion, you have to be knocked out. T F
6. A concussion can only occur if there is a direct hit to the head. T F
7. Being knocked unconscious always causes permanent damage to the brain. T F
8. Symptoms of a concussion can last for several weeks. T F
9. Sometimes a second concussion can help a person remember things that were forgotten after the first concussion. T F
10. Weightlifting helps to tone and/or build muscle. T F
11. After a concussion occurs, brain imaging (e.g., CAT Scan, MRI, X-Ray, etc.) typically shows visible physical damage (e.g., bruise, blood clot) to the brain. T F
12. If you receive one concussion and you have never had a concussion before, you will become less intelligent. T F
13. After 10 days, symptoms of a concussion are usually completely gone. T F
14. After a concussion, people can forget who they are and not recognize others but be perfect in every other way. T F
15. High school freshmen and college freshmen tend to be the same age. T F
16. Concussions can sometimes lead to emotional disruptions. T F
17. An athlete who gets knocked out after getting a concussion is experiencing a coma. T F
18. There is rarely a risk to long-term health and well-being from multiple concussions. T F

Section 2:

Directions: Please read the following scenarios and select TRUE or FALSE for each question that follows the scenarios.

*Adapted with permission from Rosenbaum, A. M. & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology, 32,* 44-55.

Scenario 1: *While playing in a game, Player Q and Player X collide with each other and each suffers a concussion. Player Q has never had a concussion in the past. Player X has had 4 concussions in the past.*

1. It is likely that Player Q's concussion will affect his long-term health and well-being. T F
2. It is likely that Player X's concussion will affect his long-term health and well-being. T F
3. It is likely that Player X's prior concussions will lead him/her to be more likely to sustain a concussion in his/her future. T F

Scenario 2: *Player F suffered a concussion in a game. S/he continued to play in the same game despite the fact that s/he could feel the effects of the concussion.*

1. Even though Player F is still experiencing the effects of the concussion, his/her athletic performance will be the same as it would be had s/he not suffered a concussion. T F
2. Even if Player F sustained a concussion, there is no reason for him/her to not continue to play. T F

Section 3:

Directions: For each question select the response that best describes what you believe about each statement.

1 = Strongly disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agee
5 = Strongly agree

1. I would continue playing a sport while also having a headache that resulted from a minor concussion. 1 2 3 4 5
2. I believe that coaches need to be extremely cautious when determining whether an athlete should return to play. 1 2 3 4 5
3. I believe that mouthguards protect teeth from being damaged or knocked out. 1 2 3 4 5
4. I believe that professional athletes are more skilled at their sport than high-school athletes. 1 2 3 4 5
5. I believe that concussions are less important than other injuries. 1 2 3 4 5
6. I believe that an athlete has a responsibility to return to a game even if it means playing while still experiencing symptoms of a concussion. 1 2 3 4 5
7. I believe that an athlete who sustains a concussion should be taken to the emergency room. 1 2 3 4 5
8. I believe that an athlete who is knocked unconscious should be taken to the emergency room. 1 2 3 4 5

*Adapted with permission from Rosenbaum, A. M. & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology, 32,* 44-55.

9. Even if a mild concussion, I believe that if an athlete experiences a concussion, parents should be notified so they can watch for symptoms. 1 2 3 4 5
10. I believe that most high-school athletes will play professional sports in the future. 1 2 3 4 5

Section 4:

Directions: For each question read the scenarios and select the response the best describes your view. For the questions that ask you what most teachers believe, base your answers on how you think MOST teachers would believe.)

1 = Strongly disagree
2 = Disagree
3 = Neither agree nor disagree
4 = Agee
5 = Strongly agree

Scenario 1: *Player R suffers a concussion during a game. Coach A decides to keep Player R out of the game. Player R's team loses the game.*

1. I believe that Coach A made the right decision to keep Player R out of the game. 1 2 3 4 5
2. Most teachers would believe that Coach A made the right decision to keep Player R out of the game. 1 2 3 4 5
3. I believe that Player R's teammates will understand why he was pulled out of the game. 1 2 3 4 5
4. Most teachers will believe that Player R's teammates will understand why he was pulled out of the game. 1 2 3 4 5

Scenario 2: *Athlete M suffered a concussion during the first game of the season. Athlete O suffered a concussion of the same severity during the semifinal playoff game. Both athletes had persisting symptoms.*

5. I believe that Athlete M should have returned to play during the first game of the season. 1 2 3 4 5
6. Most teachers would believe that Athlete M should have returned to play during the first game of the season. 1 2 3 4 5
7. I believe that Athlete M should have been reevaluated for concussion symptoms prior to returning to play. 1 2 3 4 5
8. Most teachers would believe that Athlete M should have been reevaluated for concussion symptoms prior to returning to play. 1 2 3 4 5
9. I believe that Athlete O should have returned to play during the semifinal playoff game. 1 2 3 4 5
10. Most teachers believe that Athlete O should have returned to play during the semifinal playoff game. 1 2 3 4 5

*Adapted with permission from Rosenbaum, A. M. & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology, 32,* 44-55.

