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Changes in Feelings of Anxiety and Stress During High School Physical Education, Art, and US History Classes

Kacie Lanier

ACCEPTANCE

This dissertation, CHANGES IN FEELINGS OF ANXIETY AND STRESS DURING HIGH SCHOOL PHYSICAL EDUCATION, ART, AND US HISTORY CLASSES, by KACIE V. LANIER, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree, Doctor of Philosophy, in the College of Education & Human Development, Georgia State University.

The Dissertation Advisory Committee and the student's Department Chairperson, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

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Kacie V. Lanier

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CHANGES IN FEELINGS OF ANXIETY AND STRESS DURING HIGH SCHOOL PHYSICAL EDUCATION, ART, AND US HISTORY CLASSES

by

KACIE LANIER

Under the Direction of Drs. Rachel Gurvitch and Kathryn Wilson

ABSTRACT

Mental health problems, especially anxiety and stress, are a growing concern in youth. Physical activity (PA) has been shown to help decrease these feelings in children and adolescents. Because children and adolescents spend a majority of each day in school, physical education (PE) is an environment that can provide students the opportunity to participate in PA during the school day, which could be key to supporting their mental health. However, research examining students' feelings of anxiety and stress during PE is limited. Therefore, the purpose of this study was to determine how feelings of anxiety and stress change over the course of a high school PE class, an art class, and a US history class. Participants included 9^{th}-10^{th} grade students enrolled in either PE class, art class, or US history class. Over three days, students from each class completed trait anxiety (first day only), state anxiety, and stress surveys at the beginning and end of class in addition to wearing an accelerometer to measure PA levels during class. Bivariate correlations, a chi-squared test for association, and a one-way analysis of variance (ANOVA) were performed before the main analysis in order to determine any covariates that need to be included in the main analysis. A three-way mixed model repeated measures ANCOVA was performed as the main analysis to determine if there were statistically significant differences in state anxiety and stress scores over the class period, between classes, and between days. The results of this study did not find significant changes in students state anxiety and stress scores over a class period, between classes, or between days. Future research should continue to study PE and PA in order to understand the impact it has on student mental health.

INDEX WORDS: physical activity, mental health, mental distress, youth

CHANGES IN FEELINGS OF ANXIETY AND STRESS DURING HIGH SCHOOL PHYSICAL EDUCATION, ART, AND US HISTORY CLASSES

by

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DEDICATION

To my family and friends. Thanks for all of your support.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 PHYSICAL EDUCATION PARTICIPATION AND STUDENT ANXIETY, DEPRESSION, AND/OR STRESS: A SCOPING REVIEW

Mental health and wellbeing play a key role in overall health, especially psychological health, yet mental health problems are a growing concern worldwide. The World Health Organization (WHO) defines mental health as "a state of mental wellbeing that enables people to cope with the stresses of life, realize their abilities, learn and work well, and contribute to their community" (WHO, 2022, para. 1). Wellbeing is a person's ability to feel good and function well (Huppert & So, 2013). Primary and secondary school students describe wellbeing as a state of "being" (e.g., their needs were met, they experienced a sense of satisfaction, they felt happy, loved, cared for), "having" (e.g., rights, equality, relationships, voice, confidence), and "doing" (e.g., looking after oneself, acceptance making good decisions; Powell et al., 2018). Mental health and wellbeing can positively influence self-esteem, optimism, a sense of mastery and coherence, relationships, and resilience (Lehtinen, 2008). In addition, positive mental health can help reduce mortality and diminish the risk of chronic disease (Keyes, 2005; Keyes & Simoes, 2012). For students, positive mental health is related to academic achievement, fewer social problems, and better physical health (Suldo & Shaffer, 2008).

The prevalence of mental health problems is increasing, particularly in the youth population (WHO, 2021). Research suggests that mental health exists on a continuum and can vary over the lifespan. For example, adolescents can experience exacerbated mental health problems because of puberty and expectations from family, friends, school, and work (Granlund et al., 2021). In addition, sports participation during adolescence can have a variable effect on mental health (Graupensperger et al., 2021; MacDonald et al., 2012; Merglen et al., 2014; Panza et al., 2020). Therefore, periods of good and bad mental health can be expected in the youth

population. Before the COVID-19 outbreak, the World Health Organization reported a 13% increase in mental health conditions between 2007 and 2017 (WHO, 2021). The COVID-19 pandemic resulted in an even greater increase in mental health conditions (e.g., Czeisler et al., 2020; Hossain et al., 2020; Kearney et al., 2021).

Anxiety, depression, and stress are three common mental health problems that negatively impact mental health and wellbeing. Furthermore, anxiety and depression can be classified as clinical or subclinical. While occasional anxiety, or subclinical anxiety, is a normal part of life, clinical anxiety disorders, such as generalized anxiety disorder, panic disorder, social anxiety disorder, and various phobia-related disorders, can occur when feelings of anxiety do not go away, get worse over time, and interfere with daily activities (National Institute of Mental Health, 2022). As with subclinical anxiety, feelings such as sadness, irritability, frustration, restlessness, decreased energy, and difficulty sleeping are a normal part of life, but that does not mean a person has depression (also known as major depressive disorder or clinical depression). In order to be diagnosed with depression, the signs and symptoms of depression must be present for at least two weeks (National Institute of Mental Health, 2022). This paper will focus on subclinical anxiety and depression symptoms. Definitions of these constructs are found in Table 1.

Nearly 20% of the world's children and adolescents report living with a mental health condition (WHO, 2021). Data from the 2020 National Survey of Children's Health showed that 7.8% of children up to age 17 (about 5.6 million) experience anxiety, and 3.4% of children up to age 17 (about 2.4 million) experience depression (U.S. Census Bureau, 2021). In addition, teens reported stress levels similar to adults (4.6 vs. 5.1 on a 10-point scale) and stress levels higher

than adults during the school year (5.8 vs. 5.1 on a 10-point scale; American Psychological Association, 2014).

Table 1.1

Anxiety, Depression, and Stress Definitions

Construct	Definition

Anxiety	• The apprehensive anticipation of future danger or misfortune accompanied by a feeling of worry, distress, and/or somatic symptoms of tension. The focus of anticipated danger may be internal or external (American Psychiatric Association & American Psychiatric Association DSM-5 Task Force, 2013, p.818).
	• Two types:
	  ○ Trait Anxiety is an individual's predisposition or likelihood to experience anxiety (Spielberger, 1966). It is often considered part of the personality and refers to the tendency to attend to, experience, and report negative emotions such as fears and worries (Gidron, 2013).
	  ○ State Anxiety is temporary and is characterized by physiological arousal (e.g., sweaty palms, rapid heart rate, shortness of breath, and dry mouth) and consciously perceived feelings of apprehension, dread, and tension (Endler et al., 1989; Spielberger, 1966).

Depression	• Feelings of sadness or grief. These feelings can negatively affect how a person feels, the way he/she thinks, and how he/she acts and can lead to a variety of emotional and physical problems that can lead to withdrawal from usual activities (American Psychiatric Association, 2020).
Stress	• The body's response to pressures from a situation or life event and is the degree to which a person feels overwhelmed or unable to cope with these pressures (Mental Health Foundation, 2021). • Stress can produce mental or physical responses and can be a one-time or a short-term occurrence or can happen repeatedly over time (National Institute of Mental Health, 2020). • Stress can be caused by experiencing something new or unexpected, experiencing something that threatens a person's feeling of self, or can be a feeling that a person has little control over a situation (Mental Health Foundation, 2021), but it usually goes away once the situation is over (National Institute of Mental Health, 2020).

The onset of COVID-19 and associated public health mandates (i.e., stay-at-home orders, quarantine requirements) has exacerbated symptoms of anxiety, depression, and stress among students (e.g., Active Minds, 2021; Giannopoulou et al., 2021; Tang et al., 2021). During this time, 84.3% and 82.4% of high school and college students indicated an increase in stress and anxiety, respectively, while 60.7% reported heightened symptoms of depression (Active Minds, 2021). The prevalence of anxiety, depression, and stress within student populations represents a significant problem given that associated chronic conditions can endure into adulthood (e.g., Clarke & Currie, 2009; National Institute of Mental Health, 2021; Pao & Bosk, 2011; Pinquart & Shen, 2011). Therefore, it is important to identify and understand potential mediating factors to help moderate the impact of anxiety, depression, and stress in youth populations.

Physical activity (PA) and exercise participation are two factors that may reduce symptoms of anxiety, depression, and stress and promote mental health in youth (Brown et al., 2013; Cadenas-Sanchez et al., 2021; Carter et al., 2016; McPhie & Rawana, 2015; Norris et al., 1992; Zhu et al., 2019). For example, two studies found that students who scored in the Healthy Fitness Zone on the FitnessGram PACER test were more likely to have lower depression scores (Farren et al., 2018; Rieck et al., 2013). In addition, students who indicated higher depression and stress symptoms had lower levels of PA and fitness (Olive et al., 2016), whereas higher cardiorespiratory fitness, muscular fitness, and speed scores were negatively correlated with students' levels of anxiety (Reigal et al., 2020). Opportunities for PA engagement may be important for improving mental health by reducing symptoms of anxiety, depression, and stress among youth.

Physical education (PE) is a K–12 standards-based academic subject (SHAPE America, 2015) that incorporates the study of movement by developing students' knowledge of the body

by teaching basic principles of anatomy, physiology, and biomechanics (Biel, 2019). It also helps students develop behaviors related to PA, physical fitness, sportsmanship, self-efficacy, and emotional intelligence (SHAPE America, 2015). Furthermore, it is where students can regularly engage in PA during the school day (Center for Disease Control and Prevention, 2010). In addition to enhancing motor skills and improving fitness, decision making, cooperation, and conflict resolution skills (U.S. Department of Health and Human Services, 2012), PE is also predictive of students' daily moderate to vigorous PA (Chen et al., 2014). As 95% of children and adolescents ages 5–17 attend school for 6 hr/day, 5 days/week (Center for Disease Control and Prevention, 2015), PE offers an ideal setting to support students' mental health through PA. However, the school environment and the PE context represent a complex ecosystem that may inhibit the positive mental benefits of PA in PE. For example, students who are unmotivated or bullied usually show avoidance behavior (Ntoumanis et al., 2004) and have lower PA participation in PE and overall (Jiménez-Barbero et al., 2020). It remains unknown whether PE promotes or prohibits the reduction of symptoms of anxiety, depression, and stress, as would be expected with increased PA among students.

Rationale and Purpose

There is evidence to suggest that levels of anxiety, depression, and stress continue to increase and that PA may improve these mental health problems in adults and youth. However, there are currently no existing reviews that examine how PE relates to or might impact anxiety, depression, and stress among students. Therefore, the purpose of this scoping review was to gain an understanding of the research that has been conducted on this topic. Given the relative paucity of research and heterogeneity of study designs in this area, a narrative scoping review methodology was determined most appropriate for this study. Scoping reviews allow for a broad

assessment of evidence in an area of interest that would be precluded by the more rigorous requirements of a systematic review (Peters et al., 2020). In addition, this type of review has become popular in the PE field in recent years (e.g., Killian et al., 2019; Richards et al., 2017, 2019) as it allows for the examination of the nature, scope, and volume of literature on a specific topic (Munn et al., 2018) while also serving to inform more targeted research questions for future inquiry (Davis et al., 2009). The researchers applied scoping review methods to identify and map the available evidence related to PE participation and students' feelings of anxiety, depression, and/or stress (Munn et al., 2018). Guidelines outlined in the PRISMA Extension for Scoping Reviews: Checklist and Explanation (Tricco et al., 2018) directed this review that aimed to answer the following research questions:

1. What research has been conducted on the relationship between PE and students' feelings of anxiety, depression, and stress?
2. Of the research examining the relationship between PE and students' feelings of anxiety, depression, and stress, what, if any, characteristics of the study (e.g., program characteristics, lesson characteristics, activity type, or intervention) impacted these feelings in students?

Method

Eligibility Criteria

Eligibility criteria required that studies were (a) written in English; (b) peer-reviewed; (c) available in full text; (d) included quantitative and/or qualitative measures of students' feelings of anxiety, depression, and/or stress as the primary outcome; and (e) conducted in a PE setting during school hours.

Studies were excluded if they were (a) abstracts, (b) conference proceedings, (c) book chapters, (d) unpublished dissertations, (e) articles published in non-peer-reviewed journals, (f) focused on unrelated populations (e.g., college students or PE teachers), or (g) conducted in unrelated contexts (e.g., recess or after school PA).

Search Strategy

Potential search terms were discussed between the authors during the initial phase of this review. Search terms, databases, and search strategies were finalized in consultation with a subject expert librarian (Aromataris & Riitano, 2014). Literature searches were conducted through May 6, 2022, using the following databases: Academic Search Complete, APA PsycInfo, ERIC, and SPORTDiscus. Database filters were used to ensure search results aligned closely with the eligibility criteria established for this review. Examples of search terms included PE, stress, anxiety, depression, primary school, and secondary school. The complete search algorithms can be viewed in Appendix A.1. An overview of the article selection process is provided in Figure 1.

Selection of Sources of Evidence

Title, abstract screenings, full-text reviews, and reference list searches were conducted by the first two authors. Disagreements during screening were resolved through team debriefing, and all authors agreed to the articles included in this review.

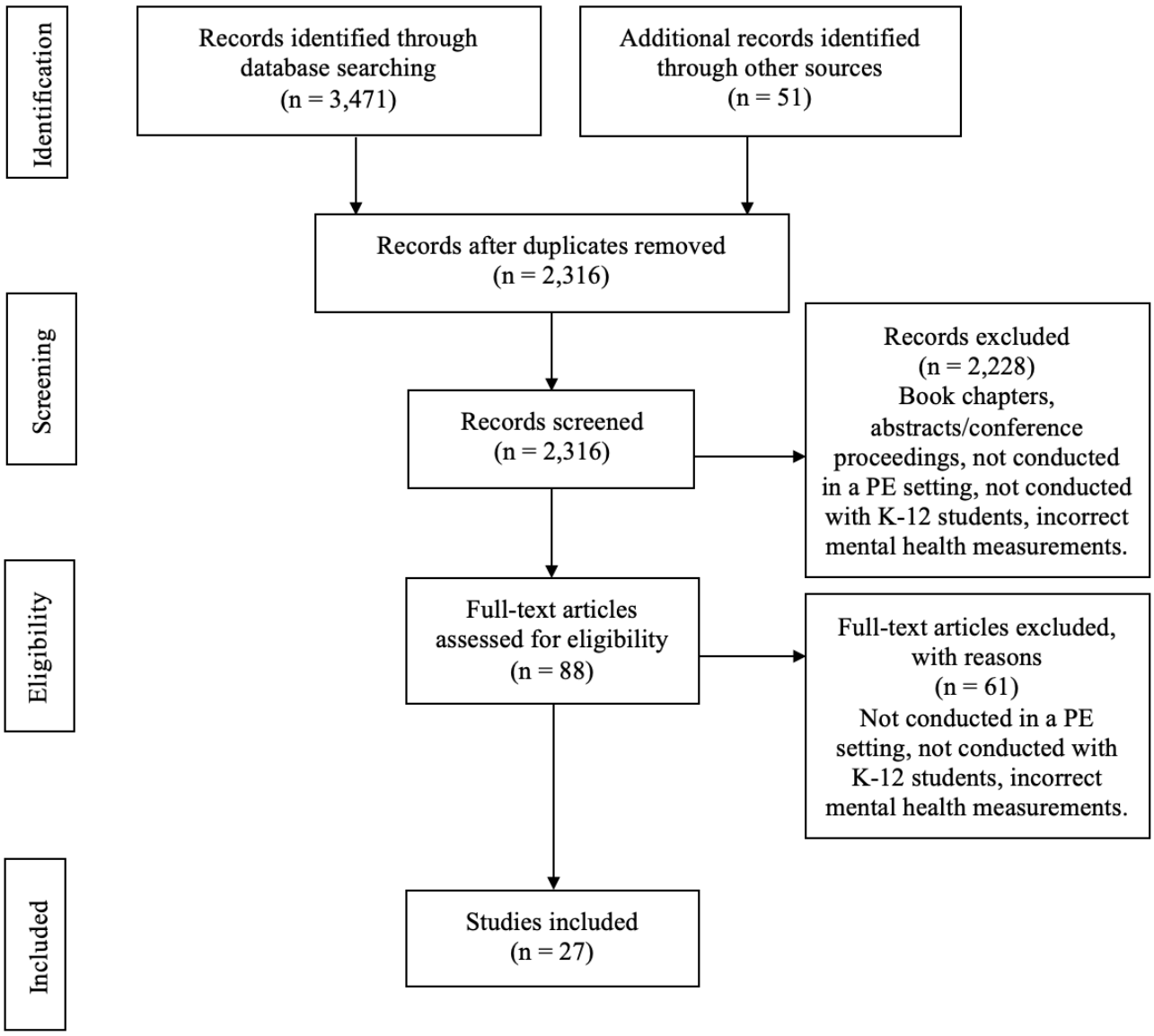
Data Charting Process

In a scoping review, the data charting process involves extracting all relevant information from the included sources through the use of a clear and comprehensive data charting form (Peters et al., 2015; Tricco et al., 2018). The lead author developed the data charting tool to identify relevant study characteristics (see Appendix A.2). Data extraction was conducted by the

lead author and occurred iteratively to ensure extraction approaches remained aligned with the purposes of this review (Colquhoun et al., 2014). During this process, questions and disagreements were noted and discussed by the authors to increase the trustworthiness of the data extraction process.

Figure 1

PRISMA flow chart including reasons for study exclusion. PRISMA Extension for Scoping Reviews (PRIMSA-ScRC): Checklist and Explanation.



Data Items

Data extracted from the included studies were coded for the following variables: (a) authors; (b) year; (c) the country where the study was conducted; (d) outcome measured (e.g., anxiety, depression, and/or stress); (e) study design; (f) participant characteristics (e.g., age, grade level, sample size); (g) study characteristics (e.g., lesson characteristics, activity type, intervention, etc.); (h) tool used to measure anxiety, depression, and/or stress; (i) PA measurement tool; and (j) key results (e.g., changes in anxiety, depression, and/or stress levels).

Summary of Results

The studies were organized into a table (see Appendix A.2) and grouped chronologically by the outcome measured (e.g., anxiety, depression, and/or stress). Study summaries include the author, country, outcome assessed, study design, participants, study characteristics (e.g., lesson characteristics, activity type, intervention, etc.), measurement instruments, and key findings.

