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Exploring Stress and Recovery Among High-Achieving Career Development Event Teams: A Mixed Methods Study

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Abstract

School Based Agricultural Education (SBAE) teachers can experience physiological stress through their various roles and responsibilities, including preparing Career Development Event (CDE) teams. Through CDE participation, students can encounter numerous benefits, but these academic competitions could be catalysts for stress. The purpose of this exploratory case study was to contextualize the experiences of high-achieving SBAE teachers and CDE participants through the lens of stress and resilience. Using a concurrent triangulated mixed methods design, physiological, quantitative data were collected through ambulatory heart rate monitors, and qualitative data were collected through teacher and CDE participant daily journals. We found that teachers encountered stress reactions the majority of the time with little to no recovery, where students experienced a more extensive range of stress reactions and recovery within the quantitative analysis. Both CDE context-specific and role-specific stress catalysts existed within the qualitative and convergent analysis. SBAE teachers and CDE participants should utilize strategies that address both (a) sleep deprivation and (b) anticipatory and in-action stress to allow for increased cognitive performance and resilience.

Keywords: physiological stress; recovery, biofeedback; career development events

Introduction

Teachers can face job-related frustration, anxiety, and tension resulting in teacher stress (Kyriacou, 2001). Research indicates teacher stress can result from student amotivation, behavior management, workload, conflicts with administration, and poor working conditions among other things (Kyriacou, 2001; Skaalvik & Skaalvik, 2015). Additionally, prolonged stress can lead to burnout and a lack of teacher retention (Skaalvik & Skaalvik, 2015). School-Based Agricultural Education (SBAE) teachers are no exception and often face moderate to high levels of daily stress and the need for increased resilience or the ability to cope with and overcome difficult situations, due to amplified responsibility and accountability (Anderson et al., 2012; Croom, 2003; Straquadine, 1990; Torres et al., 2009; Walker et al., 2004). Additionally, as SBAE teachers prepare Career Development Event (CDE) teams for academic competitions, they fulfill another stressful role which requires the additional aspects of motivating and coaching participants (Terry & Briers, 2010).

As teachers experience stress, regular recovery is necessary to balance the physical and emotional strain to develop stress resiliency. Recovery is the lack of activity levels in the body and a lack of internal and external stressors (McEwen, 1998; Sonnentag, 2001). Specifically, night-time recovery, i.e., 6 to 8 hours of quality sleep, is essential to manage stress (Firstbeat Technologies Ltd., 2014). Additionally, one should spend approximately 30% of the day in recovery as it is recommended

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that at least that much be spent in sleep or rest (Firstbeat Technologies Ltd., 2014). However, high levels of stress, alcohol consumption, strenuous exercise, and/or poor sleep time management can influence the amount of recovery experienced (Firstbeat Technologies Ltd., 2014). For example, alcohol consumption can disrupt sleep cycles and thus will decrease the amount of recovery experienced during sleep (Quick et al., 2008). Teachers can experience detrimental side effects if they experience a lack of recovery.

Sleep disruption and a lack of recovery within both teachers and students are of particular interest when considering the ability of a person to function in any task requiring a high level of cognitive engagement (Philip et al., 2004). The acts of teaching and coaching, along with students participating in the competition, all require varying degrees of higher-order thinking and cognitive engagement (Nash & Collins, 2012). Sleep disruption leading to less-than-recommended amounts of sleep, also known as sleep deprivation, can significantly impact cognitive functioning and behavioral outcomes in people across the span of age range from young children to the elderly (Meldrum & Restivo, 2014). Among high school students, sleep deficits significantly impact cognitive and behavioral outcomes with adverse effects. Furthermore, when students were accumulating less than 5 hours of sleep a night, these effects were found to be elevated (Meldrum & Restivo, 2014). In adults, sleep deprivation can reduce cognitive function in the workplace, inhibiting higher order thinking and ethical reasoning in addition to impaired driving ability (Philip et al., 2004). These points are relevant to agriculture teachers who have a cognitively demanding job in the classroom and often drive either a school bus or school/personal vehicle while transporting students to and from events.

Increased stress levels and a lack of recovery have been shown to compromise the quality of the relationships between teachers and their students and thus have a significant influence on student outcomes (Yoon, 2002). Stress can be a detriment to CDE preparation, as building teacher to student relationships were found to be a crucial part of the CDE preparation process (Ball & Bowling, 2015). Further, research indicates that strong teacher-student relationships can increase student engagement and motivation within the classroom (Christenson et al., 2009). Empirical evidence also identifies adult-youth relationships as a precursor to optimal athletic, competitive experiences (Jowett & Cockerill, 2003; Lafrenière et al., 2008). Experiencing stress and a lack of recovery can have additional side effects beyond compromising relationships.

SBAE teachers experience a wide variety of responsibilities as compared to their core counterparts, and this variety can be appealing yet stressful for pre-service and in-service teachers (Terry & Briers, 2010). In examining the range of responsibilities, research indicates that SBAE teachers spend nearly half their time on activities outside of formal classroom instruction (Torres et al., 2008). Torres et al. (2008) also found that, on average, SBAE teachers dedicate 10% of their time to preparing CDE teams. Further, coaching students in competitive activities (CDEs) is identified as a top ten responsibility out of 21 roles, an SBAE teacher fulfills (Terry & Briers, 2010). To emphasize the significance of CDEs, preparing students to participate in CDE competitions has been noted as a tenant of effective agriculture teachers (Roberts & Dyer, 2004). Due to the emphasis placed on CDEs, research indicates that CDE preparation is a stressor for female agricultural teachers in the southeastern region of the United States (King, Rucker, & Duncan, 2013). Additionally, teachers discuss a felt need for CDE-based professional development (Harris, 2008), and CDE professional development has been proposed to lessen teacher stress and increase preparedness (Torres et al., 2008).

While CDE preparation is a duty of SBAE teachers, context-specific responsibilities arise as teachers transition into more of a coaching role (Terry & Briers, 2010). Additionally, to potentially lesson stress, some SBAE teachers may choose not to coach CDE teams and may utilize community volunteers as coaches (Terry & Briers, 2010). CDE coaches need to possess knowledge and skills related to the various CDE subject areas, CDE specific rules and procedures, the ability to work with individual and team competitors, and the ability to develop motivation, teamwork, and competitiveness (Ball & Bowling, 2015; Terry & Briers, 2010). While CDE preparation and CDE coaching duties can

add to the responsibilities and stress of SBAE teachers, research indicates that students can experience benefits from CDE participation.