11. I believe that Athlete O should have been reevaluated for concussion symptoms prior to returning to play. 1 2 3 4 5
12. Most teachers would believe that Athlete O should have been reevaluated for concussion symptoms prior to returning to play. 1 2 3 4 5

Scenario 3: *Athlete B suffered a concussion and is still experiencing some level of mild symptoms. A decision must be made about whether Athlete B can return to play. Athlete B's team has an athletic trainer on the staff.*

13. I believe that the athletic trainer, rather than Athlete B, should make the decision about returning Athlete B to play. 1 2 3 4 5
14. Most teachers would believe that the athletic trainer, rather than Athlete B, should make the decision about returning Athlete B to play. 1 2 3 4 5
15. I believe that the coach and athletic trainer will likely agree on the decision about Athlete B returning to play. 1 2 3 4 5
16. Most teacher would believe that the coach and athletic trainer will likely agree on the decision about Athlete B returning to play. 1 2 3 4 5

Scenario 4: *Athlete H suffered a concussion in early morning practice and s/he has a game in two hours. S/he is still experiencing mild concussion symptoms. However, Athlete H knows that if s/he tells his/her coach about the symptoms, his/her coach will keep him/her out of the game.*

17. I feel that Athlete H should tell his/her coach about the symptoms. 1 2 3 4 5
18. Most teachers would feel that Athlete H should tell his/her coach about the symptoms. 1 2 3 4 5
19. I believe that Athlete H should tell his/her parents about the symptoms. 1 2 3 4 5
20. Most teachers would believe that Athlete H should tell his/her parents about the symptoms. 1 2 3 4 5

Section 5:

Directions: Think about someone who has had a concussion. Select all of the following signs and symptoms that you believe someone may be likely to experience WITHIN ONE HOUR after a concussion.

__ Hives
__ Headaches
__Difficulty speaking
__Arthritis
__Sensitivity to light
__Difficulty remembering
__Panic attacks
__Drowsiness
__Feeling in a fog
__Weight gain

*Adapted with permission from Rosenbaum, A. M. & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology, 32,* 44-55.

__Feeling slowed down
__Reduced breathing rate
__Excessive studying
__Difficulty concentrating
__Dizziness
__Hair loss

Directions: Think about someone who has had a concussion. Select all of the following signs and symptoms that you believe someone may be likely to experience UP TO ONE WEEK following a concussion.

__ Hives
__ Headaches
__Difficulty speaking
__Arthritis
__Sensitivity to light
__Difficulty remembering
__Panic attacks
__Drowsiness
__Feeling in a fog
__Weight gain
__Feeling slowed down
__Reduced breathing rate
__Excessive studying
__Difficulty concentrating
__Dizziness
__Hair loss

*Adapted with permission from Rosenbaum, A. M. & Arnett, P. A. (2010). The development of a survey to examine knowledge about and attitudes toward concussion in high-school students. *Journal of Clinical and Experimental Neuropsychology, 32,* 44-55.

APPENDIX C

RETURN TO LEARN QUESTIONNAIRE*
(Partially adapted from Kuzma, 2015)

Section 1.

Directions: For each question circle the number that best describes what you believe about each statement.

SD = Strongly disagree
D = Disagree
N = Neither agree nor disagree
A = Agree
SA = Strongly agree

1. Recovery from a concussion is complete when the individual is asymptomatic. SD D N A SA
2. Concussion can affect academic performance. SD D N A SA
3. Cognitive rest is important for recovery from a concussion. SD D N A SA
4. ‘Cognitive’ refers to thinking processes such as memory, attention, and learning. SD D N A SA
5. Concussed students should be eligible for accommodations such as specialized instruction or other educational accommodations. SD D N A SA
6. Long-term cognitive deficits only occur when the individual sustains multiple concussions. SD D N A SA
7. A repeated concussion that occurs before the brain recovers from the first can slow recovery or increase the likelihood of having long-term problems. SD D N A SA
8. A concussed student-athlete may have trouble remembering events from before the concussion, but usually does not have trouble learning new things. SD D N A SA
9. Symptoms of a concussion can last for several weeks. SD D N A SA
10. Once a person recovering from a concussion feels ‘back to normal’, the recovery process is complete. SD D N A SA
11. Environmental stimuli in the classroom (e.g., loud noises, bright lighting) can negatively affect a student’s academic performance when recovering from concussion. SD D N A SA
12. A student recovering from a concussion may become fatigued more easily than peers. SD D N A SA
13. A student recovering from concussion should be able to pay attention and concentrate at the same rate as peers. SD D N A SA
14. A student recovering from concussion may need longer time to complete tasks or assignments. SD D N A SA