Results

Selection of Sources of Evidence

A total of 3,522 articles were identified through database searches (n = 3,471) and reference list searches (n = 51). Once the duplicates (n = 1,206) were removed, title and abstract screenings were performed on 2,316 articles. After title and abstract screenings, an additional 2,228 articles were excluded for failing to meet eligibility criteria. A total of 88 articles went through full-text reviews where individual vetting and team deliberations occurred, resulting in an additional 61 articles being excluded. In the end, 27 articles met the eligibility criteria for this review (see Figure 1). Data from these articles is summarized in Appendix A.2.

Characteristics of Sources of Evidence

The 27 studies in this review included a total of 8,749 participants ages 6–19 years from primary schools, middle schools (6^{th}-8^{th} grades), junior high schools (7^{th}-9^{th} grades), and high schools. A total of 12 studies specifically assessed anxiety, three assessed depression, and four studies assessed stress. Four studies assessed anxiety, depression, and stress, and four studies assessed depression and stress. All classes in the included studies were considered core, compulsory PE classes. Classes were taught by PE teachers from the school (n=9), trained teachers from outside of the school (n=8), general classroom teachers (n=1), general classroom teachers plus PE teachers (n = 1), and trained teachers from outside the school plus PE teachers (n = 2). Five studies did not include information about the teacher. Studies were conducted in countries throughout Europe (n = 13), North America (n = 9), Asia (n = 2), South America (n = 2), and Australia/Oceania (n = 2). Twenty-one studies (75%) did not report a guiding theoretical framework, and seven used a theory to guide the research. Of the seven theory-based studies, four used Achievement Goal Theory, Self-Determination Theory, or a combination of the two, two used Social Cognitive Theory, and one used Achievement Goal Perspective Theory. Experimental (n = 8), quasi-experimental (n = 8), descriptive (n = 3), correlational (n = 6), and mixed methods (n = 2) study designs were used. Questionnaires or surveys were the most common measurement tool, and 31 different questionnaires used throughout the included articles. The relevant extracted data relating to the research questions and objectives are shown in Appendix A.2.

Summary of Results

A detailed description of each study can be found in Appendix A.2.

Research Question 1: What research has been conducted on the relationship between PE and students' feelings of anxiety, depression, and stress?

Anxiety. Of the 27 studies included in this review, 12 examined students' feelings of anxiety. Two studies used an experimental design, three used a quasi-experimental design, three used a correlational design, three used a descriptive design, and one used a mixed methods design. The authors found that four studies reported reduced symptoms of anxiety, three reported increased symptoms of anxiety, and five reported a mix of changes or no changes in anxiety levels.

Several key patterns also emerged from the included articles. The first pattern was the relationship between the PE environment and students' feelings of anxiety. For example, task-involving climates (e.g., focus on personal improvement and positive cognitive, affective, and behavioral responses during activity involvement) were more likely to result in or be associated with lower levels of anxiety, while ego-involving climates (e.g., focus on beating the other participants and ability is rewarded) were more likely to result in or be associated with higher levels of anxiety (Barkoukis et al., 2008, 2010; Liukkonen et al., 2010; Papaioannou & Kouli, 1999).

The second pattern that emerged was related to the motivational qualities of the students and the class climate. Of the two studies that examined motivational profiles, one found that students in the "high motivation profile" group (e.g., high levels of intrinsic motivation, identified motivation, and introjected motivation, moderate levels of external motivation, and low levels of amotivation) reported significantly higher levels of state anxiety than students in the "low motivation profile" group (e.g., low levels of intrinsic motivation, identified motivation, introjected motivation, external motivation, and amotivation). However, both of these groups

were considered to have low levels of state anxiety in PE (Yli-Piipari et al., 2009). The second study found that anxiety was positively related to amotivation, external regulation, and introjected regulation, while it was negatively related to enjoyment, intrinsic motivation, all psychological needs, and perceived competence. An ego-involving motivational climate was also positively related to anxiety, whereas a task-involving motivational climate and task orientation were negatively related to anxiety (Jaakkola et al., 2019).

The third pattern found in the included articles was the use of fitness and exercise activities when examining students' feelings of anxiety. Of the five studies that examined fitness and exercise, two found that when fitness testing was the focus of the lesson, students reported higher anxiety levels (Huhtiniemi et al., 2020; Lodewyk & Muir, 2017). However, when the PE class only involved participation in exercise, students' anxiety levels decreased (Klizienė et al., 2018; Kliziene et al., 2018; Silvestri, 1987).

Finally, the type of content during the PE lessons was related to students' feelings of anxiety. For example, one study examined the differences in students' anxiety after participation in a regular PE unit and a Teaching Games for Understanding unit. The study found that students reported significantly higher anxiety after a regular PE experience and significantly lower anxiety after the Teaching Games for Understanding experience (Lodewyk & Bracco, 2018).

Depression. Three studies examined the impact PE had on students' feelings of depression. Two studies used a quasi-experimental design, and one study used a correlational design. The first study compared bird watching and walking's impact on students' feelings of depression and found that walking decreased feelings of depression (Cobar et al., 2017). The second study found that participation in health-related personal fitness activities (e.g., the FITNESSGRAM PACER, curl-up, and push-up tests) was associated with decreases in students'

feelings of depression (Xiang et al., 2017). The third study found that exergames, active videogames (e.g., Just Dance 2015) provided by game consoles like the XBOX with Kinect, did not significantly change students' feelings of depression (Andrade et al., 2019). With only three studies directly examining students' feelings of depression, it is difficult to draw conclusions about the impact of PE on depression.

Stress. Four of the 27 included studies examined students' feelings of stress. These studies included the use of an experimental design (n = 2), a quasi-experimental design (n = 1), and a mixed methods design (n = 1).Two studies reported reduced symptoms of stress, while two reported no changes in students' stress. One finding from these studies was the Effects of a Physical Education-Based Coping Training (EPHECT) program's inconsistency in helping students cope with stress. Of the three studies that implemented this program, only one found that students reported decreases in their perceptions of stress (Lang et al., 2016). The other two studies found no change in students' stress perceptions (Lang et al., 2017, 2019).

Another study examined PE's ability to help students maintain and control their stress. This study examined the differences in seventh-, eighth-, and ninth-grade students' perceptions of the effects of PE on stress. It was found that PE participation helped students, especially seventh-grade students, forget about stress, better handle stress, have lower stress levels before arrival to PE, and have lower stress levels after participation in PE (Barney et al., 2019).

Anxiety, Depression, and Stress. Four studies examined students' participation in PE and their feelings of anxiety, depression, and stress. One study used an experimental design, two used a quasi-experimental design, and one used a correlational design. Furthermore, all four of these studies reported mixed effects on students' feelings of anxiety, depression, and stress. Extending observations highlighted in the "Anxiety" section, another study found that a task-

involved motivational climate was associated with higher pre-competition anxiety, while an ego-involved motivational climate was associated with higher post-competition stress. On the other hand, depression scores were not impacted by the type of climates to which students were assigned (Cecchini et al., 2001).

Another study implemented the HeadStrong Program. This was a school-based educational intervention that examined and taught students about mental health literacy, stigma, help-seeking, psychological distress, and suicidal ideation. The program consisted of 5 modules: mood and mental wellbeing, the low down on mood disorders, reaching out – helping others, helping yourself, and making a difference. It was delivered by the teacher over 5-8 weeks and students were assessed pre- and post-intervention and at a 6-month follow-up. After participating in the program, students' anxiety, depression, and stress scores were not significantly different from preintervention anxiety, depression, and stress scores (Perry et al., 2014).

The other two studies examining anxiety, depression, and stress demonstrated yoga's inconsistent impact on students' mental health. As seen in one study that implemented the Yoga Ed Program, students' levels of anxiety, depression, and stress did not significantly change from the beginning of the program to the end of the program (Khalsa et al., 2012). Furthermore, another study using Kripalu Yoga found that students in the yoga group reported better anxiety scores than students in the PE group at the end of the study, but there was no difference in the yoga group and the PE group's depression and stress scores from the beginning of the study to the end of the study (Noggle et al., 2012).

Depression and Stress. Of the 27 studies included in this review, four studies examined students' feelings of depression and stress. Three studies used an experimental design, and one study used a correlational design. One of the studies reported reduced symptoms of depression

and stress, one reported an increase in symptoms of depression and stress, and two studies reported increases and decreases in students' levels of depression and stress. The final study that implemented yoga as a way to help students' depression and stress corroborated its inconsistent impact on students' mental health. The study implemented Kripalu Yoga and found that students reported increases in perceived stress and depression over the course of the study (Butzer et al., 2017).

Another key finding from these articles is the continued emphasis on the importance of the motivational climate in PE (see the "Anxiety" section). One study found that if students perceived an ego-involving climate they reported greater life stress. The same study also found that depression was negatively related to caring and task-involving climates while it was positively related to ego-involving climates and life stress (Hogue et al., 2019). A second study using exergames examined their impact on depression and stress. The study found that this type of activity used in PE resulted in lower depression and stress levels in students (Andrade et al., 2020).

Finally, the Lifestyle of our Kids (LOOK) Study examined the impact of a specialist-taught PE program on depression and stress over four years. After one year of the study, students' depression scores decreased, but this was not sustained over the four-year study period. Also, stress scores did not significantly change over the course of the study (Olive et al., 2019).

Research Question 2: Of the research examining the relationship between PE and students' feelings of anxiety, depression, and stress, what, if any, characteristics of the study (e.g., program characteristics, lesson characteristics, activity type, or interventions) impacted these feelings in students?

Lesson Characteristics. Seven of the 27 studies examined lesson characteristics implemented by the researchers. These seven studies all examined how caring, task-involved climates and ego- involved climates were associated with students' feelings of anxiety, depression, and stress. Researchers for all seven studies found that caring, task-involved climates were associated with lower levels of anxiety, depression, and stress while ego-involved climates were associated with higher levels of anxiety, depression, and stress. For example, ego-involved volleyball tasks resulted in higher somatic anxiety when compared with task-involved volleyball tasks (Papaioannou & Kouli, 1999). Studies implementing the TARGET principles with the goal of comparing task-involved climates and ego-involved climates found that task-involved climates were associated with lower anxiety scores in students (Barkoukis et al., 2008, 2010).

Another study explored the relationship between motivational climates and anxiety, depression, and stress. After participation in an introduction to athletics unit followed by a track and field competition, students in the task-involved motivational climate experienced more pre-competition somatic anxiety, whereas students in the ego-involved motivational climate experienced more post-competition stress. However, students' depression scores were not affected by the type of motivational climate (Cecchini et al., 2001).

Finally, three studies examined the difference between task-involved climates and ego-involved climates. One study investigated the association between task- and ego-involving

motivational climates, task and ego orientations, and anxiety. Overall, an ego-involved climate was positively associated with an ego orientation and anxiety, and a task-involved climate was positively associated with a task orientation and negatively associated with anxiety (Jaakkola et al., 2019). The second study examined the effect of motivational climates on feelings of anxiety and found that task-involving motivational climates were associated with lower anxiety levels while ego-involving motivational climates were associated with higher levels of anxiety (Liukkonen et al., 2010). Lastly, one study examined the relationship between perceived motivational climates in high school PE classes and stress and depression. The study found that ego-involved climates were linked to greater stress in male and female high school students. Ego-involved climates were also positively associated with depression in female students. Conversely, caring climates and task-involved climates were negatively associated with stress and depression in male and female students (Hogue et al., 2019).

Activity Type. Twelve of the 27 studies included in this review examined how different activity types impacted anxiety, depression, and stress. Six of the 12 studies examined fitness activities. Two studies found that a 7-month and an 8-month exercise intervention resulted in significantly decreased anxiety scores for the children in the intervention group (Klizienė et al., 2018; Kliziene et al., 2018). A third study found that for both aerobic dance and aerobic dance with progressive relaxation, students experienced decreases in anxiety (Silvestri, 1987). Another study found that higher levels of state anxiety were associated with students participating in a fitness testing unit compared with students participating in a soccer unit (Lodewyk & Muir, 2017). A second study examining the impact of fitness testing on anxiety found that students in an aerobic endurance fitness class and a skills and muscular strength class experienced higher levels of somatic anxiety, but lower levels of cognitive anxiety when compared with students in a

general PE class (Huhtiniemi et al., 2020). The final study examined the association between depression and health-related and skill- related personal fitness. The study found that health-related personal fitness was significantly negatively related to depression while skill-related personal fitness was not significantly related to depression (Xiang et al., 2017).

Three studies examined yoga's impact on students' feelings of anxiety, depression, and stress. One study found that after participation in an 11-week yoga program, anxiety, depression, and stress scores were not significantly different between the yoga group and the PE as usual group (Khalsa et al., 2012). Another study found that anxiety scores were significantly lower for students who attended two to three yoga sessions a week over ten weeks compared to students who met two to three times a week for PE as usual over the same ten weeks. However, there were no significant differences between groups for depression and stress scores (Noggle et al., 2012). The third study found that female students in the yoga group and the PE as usual group experienced significant increases in perceived stress from pre-intervention to post-intervention and from pre-intervention to the 1-year follow-up, while male students in both groups did not report significant changes in perceived stress. In addition, the entire sample reported significant increases in depression between pre-intervention and post-intervention, pre-intervention and 1-year after the study, and six months after the study and 1-year after the study (Butzer et al., 2017).

Two studies examined exergames' impact on feelings of depression and stress. One study found that depression scores were not significantly different for the exergames group or the PE group from pre- to postintervention (Andrade et al., 2019). The second study found that boys and girls in the exergames group and the PE group experienced lower stress levels, while only boys and girls in the PE group experienced lower depression scores (Andrade et al., 2020).

One study compared students' feelings of depression after participation in either a 10-minute walk and 20-30 minutes of birdwatching or a 30–40-minute walk. The study found that from pretest to posttest depression significantly decreased for students who participated in the 30–40-minute walk. However, depression for students in the birdwatching group stayed the same between the pretest and the posttest (Cobar et al., 2017).

Interventions. Five of the 27 studies implemented intervention programs with the goal of reducing students' feelings of anxiety, depression, and stress. Three studies applied the EPHECT intervention, which specifically targeted students' feelings of stress. The intervention consists of eight modules linked with motor learning tasks, followed by a short reflection and discussion (Lang et al., 2016; Lang et al., 2017). In one study, the intervention was implemented over three months, and it found that students' perceptions of stress remained stable from pre- to postintervention (Lang et al., 2017). For the second study, the EPHECT intervention was implemented over an 8-month period, and again found that perceptions of stress remained stable from pre- to postintervention for students (Lang et al., 2019). The third study implemented the EPHECT program over a 3-month period and found that stress perceptions remained stable in the intervention group and the control group from pre-intervention to post-intervention. However, at the 7-month follow-up, there was a decrease in stress perceptions in the intervention group (Lang et al., 2016).

Another study implemented the HeadStrong program, which aimed to help improve student's feelings of anxiety, depression, and stress. This program took place over 5-8 weeks and covered topics related to mood and mental wellbeing, the low down on mood disorders, reaching out – helping others, helping yourself, and making a difference. Students participating in the intervention had anxiety, depression, and stress scores within the normal range at the pre-

intervention measurement. These scores were not significantly different at the post-intervention measurement and the 6-month follow-up (Perry et al., 2014). The LOOK intervention was a 4-year study that examined the impact of a specialist taught PE program on students' feelings of depression and stress. The study found that there was not a significant difference in depression and stress scores for the intervention and control groups at baseline, 12 months, and 4 years (Olive et al., 2019).

Discussion

This review found 27 studies that examined students' feelings of anxiety, depression, and/or stress in the context of the PE setting. Overall, the evidence is mixed and provides a poor understanding of how PE is related to students' feelings of anxiety, depression, and/or stress. More work is needed that incorporates experimental designs measurements of PA while accounting for program characteristics, lesson characteristics, activity types, and interventions that may potentially explain the impact of PE on mental health outcomes.

One key finding in this review was related to lesson characteristics and the importance of the PE climate. Results from a few studies indicated that caring, task-involved climates were consistently related to reduced symptoms of anxiety, depression, and stress among students, while performance, ego-involved climates were consistently related to increased symptoms of anxiety, depression, and stress among students (Barkoukis et al., 2008, 2010; Cecchini et al., 2001; Hogue et al., 2019; Jaakkola et al., 2019; Liukkonen et al., 2010; Papaioannou & Kouli, 1999). In task-involving climates, the emphasis is on personal development, effort, learning, and individual improvement (Jaakkola et al., 2019). Students in task-involved climates are more concerned with improving their abilities and mastering the task instead of trying to demonstrate

superior ability and outperform other students (Nicholls, 1989). Overall, these findings indicate that PE teachers should strive to establish caring, task-involved climates within the gym.

Furthermore, this review found that fitness testing had a negative impact on students' feelings of anxiety, depression, and/ or stress. Studies that examined fitness testing consistently found that students' feelings of anxiety, depression, and/or stress were negatively impacted (Huhtiniemi et al., 2020; Lodewyk & Muir, 2017; Xiang et al., 2017). However, studies that did not emphasize fitness testing, but still had students participate in exercise-related activities found that students' feelings of anxiety, depression, and/ or stress were positively impacted (Klizienė et al., 2018; Kliziene et al., 2018; Silvestri, 1987). These findings suggest that emphasizing the importance of fitness testing results may be detrimental. Teachers are therefore advised to emphasize enjoyment and personal improvement while students are participating in fitness testing activities.

Additionally, yoga is often presented as a way to improve a person's anxiety, depression, and stress (e.g., Bridges & Sharma, 2017; Chugh-Gupta et al., 2013; Li & Goldsmith, 2012), but this was not evident in the studies included in this review. Overall, most studies implementing yoga found either no change or an increase in students' symptoms of anxiety, depression, and/or stress scores. Explanations for these findings could be related to mainly female enrollment (Butzer et al., 2017; Noggle et al., 2012), student demographics (Butzer et al., 2017; Noggle et al., 2012), the length of the programs (Butzer et al., 2017; Khalsa et al., 2012), programs being taught by external personnel (Butzer et al., 2017), and the use of group randomization instead of individual randomization of participants (Butzer et al., 2017; Noggle et al., 2012). In addition, these studies compared students enrolled in a PE yoga program with students enrolled in a

traditional PE class, which could have impacted the results because yoga and PE have similar psychological and physical benefits (Khalsa et al., 2012).

Lastly, this review found that intervention programs designed to target students' feelings of anxiety, depression, and/or stress did not always have the intended effect (Lang et al., 2016, 2017, 2019; Olive et al., 2019; Perry 2014). One explanation for these program's ineffectiveness is the program's length (e.g., 5–8 weeks, three months, four months, one year, and four years). Longer programs could have led to a loss of interest, excitement, and novelty. Furthermore, more extended programs could have lacked variation and may not have evolved to fit the changing needs of the students (Lang et al., 2019; Olive et al., 2019). On the other hand, shorter programs may be expected to be less likely to produce sustained changes in mental health outcomes. The quality of teaching could have also played a role in the lack of positive results found from these programs (Lang et al., 2019; Perry et al., 2014). Finally, students in these programs could have already had a high level of mental health (Perry et al., 2014), so participating in a program to improve mental health would not have resulted in the significant changes researchers hypothesized (i.e., ceiling effect).