Participation in CDEs offers students the ability to acquire and apply career-related knowledge (Phipps et al, 2008) and the ability to engage in ethical and constructive competition (National FFA Organization, 2017). Teachers and students acknowledge the importance of CDEs as a way to gauge career choices (Croom et al, 2005; Lundry et al., 2015), and teachers recognize the importance of the competitive aspect (Croom et al., 2005). Additionally, CDEs are intended to encompass and reflect the education that occurs within an entire SBAE program (National FFA Organization, 2019) and anecdotally can provide coaches with the opportunity to differentiate and increase the depth of instruction.

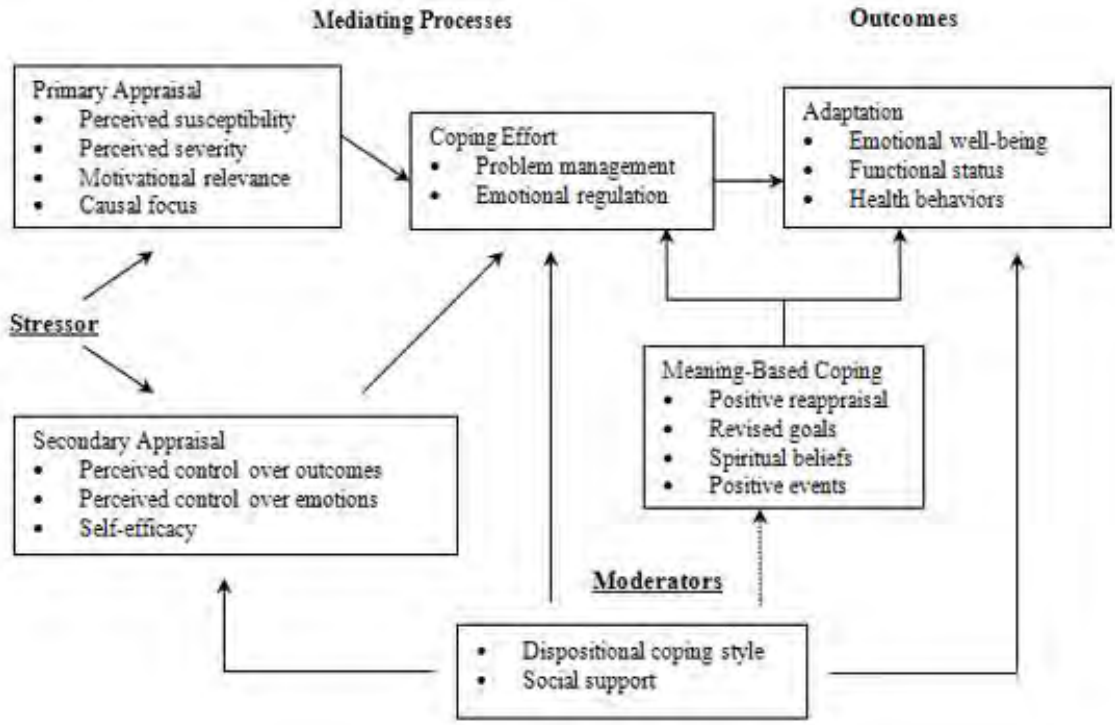
As an extension of the entire SBAE program, CDEs are a necessary part of an SBAE teachers' responsibility in many states and communities. Furthermore, CDEs provide another piece to the already complex puzzle of teacher and student accountability as an additional way to measure teacher and student performance. As a competition, CDEs produce not only scores and placings but are also as assessments for students who are considered program completers in some states (Missouri Department of Elementary and Secondary Education, 2017). Thus, CDE preparation and competitions become a unique context in which teachers and students can experience stress.

Theoretical/Conceptual Framework

For this study, we utilized both a theoretical and conceptual framework to frame (a) the human experience of stress and (b) the specific context for which stress was experienced. We applied the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) to this study as the theoretical framework. The framework is widely accepted in the study of stress and resilience. The framework outlines the human experience of stress through the transaction between the person and the environment. To situate the experienced stress within the context of CDE preparation, we utilized the conceptual framework of the Process of Preparing CDE Teams (Ball & Bowling, 2015). We used this model to view stress as a potential intervening issue between the CDE preparation strategies and the desired student outcomes.

The Transactional Model of Stress and Coping (Lazarus & Folkman, 1975) demonstrates the dynamic and contextual nature of stress and coping in humans through evaluating the stressors to outcomes experienced. The application of this model to this current study about stress and coping in high school agriculture FFA advisors and their students surrounding a CDE at the state level can apply to many different events and behaviors related to this event. In short, when employing this framework to the context of teacher/coaches within agricultural education, a mediational chain of events can be attributed, for example, teacher stressors can lead to stress responses, which cause the implementation of coping or resiliency strategies. These can then lead to work and personal life outcomes impacting teacher and student relationships, which could influence student behavioral and academic outcomes. The theoretical framework helped to drive the mixed methodology was utilized through identification of emotional and perceived stressors and physical stress and recovery outcomes. We also utilized the Transactional Model of Stress and Coping as a lens to interpret the participant journals and as a guide when analyzing the stress and recovery quantitative data.

Figure 1
Lazarus and Folkman's (1984) Diagram of the Transactional Model of Stress and Coping. Adapted from "Stress, coping, and health behavior" by Glanz, Rimer, and Viswanat (2008) in Health Behavior and Health Education: Theory Research and Practice.