*Adapted with permission from Kuzma, M. (2015). Educational professionals’ current knowledge of concussions and return to learn implementation practice (Master’s thesis). Retrieved from ProQuest. (UMI: 1586731)

15. A student recovering from concussion will have no difficulty organizing or shifting between tasks. SD D N A SA
16. It is common for persons to experience changes in behavior (e.g., irritability, emotional) after a concussion. SD D N A SA
17. It is uncommon for an individual to experience physical symptoms (e.g., headache, nausea, dizziness) following concussion. SD D N A SA
18. It is typical for adverse academic effects to occur as a result of concussion. SD D N A SA
19. It is atypical for adverse social/emotional effects to occur as a result of concussion. SD D N A SA
20. Tolerance for cognitive activity is variable for each student recovering from concussion. SD D N A SA

Section 2.

Directions: For each question circle the number that best describes what you believe about each statement.

SD = Strongly disagree
D = Disagree
N = Neutral
A = Agree
SA = Strongly Agree

21. Intervening with students who demonstrate post-concussive syndrome symptoms is the responsibility of the teacher. SD D N A SA
22. I have or will seek accommodation assistance for students who demonstrate symptoms of a concussion in the classroom. SD D N A SA
23. Consistent monitoring is necessary for students who are recovering from a concussion. SD D N A SA
24. A team approach is unnecessary for management of students with a concussion. SD D N A SA
25. Accommodations/modifications are useful in management of return to learn students. SD D N A SA
26. I always implement accommodations/modifications for return to learn students in my classroom. SD D N A SA
27. I feel confident in my ability to provide, manage, or handle concussed students within the classroom. SD D N A SA
28. I do not believe that return to learn intervention has educational relevance. SD D N A SA
29. I think my colleagues believe that return to learn intervention has educational relevance. SD D N A SA

*Adapted with permission from Kuzma, M. (2015). Educational professionals' current knowledge of concussions and return to learn implementation practice (Master's thesis). Retrieved from ProQuest. (UMI: 1586731)

30. I think my school's administration believe that return to learn intervention has educational relevance.   SD   D   N   A   SA

*Adapted with permission from Kuzma, M. (2015). Educational professionals' current knowledge of concussions and return to learn implementation practice (Master's thesis). Retrieved from ProQuest. (UMI: 1586731)

APPENDIX D

EMAIL RECRUITMENT FOR QUALTRICS PARTICIPATION

Email text to Teaching Organizations and School Districts:

Research has shown variable knowledge of concussion management within teaching populations. While information is disseminated regarding signs of concussions and the impact on the student in the classroom, teachers still report a lack of awareness and competence, specifically regarding implementing Return to Learn protocols. Ideally, conclusions from this research will assist in more effective dissemination of concussion materials to schools and teachers in the future.
We would like to reach out to teaching organizations and school districts to further explore various topics related to teachers and their knowledge and attitudes regarding student concussion. Questions will also explore teacher knowledge and attitudes about the Return to Learn protocol. To meet these goals, **I am asking teaching organizations and school districts if they would be willing to share the link below with middle and high school teachers in their areas. You can use the email text below:**

> Dear Teacher:
>
> You're invited to participate in a study of Teacher Knowledge of and Attitudes Regarding Student Concussion and the Return to Learn Protocol. This is an online survey that does not ask for any identifying information associated with survey responses. The survey will take approximately 25 minutes to complete and there is an opportunity to be entered into a random drawing for one of five $50 gift cards. The intent is to investigate variables related to teachers and their knowledge and attitudes regarding student concussion. Further information, the information sheet, and survey can be found at:

[Anonymous link to Qualtrics survey embedded here]

Please contact eperdue@tamu.edu (Study Director) or criccio@tamu.edu (Principal Investigator regarding any questions or concerns. Thank you for your consideration of this project.