A key limitation of the included studies was the lack of discussion of program characteristics and details on the quantity and quality of the included programs. By not reporting on these details, informative conclusions on the impact PE had on students' feelings of anxiety, depression, and stress could not be drawn. The inclusion of these details will allow researchers to facilitate more controlled studies in the future, which will allow for a better understanding of the impact PE has on students' mental health.

In addition, many of the included studies were lacking PA measurements. Specifically, only three studies in this review (Klizienė et al., 2018; Olive et al., 2019; Yli-Piipari et al., 2009)

included a PA measurement, and only one specifically measured PA that occurred during PE class (Olive et al., 2019). Because the majority of the studies failed to include a PA measurement, conclusions about the role of PA within PE on students' feelings of anxiety, depression, and/or stress could not be drawn. However, research conducted outside of PE has found that PA and exercise can have a positive impact on mental health and mental health problems (e.g., Dale et al., 2019; Hu et al., 2020; Pascoe et al., 2020; Stubbs et al., 2017). Furthermore, PA intensity can also affect a person's mental health. For example, one review examining the effectiveness of PA interventions on depression, anxiety, and distress reported that all modes of PA were effective at improving depression and anxiety, but that higher intensity exercise was linked to greater improvements in these feelings (Singh et al., 2023). Additionally, another review analyzing exercise as a treatment for depression reported that aerobic exercises completed at moderate or vigorous intensities were associated with larger antidepressant effects (Schuch et al., 2016). Due to limitations in the evidence, however, it remains unclear whether PA participation within the PE environment positively impacts student mental health.

A third limitation of the included studies was the lack of discussion about the PE teacher's influence on students' feelings of anxiety, depression, and/or stress. Only three studies discussed the influence the PE teacher can have on anxiety, depression, and/or stress (Barkoukis et al., 2008; Cecchini et al., 2001; Papaioannou & Kouli, 1999). Based on these studies, it appears that PE teachers should strive to create environments that focus on personal improvement, enjoyment, and mastery of the skill. However, until more studies include discussions about the PE teacher's role and how they impact the PE environment and students, it is not possible to draw conclusions about how PE teachers influence feelings of anxiety, depression, and/or stress.

Despite research showing that PA has the potential to positively impact anxiety, depression, and stress (e.g., Hu et al., 2020; Mücke et al., 2018; Stubbs et al., 2017), this review found that these results do not consistently translate to the PE setting. The complexity of the school ecosystem provides one explanation for these inconsistent results. The school environment is ever changing because of the influence of classes, peers, teachers, assignments or tests, and school activities. This can make linking students' feelings of anxiety, depression, and/or stress directly to the PE environment difficult. In addition, barriers such as limited time (Center for Disease Control and Prevention, 2015), large class sizes (Gross & Buchanan, 2014; Turner et al., 2017), lack of proper equipment and facilities (Bevans et al., 2010; Morgan & Hansen, 2008; Schmidlein et al., 2014), and lack of support (Schmidlein et al., 2014; Turner et al., 2017) make it difficult for teachers to fully engage students, which may inhibit the positive mental health benefits PE could offer. Finally, the presence of bullying (Gano-Overway, 2013; Jiménez-Barbero et al., 2020) and low motivation levels (Mowling et al., 2004; Ntoumanis et al., 2004; White et al., 2021) can cause students to avoid PE, which could limit the impact of PE on students' mental health.

Limitations

In addition to the strengths of this scoping review, there are some notable limitations. At the beginning of this review, one of the inclusion criteria was that the article included a definition of anxiety, depression, and/or stress that matched the authors' operationalized definitions. However, the authors soon realized that many of the studies did not include definitions of anxiety, depression, and/or stress. By not including a definition of anxiety, depression, and/or stress, the reader must follow up on the instruments used to understand the constructs being measured. The absence of operational definitions also negatively impacts the

transparency of the study. For example, the replicability, accountability, validity, reliability, and relevance of the study cannot be determined (Altman & Moher, 2014; Knottnerus & Tugwell, 2016). Overall, the interpretation and dissemination of results by key stakeholders could be impacted by the absence of definitions for anxiety, depression, and stress. In addition, the lack of an operationalized definition and the variety of measures used to assess anxiety, depression, and/or stress resulted in challenges related to synthesizing results. Furthermore, there was the possibility that only a small proportion of students included in the studies were affected by anxiety, depression, and/or stress; therefore, meaningful effects might have been difficult to detect because of a ceiling effect.

A second limitation of this review was the absence of consideration for other factors that may influence anxiety, depression, and stress in the PE environment, such as affective learning outcomes. PE has been reported to enhance affective learning outcomes such as self-efficacy and enjoyment of PA (Dudley & Burden, 2020), which may contribute to changes in the outcomes of interest to this review. Though more research is needed to understand how affective learning outcomes impact students' anxiety, depression, and/or stress within the PE environment, such an investigation was beyond the scope of this review.

Finally, this scoping review identified zero qualitative studies that analyzed PE's impact on students' feelings of anxiety, depression, and/or stress and two studies that used mixed methods. The lack of qualitative methodology neglects the beliefs students' hold about PE and PA's ability to influence feelings of anxiety, depression, and stress. Therefore, future research needs to include qualitative methodology to better understand the role of students' beliefs in how PE impacts their feelings of anxiety, depression, and stress.

Future Research

As research continues to examine the impact of PE on students' feelings of anxiety, depression, and stress, future research should address several key issues:

- Researchers should begin to examine the impact of program characteristics on students' feelings of anxiety, depression, and stress.
- Researchers should include operationalized definitions of the outcomes being studied.
- Researchers should include a PA measurement in order to determine the impact PA within PE has on feelings of anxiety, depression, and stress.
- Researchers should also examine characteristics of the teacher and how he/she impacts students' feelings of anxiety, depression, and stress.
- Researchers should take into consideration the impact of affective learning outcomes on students' feelings of anxiety, depression, and stress.
- Researchers should also include qualitative methodology.

Conclusion

The evidence for the relationship between PE and symptoms of anxiety, depression, and stress is mixed. Future studies should continue to work to further understand the connection between PE and students' feelings of anxiety, depression, and stress. Furthermore, research should work to understand how currently established PE classes impact students' feelings of anxiety, depression, and stress before implementing changes to the class structure or interventions designed to decrease feelings of anxiety, depression, and stress. Overall, the relationship between PE and students' anxiety, depression, and stress remains poorly understood and requires continued investigation.

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2 CHANGES IN FEELINGS OF ANXIETY AND STRESS DURING HIGH SCHOOL PHYSICAL EDUCATION, ART, AND US HISTORY CLASSES

Mental health is a multidimensional concept that incorporates mental health difficulties (e.g., psychological distress), mental illness (e.g., anxiety, depression), and social, emotional, and psychological wellbeing (e.g., positive mental health; Westerhof & Keyes, 2010). Over the past decade, improving students' mental health has become a priority (Beames et al., 2022; Institute of Medicine, 2013; O'Reilly et al., 2018), as research shows that children and adolescents' mental health is deteriorating. It is estimated that 1 in 7 (14%) people 10-19 years old experience a mental disorder (WHO, 2021) with anxiety and depression accounting for 42.9% of mental disorders among adolescents (UNICEF, 2021). Stress, especially school-related stress (Anniko et al., 2019; Kaczmarek & Trambacz-Oleszak, 2021), is another common mental disorder experienced by youth.

Anxiety and Stress Defined

Anxiety is a "palpable but transitory emotional state or condition characterized by feelings of tension and apprehension and heightened autonomic nervous system activity" (Spielberger, 1972, p. 24). It can be conceptualized as either state anxiety or trait anxiety. State anxiety is a temporary reaction to perceived feelings of tension and apprehension, which can vary in intensity and fluctuate over time. Trait anxiety is a more stable personality feature and is related to individual differences in the perception of a stimulus as dangerous or threatening (Spielberger, 1972). Anxiety can also be considered subclinical or clinical. Subclinical anxiety is characterized by feelings of apprehension, dread, tension, rapid heart rate, sweaty palms, or shortness of breath, but goes away when the stimulus is removed. These same feelings can characterize clinical anxiety. However, with clinical anxiety, these symptoms do not go away;

they get worse over time and can interfere with daily activities (National Institute of Mental Health, 2022). For this study, subclinical anxiety is examined.

Stress is the physical or mental response to internal or external pressures. It affects almost every system in the body and influences how a person feels or behaves. Signs and symptoms of stress include sweating, dry mouth, shortness of breath, fidgeting, palpitations, etc. (American Psychological Association, 2018). While stress can be a short-term occurrence or can happen over a long period of time, it usually goes away once the stimulus is resolved (National Institute of Mental Health, 2020).

Perceived stress relates to a person's feelings or thoughts about how much stress they are under at a certain point in time or over a specific time period (Phillips, 2013). It “incorporates feelings about the uncontrollability and unpredictability of one’s life, how often one has to deal with irritating hassles, how much change is occurring in one’s life, and confidence in one’s ability to deal with problems or difficulties” (Phillips, 2013, p.1453). However, it is important to remember that perceived stress does not measure the types or frequencies of stressful events but how a person feels about the general stressfulness of their life and their ability to handle that stress (Phillips, 2013). This study examines feelings of perceived stress.

Prevalence of Anxiety and Stress Among Youth

Research indicates that the prevalence of anxiety and stress continues to rise in children and adolescents. In 2007, anxiety rates among children and adolescents were 3.5% and rose to 4.1% in 2012, 7.1% in 2016, and 9.2% in 2019 (Bitsko et al., 2018; Lebrun-Harris et al., 2022). Furthermore, teens report stress levels similar to or exceeding that of adults (American Psychological Association, 2014). Additionally, another longitudinal study found that 18% of 12–24-year-olds experience persistent stress (Wiens et al., 2020).

The COVID-19 pandemic resulted in continued increases in children and adolescents' anxiety and stress. Meta-analytic data found that 20.5% of youth experienced clinically elevated anxiety symptoms (Racine et al., 2021). Additionally, 38.1% to 84.25% of youth reported experiencing increased stress since the start of the pandemic (Active Minds, 2021; Al Omari, 2020). With 62.5% of mental disorders beginning by age 25 (Solmi et al., 2022), it is important to educate children and adolescents about ways they can protect their mental health.

Physical Activity and Mental Health

Physical activity (PA) is "any bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above a basal level" (U.S. Department of Health and Human Services, 2018, p. 29). The 2018 Physical Activity Guidelines for Americans recommends that children and adolescents participate in 60 minutes or more of moderate-to-vigorous physical activity each day (U.S. Department of Health and Human Services, 2018), which research estimates to be about 10,000 to 11,700 steps per day for adolescents (Tudor-Locke et al., 2011). While no research examines step thresholds and feelings of anxiety and stress in youth, research examining the impact of PA on mental health has found that participation in PA can not only support mental health but is also one way to combat symptoms of anxiety and stress. For example, physical fitness, self-reported PA, and pedometer-measured (steps/min) PA are positively associated with physical and mental functioning of health-related quality of life (Gu et al., 2016). Additionally, two systematic reviews examining the impact of PA and physical fitness on mental health in youth found that PA is related to lower levels of psychological ill-being (i.e., depression, stress; Rodriguez-Ayllon et al., 2019) and physical fitness (i.e., cardiorespiratory fitness and muscular fitness) is negatively associated with

depression and anxiety (Cadenas-Sanchez et al., 2021). Despite the documented benefits of PA, 81% of adolescents do not meet daily PA recommendations (Guthold et al., 2020).

Physical Education and Student Mental Health

Schools can play a key role in helping promote adequate PA and, by extension, mental health in youth. Evidence suggests that school-related PA interventions can help promote mental health and wellbeing among children and adolescents (Andermo et al., 2020; Hale et al., 2021). For example, the Creating Opportunities for Personal Empowerment (COPE) Healthy Lifestyles Thinking, Emotions, Exercise, and Nutrition (TEEN) program aimed to develop the cognitive and behavioral skills needed to promote health behaviors, healthy choices, and appropriate health beliefs in teens while also increasing their nutrition and physical activity knowledge and stress management. Adolescents who participated in this program had significantly lower levels of anxiety and had increased PA and stress management skills, which were maintained over 12 months (Ardic & Erdogan, 2017).

Physical education (PE) is a primary environment where students have the ability to accumulate instructional PA opportunities during the school day. Therefore, it may represent a key context not only for supporting students' accumulation of regular PA but also for their mental health. However, research examining PA and youth mental health in PE is limited (Lanier et al., 2022) and is primarily conducted in alternative settings outside of PE. For instance, one scoping review examining PA and exercise for youth mental health promotion included 30 studies, of which only three took place in a PE setting (Pascoe et al., 2020). In addition, a systematic review and meta-analysis examining the effects of interventions with PA components and adolescent mental health had similar results, with only one of the 13 included studies occurring within the PE environment (Neill et al., 2020).

While research within the PE classroom is limited, there is evidence to suggest that PE can have a positive impact on students' feelings of anxiety and stress (Lanier et al., 2022). For instance, caring, task-involved PE climates (Barkoukis et al., 2010; Jaakkola et al., 2019; Liukkonen et al., 2010) and exercise participation without a focus on fitness testing (Klizienè et al., 2018; Klizienè et al., 2018; Silverstri, 1987) have consistently shown a reduction in, or an association with, reduced levels of anxiety in PE. Additionally, students who participated in the Effects of a Physical Education based Coping Training (EPHECT) program experienced improved stress coping skills from pre- to post-intervention and a decrease in stress from post-intervention to the 6-month follow-up (Lang et al., 2016). This underscores the need for more research within the PE environment to further understand its potential benefits for student mental health.

Even though the available research suggests that PE can have a positive impact on mental disorders like anxiety and stress, there are several limitations in the current research that should be addressed. First, most of the current research does not include an operationalized definition of anxiety and stress (Lanier et al., 2022). This study includes a definition of each construct (see anxiety and stress defined section) and utilizes measurement instruments that align with the provided definitions. A second limitation of current research examining changes in feelings of anxiety and stress in PE is the lack of PA measurements (Lanier et al., 2022). Previous research indicates that PA can positively impact psychological well-being and psychological ill-being (e.g., symptoms of anxiety and stress) in youth (Pascoe et al., 2020; Rodriguez-Ayllon et al., 2019). Specifically, moderate-to-vigorous-intensity and light-intensity PA interventions may reduce symptoms of anxiety, but it is unclear how the intensity of PA impacts symptoms of stress (Pascoe et al., 2020). This implies that research conducted in the PE environment should

include PA measurement instruments in order to understand what PA intensities have the greatest impact on students' feelings of anxiety and stress. Therefore, this study includes measurements of students' feelings of anxiety, stress, and PA levels during class.

Purpose and Research Questions

With research showing increases in mental disorders (WHO, 2021) and decreases in youth PA participation (Farooq et al., 2020), schools, specifically PE teachers, should strive to play a more significant role in the promotion of students' mental health. Furthermore, before quality interventions can be implemented or policy changes made, researchers' and educators' understanding of how PE influences students' feelings of anxiety and stress needs to improve. Therefore, the purpose of this study was to examine how indicators of anxiety and stress change over the course of a high school PE class, art class, and US history class and how PA impacts these changes. Specifically, the following research questions will be addressed:

1. How do students' feelings of anxiety and stress change over the course of a high school PE class?
2. How does PA during a PE class impact students' feelings of anxiety and stress?
3. How do feelings of anxiety and stress differ between a PE class, an art, and a US history class?

A quasi-experimental pre-/post-test design was used for the study. This design has been used in many studies examining PE's influence on students' feelings of anxiety and stress (Lanier et al., 2022). However, in the majority of these studies, the experimental group, which experienced a change to the normal class routine, was compared to a control group of PE as usual, which did not experience a change to the normal class routine (e.g., Andrade et al., 2019; Khalsa et al., 2012; Klizienè et al., 2018; Lang et al., 2016; Perry et al., 2014). Only one study

used a control group that did not participate in PE during the pre-and post-test (Silvestri, 1987). By including control groups outside of the PE environment, a better understanding of how PE and PA impacts feelings of anxiety and stress compared to other types of classes can be achieved.

Methods

Prior to participant recruitment and data collection, approval from the Georgia State University Institutional Review Board (IRB) and the principal of the participating school was obtained.

Research Design

This study intended to use a mixed methods approach. The quantitative part of the study used a quasi-experimental pre-/post-test design. A quasi-experimental design was used because students could not be randomly assigned to the three groups. Instead, classes were assigned to groups based on the class type (PE, art, or US history). Then, the differences among students' feelings of anxiety and stress were examined (Matthews & Kostelis, 2011). A pre-/post-test design compared the beginning-of-class anxiety and stress scores to the end-of-class anxiety and stress scores over three class periods. From this comparison, conclusions were made about PE, art, and US history's impact on students' feelings of anxiety and stress (Matthews & Kostelis, 2011).

The qualitative part planned to involve teachers participating in an interview that explored their perceptions of their teaching style and classroom environment and its impact on student anxiety and stress. However, despite being asked multiple times to participate in the interview, the teachers did not agree to do so. Therefore, the qualitative part of the study describes what would have taken place if teachers had agreed to participate. The interview would

have lasted 45 minutes to one hour and would have taken place after the quantitative data were collected. The teacher would have chosen how she wanted to participate in the interview (e.g., face-to-face, phone, or Webex). Regardless of the method chosen, the interview would have been recorded through Webex for transcription purposes.

Participants

Participants included 9th through 10th-grade students from a high school located in South Alabama. Students were excluded if they had a significant physical or cognitive disability that interfered with their ability to correctly wear the accelerometer and/or comprehend and complete the surveys. Power analysis using G*Power 3.1(Faul et al., 2009; Faul et al., 2007) indicated that a sample of 63 students would be sufficient to detect a small effect size (f = 0.15) with 80% power and an alpha of 0.05 for a 3 (day) x 3 (class type) x 2 (pre and post) mixed model repeated measures analysis of covariance (ANCOVA).