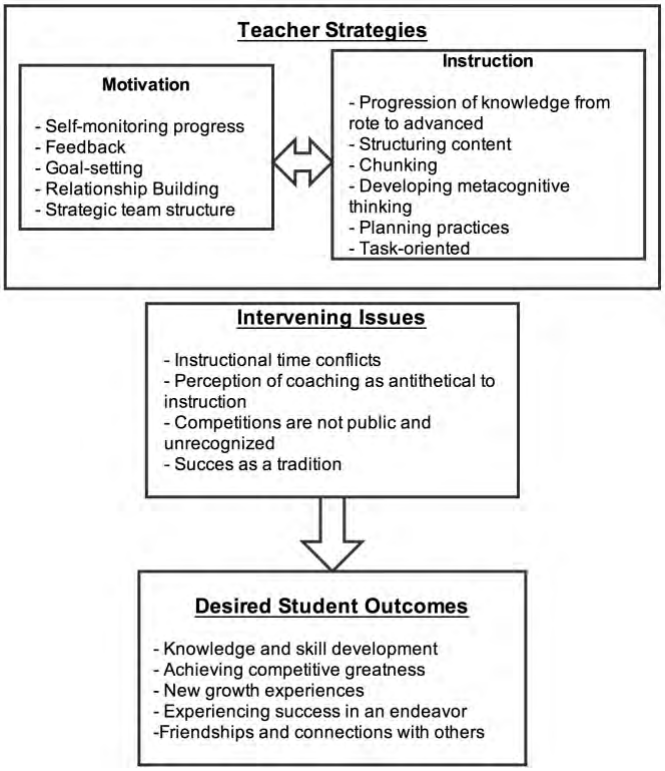
To break down the components of the mediational chain, the domain of "Primary Appraisal" would be applied in the instance of the advisor and students as they qualified at the district level for the state competition. Their primary appraisal would include factors such as motivation and focus resulting from the realization of having approximately one month to prepare for the competition. The secondary appraisal would be related to their determination of their self-efficacy regarding the competitions. All teachers demonstrated previous success at the state-level competition, and students had qualified by placing among the top at their district competition. We can extrapolate and say these would most certainly have been factors in the determination of perceived self-efficacy on both parts.

In this model, moderators impact coping effort, secondary appraisal, and meaning-based coping. Everyone develops their ways of coping, so it stands to reason that the coping styles utilized by the advisor and the students may vary. Within the context of CDE participation, the social support moderator could be particulary relevant as preparation occurs within a team setting and can also be influenced by the CDE coach, the team itself, the community of FFA Advisors, the FFA Chapter, and the school community. Competition could impact the social support aspect in that the community of FFA Advisors could be lacking in support when competing against one another. Young people participating in organized sports indicate a need for social support, and the coach/advisor can often be one of the primary sources of this essential social support (Kristiansen & Roberts, 2010).

A conceptual framework also informed this study that applies explicitly to Career Development Event coaching and preparation. This framework is the Process of Preparing CDE Teams (Ball &

Bowling, 2015). The conceptual framework helped us to frame the problem of physiological stress as an intervening issue within CDE preparation and helped to determine participant selection. Within the conceptual model, Ball and Bowling (2015) identified the process in which high achieving SBAE teachers prepared teams of students to compete in CDEs. In the process, both motivational and instructional based strategies were identified, which teachers utilized to achieve the desired student outcomes. However, intervening issues emerged that interfered with the teachers' ability to help students reach the desired outcomes. While not explicitly identified within the model, physiological stress has emerged through the literature as a potential intervening issue. As an intervening issue, stress could not only influence the teachers' ability to prepare CDE teams, but also could influence the students' knowledge and skill development, ability to grow as individuals, and ability to experience a wide range of success.

Figure 2
Process of Preparing CDE Teams Adapted from Ball and Bowling (2015)



The previous review of literature explored stress and recovery through the lens of the broader research related to education. Readers should consider this study exploratory from a conceptual perspective in that we could find no published studies that apply physiological stress and recovery measures to CDE participation and coaching. A secondary aim of this study is to explore the feasibility and application of physiological measures to the CDE participation and coaching context.

Problem Statement

Although CDE preparation can be a potential stressor, agriculture teachers are still devoting 10% of their professional time to coaching CDE teams. Additionally, teachers and participants may experience pressure to perform well at competitions from various sources ranging from administrators to parents to community members. By coupling the high level of cognitive engagement necessary, time

consumed, and pressure to perform, the level of stress surrounding CDE events could impact everything from student performance to teacher wellness. CDE specific stress could impact teacher burnout, sleep deprivation, decreased cognitive function, and increased safety concerns as SBAE teachers drive to and from events. Due to the impacts stress could have on students and teachers, the exploration of CDE context specific stress is necessary and could have implications for teacher retention, teacher performance, and student outcomes.

Purpose and Research Objectives

The purpose of this mixed methods case study was to contextualize the experiences of CDE coaches and participants during the Missouri CDE competition through the lenses of stress and resilience. The central question of this study was, "What do teachers and students experience related to stress and resilience during a state-level CDE competition?" The following research objectives and questions set the direction for the study:

1) Describe physiological stress levels of CDE coaches who are also agriculture teachers during integral periods that are related to state-level competition.
2) Describe the physiological stress levels of CDE participants during integral periods that are related to state-level competition.
3) How can the stress and resilience experiences of CDE coaches who are also agriculture teachers and participants be contextualized within the Missouri CDE competitions?

Methods

This exploratory case study utilized a concurrent triangulated (QUAN + qual) mixed method design (Tashakkori & Teddlie, 2010). The methodology utilized for this study is exploratory in that we are seeking to view stress and resiliency through the lens of CDE competition. The methodology accomplished by combining quantitative physiological data with qualitative data to add contextual information to the physiological data. Within the design, both qualitative and quantitative data were collected simultaneously from CDE coaches and CDE participants. The qualitative and quantitative data analyses were triangulated to present mixed methods findings.

Setting

While lessons that relate to CDE content are taught throughout the year, in Misosuri, the majority of CDE preparation and all competitions occur within four months during the school year. Toward the end of the preparation period, district competitions serve as qualifiers for the state competition. Following the district competitions, all CDE state competitions occur over a day and a half in conjunction with the state convention. CDE participants are allowed to participate in one CDE each preparation period. Participants can continue to participate in the same CDE content area from year to year until they qualify and compete at the state level. Once, a student competes at the state level; they are not allowed to participate in that specific content area again.

At the local level, CDE preparation varies in both how and when students prepare. CDE preparation can occur before, during, or after school, and participants may vary in the amount of individual time dedicated to CDE preparation. CDE coaches will also vary in the number of teams they prepare at once. We observed this variety in approaches to CDE preparation within the study participants. The sampled CDE teams practiced both before and after school, and students conducted independent study time to prepare for the state competition during their SBAE classes. CDE participants also indicated a variety of individual study time at home. The CDE coaches for this study all prepared two to three state-qualifying teams at once.