Sincerely,

Elizabeth Perdue, M.Ed.
TAMU IRB Number IRB2018-1197
IRB Expiration Date 11/16/2023

APPENDIX E

SOCIAL MEDIA RECRUITMENT FOR QUALTRICS PARTICIPATION

Social Media Recruitment Text:

Dear Teacher:

You're invited to participate in a study of Teacher Knowledge of and Attitudes Regarding Student Concussion and the Return to Learn Protocol. This is an online survey that does not ask for any identifying information associated with survey responses. The survey will take approximately 25 minutes to complete and there is an opportunity to be entered into a random drawing for one of five $50 gift cards. The intent is to investigate variables related to teachers and their knowledge and attitudes regarding student concussion. Further information, the information sheet, and survey can be found at:

[Anonymous link to Qualtrics survey embedded here]

Please contact eperdue@tamu.edu (Study Director) or criccio@tamu.edu (Principal Investigator) regarding any questions or concerns. Thank you for your consideration of this project.

APPENDIX F

AMAZON MTURK POST INFORMATION FOR QUALTRICS PARTICIPATION

MTURK Post Information:
Title: TEACHERS ONLY: Complete survey about concussion and Return to Learn
Description: Complete survey about knowledge of and attitudes regarding student concussion and Return to Learn protocol
Keywords: survey, teachers, concussion
Reward per assignment (This is how much a Worker will be paid for completing an assignment): $1.00
Number of assignments per HIT (This is how many unique Workers I want to work on each HIT): 175

APPENDIX G

INFORMED CONSENT INFORMATION PAGE FOR EMAIL/SOCIAL MEDIA

QUALTRICS

Title of Research Study: Teacher Knowledge of and Attitudes Regarding Student Concussion and the Return to Learn Protocol

Study Director: Elizabeth A. Perdue, M.Ed.
Principal Investigator: Cynthia A. Riccio, Ph.D.

Why am I being asked to take part in this research study?

You are invited to participate in this study because we are trying to learn more about various topics related to teachers and their knowledge and attitudes regarding student concussion. Survey questions will also explore teacher knowledge and attitudes about the Return to Learn protocol.
You were selected as a possible participant in this study because you are currently employed as a general education teacher, including special service teachers (foreign language teacher, physical education teacher, etc.) in any public or private school setting. You must be 18 years of age or older to participate. If you do not meet these criteria, please do not complete the survey as it will impact the validity of the survey results.

Why is this research being done?

The survey is designed to explore variables among the teacher population that may explain discrepancies in knowledge of and attitudes toward student concussion, as well as to the Return to Learn protocol within the school environment. Ideally, conclusions from this research will assist in more effective dissemination of concussion materials to schools and teachers in the future.

How long will the research last?

It will take about 25 minutes to complete the survey.

What happens if I say "Yes, I want to be in this research"?

If you decide to participate, please do the following: *Click the "I Agree" button below and you will be taken to the survey. Directions are provided for each section.*

What happens if I do not want to be in this research?

Your participation in this study is voluntary. You can decide not to participate in this research and it will not be held against you. You can leave the study at any time.

Is there any way being in this study could harm me?

There are no sensitive questions in this survey that should cause discomfort. You can, however, skip any question you do not wish to answer, or exit the survey at any point.

What happens to the information collected for the research?

You may view the survey host's confidentiality policy at: *https://www.qualtrics.com/privacy-statement/*

All information will be kept on a password protected computer and is only accessible by the research team. The results of the research study may be published or presented, but as group data and no one will be able to identify you.

What else do I need to know?

There is no cost to you other than the time complete the survey. You will not be compensated for your time. You will be invited to participate in a drawing at the end of the survey using a separate link not attached to your responses. You will be asked to provide your email so we can send you the giftcard should you win. Five participants will be randomly selected to receive one of five $50 gift cards. This is optional; you may still participate in the study if you do not want to participate in the drawing or provide your email address.

Who can I talk to?

Please feel free to ask questions regarding this study. You may contact Elizabeth Perdue if you have additional questions or concerns at *eperdue@tamu.edu*.

You may also contact the Human Research Protection Program at Texas A&M University (which is a group of people who review the research to protect your rights) by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu for:

- additional help with any questions about the research
- voicing concerns or complaints about the research
- obtaining answers to questions about your rights as a research participant
- concerns in the event the research staff could not be reached
- the desire to talk to someone other than the research staff

If you want a copy of this consent for your records, you can print it from the screen.

- ➢ If you wish to participate, please click the **"I Agree"** button and you will be taken to the survey.
- ➢ If you do not wish to participate in this study, please select **"I Disagree"** or select **X** in the corner of your browser.

APPENDIX H

INFORMED CONSENT INFORMATION PAGE FOR AMAZON MTURK QUALTRICS

Title of Research Study: Teacher Knowledge of and Attitudes Regarding Student Concussion and the Return to Learn Protocol

Study Director: Elizabeth A. Perdue, M.Ed.
Principal Investigator: Cynthia A. Riccio, Ph.D.

Why am I being asked to take part in this research study?