Procedures

Participant Recruitment. Convenience sampling, a type of non-probability sampling that allowed participants to self-select if they wanted to participate in the study (Stratton, 2021), was used to obtain participants. The researcher contacted the school principal to ask if he would allow his school to participate in the study. If the principal agreed to have his school participate (see Appendix B.1 for a signed approval letter), then the researcher reached out to the teachers provided by the principal to ask if they would allow their classes to participate in the study. If the teachers agreed, then the researcher established a time to visit each class to inform students about the study and pass out the wavier of consent form (see Appendix B.2). Additionally, the teachers of the participating classes were asked to take part in a 45-minute to one hour interview at the end of data collection.

Study Protocol Students. One week before the study, the researcher informed students in each class that a study examining how students feel during the school day and how their movements relate to those feelings would take place. The researcher told students that their involvement would last four class periods if they chose to participate in the study. Students were also told that they would answer a survey at the beginning and end of each class that asked questions related to their emotions. In addition to answering questions about their emotions, students answered demographic questions (e.g., student number, accelerometer name, age, grade level, sex/gender, race/ethnicity) on the first survey. Additionally, if a student was in more than one class being assessed, then only their data from the first class was included in the study. Students were also informed that they would wear an accelerometer, which measured their movement during the class period. After the researcher informed students about the study and answered any questions, a waiver of consent was handed out. See Appendix B.2. The researcher told students they needed to give this form to their parents or legal guardians, and if their parents or legal guardians did not want them to participate in the study, then they needed to turn the form back in to their teacher or the researcher on the first day of the study. Additionally, a copy of the waiver of consent form was given to the teacher. This allowed the teacher to email the form to the parents, upload it to the class website, or provide additional copies to students. Finally, the researcher told students that their grade in the class would not be affected by their participation or non-participation in the study.

Students in each group (PE, art, and US history) participated in study procedures for one week. During the week, data were collected four times for each group, with the first day being a familiarization day. On each data collection day, students completed a pre- and post-survey that consisted of questions related to anxiety and stress. Students also wore accelerometers during

each class to track their movement. The survey instruments can be found in Appendices C.1, C.2, and C.3.

Day one of the study was a familiarization day, which allowed students to become accustomed to the study procedures, the surveys, and the accelerometers. On the first day, the researcher reminded students about the purpose of the study and asked if any students had the waiver of consent form (Appendix B.2) to turn in. If students did not turn in the waiver of consent form, then the researcher gave them an assent form to complete (Appendix B.3). If a student indicated that he/she did not want to participate in the study on the assent form, then he/she was not given the survey packet (Appendix D.1). They also were not given an accelerometer to wear during class. If a student indicated that he/she would participate in the study, then he/she was given the survey packet and instructed to complete the first survey. As students completed the first survey, the researcher gave the accelerometers to the students to attach their wrists. Students participated in the planned lesson, and at the end of class, the researcher instructed the students to complete the second survey. The researcher also collected the accelerometer from the students. Because day one was a familiarization day, the only information used during data analysis were student responses to the demographic questions related to age, grade, sex/gender, and race/ethnicity and their responses to the trait anxiety questions.

Data collected on days two, three, and four were used during the analysis. On these days, students participating in the study came into class and were given the survey packet (Appendix D.2) and an accelerometer. The researcher instructed the students to complete the first survey and put the accelerometer on their wrists. Students were told to complete the second survey at the end of class while the researcher collected the accelerometers.

On each data collection day, the researcher emphasized to students the importance of answering every question in order to have a complete data set for each student. Additionally, they were reminded of the importance of answering the demographic questions related to their student number, class name, and accelerometer name because this allowed students' survey data and movement data to be paired. Students were also reminded that they could stop participating in the study at any time. The researcher also explained that if students stopped participating, they could not rejoin the study after dropping out.

Study Protocol Teachers. After informing students about their part in the study, the researcher also asked the class teachers to participate in an interview at the end of student data collection. The researcher asked the teachers to participate in a 45-minute to one-hour interview that inquired about mental health problems students face, their teaching style, the type of classroom environment they have established for their students, and the impact their teaching style and classroom environment have on students. The interview guide can be found in Appendix B.5. The researcher informed the teachers that the interview could take place in person, over the phone, or over Webex. Teachers were told that the interviews would be audio and/or video recorded, and the audio or video file would be deleted once the interview had been transcribed. The researcher also informed the teachers that they would be provided with a transcription of the interview in order to review their responses and make any necessary changes or clarifications. Additionally, the researcher advised the teacher that any identifying information (e.g., teacher name, student name, school name, etc.) would be replaced with a pseudonym. The researcher also told the teachers they could choose not to answer a question or stop the interview at any time. After informing the teachers of the interview and answering any questions, they were given

a consent form (Appendix B.4). If the teacher agreed to participate, a day, time, and method was set up to conduct the interview.

On the day of the interview, the teacher would have been reminded of the purpose of the interview, that the interview would have been audio and/or video recorded, that it would have lasted 45-minutes to one hour, that they could have chosen not to answer a question, and that they could have stopped the interview at any time. After reviewing this information, the researcher would have confirmed that the teacher still agreed to participate in the interview. If the teacher would have agreed to participate, the interview would have begun.

Data Collection

Students. On day one (familiarization day), students who agreed to participate in the study completed the first survey (Appendices D.1). This survey asked students for demographic information related to their student number, class name, accelerometer name, age, grade, sex/gender, and race/ethnicity, state and trait anxiety, and stress. The researcher also passed out the accelerometers and showed students how to attach them to their wrists. All students enrolled in the classes participated in the day's lesson. At the end of class, students participating in the study completed the second survey (Appendices D.1), which included state anxiety and stress items. Students also returned the accelerometers. As previously mentioned, the familiarization day allowed students to become comfortable with the study procedures and study instruments. The only data used from this day was the demographic information related to age, sex/gender, and race/ethnicity and trait anxiety. On days two, three, and four, students completed the first survey, which consisted of demographic questions related to their student number, class name, and accelerometer name along with the state anxiety and stress items (Appendix D.2). While the students were completing the first survey, the researcher passed out the accelerometers. Next,

students participated in the lesson the teacher had planned before completing the second survey, which contained the state anxiety and stress items (Appendix D.2). The data collected on days two, three, and four were used in the analysis. At the end of data collection, the researcher downloaded the accelerometer data and paired each day's data to the corresponding survey data.

Teachers. Teachers were supposed to participate in one semi-structured, individual interview (Appendix B.5). The interview was intended to last 45-minutes to one hour and would have been audio or video recorded. The researcher would have conducted interviews at a time and in a format (e.g., in-person, over the phone, on Webex) chosen by the teacher. The researcher and a committee member developed the interview protocol with a particular focus on the teacher's teaching style and classroom environment and how these impact students' mental health. The questions were grouped into a general questions section and a teacher/class specific questions section. Sample questions included (a) 'what is your view on the current status of student mental health in your school?', (b) 'how have you integrated supporting students' mental health into your classroom?', and (c) 'in your opinion, what type of teaching styles support students' mental health?'

Measures

Demographic Information. The demographic questions collected data about age, sex/gender, grade level, and race/ethnicity in addition to the students' student number, class name, and accelerometer name (Appendix C.1). These questions were part of the first survey handed out by the researcher. Students completed the age, grade, sex/gender, and race/ethnicity questions only on day one and the student number, class name, and accelerometer name questions on each survey.

Anxiety. The State Trait Anxiety Inventory-5 (STAI-5) was used to measure students' feelings of state anxiety and trait anxiety (Zsido et al., 2020). See Appendix C.2. While the original version of the STAI consisted of 40 questions, 20 relating to state anxiety and 20 relating to trait anxiety (Spielberger, 1983), the short form consisted of 10 questions, 5 measuring state anxiety and 5 measuring trait anxiety (Zsido et al., 2020). Each question was scored on a 4-point Likert Scale (1 = not at all, 2 = somewhat, 3 = moderately so, 4 = very much so). The total score for each scale was calculated by summing the scores for each of the 5 items. A score of greater than or equal to 10 on the STAIS-5 (state anxiety scale) and/or greater than or equal to 14 on the STAIT-5 (trait anxiety scale) indicated that an individual could be considered potentially clinically anxious (Zsido et al., 2020). Both scales have shown high internal consistency (Cronbach's alpha = 0.90 and 0.82) in addition to being highly correlated with the original 40-item scale, *r's* > 0.86 (Spielberger, 1983; Spielberger et al., 1970; Zsido et al., 2020).

While this specific version of the STAI has not yet been used to measure students' feelings of anxiety during PE, the full version of the STAI (Spielberger, 1983) and the STAI-6 (Marteau & Bekker, 1992) have both been used to measure students' feelings of anxiety in relation to PE (Lodewyk & Muir, 2017; Silvestri, 1987). The STAI-5 was chosen for this study because it included a scale for both state and trait anxiety that could be administered to students with minimal interruption to class time. Additionally, the use of this version of the STAI allowed analysis not only of how students' state anxiety changed over the class period but also allowed analysis of how students' trait anxiety was related to the changes in state anxiety. Students answered the state and trait anxiety questions on the first survey and only the state anxiety questions on the remaining surveys.

Stress. Students' levels of perceived stress were measured using the 10-item version of the Perceived Stress Scale (PSS), which was shortened from the original 14-item version (Cohen et al., 1983; Cohen & Williamson, 1988). See Appendix C.3. This scale "measures the degree to which situations in one's life are appraised as stressful" (Cohen et al., 1983, p. 385). The items included in this scale measured the degree to which a person finds their life unpredictable, uncontrollable, and overloaded (Cohen et al., 1983). Each item was scored on a 5-point Likert scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, 4 = very often). The total score for each scale was calculated by summing the score for each of the 10 items after reverse scoring the four positively stated items (items 4, 5, 7, and 8). Scores range from 0 to 40, with higher scores representing a higher level of perceived stress. Previous studies have found that the PSS-10 showed acceptable internal consistency (Cronbach's alpha > .70) and test-retest reliability ($r > .70$) across diverse populations (Lee, 2012). When used specifically in adolescent populations, the PSS-10 has shown adequate internal consistency with Cronbach's alpha coefficients of .70 and .79 as judged by conventional standards (Kechter et al., 2019; Liu et al., 2020). Furthermore, when used in the PE environment, the PSS has been used to measure students' stress after participation in yoga programs (Butzer et al., 2017; Khalsa et al., 2012; Noggle et al., 2012) and when comparing caring, task-involved motivational climates to ego-involved motivational climates (Hogue et al., 2019). This scale was chosen for this study because of its ability to be administered in only a few minutes. The students answered the PSS items at the beginning and end of class.

Physical Activity. This study measured students' steps during each class using the ActiGraph wGT3X accelerometers (ActiGraph, LLC, Pensacola, FL, USA). The wGT3X was a compact triaxial monitor that measured physical activity and sleep patterns. Before the start of the study,

each accelerometer was initialized according to the manufacturer's specifications. Data from the accelerometers were downloaded and analyzed using the ActiLife software. Students wore the wGT3X on their wrists for the entire class period. Previous research has found that wrist worn Actigraph accelerometers are valid in measuring steps counts in youth populations (Hickey et al., 2016; Lee et al., 2016; Romanzini et al., 2014). The researcher provided students with the accelerometer, demonstrated how to attach the monitor to their wrists, and walked students through attaching it to their wrists.

Field Notes. The researcher recorded field notes each day of the study. Field notes are often used to describe the context when completing mixed methods research. By recording field notes, the researcher could make informal observations about events and behaviors, which could then be used to help explain the findings from the quantitative data (Wright et al., 2024). The field notes also provided a space for reflection and analysis during the research process (Thorpe & Olvie, 2017). Researchers typically document the physical setting, participants, activities and interactions, conversations, factors such as nonverbal communication, dress, symbols, and what is "not" happening, and the observer's own behavior and role when recording field notes (Wright et al., 2024). Therefore, the field notes in this study aimed to include information about the overall setting of the school and each class, the students, the teacher, the content covered in each class, the structure of each class, the environment of each class, the interaction between the teacher and students, and the interaction between students.

When looking specifically at the environment of each class, the researcher examined if it was a task-involved climate or an ego-involved climate. In task-involved climates, the goal was for the students to develop mastery, improvement, or learning. Students' ability was self-referenced, and when they demonstrated mastery or showed improvement, they knew they were

successful. In an ego-involved climate, the goal was to outperform others, so students' ability was other-referenced. Students realized success when they could outperform others (Nichols, 1984, 1989). The field notes were hand-written and then transcribed into a Word document at the end of the study. The researcher then studied the field notes for themes related to task-involved or ego-involved climates in addition to noting the content covered and the structure of each class.

Analysis

Students. Demographic information related to age, grade, sex/gender, and race/ethnicity and trait anxiety item responses collected on day one and state anxiety, perceived stress, and steps data collected on days two, three, and four were entered into SPSS by the researcher and were analyzed using SPSS 29. Data were screened for missingness before conducting the preliminary and main analyses. The expectation maximization approach (Dong & Peng, 2013) replaced missing data from students who missed an item response or missed a day. Data from participants who dropped out of the study were not analyzed. Before conducting the primary analysis, preliminary tests helped determine covariates, if any, to include in the primary analysis. Bivariate correlations were calculated to determine significant associations between continuous variables. A chi-squared test for association was performed to determine any between group differences in categorical variables. A series of one-way analyses of variances (ANOVAs) were also performed to determine if there were any between group differences in the continuous variables. Another series of one-way ANOVAs were performed to identify differences in the continuous outcome variables according to the categorical demographic characteristics.

Two three-way mixed model repeated measures analyses of covariances (ANCOVAs) were executed to determine if there were statistically significant differences in state anxiety and perceived stress scores over time, between classes, and between days while controlling for trait

anxiety and steps. Accelerometer step measurements and trait anxiety scores were analyzed as covariates in order to help explain the changes in state anxiety and perceived stress scores. Additionally, any other variables identified as having significant associations with the outcome variables in the preliminary analysis were entered into the model(s) as covariates. Pairwise comparisons were conducted using Tukey's LSD adjustment in the case of a significant interaction. In cases where sphericity was violated, the Huynh-Feldt correction was used to interpret results (Huynh & Feldt, 1976).

Teachers. If the interviews with each teacher had been conducted, the audio would have been transcribed into a Word document. The data would have been analyzed using a deductive and inductive approach (Patton, 2015). Deductive analysis would have involved organizing data according to preestablished codes (e.g., student mental health problems, programs/policies/practices used to support students' mental health, teaching styles, classroom environment, etc.; Patton, 2015). The codes were established based on the research question, interview questions, and discussions with committee members. Inductive analysis would have involved discovering patterns or themes in the data (Patton, 2015). The discovery of patterns and themes would have been done through open coding, which would have allowed for the identification of concepts and patterns in the data, and axial coding, which would have allowed connections between the patterns to be established (Corbin & Strauss, 1990; Richards & Hemphill, 2018).

To ensure the trustworthiness of the findings, triangulation (Lincoln & Guba, 1985; Patton, 2015), peer debriefing (Lincoln & Guba, 1985), and member checks (Lincoln & Guba, 1985) procedures would have been applied. Triangulation would have involved using different data sources and different investigators to improve the credibility of the findings (Lincoln &

Guba, 1985; Patton, 2015). Peer debriefing would have occurred between the researcher and committee members to encourage conversations about data analysis and emerging themes (Lincoln & Guba, 1985). Member checks would have been performed informally throughout the interviews to confirm that the interviewer interpreted and understood teachers' responses. Additionally, after each interview was transcribed, the researcher would have provided teachers with a copy of their interview and allowed them to verify or adjust responses (Lincoln & Guba, 1985).

Results

Preliminary Analyses

Sample description. Demographic characteristics are displayed in Table 2.1. Participants included 88 high school students (ages 14-17) from a predominantly white school in South Alabama who participated in either a PE (n = 41), art (n = 25), or US history (n = 22) class. Of the 88 students, zero turned in the waiver of consent form, while 12 students did not complete the assent form, indicating they did not want to participate in the study. In the PE class, 41 students out of a total of 50 agreed to participate in the study. In the art class, 25 out of 28 students agreed to participate in the study. In the US history class, all 22 students agreed to participate in the study.

Data for both sex (male = 35, female = 46, other/prefer not to answer = 3) and gender (male =36, female = 47, other/prefer not to answer = 1) were collected, and analysis revealed a perfect positive correlation (r = 1.000; p < .00) between these variables. Therefore, only sex was included in the analysis. Students scored an average of 9.86(3.72) trait anxiety scale and 6.93(2.83) state anxiety scale at baseline[1], which indicated that students were not considered

[1] Baseline refers to the average scores on the first state anxiety and perceived stress surveys completed on day 2 (the first day of data collection included in the analysis)

potentially clinically anxious (Zsido et al., 2020). Students were also considered not to have high levels of perceived stress as they scored an average of 18.63(7.70) on the PSS-10 at baseline (Cohen & Williamson, 1988). Over the three days of this study, students took an average of 723.92(383.22) steps.

While zero students dropped out of the study, 54.5% had missing data. 29.5% of students were missing data because they missed a day of the study. Of the students who did not miss a day of the study, the analysis revealed that 1.6% of students were missing data on the STAIT-5, 16.1% of students were missing data on the STAIS-5, 14.5% of students were missing data on the PSS-10, and 8.1% of students were missing PA data because they did not respond to survey items. When combining students who missed a day and students who did not respond to a survey item, total missing data values were 6.8% on the STAIT-5, 38.6% on the STAIS-5, 37.5% on the PSS-10, and 39.8% for PA data. Missing data were replaced using the expectation maximization approach (Dong & Peng, 2013).