Participants

The CDE coaches featured in this study were purposively sampled based on their resilience and success displayed while preparing CDE teams, as outlined in the inclusion criteria. For this study, a CDE coach is any individual (SBAE teacher or volunteer) preparing students to compete in CDE events. Inclusion criteria for the CDE coach included the following: agriculture teachers who also coach CDE teams, teachers who prepared CDE teams for five or more years, continued engagement within the teaching profession for five or more years, preparing two or more CDE teams within each preparation period, and retaining multiple CDE participants from year to year. Additionally, previous success at the district and state level when preparing CDE teams was required. Participants came from a single Missouri FFA District with a history of producing winning state-level teams. Four (n = 4) teachers were found to meet all inclusion criteria. Following data collection, three (n = 3) teachers had usable data.

The teachers were between 30 and 40 years old, taught in rural school districts, and graduated from the same university and received traditional teacher licensure. None of the teachers had switched schools more than once during their tenure as teachers. Two participants taught in SBAE programs with two teachers, and one participant taught in a single-teacher SBAE program. All teachers had previous experience preparing teams within a range of CDE content areas and have previously prepared several teams in the specific content area selected for this study. The teachers were the primary individuals who prepared their CDE teams. They also prepared CDE teams simultaneously during class time and before and after school. All teachers were of average physical fitness and standard Body Mass Indices (BMIs). Two of the teachers were female, and one was male. However, the findings will not be disaggregated by gender due to privacy concerns and compliance with university research ethics.

During the state convention, all teacher participants were supervising CDE teams and FFA members who were participating in other state convention activities such as leadership workshops, award sessions, and a career show. The teachers were responsible for student transportation to and from the state convention site, which also serves are the primary CDE competition site. University faculty, staff, and students coordinate the CDE competitions, and the teacher participants had no responsibilities associated with the CDEs. All three teachers and their students traveled between the convention site and home each day.

For each teacher participant, we selected one CDE team for the study. The primary inclusion criteria for the teams selected included: placing in the top three places at the state-qualifying district competition. If teachers had more than one team meeting that criteria, the teachers were asked to identify the team they felt was the most motivated for high performance at the state competition. For each team, all four participants were recruited and consented to participate (n = 12). None of the student participants had participated in their respected CDE content area before and the content areas consisted of various plant science areas and production management. Due to improper heart rate monitor use and upkeep, quantitative physiological stress data were not collected on two participants, resulting in a usable sample of n = 10. Students aged between 16 and 18 years. Students were of varying physical fitness, with some participating in school sporting events, while others did not. From the available sample, there were more females (n = 7) than there were males (n = 3). Similarly to the teachers in the study, data will not be disaggregated by gender in the interest of maintaining participant confidentiality.

Data Handling

Based upon the bounded systems in which the teachers prepare teams, the data were analyzed and reported as collective case studies within the mixed methods study. We considered each team and advisor as a case, the advisors as a case, and the student competitors were also considered a case. As prescribed by Yin (2009), we will report findings on both individual cases and cross-case basis. When using the case study method in a mixed methods study, Yin's convention where the "case study encompasses the other methods" (Yin, 2009, p. 173) was our choice for the current study. We will be

using the case study as the umbrella for the design of the study and presentation of our findings, with all data sources folded into each case of study.

Physiological Stress Data

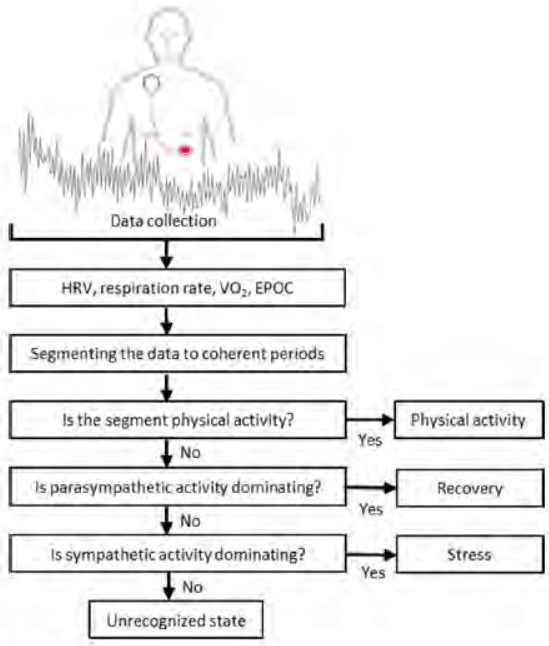
For the quantitative portion of this study, participants wore ambulatory heart rate monitors (commonly used by athletic teams) that collected beat-to-beat heart rate (HR) data (RR-interval data), respiration rate, heart rate variability, and physical movement for triangulation of evidence indicating stress and recovery responses (Firstbeat Technologies Ltd., 2014). Participants wore the monitors for a total of six days: four days before the competition, the day of the competition, and one day following the competition. The monitors were worn days before the competition to reduce any stress wearing the monitors may induce and to establish baseline readings for participants. While we established a baseline for participants, it is essential to note that the average heart rate of adults is 60 to 100 beats a minute and 70 to 100 beats a minute for adolescents (Cleveland Clinic, 2019). The small monitors allowed for monitoring of physiological indicators around the clock during pre-competition preparation, the state competition, post-competition recovery, and sleep. Heart rate variability (HRV) is the beat-to-beat variation in heart rate and is an accurate indicator of parasympathetic (vagal) activity and sympathetic activity of the autonomic nervous system in humans (Firstbeat Technologies Ltd., 2014). A researcher trained and experienced in the analysis of physiological indicators interpreted the quantitative data.

Firstbeat Technologies Ltd. provided the data analysis through proprietary software on their online server, where we loaded data from the BodyGuard devices. We provided background information on the participants for the server (age, sex, height, weight, and physical activity classification). The software then estimates the individual's maximal oxygen consumption (VO2max) and maximal heart rate (HRmax). We obtained ranges of physiological variables (resting HR and HRmax) on an individual basis and corrected them from background data calculations as needed from the RR-interval data.

Measuring Physiological Stress and Physical Activity. Once uploaded, RR-interval data are put through an artifact detection filter to correct missed, premature, and falsely detected heartbeats. RR-intervals, now artifact-corrected, are re-analyzed at a rate of 5 Hz using linear interpolation. The software will then remove low-frequency trends and variances outside of the target frequency band using a polynomial filter and a digital FIR band-pass filter (0.03-1.2 Hz). To measure stress, the analysis software indicates when a participant is in a state of stress. When a sympathetic activity is proportionally higher than the parasympathetic activity of the autonomic nervous system, a state of stress is indicated.