You are invited to participate in this study because we are trying to learn more about various topics related to teachers and their knowledge and attitudes regarding student concussion. Survey questions will also explore teacher knowledge and attitudes about the Return to Learn protocol.
You were selected as a possible participant in this study because you are currently employed as a general education teacher, including special service teachers (foreign language teacher, physical education teacher, etc.) in any public or private school setting. You must be 18 years of age or older to participate. If you do not meet these criteria, please do not complete the survey as it will impact the validity of the survey results.

Why is this research being done?

The survey is designed to explore variables among the teacher population that may explain discrepancies in knowledge of and attitudes toward student concussion, as well as to the Return to Learn protocol within the school environment. Ideally, conclusions from this research will assist in more effective dissemination of concussion materials to schools and teachers in the future.

How long will the research last?

It will take about 25 minutes to complete the survey.

What happens if I say "Yes, I want to be in this research"?

If you decide to participate, please do the following: *Click the "I Agree" button below and you will be taken to the survey. Directions are provided for each section.*

What happens if I do not want to be in this research?

Your participation in this study is voluntary. You can decide not to participate in this research and it will not be held against you. You can leave the study at any time.

Is there any way being in this study could harm me?

There are no sensitive questions in this survey that should cause discomfort. You can, however, skip any question you do not wish to answer, or exit the survey at any point.

What happens to the information collected for the research?

You may view the survey host's confidentiality policy at: *https://www.qualtrics.com/privacy-statement/*

All information will be kept on a password protected computer and is only accessible by the research team. The results of the research study may be published or presented, but as group data and no one will be able to identify you.

What else do I need to know?

There is no cost to you other than the time complete the survey. You will be compensated $1.00 through Amazon MTurk upon completion of the survey.

Who can I talk to?

Please feel free to ask questions regarding this study. You may contact Elizabeth Perdue if you have additional questions or concerns at *eperdue@tamu.edu*.

You may also contact the Human Research Protection Program at Texas A&M University (which is a group of people who review the research to protect your rights) by phone at 1-979-458-4067, toll free at 1-855-795-8636, or by email at irb@tamu.edu for:

- additional help with any questions about the research
- voicing concerns or complaints about the research
- obtaining answers to questions about your rights as a research participant
- concerns in the event the research staff could not be reached
- the desire to talk to someone other than the research staff

If you want a copy of this consent for your records, you can print it from the screen.

- ➢ If you wish to participate, please click the **"I Agree"** button and you will be taken to the survey.
- ➢ If you do not wish to participate in this study, please select **"I Disagree"** or select **X** in the corner of your browser.

APPENDIX I

COMPENSATORY METHODS FOR PARTICIPANT RECRUITMENT

Rafflecopter message – added at the conclusion of the Qualtrics survey recruiting participants via social media, email, and national teaching organizations

> Thank you for participating in this survey! If you are interested in being entered to win one of five $50 gift cards, please continue to the following link:
>
> [Link embedded in survey]
>
> Password: -----
>
> If you are not interested in being entered to win a gift card, your survey responses will still be saved. Thank you!

MTurk message – added at the conclusion of the Qualtrics survey recruiting participants via Amazon MTurk

> Please submit your worker ID for Amazon MTurk.
>
> ______________________________________

APPENDIX J

	Variables							
Measures		Sex, Age, Race/Ethnicity, Location, Education	School context and experience	Sport context and experience	Concussion knowledge	Concussion attitudes	RTL knowledge	RTL adherence
	Demographic Questionnaire	●	●	●				
	Adapted RoCKAS-ST: Sections 1, 2, 5				●			
	Adapted RoCKAS-ST: Sections 3, 4					●		
	RTL Questionnaire: Section 1						●	
	RTL Questionnaire: Section 2							●

Figure 5. Variable by measure matrix for the present study. This figure identifies the measure that will account for each variable in the study.

APPENDIX K

Table 31

Coefficients of main effect model for dependent variable Return to Learn Knowledge Index

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	T	Significance	Confidence Interval (95%)	
						Lower Bound	Upper Bound
(Constant)	-56.648	12.280		-4.613	<.001***	-81.038	-32.258
CKI	2.947	.395	.580	7.458	<.001***	2.162	3.732
CAI	.366	.079	.358	4.641	<.001***	.523	.309
Sex	5.543	2.998	.090	1.849	.068	-.411	11.498
Age	.353	.172	.155	2.053	.043*	.012	.695
State	-.201	1.580	-.006	-.127	.899	.3.339	2.938
Population	.009	.904	.000	.010	.992	-1.787	1.805
Educational Attainment	.577	2.153	.013	.268	.789	-3.700	4.853
Years of Teaching	-.249	.197	-.099	-1.267	.209	-.640	.142
Grades	.675	.847	.039	.797	.427	-1.007	2.358
Classes	.361	1.778	.010	.203	.840	-3.170	3.892
Clinic/Inservice	3.098	2.951	.059	1.050	.297	-2.763	8.959
Worked with Student with Concussion	.979	3.031	.016	.323	.747	-5.040	6.998
Hx Sport Participant	-2.628	3.575	-.036	-.735	.464	-9.728	4.473
Hx Sport Coach	-2.338	2.567	-.045	-.911	.365	-7.437	2.761
Hx Sport Trainer	-3.995	7.486	-.025	-.534	.595	-18.862	10.872
Hx Concussion Self/Family/Friend	-3.481	2.533	-.067	-1.374	.173	-8.512	1.550