Table 2.1

Descriptive Statistics Table

	All Classes	PE	Art	US History
Students, n(%)	88	41(46.6)	25(28.4)	22(25)
Grade, n(%)*				
9th Grade	53(60.2)	41(100)	12(48)	0(0)
10th Grade	34(38.6)	0(0)	12(48)	22(100)
11th Grade	1(1.1)	0(0)	1(4)	0(0)
Race/Ethnicity, n(%)				
Asian	0(0.0)	0(0)	0(0)	0(0)
African America or Black	2(2.3)	1(2.44)	1(4)	0(0)
American Indian or Alaska Native	2(2.3)	1(2.44)	1(4)	0(0)
Hispanic/Latino	4(4.5)	0(0)	2(8)	2(9.09)
Native Hawaiian or Other Pacific Islander	1(1.1)	0(0)	0(0)	1(4.55)
White	69(78.4)	35(85.37)	18(72)	16(72.73)
Multiracial	6(6.8)	3(7.32)	3(12)	0(0)
Sex, n(%)				
Male	35(39.8)	11(26.83)	13(52)	11(50)
Female	46(52.3)	26(63.41)	12(48)	8(36.36)
Other	1(1.1)	1(2.44)	0(0)	0(0)
Prefer Not to Answer	2(2.3)	2(4.88)	0(0)	0(0)
Gender, n(%)				
Male	36(40.9)	12(29.27)	13(52)	11(50)
Female	47(53.4)	27(65.85)	12(48)	8(36.36)
Other	1(1.1)	1(2.44)	0(0)	0(0)
Prefer Not to Answer	0(0.0)	0(0)	0(0)	0(0)
Age, M(SD)*	14.98(0.89)	14.47(0.60)	15.08(0.81)	15.89(0.74)
Trait Anxiety, M(SD)	9.86(3.72)	10.39(3.71)	9.76(4.08)	9.00(3.30)
Average Steps, M(SD)*	723.92(383.22)	1093.77(210.43)	350.67(97.73)	458.82(81.35)
State Anxiety (Baseline), M(SD)	6.93(2.83)	7.02(3.13)	6.52(2.73)	7.23(2.41)
Perceived Stress (Baseline), M(SD)	18.64(7.70)	19.05(7.13)	17.32(7.52)	19.36(8.04)

Caption: Four students did not report race/ethnicity, sex, gender, and age.
*****Indicates there was a significant difference between classes for grade, age, and average steps

Baseline differences between classes. Before analyses could be conducted to determine if there were baseline differences between classes, race/ethnicity was collapsed into white or non-white due to the low number of responses for classifications other than white. A chi-squared test for association was conducted between class and sex, grade, and race/ethnicity. The results revealed a statistically significant association between class and grade ($\chi^2(2) = 61.798$; $p < .001$) such that a greater proportion of PE students were in 9th grade than would be expected (adjusted standardized residual = 7.1) and a greater proportion of US history students were in 10th grade than would be expected (adjusted standardized residual = 6.8) if groups were equal. However, there was no significant association between class and sex ($\chi^2(2) = 5.197$; $p = .074$) or class and race/ethnicity ($\chi^2(2) = 4.383$; $p = .112$).

A series of one-way ANOVAs were conducted to determine if there were differences between the classes in continuous variables. Results revealed a significant difference between classes in age ($F(2,80) = 26.622$; $p < .001$). Post hoc analyses revealed that students in PE were significantly younger than students in art [14.48 vs. 15.08; 95% CI (-1.04, -.17); $p = .004$] and US history [14.48 vs. 15.89; 95% CI (-1.89, -.95); $p < .001$], and that students in art were significantly younger than students in US History [15.08 vs. 15.89; 95% CI (-1.33, -.30); $p < .001$]. A significant difference was also found between classes in average steps across all three days ($F(2,85) = 211.312$; $p < .001$). The post hoc test revealed that students in PE took significantly more steps than students in art [1093.77 vs. 350.67; 95% CI (647.06, 839.13.04); $p < .001$] and students in US History [1093.77 vs. 458.82; 95% CI (534.94, 734.97); $p < .001$]. There were no statistically significant differences between classes on trait anxiety scores ($F(2,84) = 1.028$; $p = .362$), state anxiety baseline scores ($F(2,84) = 0.595$; $p = .554$), and perceived stress baseline scores ($F(2,84) = 0.558$; $p = .575$).

Relationships between outcome variables at baseline and potential covariates. Correlational analysis between the continuous variables, as shown in Table 2.2, revealed a small negative correlation between age and trait anxiety (r = -.243; p < .05). In addition, there was a strong positive correlation between trait anxiety and state anxiety at baseline (r = .532; p < .01), trait anxiety and perceived stress at baseline (r = .538; p < .01). Additionally, baseline outcome variables (state anxiety and perceived stress) were significantly related with a strong, positive association (r = .498; p < .01). Correlations between all continuous variables in the study can be viewed in Supplemental Table 1 (Appendix E.1).

Table 2.2

Correlation Table

	1.	2.	3.	4.
1. Age	1	-.243*	-.147	-.070
2. Trait Anxiety		1	.532**	.538**
3. State Anxiety Baseline			1	.498**
4. Perceived Stress Baseline				1

** p < .01
* p < .05

A one-way ANOVA was conducted to examine relationships between outcome variables (state anxiety and perceived stress) at baseline and categorical demographic variables. Results revealed that there were no significant differences in state anxiety baseline scores and sex (F(1,79) = 0.000; p = .993), race/ethnicity (F(1,79) = 1.477; p = .228), and grade (F(1,85) = 0.120; p = .730). Additionally, there were no significant differences in perceived stress baseline scores according to race/ethnicity (F(1,79) = 3.181; p = .078) or grade (F(1,85) = 0.066; p = .798). However, significant differences in perceived stress baseline scores according to sex (F(1,79) = 7.611; p = .007) were observed. Further analyses revealed that female students [M(SD) = 20.41(6.96)] were more stressed than male students [M(SD) = 15.97(7.46)].

Additionally, a one-way ANOVA was performed for age according to grade to ensure that grade and age were not redundant variables. Results revealed only 47.8% shared variance between the two variables (partial $\eta^2 = .478$), so both were kept in the model as covariates. Therefore, based on the results of the preliminary analyses, grade, age, trait anxiety, and steps were examined as covariates in the primary analyses of state anxiety and perceived stress. Further, sex was also included as a model covariate in the analysis of perceived stress.

Main Analysis

State Anxiety. A three-way repeated measures ANOVA was conducted to assess the interaction of class, day, and time on state anxiety scores (Table 2.3). There were no significant main effects of day ($F(1.925,163.651) = 2.048$; $p = .134$; partial $\eta^2 = .024$; observed power, $\beta = .409$), time ($F(1,85) = .485$; $p = .488$; partial $\eta^2 = .006$; observed power, $\beta = .106$), or class ($F(2,85) = .132$; $p = .877$; partial $\eta^2 = .003$; observed power, $\beta = .070$). Results revealed no significant interaction between class, day, and time ($F(3.349,142.311) = .416$; $p = .763$; partial $\eta^2 = .010$; observed power, $\beta = .136$). There were also no significant interactions between class and time ($F(2,85) = .456$; $p = .636$; partial $\eta^2 = .011$; observed power, $\beta = .122$), class and day ($F(3.851,163.651) = .274$; $p = .888$; partial $\eta^2 = .006$; observed power, $\beta = .108$), or day and time ($F(1.674,142.311) = 2.566$; $p = .090$; partial $\eta^2 = .029$; observed power, $\beta = .461$). Effects remained non-significant when controlling for grade, age, trait anxiety, and steps as covariates.

Table 2.3

State Anxiety Three-Way ANCOVA Results

	Pre	Post	F	p	η^2	β
State Anxiety, M(SD)	6.54(2.01)	6.48(2.11)				
Class			.132	.877	.003	.070
Day			2.048	.134	.024	.409
Time			.485	.488	.006	.106
Day*Class			.274	.888	.006	.108
Day*Time			2.566	.090	.029	.461
Class*Time			.456	.636	.011	.122
Day*Time*Class			.416	.763	.010	.136

Perceived Stress. A three-way repeated measures ANOVA was conducted to assess the effects of class, day, and time on high school students' feelings of perceived stress (Table 2.4). Results showed no main effect of day (F(1.928,163.882) = 1.480; p = .231; partial η^2 = .017; observed power, β = .307), time (F(1,85) = .357; p = .552; partial η^2 = .004; observed power, β = .091), or class (F(2,85) = .734; p = .483; partial η^2 = .017; observed power, β = .171). The interactions between class and day (F(3.856,163.882) = .579; p = .672; partial η^2 = .013; observed power, β = .186) and day and time (F(1.735,147.491) = 1.493; p = .229; partial η^2 = .017; observed power, β = .293) were also non-significant. Furthermore, there was no significant interaction between class, day, and time (F(3.470,147.461) = 1.883; p = .126; partial η^2 = .042; observed power, β = .519).

There was a seeming trend for an interaction between class and time (F(2,85) = 2.835; p = .064; partial η^2 = .063; observed power, β = .543). Inspection of the mean(SD) pre- and post-class perceived stress scores revealed that perceived stress scores increased after participation in PE [18.827(6.258) vs. 19.016(6.523)] and art [16.827(6.719) vs. 16.907(6.915)] and decreased

after participation in US History [18.909(7.645) vs. 18.288(7.334)]. Individual paired samples T-tests for pre- to post-class change were nonsignificant in each class (all T degrees of freedom ≤ |1.488| and all p-values ≥ .145), consistent with the absence of a main effect of time in the full model. However, the inclusion of sex ($F(2,77) = 3.569$; $p = .033$; partial $\eta^2 = .085$; observed power, $\beta = .646$), age ($F(2,80) = 3.038$; $p = .053$; partial $\eta^2 = .071$; observed power, $\beta = .573$), and trait anxiety ($F(2, 84) = 3.022$; $p = .054$; partial $\eta^2 = .067$; observed power, $\beta = .571$) independently, as well as combined ($F(2,75) = 3.716$; $p = .029$; partial $\eta^2 = .090$; observed power, $\beta = .665$) revealed a significant interaction between class and time. Post hoc analysis revealed that this interaction was not due to the differences in perceived stress scores between classes when isolating the pre and post time points, but was due to the significant change in pre to post perceived stress scores in the US history class (18.74 vs. 17.82; $p = .022$). However, there was no longer a significant interaction between class and time when steps were added as a covariate along with age, sex, and trait anxiety ($F(2,74) = 2.587$; $p = .082$; partial $\eta^2 = .065$; observed power, $\beta = .501$).

Table 2.4

Perceived Stress Three-Way ANCOVA Results

	Pre	Post	*F*	*p*	η^2	β
Stress, M(SD)	18.25(6.74)	18.23(6.82)				
Class			.734	.483	.017	.171
Day			1.480	.231	.017	.307
Time			.357	.552	.004	.091
Day*Class			.579	.672	.013	.186
Day*Time			1.493	.229	.017	.293
Class*Time			2.835	.064	.063	.543
Day*Time*Class			1.883	.126	.042	.519

Field Notes

School. The school was located in south Alabama. It was a K-12 public school with grades K-6 in one building and 7-12 in another. The school also had a science building, library, cafeteria, gym, weight room, and football and baseball/softball fields. This study took place the week after Thanksgiving break. The full field notes can be found in Appendix F.

PE. The gym was a separate building at the school. It had a lobby with bathrooms and offices, two basketball goals**,** bleachers on each side, and male and female locker rooms. The teacher was a white female. There were 50 9th-grade students in th**e** class. It was their first class of the day**,** and it lasted 50 minutes. Students were taught the badminton underhand serve for the first two days of the study. The last day of the study was a free day where students chose if they wanted to play basketball, volleyball, or walk. Even with the deviation in topic on the last day, students completed the same general routines each day. At the start of class, students came in, dressed out, completed the first survey, and put on the accelerometers. After completing this, students lined up in their stretch lines and took themselves through the warm-up. Once students completed the warm-up, the teacher informed them of what would happen in class that day and proceeded to take them through the lesson. Students completed the second survey, turned in the accelerometers, and changed back into their school clothes at the end of class. See Appendix F.1 for the PE field notes.

On the first day, the teacher reviewed the cues, demonstrated the cues, and then had the students shadow the cues. After the introduction, students got into partners, and they shadow-performed and said the cues ten times. Next, the teacher put students into five groups, and students used their hands to serve the birdie back and forth to each other. During this activity, the teacher walked around and monitored the students. She stopped at one group of girls to make

sure they were contacting the birdie below the waist. She repeated the cue of “strike birdie below the waist” and demonstrated this to the group (November 28th, 2023). After practicing the serve with their hand, the teacher passed out a badminton racket to each group, and the students practiced hitting the serve with a badminton racket. During this activity, the teacher stopped one group and appeared to demonstrate how to hit the birdie with the badminton racket, but the researcher could not hear what she said to the group (November 28th, 2023). While completing these activities, students could interact and talk with each other, but they also listened when the teacher talked and followed her directions. Overall, the teacher established a physically and emotionally safe environment where there was respect between her and the students and between the students. She tried to provide students with as many practice opportunities as possible, even though she only had about ten birdies, five badminton rackets, one tennis racket, and no nets.

On the second day, students continued to practice the badminton underhand serve. The teacher briefly reviewed the cues of the serve and had students say and shadow the cues. After this, the teacher put students into five groups and tells them they will first use their hands to serve the birdie back and forth to each other. While the teacher was walking around and monitoring the activity, she stopped to talk to a couple of students. However, she was too far away to hear what was said (November 30th, 2023). After the first activity, the teacher gave each group a badminton racket. Students used the badminton racket to serve the birdie back and forth to each other. The teacher walked around and monitored students. Besides having to stop students once to refocus them on the task, she did not have much interaction with the students (November 30th, 2023). Again, the teacher created a physically and emotionally safe environment. However, the teacher did not interact as much with the students on this day, nor did

she try to get students interested in learning about the underhand serve. She also did not try to make the tasks challenging for the students.

On the third day of the study, students entered the gym and completed their normal routine. However, after completing the warm-up, the teacher told students they would not be learning the underhand serve today. Instead, she told students they could choose the activity they wanted to participate in. The students were able to choose between basketball, volleyball, and walking. The teacher also told the students that they could not sit down and had to be doing something the entire class period (December 1st, 2023). Most of the boys chose to play basketball and selected their own teams to play half-court games on both sides of the floor. Most of the girls chose volleyball. They got into groups of two to four and would volley or set the ball back and forth to each other. Some even tried to see how many times they could volley or set the ball without it touching the ground. The students who did not want to play basketball or volleyball chose to walk around the outside edge of the gym floor. Day three of the study seemed to be the most fun day for the students. They enjoyed participating in an activity that they were to choose. After telling the students what would happen during class, the teacher had very little interaction with the students.

Art. The art classroom was located in the 7th-12th grade building. The room was full of art supplies and students' artwork. The classroom also had a Smart Board and Chrome books. The teacher was a white female. There were 28 9th and 10th-grade students in the class. The class was 50 minutes long. As students came into class each day, the researcher would have the survey packets, accelerometers, and pencils laid out on each table for the students. They would come into the classroom, pick up a survey packet, accelerometer, and pencil, complete the first survey, and attach the accelerometer to their wrist. At the end of class, the students would complete the

second survey and leave the survey packet, accelerometer, and pencil on the table for the researcher to collect. See Appendix F.2 for the art field notes.

On day one of the study, the teacher told students they would continue learning about Exacto knife blades. She also told them that once they were comfortable using the blade, they would create a positive and negative space project using them. In addition to going over how to hold the blade, cut with the blade, and the safety rules, the teacher provided students with more history related to Exacto knife blades. Once she did this, the students got a blade, cutting mat, ruler, and a blank sheet of paper. Students continued to practice cutting a perfectly straight line with the Exacto knife. As students were doing this, the teacher walked around, making sure students were holding the blade correctly. While doing this, she stopped and helped a couple of students line their sheet of paper and ruler up correctly so they could cut a straight line (November 28th, 2023). Once students could cut a perfectly straight line with the blade, they got the Exacto knife worksheet, where they practiced cutting different shapes and patterns like squares, zig-zags, circles, and stars. The teacher created a safe and secure learning environment where students were encouraged to succeed but knew it was ok if they did not get it right the first time. The teacher made sure to let students know that it was ok if they could not cut a straight line on the first try and that there was more paper for them to use to practice (November 28th, 2023). There was respect between the teacher and students and between the students. Not only were students allowed to interact with each other while they worked, but the teacher also interacted and talked with students while helping them with the activities.

On the second day of the study, the students continued to work with the Exacto knives. Most students had moved on to the Exacto knife worksheet, but a few were still working on cutting their straight line. As soon as the teacher signed off on their straight line, they moved to

the worksheet. While working on the worksheet, several students struggled to cut the circle. When the teacher saw this, she stopped the entire class and demonstrated how to use the Exacto knife when cutting the circle. She also gave tips on how to hold the blade and move the paper as they were cutting (November 30th, 2023). The teacher again emphasized that it was ok to fail or make a mistake and that there were extra worksheets for the students to use if needed.

On day three, the teacher reviewed the positive and negative space project with the students. She provided examples such as Notan's finding the shadow. She also told students they would use the Exacto knife blades to create this project. After going over this, the students continued to work on the Exacto knife worksheet. Once students completed the worksheet, they began working on their project. The students got a Chrome book to look at different types of positive and negative space artwork to get an idea of what they wanted to create for their project. The teacher walked around helping students with their worksheet or helping them decide what they wanted to do for their project. When a student chose an idea that the teacher thought was too easy, she encouraged him/her to choose an idea that would challenge his/her skills. During the class, students could quietly talk to each other as long as they worked on their assignments.

History. The history classroom was located in the 7th-12th grade building. The room consisted of desks, a Smart Board, and Chrome books. There were 25 10th-grade students in the class. The teacher was a white female. The class was 50 minutes long and was the first class after lunch. Students would come into the classroom and sit at their desks. While they did this, the researcher would pass out the survey packets, accelerometers, and pencils. The teacher began the lesson after the students finished the first survey and attached the accelerometers to their wrists. Students would complete the second survey and then turn in the survey packet, accelerometers, and pencils at the end of class. See Appendix F.3 for the US history field notes.

Students were learning about the Amendments over the course of this study. On the first day of the study, the teacher reviewed the first two Amendments and then covered Amendments three through seven. She presented each Amendment individually and asked students if they knew what it was or what it meant before going into detail about it. The teacher provided examples of how the Amendments affect their everyday life and encouraged the students to provide their own examples or ask questions. While covering these amendments, the students found the Fifth Amendment's double jeopardy clause interesting (November 28th, 2023). As this was a more traditional class structure, students could not interact with each other while the teacher was lecturing. However, the teacher did a good job facilitating a class discussion.

On day two of the study, the teacher covered Amendments 16-27. Like the first day, the teacher presented each Amendment individually and provided examples of how it impacts everyday life. Again, the students were interactive with the lecture and were encouraged to ask questions when they were unsure of something (November 30th, 2023). After covering the last Amendment, the teacher introduces the Amendment project. For this project, each student was assigned an amendment, and then they created a poster that included the Amendment written out along with an illustration.

On the third day of the study, students started working on their Amendment project. Before starting the project, the teacher showed examples of past students' work so they would know what she was expecting. The teacher provided construction paper, markers, colored pencils, glue sticks, and other supplies the students might have needed. The students either wrote their Amendment on their paper or the teacher printed it out, and they glued it on their paper. Once they had the Amendment on their paper, the students decided what type of illustration would best represent it. While students were working on their project, the teacher walked around

and answered any questions the students had. The students were also allowed to talk quietly while working. If students did not finish their project, they took the project home to work on it over the weekend.

Discussion

The purpose of this study was to examine how high school students' feelings of anxiety and stress changed over the course of a PE class and how these changes differed from students in an art and US history class. Additionally, this study evaluated how steps during class impacted feelings of anxiety and stress. This study also sought to examine teachers' perceptions of their teaching style and classroom environment and how these impacted students' feelings of anxiety and stress by interviewing the teachers of the participating classes. However, the teachers did not agree to participate in the one-on-one interview, so this research question could not be addressed.