Conversely, higher parasympathetic activity when compared to sympathetic indicates a recovery or resilent state. Elevated oxygen consumption combined with accelerometer data showing movement indicates a state of physical activity (Firstbeat Technologies Ltd., 2014). Oxygen consumption (VO2) and accelerometer data were factored to determine physical activity states. The state of "daily physical activity" is implicated when VO2 is 20-30% of VO2max, while "physical activity" states are implicated when VO2 is above 30% of the personalized VO2max. The following diagram (Figure 3) from Firstbeat Technologies Ltd. provides a visual summary of how the physiological states are analyzed and determined.

Figure 3
Simplified illustration of the analysis procedure (Firstbeat Technologies Ltd., 2014).



Measuring Recovery. To measure recovery, the analysis software indicates when a participant is in a recovery state. While in a recovery (parasympathetic dominant) state, heart rate is typically low, and HRV is both high and constant. This state is typically detected during sleeping/ napping, relaxation, or passive working and includes low movement of the physical body. While in a stress state (sympathetic/vagal dominant), heart rate elevates, HRV decreases (compared to resting), and respiration rate is low when compared to heart rate.

Triangulation of Physiological Stress Data Analysis with Qualitative Data Collection and Analysis

For the qualitative portion, the participants completed daily activity journals while wearing heart rate monitors. Within the daily journals, participants documented their day to day activities within 24 hour periods at 15-minute increments. The participants were asked to report daily activities which included but were not limited to: CDE specific activities (organized practices, class-based activities, self-guided studying), school-based activities (attending classes, assessments, studying, deadlines), physical activity, feelings of stress, and sleep/recovery (naps, time to bed, time they woke up, quality of sleep). Additionally, timelines provided by the organizers of the CDE events documented the competition start and end times, student competition rotations, the window for students and teachers to review the competition materials, and online results release time. The state CDE competitions were observed to document field notes. The researcher observed study participants before the competition as they waited to register and then entered the CDE waiting area, during the competition, and after the competition, as the teachers and students reviewed the CDE materials. The researcher documented teacher to student(s) interactions, student to student(s) interactions, the body language of participants, potential times of visible stress, and competition timelines.

We considered the daily activity journals as our primary qualitative data source, with the CDE timeline and field notes being ancillary data sources. For the data analysis, the daily journals were open

coded to identify possible times of high or low stress. The CDE timeline and field notes were then individually open coded and triangulated with the daily journal codes. We compared open codes across student participants and teacher participants to identify potentially shared times of stress.

For the convergent data analysis, the quantitative and qualitative data were collected and analyzed concurrently. We triangulated data through the use of multiple data sources, including personal daily journals of students, the journals of the teachers, researcher field observations, and information provided by the organizers of the CDE. Due to the emphasis placed on the quantitative portion of the research methodology, the quantitative data analysis served as the foundation for which the findings emerged. The qualitative analysis results were triangulated to the quantitative results to support identified times of stress and recovery.

Rigor and Relevance

Trustworthiness was upheld through the use of peer debrief, triangulation, member checking, and thick, rich descriptions (Lincoln & Guba, 1985). In examining validity and reliability by looking at previous work, the study of physiological stress is a growing field. There are multiple means through which to measure the physiological stress response. These measures include, but are not limited to, galvanic skin response (GSR), cortisol levels as measured in bodily fluids, and rates of respiration. Multiple researchers indicate heart rate variability as a valid and reliable measure of physiological stress across many fields of study (Brosschot et al., 2006; Delaney & Brodie, 2000; Hall et al., 2012; Hjortskov et al., 2004; McCraty & Atkinson, 1996; McCraty et al., 1995; Vrijkotte, van Doornen, & Geus, 2000). In an independent study, the Firstbeat ambulatory heart rate monitors were found to be reliable for both heart and respiratory rates, with all but one correlation above .79 ($p < .05$; Bogdany et al., 2016).

Limitations of the Study

This study is not without several limitations. Therefore generalization of the findings to other populations is not possible. Teacher educators and SBAE teachers should consider the study limitations but are encouraged to reflect on how this study could relate to their situation. The primary limitation is in the small sample size. Due to the nature of this study as exploratory both conceptually and methodologically, the smaller sample size was chosen for this mixed methods study (Creswell & Plano Clark, 2010). A second limitation is the sample selection of only exemplary teachers in a single state who also have a history of success in Career Development Event competitions. Next, we acknowledge the process of wearing the ambulatory heart rate monitor and the monitoring process, in general, could have an impact on the findings of stress levels. Finally, within Missouri, the state CDE competitions are integrated into the state FFA convention. While we were able to indetify key moments before, during, and after the CDE competition,s multiple other stressors could be occurring simultaneously for both teachers and students.