Notes. Hx= History of; *p<.05, **p<.01, ***p<.001

APPENDIX L

Table 32

Coefficients of main effect model for dependent variable Return to Learn Adherence Index

Model	Unstandardized B	Coefficients Std. Error	Standardized Coefficients Beta	T	Significance	Confidence Interval (95%)	
						Lower Bound	Upper Bound
(Constant)	-5.552	15.886		-.350	.728	-37.103	25.998
CKI	.884	.511	.247	1.650	.102	-.172	1.859
CAI	.197	.102	.286	1.933	.056	-.005	.400
Sex	2.922	3.878	.070	.753	.453	-4.781	10.625
Age	-.036	.223	-.024	-.163	.871	-.478	.406
State	-1.886	2.044	-.083	-.923	.359	-5.946	2.174
Population	-2.294	1.170	-.175	-1.962	.053	-4.617	.029
Educational Attainment	2.185	2.785	.072	.784	.435	-3.347	7.717
Years of Teaching	-.160	.255	-.094	-.627	.532	-.665	.346
Grades	-.458	1.096	-.039	-.418	.677	-2.635	1.719
Classes	.110	2.300	.004	.048	.962	-4.457	4.678
Clinic/Inservice	1.721	3.817	.048	.451	.653	-5.861	9.303
Worked with Student with Concussion	-1.871	3.920	-.047	-.477	.634	-9.657	5.915
Hx Sport Participant	-3.965	4.625	-.080	-.857	.394	-13.150	5.221
Hx Sport Coach	-4.740	3.321	-.136	-1.427	.157	-11.336	1.856
Hx Sport Trainer	-2.998	9.683	-.028	-.310	.758	-22.230	16.233
Hx Concussion Self/Family/Friend	4.064	3.277	.115	1.240	.218	-2.444	10.572