This study surveyed 88 9th and 10th-grade students enrolled in either PE, art, or US history over three days. At baseline, the students were not considered potentially clinically anxious (state anxiety average: 6.93; trait anxiety average: 9.86) and did not demonstrate elevated levels of perceived stress (18.64). The students took an average of 723.92 steps over the course of the study.

Overall, the results of this study did not find a significant main effect or interaction effect for class, day, and time. This suggests that participation in a PE, art, or US history class did not have a significant impact on students' feelings of anxiety and stress. However, there was a trend towards an interaction between class and time for perceived stress. Further analysis revealed a trend toward increasing perceived stress scores for students in PE and art and decreasing perceived stress scores for students in US history. This trend became significant when sex, age, and trait anxiety were entered as covariates. Further analysis revealed that the significant

interaction was due to the significant decrease in US history students perceived stress scores. However, the significant interaction disappeared when steps were added as a covariate.

Before interpreting the results of this study, it is important to note that the results of this study might have been due to a floor effect. A floor effect occurs when participant responses are clustered toward the bottom end of a scale, which can result in the intervention or experimental treatment being viewed as ineffective (Cramer & Howitt, 2004; Garin, 2014). In this study, students' initial anxiety and stress levels were low. Therefore, the anxiety and stress scales might not have been able to detect significant changes in scores from the beginning to end of class, over the three days of the study, or between classes. This could have led to the non-significant findings in this study even if there were actual changes in students' feelings of anxiety and stress after participation in PE, art, or US history. In order to address this potential floor effect, future studies should consider using more sensitive anxiety and stress measures, increasing the sample diversity to include students with a broader range of baseline anxiety and stress levels, and conducting a qualitative analysis consisting of interviews or open-ended surveys in order to capture the nuances in students' experiences and feelings.

There were also methodological concerns that might have impacted the results of this study. The first was the level of missing data. In educational and psychological studies, missing data rates of 15-30% appear to be common (Enders, 2003; Peugh & Enders, 2004). However, in this study, 54.5% of students were missing data. Research conducted in educational settings has reported that data can be missing for one of three reasons: students were absent without predictable reasons, students were absent because they were representing their school in competitions, or students did not respond to items on the survey (Pampaka et al., 2016). For this study, missing data were attributed to students being absent without predictable reasons and not

responding to survey items. The EM approach was used to replace missing data in this study. This method estimated missing values by repeating two alternating steps. In the expectation step, a value was calculated for the missing value based on the available data and its distribution. In the maximization step, a value was calculated based on the current updated data set. After the final iteration, the EM calculated value was imputed into the data set (Blankers et al., 2010). Two studies have examined the efficacy of EM for handling extreme data missingness. One study had a missing data rate of 50%, and the other used multiple missing data rates up to 60%. Both studies found that the EM method successfully estimated values that resembled the reference values of the complete data set (Blankers et al., 2010; Dong & Peng, 2013). Even though all principled missing data methods suffer from large biases as missing data rates increase when compared to the complete data set (Dong & Peng, 2013), results from the analyses and the observations made from those results can be cautiously trusted and should be replicated with similar and more diverse samples.

Another methodological concern was the stress scale that was chosen. The PSS measured changes in students' perceived stress during the last month (Cohen et al., 1983; Cohen & Williamson, 1988). While completing the PSS questions over the course of the study, some students asked how their feelings of stress were supposed to change from the beginning to the end of class when the directions indicated that they should think about their stress-related feelings and thoughts during the last month. Because of these directions, it is possible that the PSS did not accurately reflect students' feelings of stress. Therefore, the instructions could have been adapted to ask students about their feelings of stress right now instead of over the past month. Additionally, a survey asking students about their feelings of stress over a shorter period could have been used. For example, the Perceived Stress Scale-Children (PSS-C) and Depression

Anxiety Stress Scales-Youth (DASS-Y) ask students to think about their feelings of stress over the past week. Using one of these scales would also be appropriate for the expanded study time frame, as students would only have to think about the feelings and thoughts of stress they experienced between survey administration days.

Additionally, the time frame of this study was another methodological issue. This study took place over one week, which could have contributed to survey fatigue. Survey fatigue occurs when "people become overwhelmed by the number of surveys they encounter in daily life" (Karlberg, 2015, p. 2). The students in this study took a total of eight surveys over five days. These surveys also consisted of many of the same questions each day. Because of this, students' interest and/or enthusiasm in completing the surveys could have been reduced (Karlberg, 2015; Porter et al., 2004). This could have led to incomplete survey responses or students quickly circling answers to finish the survey, which could have negatively impacted the results of this study. In order to prevent survey fatigue, this study could have taken place over a month instead of a week, allowing students to take the surveys once a week instead of 4 times in one week, and in turn, could have led to more complete and potentially accurate responses. Furthermore, lengthening the study's time frame would also address the issue with the stress scale discussed in the previous paragraph.

While taking into consideration the methodological concerns of this study, an interesting finding of this study was how the significant interaction between class and time when controlling for sex, age, and trait anxiety was due to the significant decrease in US history perceived stress scores and how this significant interaction disappeared when steps were added as a covariate. This suggests that the reduction in stress in US history was due to the differences in PA. More specifically, less active students experienced a more significant stress reduction. These results

could be because students were zoning out during class, the time of day of the class, or the methodological concerns previously mentioned. Therefore, these results are untrustworthy, and more rigorous research is needed to understand the relationship between stress and PA in a US history class.

Previous research also indicated that caring, task-involved climates were significantly associated with lower feelings of anxiety and stress (e.g., Barkoukis et al., 2010; Jaakkola et al., 2019; Liukkonen et al., 2010; Papaioannou & Kouli, 1999). Based on the researcher's observations, the teacher of the PE class worked to establish a caring, task-involved climate. For example, the students were learning to do the underhand serve in badminton. While learning this skill, the teacher made sure to not only emphasize the cues of the skill but also made sure to provide as much practice time as possible so that the students could master the skill (Appendix F.1). The teacher of the art class also established a caring, task-involved climate by continually reminding students that it was ok not to be able to cut a perfectly straight line or to perfectly cut the different shapes with the Exacto knife on the first try. She even encouraged students to get multiple pieces of paper or worksheets so that they could have more practice while mastering using the Exacto knife (Appendix F.2). Additionally, the US history teacher established a caring, task-involved climate by encouraging students to ask questions and participate in the class discussion about the Amendments (Appendix F.3). Even though these were caring, task-involved climates, students' feelings of anxiety and stress were not significantly impacted. While taking into account the methodological concerns, these results suggest that more than just establishing a caring, task-involved climate is needed in order for PE, art, or US history classes to positively impact students' mental health. However, more research is needed in order to understand the relationship between class environment and students' feelings of anxiety and stress.

Additionally, previous research indicated that PE does have the potential to improve students' feelings of anxiety and stress (e.g., Barney et al., 2019; Kliziene et al., 2018). However, this was not the case for this study. In addition to the methodological concerns, one reason for these findings could be that PE was the first class of the school day. Research indicates that school is a key stressor for students, especially when it comes to performance, tests, and participating in class (Anniko et al., 2019; Kaczmarek & Trambacz-Oleszak, 2021). Because it was the first class, students might have become more worried about upcoming assignments, tests, projects, etc., as the class progressed, so stress levels increased instead of decreased. However, more rigorous research is needed to understand the relationship between class time and students' feelings of anxiety and stress.

It is also important that PE teachers take into account students' interests and offer them choices during PE. When providing students' choices in the types of activities, their need for autonomy is supported (Agbuga et al., 2016; How et al., 2013), which can increase participation (Mitchell et al., 2015), lead to more engagement (Agbuga et al., 2016), and lead to increased levels of MVPA (How et al., 2013). In this study, students were not offered a choice until the last day of the study when the teacher let them choose the activity they wanted to participate in. While this did not lead to significant changes in students' feelings of anxiety and stress, students might be more likely to experience the emotional benefits of PE if they are continually provided choices during PE class. However, due to the methodological concerns of this study, more research is needed to fully understand the impact choice has on students' feelings of anxiety and stress.

Another change that could that could enhance the PE environment is smaller class sizes. Currently, there could be 28 to 54 students per teacher (Gross & Buchanan, 2014). The PE class

in this study consisted of about 50 students, which is not only consistent with the research but also more than double the average public school class size of 21 students per teacher (National Center for Education Statistics, 2022). SHAPE America recommends a ratio of 30 students per teacher for high school PE classes (SHAPE America, 2022) because optimal PE practices are not utilized when teaching loads are too high for PE teachers (Turner et al., 2017). Research indicates that large class sizes negatively impact the amount of time students are able to participate during class, the amount of time spent in MVPA, the amount of time spent sitting, the amount energy expended, and the amount of instruction time (Bevans et al., 2010; Chow et al., 2009; Hills et al., 2015; Hollis et al., 2017). Therefore, advocating for smaller PE class sizes is crucial. This change might not only allow students to experience the physical benefits of PA, but also, the emotional benefits, empowering teachers, principals, administrators, state officials, etc. to make informed decisions for the wellbeing of their students. However, more rigorous research is needed to understand how class size influences students' feelings of anxiety and stress.

The lack of equipment and access to physical activity facilities is a significant concern that could potentially impact students' feelings of anxiety and stress. With PE budgets ranging from $100 to $7,000 per year (M = $915 per year; Turner et al., 2017), running an optimal and developmentally appropriate PE program can be challenging. The PE teacher in this study had 6-7 badminton rackets, about 10 birdies available for students, and no badminton nets. This lack of equipment led to students spending a lot of class time standing in lines waiting for a turn, which negatively impacted student engagement and the number of steps students were able to take. According to the Every Student Succeeds Act, PE is part of a well-rounded education and should be offered to all students (SHAPE America, 2018). Therefore, schools should invest resources into equipment and facilities that allow teachers to develop quality PE programs. Considering the

methodological concerns of this study, if teachers are able to develop quality PE programs with adequate equipment for students, then their feelings of anxiety and stress might be more likely to decrease. However, more research is needed to fully understand the impact quality PE programs have on feelings of anxiety and stress.

Strengths

One strength of this study was that there were no significant differences between groups at baseline, which indicated that all students started with similar levels of anxiety and stress. This allowed for meaningful interpretations of the changes since all three classes started from the same point. Additionally, even though the baseline outcome variables were significantly related, these variables were not redundant and, therefore, could be examined independently in the study (r^2 = 24.8%). While this study did not find significant changes in students' feelings of anxiety and stress, it did add to the limited research on changes in feelings of anxiety and stress after participation in PE. It also extended the current research by comparing changes in students' feelings of anxiety and stress after participation in PE to changes in students' feelings of anxiety and stress after participation in art and US history classes (Lanier et al., 2022). Another strength of this study was that it included a PA measurement. Few of the previous studies analyzing changes in students' feelings of anxiety and stress during PE included a PA measurement (Lanier et al., 2022).

Limitations

As previously mentioned, this study had three methodological limitations: the level of missing data, the time frame of the stress instrument used, and the time frame of the study. Additionally, because the study was conducted at a predominantly white high school, these results cannot be generalized to high school students of different races or ethnicities. Future

studies should expand this research into more diverse high school environments. This would allow research to gain a better understanding of how students' feelings of anxiety and stress change over a class period and how PA impacts these changes. Another limitation of this study was that the field notes were not triangulated. Therefore, the observations made in the field notes must be interpreted with caution as they cannot be confirmed by another observer.

Conclusion

PE is a complex subject within a complex education ecosystem. As researchers, we have to take into account that PE is not like other academic subjects. Teachers struggle to create meaningful experiences and engage students in enough PA that can potentially lead to positive mental health outcomes. Because of these challenges, it is difficult to truly understand the relationship between PE, PA, and students' mental health.

Additionally, the mental health of adolescents is an issue that continues to be addressed not only in the media but also in research, as prevalence rates of anxiety and stress continue to rise. The important role of PA when it comes to combatting feelings of anxiety and stress also continues to be emphasized, yet 81% of adolescents do not meet daily PA recommendations (Guthold et al., 2020). Furthermore, PE is often overlooked as a way to not only get students physically active but also as a way to support their mental health.

Despite the lack of significant findings, the relationship between PE and student mental health remains a crucial area of research. Future research must continue to examine this topic by not only continuing to measure changes in students' feelings of anxiety and stress over a class period but also across an entire school day. These studies must also include a PA measurement in order to further understand PA impact on feelings of anxiety and stress. Additionally, more qualitative research needs to be conducted. These studies should examine teachers' perceptions

of their teaching style and classroom environment and its impact on students' mental health. They should also ask students how PE and PA might impact their feelings of anxiety and stress. While this study added to the current research examining students' anxiety and stress in a PE environment, this relationship is still unclear and needs to continue to be studied.

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APPENDICES

Appendix A

Appendix A.1 Search Algorithms

Search Number	Algorithm
1	(“physical education” OR PE) AND (K-12 OR “elementary school” OR “primary school” OR “middle school” OR “high school” OR “secondary school” OR student OR youth OR child* OR adoles* OR teen*) AND (stress OR anxiety OR depress* OR “mental health”)
2	(“physical education” OR PE) AND (K-12 OR “elementary school” OR “primary school” OR “middle school” OR “high school” OR “secondary school” OR student OR youth OR children OR adoles* OR teen*) AND (“mental distress” OR mood)

Appendix A.2 Overview of Reviewed Studies of Physical Education and Students' Anxiety, Depression, and/or Stress

Author (Year), Country	**Outcome Assessed**	**Study Design, Participants**	**Study Characteristics (Lesson Characteristics, Activity Type, or Intervention)**	**Tool Used**	**PA Measurement**	**Key Results**
Silvestri (1987), USA	Anxiety	Quasi-Experimental, Pre-Test/Post-Test Design High School Female Students (n = 90) Exercise-Only Group: 30 students Exercise/Relaxation Group: 30 students Control Group: 30 students	Aerobic Dance, Aerobic Dance + Progressive Relaxation	State Trait Anxiety Inventory	N/A	All groups lowered trait and state anxiety scores, but not significantly. Additionally, students were grouped into a low or high anxiety group and results showed that students in the high anxiety group lowered anxiety scores more than students in the low anxiety group. Since all groups' anxiety scores changed from pre- to post-test, treatment was not solely responsible for the changes.
Papaioannou and Kouli (1999), Greece	Anxiety	Descriptive, Questionnaire Junior high school students with a mean age of 13 (n = 239)	Task-Involving Volleyball Drills vs. Ego-Involving Volleyball Drills	CSAI-2, TEOSQ	N/A	Ego-involving tasks resulted in higher somatic anxiety when compared to task-involving tasks. In task-involving and ego-involving lessons, the perception of teachers who emphasized learning orientation negatively predicted somatic anxiety. The perception of teachers who emphasized competition in task-involving activities positively predicted somatic anxiety.

Barkoukis et al. (2008), Greece	Anxiety	Quasi-Experimental 8th and 9th grade with a mean age of 13.8 years (n = 374) Intervention Group: 193 students Control Group: 181 students	Use of the TARGET principles (task-involving climate vs. ego-involving climate)	PETAS	N/A	The implementation of the TARGET principles resulted in significantly lower levels of worry in the intervention group compared to the control group. Somatic anxiety and cognitive processes were not significantly different in the intervention group and the control group from pre-intervention to post-intervention. Overall, results imply that students felt less anxiety in task-involving climates.
Yli-Piipari et al. (2009), Finland	Anxiety	Correlational, Cluster Analyses of Questionnaires Grade 6 elementary school students between 12 and 15 years old (n = 429)	N/A	PESAS	Health Behavior in School-Aged Children Research Protocol	While state anxiety levels were overall low for both the "High Motivational Profile" group and the "Low Motivational Profile" group, state anxiety levels were significantly higher in the "High Motivation Profile" group compared to the "Low Motivation Profile" group. Overall, both groups were considered to have low levels of state anxiety in PE.
Barkoukis et al. (2010), Greece	Anxiety	Quasi-Experimental High school students with a mean age of 13.9 years (n = 317) Intervention Group: 57 males, 74 females Control Group: 90 males, 96 females	Track and Field tasks using principles of the TARGET program (task-involving climate)	PESAS	N/A	Results showed that anxiety decreased after the intervention for both groups. While there was a trend of lower anxiety scores in the intervention group, the intervention did not significantly impact students' anxiety.