Findings

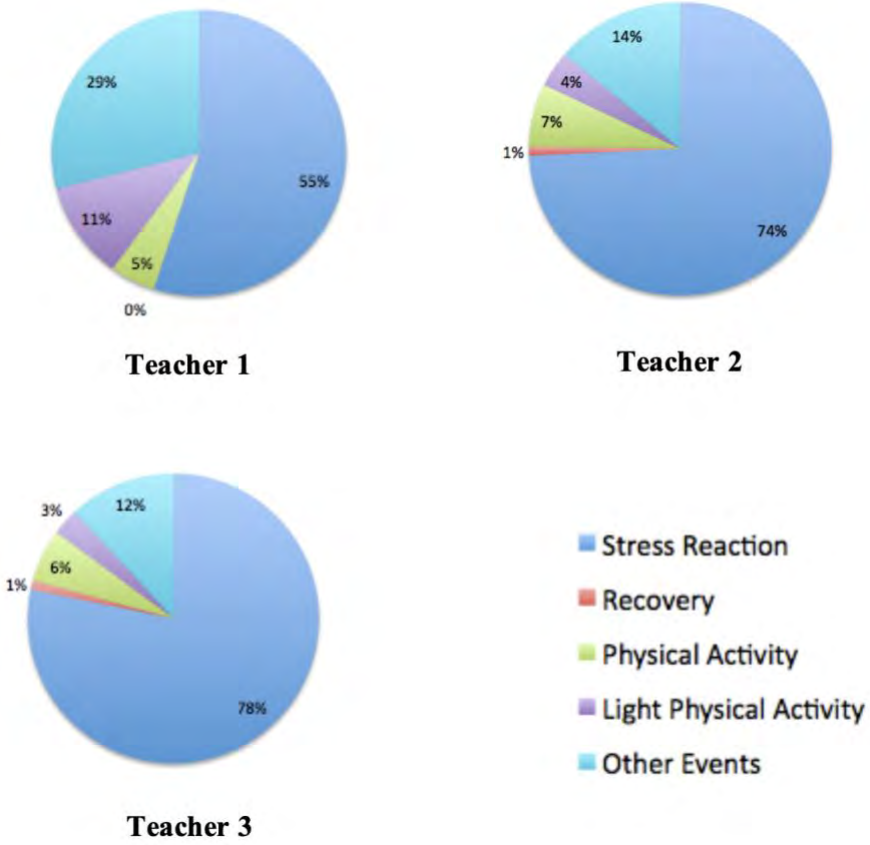
Objective 1

Research objective one sought to describe physiological stress levels of CDE coaches during integral periods that are related to state-level competition. Results revealed commonalities and differences between the teachers in stress responses surrounding state-level CDE events (see Figure 4). All teachers were found to exhibit stress reactions the majority of the time (Teacher 1 = 13h 25min, 55%; Teacher 2 = 18h 49min, 75%; Teacher 3 = 19h 54 min, 78%) during the day that spanned from bedtime the night before the contest, to bedtime the night of the competition. When combining stress

and physical activity states, due to physical activity is a physiological stressor (Firstbeat Technologies Ltd., 2014), the amount of time each teacher spent in a state of physiological stress composed a majority of their time (Teacher 1 = 71%, Teacher 2, 43%, Teacher 3 = 87%). They all exhibited elevated average heart rates at 95, 81, and 79 beats per minute (bpm), respectively, for the duration of the time measured. The teachers varied negligibly (Teacher 1 = 0 min, 0%; Teacher 2 = 14 min, 1%; Teacher 3 = 12 min, 1%) in the amount of recovery detected. All teachers exhibited elevated heart rates (Teacher 1 = >80 bpm, Teacher 2 = >70 bpm, Teacher 3 = >80bpm) during sleep and also upon meeting students the morning of the contest and during their students' competition. The teachers again diverged upon the posting of results from the contest with Teacher 1, showing a lack of stress response, but no recovery, while Teacher 2 and Teacher 3 both had an immediate onset of the physiological stress response.

Figure 4

Physiological Stress Reactions Of CDE Coaches Related To A State-Level CDE



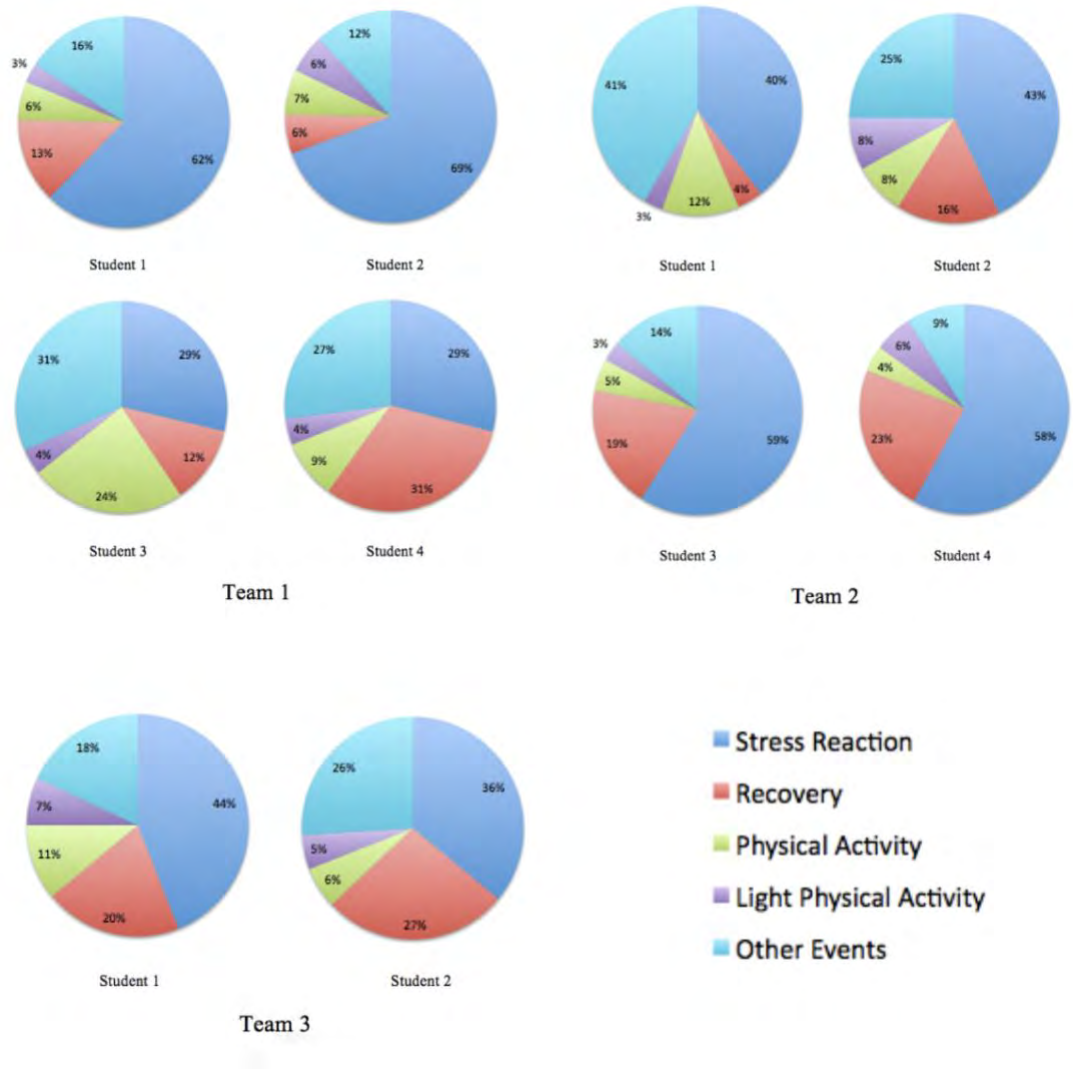
Objective 2

Quantitative research objective two sought to describe physiological stress levels of CDE participants during integral periods that are related to state-level competition. While all students did see more recovery than the teachers, ranging from 4% (Team 2 Student 4) to 31% (Team 1 Student 4), there was only one student who reached the minimum recommended 30% of the day spent in recovery. When examining stress responses, students ranged from a low of 29% (Team 1 Student 3 & Student 4) to a high of 69% (Team 1 Student 2). If the stress reaction, light physical activity, and physical activity responses are combined due to the physical activity being considered a physiological stressor, the

lowest stress response was 42% (Team 1 Student 4) and the highest was 68% (Team 2 Student 4). Several students were found to exhibit stress responses the majority of the time (Team 1 Students 1 & 2; Team 2 Students 3 & 4).