Notes. Hx= History of

APPENDIX M

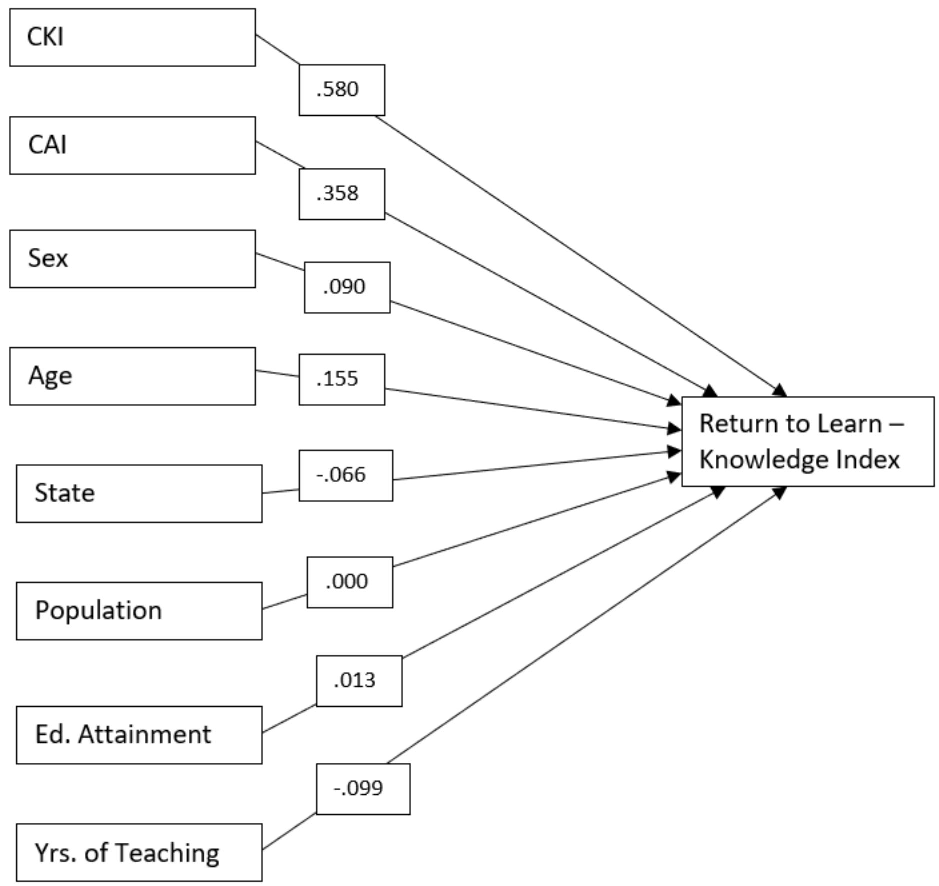

Figure 6. Standardized beta coefficients for variables on dependent variable Return to Learn Knowledge Index.

APPENDIX N

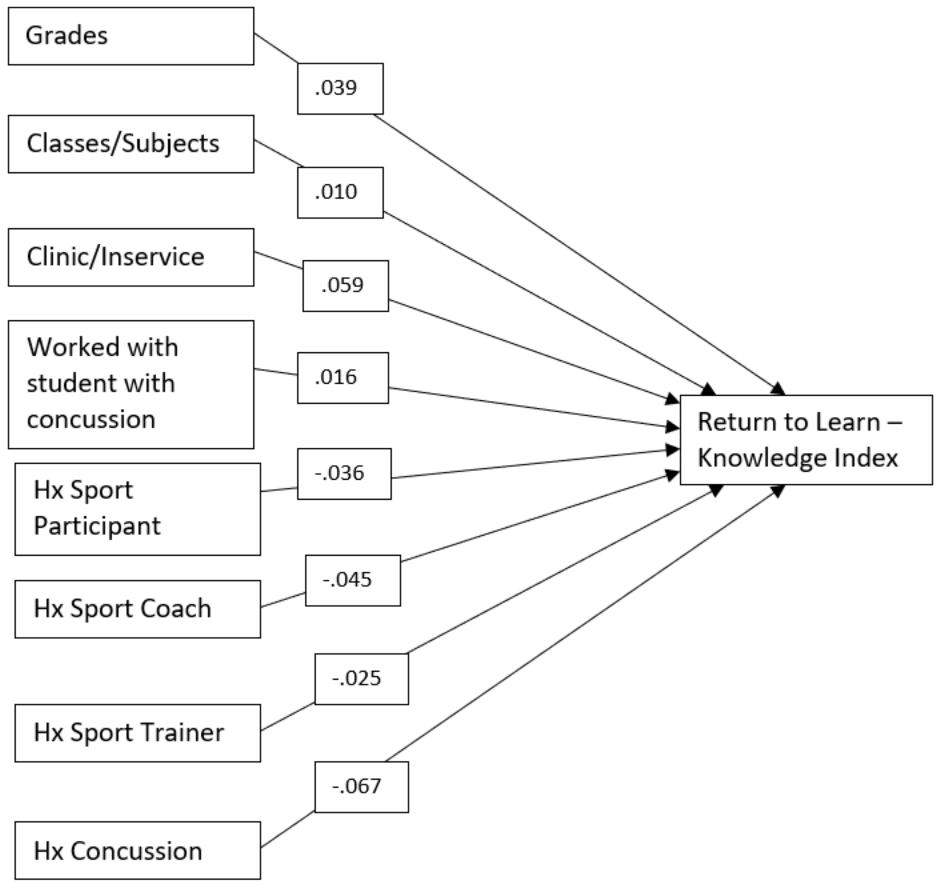

Figure 7. Standardized beta coefficients for variables on dependent variable Return to Learn Knowledge Index.