Liukkonen et al. (2010), Finland	Anxiety	Correlational Grade 6 students ages 11-12 years old (n = 338)	Task-involving climate vs. Ego-involving climate	PESAS	N/A	An ego-involving climate is associated with overall higher levels of anxiety in PE. A self-determined motivational climate (task-involving climate) was associated with lower levels of anxiety.
Lodewyk and Muir (2017), Canada	Anxiety	Mixed-Methods Grade 9 female students ages 14-15 years old (n = 67) Two Classes: 5-lesson soccer unit (n = 34) Two Classes: 5-lesson fitness testing unit (n = 33)	Soccer vs. Fitness Testing	Shortened STAI-6, Situational SPAS	N/A	When examining soccer and fitness testing, significant correlations were found among state anxiety and social physique anxiety. Significantly higher levels of state anxiety were found in fitness testing than in soccer.
Kliziene et al. (2018), Lithuania	Anxiety	Pre-Test/Post-Test Experimental Design Adolescent girls and boys 14-15 years old (n = 428) Experimental Group: 217 students Control Group: 211 students	7-Month Exercise Intervention	RCMAS	N/A	The experimental group showed a significant decrease in anxiety after participation in an exercise intervention consisting of sports, games, and Pilates when compared to the control group.
Klizienė et al. (2018), Lithuania	Anxiety	Pre-Test/Post-Test Experimental Strategy	8-Month Exercise Intervention	RCMAS	Children's Physical	The experimental group experienced a significant decrease in anxiety after participation in an exercise intervention

		Primary school children ages 6-7 (n = 138) Experimental Group: 70 students Control Group: 68 students			Activity Questionnaire	consisting of dynamic exercise, intense motor skills repetition, differentiation, reduction of parking and seating, and physical activity distribution in the classroom (DIDSFA model).
Lodewyk and Bracco (2018), Canada	Anxiety	Descriptive, Survey 9th grade high school female students (n = 25)	Previous PE experience vs. TGfU unit	MSLQ	N/A	When compared to previous PE experiences, the participants reported significantly lower anxiety in the TGfU unit.
Jaakkola et al. (2019), Finland	Anxiety	Correlational Grade 5 students with a mean age of 11.27 (n = 1148)	Task-involving vs. Ego-involving motivational climates	PESAS	N/A	Anxiety was correlated positively and moderately with an ego-involving motivational climate while it was negatively and low to moderately correlated with a task-involving motivational climate.
Huhtiniemi et al. (2020), Finland	Anxiety	Descriptive, Questionnaire Grade 5 students with a mean age of 11.2 years (n = 328) and Grade 8 students with a mean age of 14.2 years (n = 317)	General PE vs. Fitness Testing (Aerobic Endurance Class and Skills and Muscular Strength Class)	PESAS	N/A	Lower levels of cognitive anxiety and higher levels of somatic anxiety were perceived by students in the fitness testing classes. Levels of worry were about the same in general PE and during the fitness testing classes.
Cobar et al. (2017), Philippines	Depression	Quasi-Experimental	Walking vs. Birdwatching	Abbreviated POMS	N/A	Depression significantly decreased in the walking group. Depression in the birdwatching group stayed the same

		High school senior students with a mean age of 16.16 years (n = 43) Walking Group: 13 students Birdwatching Group: 30 students				between pre-test and post-test. Birdwatching did not result in a significant decrease in depression among senior high school students.
Xiang et al. (2017), China	Depression	Correlational 7th and 8th grade middle school students age 13-17 years old (n = 144)	Health-Related Personal Fitness vs. Skill-Related Personal Fitness	CES-DC	N/A	Health-related PF was significantly related to depression while skill-related PF was not significantly related to depression.
Andrade et al. (2019), Brazil	Depression	Nonrandomized Control Trial 4th and 5th grade students ages 7 – 11 (n = 140) Experimental Group: 68 students Control Group: 72 students	Exergames vs. PE	BRUMS	N/A	Depression scores were not significantly different in the EG or CG from pre- to post-intervention.
Lang et al. (2016), Switzerland	Stress	Cluster RCT Vocational students with a mean age of	EPHECT Program	ASQ	N/A	Stress perception remain stable in both groups from baseline to post-intervention assessment, but a significant time x group interaction

		16.22 years (n = 131) IG: Four classes (n = 67) CG: Four classes (n = 64)				effect occurred at follow-up indicating decreased stress perceptions in the IG.
Lang et al. (2017), Switzerland	Stress	Cluster RCT First year vocational students with a mean age of 16.22 (n = 131) IG: Four classes (n = 67) CG: Four classes (n = 64)	EPHECT Program	ASQ	N/A	No significant main effect for time was observed for perceived stress. Perceived stress scores remained relatively stable from pre-test to post-test for the IG and CG.
Barney et al. (2019), USA	Stress	Quasi-Experimental, Mixed Methods Design 7^{th} – 9^{th} grade junior high school students ages 11-15 (n = 872)	N/A	12-Question Survey Instrument Developed by Researchers	N/A	Results found that PE reduced stressed for each grade level. However, 7^{th} grades students were more likely to forget about stress when coming to PE, better handle stress after participating in PE, have lower stress levels before arrival to PE, and have lower stress levels after participation in PE. Qualitative analysis found that PE had mitigating effects on stress, allowed social bonding, which reduced stress, and classmates could produce stress.

						Stress reduction was also depended on activity type.
Lang et al. (2019), Switzerland	Stress	Quasi-Experimental Study Vocational students with a mean age of 17.87 (n = 864) IG: One school (n = 434) CG: One school (n = 430)	EPHECT Program	ASQ	N/A	EPHECT Program did not reduce students' stress perceptions from pre-intervention to post-intervention.
Cecchini et al. (2001), Spain	Anxiety, Depression, Stress	Experimental 11-12-year-old children attending a state school (n = 115) Group A: 57 students Group B: 58 students	Task Involved Motivational Climate vs. Ego Involved Motivational Climate	CSAI-2, POMS	N/A	After a 4-week introduction to athletics unit followed by a track and field competition, students in the task-involved motivational climate (mastery climate) experienced more pre-competition somatic anxiety while students in the ego-involved motivational climate (performance climate) experienced more post-competition stress. Depression scores were not affected by the type of climate.
Khalsa et al. (2012), USA	Anxiety, Depression, Stress	Quasi-Experimental 11^{th} & 12^{th} grade 15-19-year-old students (n = 121)	Modified Version of the Yoga Ed Program vs. PE	BASC-2, POMS-SF, PSS, IPPA	N/A	After the 11-week program, stress, anxiety, and depression measures were not significantly different between the yoga group and the PE as usual group.

		Active Treatment: Yoga, 4 classes (n = 74) No Treatment Control: PE-as-usual, 3 classes (n = 47)				
Noggle et al. (2012), USA	Anxiety, Depression, Stress	Group RCT 11th & 12th grade high school students with an average age of 17 years old (n = 51) Active Control: PE-as-usual (n = 15) Active Treatment: Yoga (n = 36)	Kripalu Yoga vs. PE	POMS-SF, PSS, IPPA	N/A	POMS-SF scores for the subscale of Tension-Anxiety were significantly better for the yoga group than the PE as usual group while there was no significant difference between groups for the subscale of Depression-Dejection. There were not statistically significant differences in perceived stress between the yoga group and PE as usual group.
Perry et al. (2014), Australia	Anxiety, Depression, Stress	RCT Year 9 and 10 secondary school students 13-16 years old (n = 380) Experimental Condition: HeadStrong Program (n = 207)	HeadStrong Program	D-Lit, DSS, DASS	N/A	Anxiety, depression, and stress scores for the participants were in the normal range and were not significantly different after participation in the intervention.

		Control Condition: Class as usual (n = 173)				
Butzer et al. (2017), USA	Depression, Stress	RCT 7th grade students with a mean age of 12.64 years (n = 209) Intervention Group: Yoga (n = 116) Control Group: PE-as-usual (n = 93)	Kripalu Yoga vs. PE	BRUMS, PSS	N/A	Females in both groups reported significant increases in perceived stress between time 1 (M = 17.13, SD = 7.24) vs. time 2 and time 1 vs. time 4, but males in both groups did not report significant changes in perceived stress. The entire sample reported significant increases in depression between time 1 vs. time 2, time 1 vs. time 4, and time 3 vs. time 4.
Hogue et al. (2019), USA	Depression, Stress	Correlational High school students with a mean age of 15.69 (n = 349)	Caring, Task-Involved Motivational Climate vs. Ego-Involved Motivational Climate	PASA, PSS, BDI-PC	N/A	There were significant negative correlations between life stress and a caring climate and a task-involving climate. There was a significant positive correlation between life stress and an ego-involving climate. There were significant negative correlations between depression and a caring climate, a task-involving climate. There were significant positive correlations between depression and an ego-involving climate, life stress, and primary stress appraisal. There were significant mean differences between males and females for life stress and primary stress appraisal with females

						reporting significantly higher values than males. An ego-involving climate was linked to greater life stress in male and female high school students.
Olive et al. (2019), Australia	Depression, Stress	Cluster RCT Grade 2 students with a mean age of 8 years (n = 821) Intervention Group: LOOK Study (n = 457) Control Group: PE class (n = 396)	Lifestyle of our Kids Study (4-year study, guided discovery approach vs. usual practice PE)	CDI, CSQ	SOFIT	No significant differences in overall depression scores were found at baseline and at 12 months after the intervention. No significant difference in stress scores between the IG and CG at baseline or after the 12-month intervention. Overall, no intervention effect occurred over the 4 years for depression and stress.
Andrade et al. (2020), Brazil	Depression, Stress	Cluster-Randomized Natural Experiment Elementary school students with a mean age of 9.41 years (n = 140) EG: Exergames (n = 68) CG: PE Group (n = 72)	Exergames vs. PE	Brunel Mood Scale	N/A	Analysis revealed that boys in both the exergames group and the PE group experienced lower stress levels while only boys in the PE group experienced lower depression scores. Girls in the exergames group and the PE group experienced reduced stress while only girls in the PE group reported lower levels of depression..

Appendix B IRB Material

Appendix B.1 Principal Approval Letter

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University

Mr. Robison,

My name is Kacie Lanier, and I am a PhD student at Georgia State University. I am in the process of completing my dissertation and would like for your school to participate in my study. Below you will find information about the study.

Name: Changes in Feelings of Anxiety and Stress During a High School Physical Education Class

Researchers: Kacie Lanier; Dr. Kathryn Wilson, Assistant Professor Georgia State University, Dr. Rachel Gurvitch, Associate Professor Georgia State University; Dr. Deborah Shapiro, Professor Georgia State University and Dr. Chad Killian, Assistant Professor University of New Hampshire

Study: The purpose of this study is to determine how high school students' feelings of anxiety and stress change over a class period how their movements impact those feelings. Additionally, the researchers will examine teachers' perceptions of their teaching style and classroom environment and its impact on student mental health. The following research questions will guide this study:

1. How do students' feelings of anxiety and stress change over the course of a high school PE class?
2. How does PA during a PE class impact students' feelings of anxiety and stress?
3. How do feelings of anxiety and stress differ between a PE class, an elective class, and an academic class?
4. What are teachers' perceptions of their teaching style and classroom environment and its impact on student mental health?

By conducting this study, I hope to gain an understanding of how physical activity in a PE class changes the way students' feel over a class period. I also hope to gain an understanding of the role the teacher and the classroom environment plays in the changes found.

If you choose to allow your school to participate, can you please sign on the line below.

Jared Robison
Jared Robison (Oct 23, 2023 16:30 CDT)
Principal Signature

Thank you for your time and I look forward to potentially working with you and your students.

Kacie V. Lanier

Kacie Lanier, MEd, MS
Doctoral Candidate

Department of Kinesiology and Health
College of Education and Human Development
Georgia State University

Appendix B.2 Waiver of Consent Form

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University
Waiver of Parental Permission Form

Title: How do Students Feel During the School Day and How Does Movement Impact Those Feelings?
Principal Investigator: Dr. Rachel Gurvitch, Associate Professor of Kinesiology & Health, Georgia State University
Student Principal Investigator: Kacie Lanier, Research Assistant, Georgia State University
Co-Investigators: Dr. Chad Killian, Assistant Professor of Kinesiology, University of New Hampshire; Dr. Deborah Shapiro, Professor of Kinesiology & Health, Georgia State University; Dr. Kathryn Wilson, Assistant Professor of Kinesiology & Health, Georgia State University

Introduction and Key Information
Your child is invited to take part in a research study. It is up to you to decide if you would like them to participate.

The purpose of this study is to determine how students feel during the school day and how their bodily movements impact those feelings.

Your child's role in the study will last four class period.

Your child will be asked to do the following:

- Participate in class activities as he/she usually would
- Complete a survey that measures how they feel at the beginning and end of class
- Wear an accelerometer mounted to the hip to measure bodily movements during class

Your child's involvement in this study will not expose them to any more risks than they would experience in a normal school day.

This study is not designed to benefit your child. We are simply hoping to gain information about how students feel during the school day and how their bodily movements impact those feelings.

Purpose
The goal of the study is to understand how students feel during the school day and how their bodily movements impact those feelings. Your child is invited to take part in this study because they are a 9^{th}-12^{th} grade student enrolled at the participating school. A total of 500 students are invited to participate in this study.

Procedures
This study will take place over 4 days. If your child takes part in the study, they will complete a survey that will measure their feelings at the beginning and end of class. Your child will also answer questions about their age, grade level, sex/gender, and race/ethnicity. The researcher will inform students when it is time to complete the survey. Each survey should take about 10-minutes to complete. No personal information will be collected that could identify your child. Your child will also wear an accelerometer during class to measure their bodily movements.

Future Research
Researchers will not use or distribute your child's data for future research studies.

Risks
In this study, your child will not experience any more risks than they would on a normal school day. No injury is expected from this study. If you believe your child has been harmed, contact the research team as soon as possible. Georgia State University and the research team have not set aside funds to compensate for any injury.

Benefits
This study is not designed to benefit your child. We hope to gain information about how students feel during the school day and how their bodily movements impact those feelings.

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Alternatives
The alternative for your child is to not participate in the study.

Voluntary Participation and Withdrawal
Involvement in this study is up to you and your child. If you change your mind about your child's participation, you have the right to withdrawal them at any time. Your child can also choose not to participate in the study. No preference will be given to those who participate. Your child's grade will not be impacted regardless of involvement.

Confidentiality
No personal information will be collected. We will keep your child's records private to the extent allowed by law. The following people and departments will have access to the information your child provides:

- Dr. Rachel Gurvitch, Kacie Lanier, Dr. Chad Killian, Dr. Deborah Shapiro, and Dr. Kathryn Wilson
- GSU Institutional Review Board
- Office for Human Research Protection (OHRP)

We will not collect any personal information about your child. Your child's survey answers will be stored on a secure computer or in a secure filing cabinet on the Georgia State University campus.

When we present or publish the results of this study, we will not use your child's name, the school's name, or other information that may identify them.

Contact Information
Contact Dr. Rachel Gurvitch at 404-413-8374 or rgurvitch@gsu.edu, Kacie Lanier at 912-687-6381 or klanier7@student.gsu.edu:

- If you have questions about the study or your child's part in it
- If you have questions, concerns, or complaints about the study

The IRB at Georgia State University reviews all research that involves human participants. You can contact the IRB if you would like to speak to someone who is not directly involved with the study. You can contact the IRB for questions, concerns, problems, information, input, or questions about your child's rights as a research participant. Contact the IRB at 404-413-3500 or irb@gsu.edu.

Consent
If you **do not** want your child to participate in this study, please check the box below. Write your child's name on the line. Sign and date this form. Return it to your child's teacher or the researcher.

[ ] I **do not** want my child, _____, to participate in this study.
(Name)

_____
Printed Name of Parent or Guardian

_____ _____
Signature of Parent or Guardian Date

_____ _____
Principal Investigator or Researcher Obtaining Consent Date

Appendix B.3 Student Assent Form

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University
Student Assent Form

Title: How do Students Feel During the School Day and How Does Movement Impact Those Feelings?
Principal Investigator: Dr. Rachel Gurvitch, Associate Professor of Kinesiology & Health, Georgia State University
Student Principal Investigator: Kacie Lanier, Research Assistant, Georgia State University
Co-Investigators: Dr. Chad Killian, Assistant Professor of Kinesiology, University of New Hampshire; Dr. Deborah Shapiro, Professor of Kinesiology & Health, Georgia State University; Dr. Kathryn Wilson, Assistant Professor of Kinesiology & Health, Georgia State University

Introduction and Key Information
You are invited to take part in a research study. It is up to you to decide if you would like to participate.

The purpose of this study is to determine how students feel during the school day and how their movements impact those feelings.

Your role in the study will last four class period.

You will be asked to do the following:

- Participate in class activities as you normally would
- Complete a survey that measures how you feel at the beginning and end of class
- Wear an accelerometer mounted to the hip to measure movement during class

Involvement in this study will not expose you to any more risks than you would experience in a normal school day.

This study is not designed to benefit you. We are simply hoping to gain information about how students feel during the school day and how their movements impact those feelings.

Purpose
The goal of the study is to understand how students feel during the school day and how their movements impact those feelings. You are invited to take part in this study because you are a 9^{th}-12^{th} grade student enrolled at the participating school. A total of 500 students are invited to participate in this study.

Procedures
This study will take place over 4 days. If you take part in the study, you will complete a survey that will measure your feelings at the beginning and end of class. You will also answer questions about your age, grade level, sex/gender, and race/ethnicity. The researcher will inform you when it is time to complete the survey. Each survey should take about 10-minutes to complete. You will spend a total of 80 minutes in study related activities. No identifying information will be collected. No identifying information will be collected. You will also wear an accelerometer during class to measure your movements.

Future Research
Researchers will not use or distribute your data for future research studies.

Risks
In this study, you will not experience any more risks than you would in a normal school day. No injury is expected from this study. If you believe you have been harmed, contact the research team as soon as possible. Georgia State University and the research team have not set aside funds to compensate for any injury.

Benefits
This study is not designed to benefit you. We hope to gain information about how students feel during the school day and how their movements impact those feelings.

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Alternatives
The alternative for you is to not participate in the study.

Voluntary Participation and Withdrawal
You do not have to participate in this study. Even if your parents or legal guardian have granted permission for you to participate in the study, you can choose not to participate in it. No one will be mad at you if you decide not to take part in the study. You can choose to be in the study and stop participating at any time. You may skip questions. Your grade will not be impacted by your decision to participate or not participate.

Confidentiality
No personal information will be collected. We will keep your records private to the extent allowed by law. The following people and departments will have access to the information you provide:

- Dr. Rachel Gurvitch, Kacie Lanier, Dr. Chad Killian, Dr. Deborah Shapiro, and Dr. Kathryn Wilson
- GSU Institutional Review Board
- Office for Human Research Protection (OHRP)

We will not collect any personal information about you. Your survey answers will be stored on a secure computer or in a secure filing cabinet on the Georgia State University campus.

When we present or publish the results of this study, we will not use your name, the school's name, or other information that may identify you.

Contact Information
Contact Dr. Rachel Gurvitch at 404-413-8374 or rgurvitch@gsu.edu or Kacie Lanier at 912-687-6381 or klanier7@student.gsu.edu:

- If you have questions about the study or your part in it
- If you have questions, concerns, or complaints about the study

The IRB at Georgia State University reviews all research that involves human participants. You can contact the IRB if you would like to speak to someone who is not directly involved with the study. You can contact the IRB for questions, concerns, problems, information, input, or questions about your rights as a research participant. Contact the IRB at 404-413-3500 or irb@gsu.edu.

Assent
If you wish to participate in this study, please print and sign your name on the lines below.

_____
Printed Name

_____ _____
Signature Date

_____ _____
Principal Investigator or Researcher Obtaining Consent/Assent Date

Appendix B.4 Teacher Informed Consent

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University
Informed Consent

Title: How do Students Feel During the School Day and How Does Movement Impact Those Feelings?
Principal Investigator: Dr. Rachel Gurvitch, Associate Professor of Kinesiology & Health, Georgia State University
Student Principal Investigator: Kacie Lanier, Research Assistant, Georgia State University
Co-Investigators: Dr. Chad Killian, Assistant Professor of Kinesiology, University of New Hampshire; Dr. Deborah Shapiro, Professor of Kinesiology & Health, Georgia State University; Dr. Kathryn Wilson, Assistant Professor of Kinesiology & Health, Georgia State University

Introduction and Key Information
You are invited to take part in a research study conducted by Kacie Lanier at Georgia State University.

This study has two purposes. The first purpose is to determine how students feel during the school day and how their bodily movements impact those feelings. The second purpose is to determine how the teacher can potentially impact students' feelings during class. If you agree to participate in this study, you will be interviewed by the researcher. The interview will be audio or video recorded with your consent. The interview will last about 30 minutes. You will be asked questions related to the previously mentioned study purposes.