Figure 5

Physiological State Reactions Of CDE Participants Related To A State-Level CDE



The calculated resting heart rates and range of minimum and maximum heart rates are displayed in Table 1 below for reference. Most participants were below 60 beats per minute (bpm) with one student participant from Team 1 being at 60 bpm and one teacher participant being just below at 59 bpm. Several students indicated a high maximum heart rate, so we investigated their journals for factors that might contribute to these elevated heart rates. Some students did not provide details that would lead to elevations in heart rates. However, one student (Team 1 Student 3) did indicate the use of anti-anxiety medication, which does elevate heart rate. Students 1 and 4, also from Team 1, indicated exercise and athletic sporting events.

Table 1
Resting And Range Of Heart Rate Related To A State-Level CDE Competition By Team

Team	Participant	Resting HR	Min-Max HR
Team 1			
	Teacher	55	70-176
	Student 1	51	51-189
	Student 2	45	53-135
	Student 3	60	62-196
	Student 4	47	48-192
Team 2			
	Teacher	59	59-133
	Student 1	51	59-187
	Student 2	51	54-170
	Student 3	53	54-140
	Student 4	48	51-146
Team 3			
	Teacher	52	60-155
	Student 1	53	53-166
	Student 2	41	41-178

Note. All values are in beats per minute (bpm).

Objective 3: Contextualizing the experiences of coaches and participants

Common Experiences

The qualitative research question sought to identify experiences related to stress and resilience during state CDE competitions. From the daily activity journals, the analysis revealed that reviewing the CDE materials following the competition induced high amounts of physiological stress for both coaches and participants. The time between the conclusion of the competition and when results were posted was another stressor. Both teachers and students indicated high levels of stress while waiting for results, and stress levels varied following result announcements depending on the teams' results and expectations. Sleep deprivation was also another collective experience that emerged through qualitative analysis. The teachers were below the recommended seven and a half to eight-hour sleep period for their age range, two only slightly below at seven hours and the other significantly below at five hours. A majority of CDE participants experienced a lack of sleep and recovery due to late-night studying and cramming before the state competition. Teachers and students also experienced high levels of stress during teacher to student and student to student interactions. While each teacher and student were undergoing their level of stress, the experienced stress seemed to compound as the CDE team engaged with one another.

Unique Experiences of Coaches

Beyond competition related stress, the analysis also revealed events and situations from both the personal and professional lives of the teachers impacting physiological stress and recovery. Alcohol consumption was found to affect sleep negatively in two coaches, elevating the heart rate above the level where physiological recovery would be able to occur for Teacher 1 and 3. The alcohol consumption consisted of two to three drinks at the teacher's home or out to dinner with family/friends. Mostly both teachers had no recovery effect during the entire night's sleep before the competition. The sleep patterns for Teacher 2 showed disruption in caring for an infant, resulting in no physiological recovery as well. Additionally, none of the coaches were observed to engage in intentional

physical/athletic pursuits during the measurement time.

It is a common practice in Missouri for agriculture teachers to have their CDL to drive a school bus for the various trips their students go on. The State FFA Convention, where these CDE contests took place, was no exception to this norm. Two of the coaches in the study had to wake up early so they could pick up the school bus and be ready before students' arrival for departure. While Teacher 1 did not drive a school bus to the competition, they did arrive early to drive the CDE team in their personal vehicle.

Unique Experiences of Participants

CDE participants experienced specific stress and recovery events during the competition. One student indicated that as her team reviewed the plant identification and disorder specimens, she worried she had "missed a lot and was freaking out." During the review period, students were experiencing stress levels high enough to inhibit memory and other cognitive processes. CDE participants also experienced situations in their personal lives, which impacted their physiological stress and recovery. Some situations and events negatively impacted stress and recovery, including the death of a family member and pharmaceutical prescriptions for depression and anxiety. Also observed were events that positively impacted stress and recovery; the most significant of those was athletic participation ranging from dance to team sports.

Discussion

It is important to note that as researchers, we prefer to focus more on the importance of recovery in producing an optimal performance as opposed to emphasizing the instances of stress response activation. This focus is primarily because the stress response is involuntary and beyond the control of the individual, while recovery can be voluntary and is easily controlled in most people. None of the teachers were getting sufficient recovery during the time measured to recovery from daily activities. The majority of recovery for humans takes place during regular sleeping hours, and in adults and teens achieving the appropriate quantity and quality of sleep, recovery should account for a minimum of 30% of their day (Firstbeat Technologies Ltd., 2014). This lack of recovery would indicate possible cognitive impairment (Philip et al., 2004), which could mean the teachers are not performing to their fullest potential as both teachers and CDE coaches. Due to the possible cognitive impairment, a lack of teacher recovery could be a potential interventing issue not previously identified within the CDE preparation process (Ball & Bowling, 2015).

Sleep deficits can be a safety risk for motor vehicle operators to the point that commercial vehicle operation regulations provide stipulations on the amount of sleep required for drivers. There is a significant body of empirical evidence which provides a cognitive performance comparison in adults for sleep deprivation and being intoxicated by alcohol. This comparison is necessary to note as, in the state of Misosuri, agriculture teachers are frequently also the bus or van drivers for FFA trips. In this study, all three teachers were the driver transporting students with two operating buses and one operating a personal vehicle.

Nine of ten students participating in the study showed insufficient recovery for optimal performance, both cognitively and physically. The lack of recovery is vital as these young people were having high cognitive demands placed on them by having to maintain a standard of academic performance, as noted in their daily journals, during the days leading up to the CDE competition in addition to preparing for the competition and competing. The competitions, in combination with the State FFA Convention, can also be physically demanding. The competitions require students to be cognitively and physically engaged for up to four consecutive hours at a time, with the convention often requiring quite a bit of movement among various venues. This lack of balance of recovery and stress responses could have some long-lasting negative impacts on the students (Glanz et al., 2008).