APPENDIX O

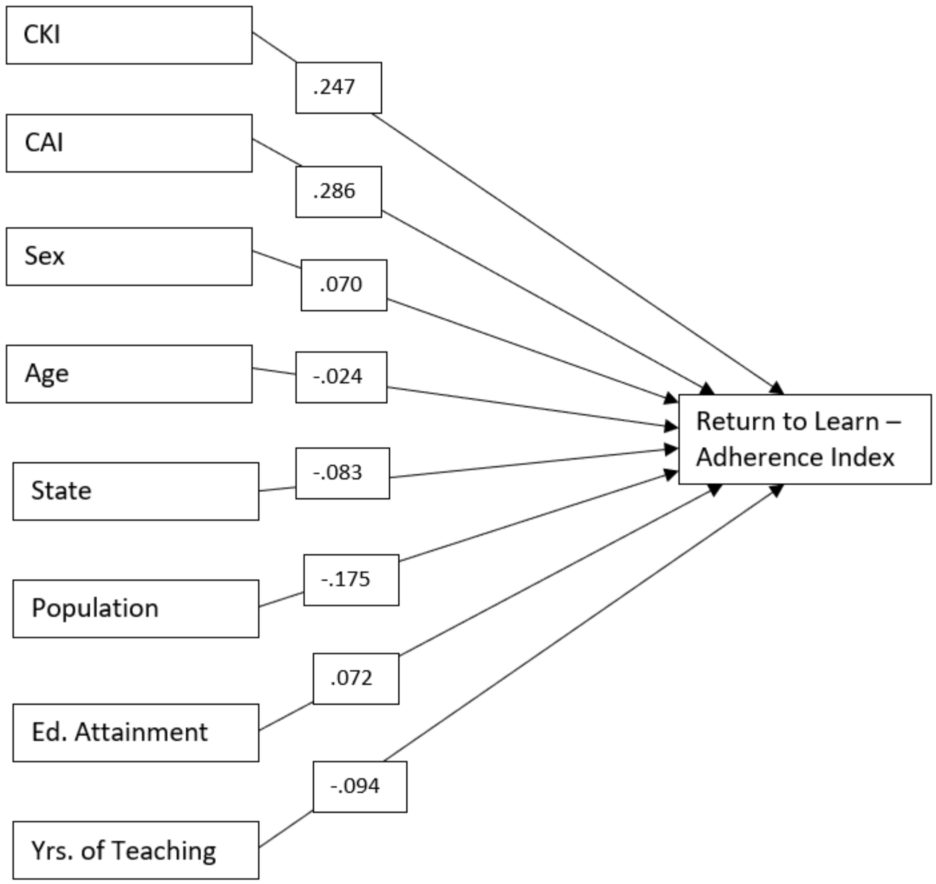

Figure 8. Standardized beta coefficients for variables on dependent variable Return to Learn Adherence Index.

APPENDIX P

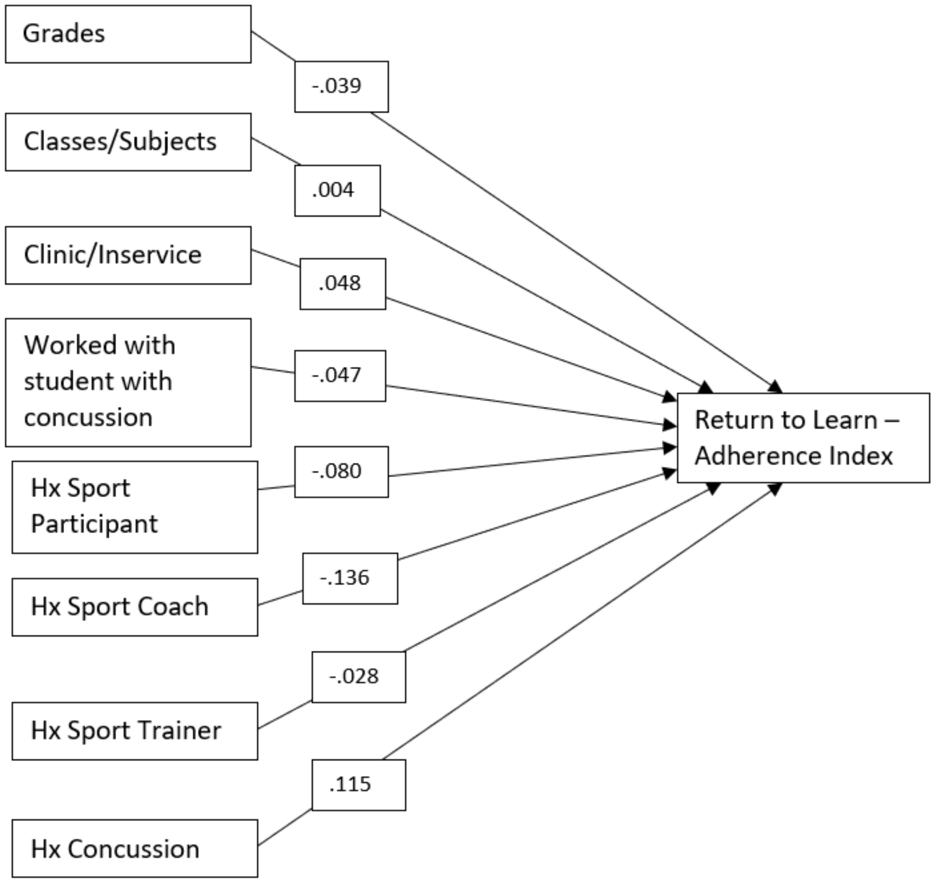

Figure 9. Standardized beta coefficients for variables on dependent variable Return to Learn Adherence Index.