Compromise of memory and cognitive processing ability occur when recovery is insufficient and is a valid concern among this group of students, as the goal of a CDE is for students to expand and assess their depth of knowledge related to career-specific skills and content. The impact of a lack of recovery on students' cognitive functioning and retention is a potential intervening issue not previously identified (Ball & Bowling, 2015).

The lack of recovery for both teachers and students can have cumulative effects on both interactions and relationships. Within the findings, it emerged that teachers and students experienced heightened stress responses when interacting with other participants who were lacking recovery and experiencing stress. These experiences occurred within both teacher to students and student to student interactions. This interaction raises the question of if communicative stress is being observed or if the simple interaction with a specific person is the origin of the elevated stress. Beyond influencing interactions, experiencing a lack of recovery can influence the relationships experienced between teachers and students. While not explicitly identified by participants and within the time frame of this study, a lack of recovery could negatively impact relationships (Yoon, 2002) which are vital within CDE preparation processes (Ball & Bowling, 2016) and classroom learning (Christenson et al., 2008; Niemiec & Ryan, 2009). Thus, a lack of recovery experienced could impact relationships that expand beyond the context of CDEs.

Conclusions and Recommendations

In examining the findings from the first objective, it emerged that all three teachers had stress responses caused by various events specific to state-level CDE participation. The lack of recovery and abundance of stress responses observed indicate that the teachers were both in a depletion cycle regarding energy resources. This depletion cycle makes self-care and intervention for stress management integral to optimal performance and resilience in the weeks following.

The findings from the second objective indicated that all students experienced stress reactions related to participating in a state-level CDE competition. While we observed a lack of the recommended amount of recovery within all but one student, students tended to exhibit more recovery than the teachers. However, the observed recovery was not enough to counterbalance a depletion cycle of energy resources. Students also experienced relatively average heart rates, with elevated events occurring throughout the study. While prescription medication and documented exercise accounted for some of the elevated events, details did not exist for a majority of the events.

The findings from the third objective could highlight context-specific stress-inducing experiences and ineffective and potentially even harmful coping mechanisms. Teachers and students both experienced high levels of stress during the post-competition review period and while waiting for results to be posted. A majority of students and all teacher participants experienced sleep deprivation, which influenced their ability to recover. As seen within two of the teachers, alcohol consumption hindered their sleep patterns and their ability to experience any recovery. Students indicated sleep deprivation due to studying or cramming the night/early morning before the contest. If these coping mechanisms continue in use, long-term, harmful, and undesirable impacts on health, wellness, and teacher effectiveness are likely to occur (Jarczok et al., 2013). The findings also highlighted felt communicative stress within the interactions between the teacher and students.

Based on the findings, practical recommendations can be made to mitigate stress and encourage recovery. To begin, teachers should be aware of the detriments of sleep deprivation for themselves and their students. Specifically, teachers should investigate the dangers associated with sleep deprivation and driving. Teachers also need to be aware of and communicate to students the impact of sleep deprivation on their cognitive processes. Schools and administrators could encourage teachers to engage in stress minimizing and recovery strategies by having health professionals host seminars or encouraging teachers to engage in stress and recovery professional development. Professional development should center around the utilization of teacher recovery boosting strategies. Additionally,

it should be noted that someone besides the agriculture teacher may fulfill the role of the CDE coach. This circumstance must be considered when developing and disseminating professional development opportunities around CDE psychological stress.

CDE preparation and study strategies should be developed and utilized to (a) prevent "cramming" before the competition and (b) encourage healthy sleep patterns. Teachers should also explore stress mitigating/resiliency strategies such as but not limited to: rational problem solving (Antoniou et al., 2013; Thieman et al., 2012), exercise (Austin et al., 2005), meditation (Csaszar, & Buchanan, 2015), controlled breathing, or journaling. These mitigation strategies could also be incorporated into CDE preparation practices. CDE coaches could provide practice breaks where meditation and controlled breathing exercises are encouraged. CDE participants could also practice controlled breathing strategies during practicals or mock competitions to then be able to use these strategies to reduce stress during actual competitions. Additionally, due to the emphasis on communitive stress and the amount of time CDE coaches work with students, additional strategies should be disseminated, which help students to manage anticipatory and in-action stress to allow for increased cognitive performance and resilience. Alterations could be made to the CDE competitions to reduce teacher and student stress. One of the most stressful time for both teachers and students was the post-competition review period. Many CDE teams use this time to further their knowledge and assess how successful they believe they were. While this is the goal of the review period, all participants registered high enough stress levels that their cognitive processing would have been negatively impacted. To address this, competition cooridnators could take pictures of the competition sections which could be reviewed and made available for teams to review after results are posted and after stress levels have decreased.

Additionally, benefits could exist if teacher preparation programs become more intentional in integrating CDE coaching/preparation within preservice teacher development. Intentional integration of CDE coaching could include lessons on CDE preparation strategies, lessons which integrate motivation and teaching strategies, early field experiences where pre-service teachers observe CDE preparation practices, and student teaching field experience guidelines which require pre-service teachers to prepare CDE teams at their cooperating site. Through more intentional integration of CDE preparation, pre-service teachers could develop more CDE preparation strategies, which could reduce teacher and student stress. During teacher preparation, CDE preparation is often lumped in with FFA Chapter advisement along with leadership development and award and recognition programs. Additionally, CDE preparation is not indicated in the list of suggested qualifiers for a placement site for student teachers (Miller & Wilson, 2010). We can only assume that preservice requirements related to CDE preparation fall within the qualifier of the "Active FFA Chapter." Further, field experiences are encouraged, which provide opportunities to analyze the relative amount of emphasis placed on classroom/laboratory instruction, SAE, and FFA in different SBAE programs (Miller & Wilson, 2010). CDE coaching accounts for 10% of teachers time, and teacher preparation programs need to bridge the underlying preparation to practice gap, whereas the roles and in practice devoted time as described by Torres et al. (2008) and Terry and Briers (2010) does not align with the recommendations for pre-service site selection and implementation as identified by Miller and Wilson (2010).

This exploratory case study elucidates preliminary variables of interest in gaining more knowledge on the lives of teachers to address issues of retention, teacher effectiveness, and general health and wellness of those in the teaching profession. Further research is warranted to investigate the experience of psychological stress within CDEs. This study should be replicated to include a larger sample. Additionally, the study expansion should include students and coaches engaging in a variety of different CDE administrative models to include a range of fators relating to guidelines for student participation on multiple teams to the format of the competitive events calendar.

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