Participating in this study will not expose you to any more risks than you would experience in a typical school day.

The study will allow the researcher to better understand how students feel during the school day, the role movement plays with those feelings, and how teachers can potentially impact the way students feel.

If you do not wish to take part in this study, the alternative is to not participate in the study.

Purpose
The first goal of the study is to understand how students feel during the school day and how their bodily movements impact those feelings. The second goal is to determine how teachers can potentially impact students' feelings during class. You are invited to take part in this study because you are the teacher of one of the classes participating in this study. A total of 3 teachers will be invited to take part in this study.

Procedures
If you decide to take part, you will be interviewed by the researcher. The interview will be audio or video recorded with your consent. The interview will last about 30 minutes. You will be asked questions related to how the classroom environment and teaching styles potentially impact the way students feel during class.

Future Research
Researchers will remove information that may identify you or your school. We may also use your data for future research. If we do this, we will not ask for any additional consent from you.

Risks
In this study, you will not expose you to any more risks than you would experience in a typical school day. No injury is expected from this study. If you believe you have been harmed, contact the research team as soon as possible. Georgia State University and the research team have not set aside funds to compensate for any injury.

Benefits
This study is not designed to benefit you personally. We hope to gain information about how students feel during the school day, how their bodily movements impact those feelings, and how teachers can potentially impact the way students feel. Overall, this study will provide insight into the feelings students experience during the school day and the role teachers play in relation to those feelings.

Alternatives
The alternative to taking part in this study is to not take part in the study.

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Voluntary Participation and Withdrawal
You do not have to be in this study. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may choose not to answer an interview questions. You may stop the interview at any time. The decision to engage in this research, declining to answer questions, or withdrawing from the study will have no effect on your relationship with Georgia State University. Your participation or lack of participation will not be shared with anyone at any time. This will not cause you to lose any benefits to which you are otherwise entitled.

Confidentiality
We will keep your records private to the extent allowed by law. The following people and entities will have access to the information you provide:

- Dr. Rachel Gurvitch, Kacie Lanier, Dr. Chad Killian, Dr. Deborah Shapiro, and Dr. Kathryn Wilson
- GSU Institutional Review Board
- Office for Human Research Protection (OHRP)

We will use pseudonyms rather than your name on study records. The information you provide will be stored in a secure location at all times. None of you personally identifiable information will ever be disclosed. Under no circumstances will the audio or video recordings ever be made public. Your participation in this study will remain confidential at all times.

When we present or publish the results of this study, we will not use your name, the school's name, or other information that may identify you.

Contact Information
Contact Dr. Rachel Gurvitch at 404-413-8374 or rgurvitch@gsu.edu, Kacie Lanier at 912-687-6381 or klanier7@student.gsu.edu:

- If you have questions about the study or your child's part in it
- If you have questions, concerns, or complaints about the study

The IRB at Georgia State University reviews all research that involves human participants. You can contact the IRB if you would like to speak to someone who is not directly involved with the study. You can contact the IRB for questions, concerns, problems, information, input, or questions about your child's rights as a research participant. Contact the IRB at 404-413-3500 or irb@gsu.edu.

Consent
We will give you a copy of this Informed Consent Form to keep.

If you are willing to participate in this research study, please sign below.

_____
Printed Name of Participant

_____ _____
Signature of Participant Date

_____ _____
Principal Investigator or Researcher Obtaining Consent Date

Appendix B.5 Teacher Interview Guide

How Teachers Impact Student Mental Health
Semi-Structured Interview Guide

Research Questions

1. How do students' feelings of anxiety and stress change over the course of a high school PE class?
2. How does PA during a PE class impact changes in students' feelings of anxiety and stress?
3. How do feelings of anxiety and stress differ between a PE class, an exploratory/connections class, and an academic class?
4. What are teachers' perceptions of their teaching styles and classroom environment and its impact on student mental health?

General Questions

1. How long have you been a teacher?
2. How long have you been a teacher at your current school?
3. What does mental health mean to you? How would you define it?
4. What is your view on the current status of student mental health in your school?
    a. What do you think the most common mental health issue is at your school?
    b. What do you think is the biggest thing students are struggling with?
5. In your opinion, how have increased awareness efforts and the de-stigmatization of mental health (e.g., celebrities/public figures talking about their own mental health problems, interventions within schools, charity campaigns, etc.) impacted the current state of student mental health?
    a. Are you seeing more problems in students that once were not there?
    b. Are students self-diagnosing or reporting more mental health problems than before?
6. How is the school addressing student mental health issues?
    a. Are there policies in place to support student mental health?
    b. Are there policies in place that require you to address students' social emotional health or mental health issues within the classroom?
        i. What are they?
7. How are other teachers at your school supporting students' mental health?
8. How has the school supported teachers in their efforts to address student mental health?
9. In your opinion, do you believe this increased focus on supporting students' mental health in schools is leading to an increased diagnoses in mental health problems?
    a. Or is the increased focus on mental health helping students label the feelings they experience and then seek help to managing these feelings?
10. What type of professional development have you received from the school district in relation to students' social emotional health/mental health?
11. Have you pursued any professional development on your own?
    a. If yes, what type of professional development?
    b. What about it did you find valuable? Lacking?

Teacher/Class Specific Questions

12. How have you integrated supporting students' mental health into your classroom?
    a. What specific strategies have you used?
    b. If no, why have you not integrated specific strategies related to supporting students' mental health into your classroom?
13. In your opinion, what type of teaching styles support students' mental health?
    a. Are you able to use these teaching styles in your classroom? Can you provide examples?
14. In your opinion, what does a classroom environment that supports students' mental health look like?
    a. What is your role in that environment?
    b. What are the students' role in that environment?
15. Do you believe you have been successful in establishing a learning environment that supports students' mental health?
    a. How do you know you have been successful? Can you provide examples?
16. **PE teacher only:** What is your view on PA, specifically within the PE environment, as a treatment or buffer for mental health?
    a. If it is viewed as important, what strategies have you implemented to promote students PA during class?

Appendix C Survey Instruments

Appendix C.1 Demographic Questions

Demographic Questions

Directions: Answer the following questions in the space provided.

1. Enter your student number in the space below.

2. What class are you in?

3. Enter your accelerometer name/number in the space below.

Directions: Answer the following background questions by circling the correct answer choice.

1. How old are you?
    a. 14 years old
    b. 15 years old
    c. 16 years old
    d. 17 years old
    e. 18 years old
    f. 19 years old

2. What is your biological sex?
    a. Female
    b. Male
    c. Other _____
    d. Prefer not to answer

3. What is your gender?
    a. Female
    b. Male
    c. Other _____
    d. Prefer not to answer

4. What grade are you in?
    a. 9th grade
    b. 10th grade
    c. 11th grade
    d. 12th grade

5. What is your race/ethnicity? (Select one or more responses)
    a. American Indian or Alaska Native
    b. Asian
    c. Black or African American
    d. Hispanic or Latino
    e. Native Hawaiian or Other Pacific Islander
    f. White

Appendix C.2 State Trait Anxiety Inventory (STAI-5)

State Trait Anxiety Inventory

State Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU FEEL RIGHT NOW**, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel upset.	1	2	3	4
I feel frightened.	1	2	3	4
I feel nervous.	1	2	3	4
I am jittery.	1	2	3	4
I feel confused.	1	2	3	4

Trait Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU GENERALLY FEEL**. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel. Thank you.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel that difficulties are piling up so I cannot overcome them.	1	2	3	4
I worry too much over something that really doesn't matter.	1	2	3	4
Some unimportant thoughts run through my mind and bother me.	1	2	3	4
I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

Appendix C.3 Perceived Stress Scale

Perceived Stress Scale

Directions: The questions in this scale ask you about your feelings and thoughts **DURING THE LAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

	Never	***Almost Never***	***Sometimes***	***Fairly Often***	***Very Often***
In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

Appendix D Survey Packet

Appendix D.1 Day 1 Complete Survey Packet

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University

Survey Questions

Directions: Answer the following questions in the space provided.

1. Enter your student number in the space below.

2. What class are you in?

3. Enter your accelerometer name/number in the space below.

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Georgia State University

Demographic Questions

Directions: Answer the following background questions by circling the correct answer choice.

1. How old are you?
    a. 14 years old
    b. 15 years old
    c. 16 years old
    d. 17 years old
    e. 18 years old
    f. 19 years old

2. What is your biological sex?
    a. Female
    b. Male
    c. Other _____
    d. Prefer not to answer

3. What is your gender?
    a. Female
    b. Male
    c. Other _____
    d. Prefer not to answer

4. What grade are you in?
    a. 9th grade
    b. 10th grade
    c. 11th grade
    d. 12th grade

5. What is your race/ethnicity? (Select one or more responses)
    a. American Indian or Alaska Native
    b. Asian
    c. Black or African American
    d. Hispanic or Latino
    e. Native Hawaiian or Other Pacific Islander
    f. White

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State Trait Anxiety Inventory

State Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU FEEL RIGHT NOW**, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel upset.	1	2	3	4
I feel frightened.	1	2	3	4
I feel nervous.	1	2	3	4
I am jittery.	1	2	3	4
I feel confused.	1	2	3	4

Trait Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU GENERALLY FEEL**. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel. Thank you.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel that difficulties are piling up so I cannot overcome them.	1	2	3	4
I worry too much over something that really doesn't matter.	1	2	3	4
Some unimportant thoughts run through my mind and bother me.	1	2	3	4
I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

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Perceived Stress Scale

Directions: The questions in this scale ask you about your feelings and thoughts **DURING THE LAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

	Never	***Almost Never***	***Sometimes***	***Fairly Often***	***Very Often***
In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

STOP HERE. DO NOT MOVE ON TO SURVEY #2 UNTIL INSTRUCTED TO DO SO BY THE TEACHER OR RESEARCHER.

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State Trait Anxiety Inventory

State Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU FEEL RIGHT NOW**, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel upset.	1	2	3	4
I feel frightened.	1	2	3	4
I feel nervous.	1	2	3	4
I am jittery.	1	2	3	4
I feel confused.	1	2	3	4

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Perceived Stress Scale

Directions: The questions in this scale ask you about your feelings and thoughts **DURING THE LAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

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In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

STOP HERE. TURN YOUR COMPLETED SURVEY PACKET IN TO THE TEACHER OR RESEARCHER.

Appendix D.2 Days 2-4 Complete Survey Packet

DEPARTMENT OF KINESIOLOGY AND HEALTH
College of Education and Human Development

Georgia State University

Survey Questions

Directions: Answer the following questions in the space provided.

1. Enter your student number in the space below.

2. What class are you in?

3. Enter your accelerometer name/number in the space below.

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State Trait Anxiety Inventory

State Anxiety Directions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the statement that indicates **HOW YOU FEEL RIGHT NOW**, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel upset.	1	2	3	4
I feel frightened.	1	2	3	4
I feel nervous.	1	2	3	4
I am jittery.	1	2	3	4
I feel confused.	1	2	3	4

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Perceived Stress Scale

Directions: The questions in this scale ask you about your feelings and thoughts **DURING THE LAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

	Never	***Almost Never***	***Sometimes***	***Fairly Often***	***Very Often***
In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

STOP HERE. DO NOT MOVE ON TO SURVEY #2 UNTIL INSTRUCTED TO DO SO BY THE TEACHER OR RESEARCHER.

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State Trait Anxiety Inventory

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	Not at All	***Somewhat***	***Moderately So***	***Very Much So***
I feel upset.	1	2	3	4
I feel frightened.	1	2	3	4
I feel nervous.	1	2	3	4
I am jittery.	1	2	3	4
I feel confused.	1	2	3	4

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Perceived Stress Scale

Directions: The questions in this scale ask you about your feelings and thoughts **DURING THE LAST MONTH**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

	Never	***Almost Never***	***Sometimes***	***Fairly Often***	***Very Often***
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In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
In the last month, how often have you felt nervous and "stressed"?	0	1	2	3	4
In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
In the last month, how often have you felt that things were going your way?	0	1	2	3	4
In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

STOP HERE. TURN YOUR COMPLETED SURVEY PACKET IN TO THE TEACHER OR RESEARCHER.

Appendix E Supplemental Tables

Appendix E.1 Supplemental Correlations Table

Supplemental Table 1

Correlation Table

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Age	1	-.243*	-.147	-.070	-.072	-.122	-.099	-.060	-.077	-.045	-.142	-.197	-.058	-.078
2. Trait Anxiety		1	.532**	.507**	.538**	.533**	.594**	.502**	.549**	.526**	.327**	.382**	.462**	.445**
3. Day 2 SA Pre			1	.910**	.498**	.493**	.551**	.513**	.338**	.290**	.404**	.448**	.306**	.249**
4. Day 2 SA Post				1	.468**	.460**	.494**	.499**	.286**	.238*	.353**	.404**	.264*	.200
5. Day 2 PSS Pre					1	.959**	.317**	.348**	.829**	.821**	.281**	.243*	.808**	.814**
6. Day 2 PSS Post						1	.356**	.339**	.857**	.846**	.359**	.332**	.808**	.812**
7. Day 3 SA Pre							1	.604**	.385**	.385**	.484**	.521**	.337**	.309**
8. Day 3 SA Post								1	.351**	.345**	.398**	.436**	.352**	.271*
9. Day 3 PSS Pre									1	.938**	.377**	.347**	.878**	.857**
10. Day 3 PSS Post										1	.322**	.306**	.826**	.855**
11. Day 4 SA Pre											1	.909**	.388**	.340**
12. Day 4 SA Post												1	.345**	.316**
13. Day 4 PSS Pre													1	.959**
14. Day 4 PSS Post														1

** $p < .01$
* $p < .05$

Appendix F Field Notes

Appendix F.1 PE Field Notes

November 28th, 2023

School

- K-12 public school
    - K-6 grades are in one building
    - 7-12 grades are in one building
    - Gym
    - Science building
    - Football and baseball/softball field

Gym

- Lobby with bathrooms and offices
- Wood gym floor with 2 basketball goals on each end
- Bleachers on each side (one side was pulled out and one side was pushed against the wall
- Male and female locker rooms

Teacher: white, female teacher

Students: 50 9th grade

Class Time: 8:14am – 9:04am

Topic: Badminton Underhand Serve

8:14-8:24 students dress out, complete the first survey, and put on accelerometers

Warm-Up

- Students got in their stretch lines and led themselves through stretches (e.g., jumping jacks, hamstring stretches, quad stretches, shoulder stretches)
- Some students were talking and not completing the stretches, but when the teacher told them to stop talking and participate in the warm-up they did
- After completing the warm-up, students jogged/walked 4 laps around the gym

Introduction

- Teacher tells students they will be continuing to practice the underhand serve
- Demonstrates and goes over the cues of the underhand serve
    - Cues: stagger stance, hold birdie by the neck, strike birdie below the waist, follow through
- Students shadow the cues

Activity 1

- Students are in partners

    - One partner performs and says the cues 10 times then switch
- Teacher walks around and monitors the students
- Students follow the directions the teacher gave

Activity 2

- The teacher puts students into 5 groups
    - Set up: x x x x x x x x x x
    - After a student serves the birdie they go to the back of their line
- Students use their hand to serve the birdie back and forth to each other and practice the cues
    - The teacher has about 10 birdies to use for the whole class
- Teacher walks around and monitors the students
- Teacher pauses a group of girls to make sure they are making contact with the birdie below their waste
- Teacher later pauses the entire class in order to refocus the students
    - She wants them to slow down and really focus on performing the cues correctly

Activity 3

- Students stay in their groups with the same set up
- The teacher now pass out a badminton racket to each group
    - The teacher has a total of 5 badminton rackets and 1 tennis racket to use for the whole class
- Students use the badminton racket to serve the birdie back and forth to each other
- Teacher walks around and monitors students
    - Stops and talks to one group, but I was not able to hear what was said

8:54 students complete the second survey, take off the accelerometers, and change clothes

Notes

- Task-oriented environment
    - Focus on cues and making sure cues and skills are performed correctly
- Students were able to interact with each other
- There was respect between the teacher and students and between the students
- Physically and emotionally safe environment
- Students followed directions and listened when the teacher was talking

November 30th, 2023

Class Time: 8:14am – 9:04am

Topic: Badminton Underhand Serve

8:14-8:22 students dress out, complete the first survey, and put on accelerometers

Warm-Up

- Students got into their stretch lines and led themselves through stretches (e.g., jumping jacks, hamstring stretches, quad stretches, shoulder stretches)
- After completing the warm-up, students jogged/walked 4 laps around the gym

Introduction

- While students are still in their stretch lines, the teacher tells students they will continue working on the underhand serve.
- She reviews the cues of the underhand serve
- Students say and shadow the cues
- After reviewing the cues, the teacher puts students into 5 groups
    - She has to repeat herself a couple of times because students do not initially listen to what she says

Activity 1

- Set up: x x x x x x x x x x
- Students use their hand to serve the birdie back and forth to each other and practice the cues
- Teacher walks around and monitors the students
- She talks to a couple of students, but I was not able to hear what she said

Activity 2

- Same set up as activity 1
- The teacher hands out 1 badminton racket to each group
- Student now use the badminton racket to serve the birdie back and forth to each other
- Teacher walks around and monitors
- Besides having to stop the students and refocus them on the task, there is not a lot of interaction with them

8:55 students complete the second survey and change clothes

Notes

- There are no badminton nets for the students to hit the birdie over
- The teacher does not try to get the students interested in learning the underhand serve
- She does not make the tasks challenging for the student
- The students enjoy being able to interact and talk with each other
- The teacher does not interact with students as much today as the previous day
- Physically and emotionally safe environment

December 1st, 2023

Class Time: 8:14am – 9:04am

Topic: Free Day

8:14-8:22 students dress out, complete the first survey, and put on accelerometers

Warm-Up

- Students got into their stretch lines and led themselves through stretches
- Students jogged/walked 4 laps around the gym

Introduction

- After completing the warm-up, the teacher told students that today would be a free day
- Students choose between basketball, volleyball (but no nets), or walking around the gym

Activity

- Students choose the activity they want to participate in
- They are not allowed to sit down; they have to be doing something
- Most of the boys choose to play basketball
- Most of the girls choose to volley and set the volleyball back and forth to each other
    - Some groups try to see how many times they can volley/set the ball without it hitting the ground
- A handful of student choose to walk around the outside of the gym floor

Notes

- This was the most fun students had over the course of the study
    - Students were a lot more active than previous days
- Physically and emotionally safe environment
- After telling students what was happening, the teacher did not really interact with the students
- Students stayed on task during the whole class period
- The teacher also played music on the third day

Appendix F.2 Art Field Notes

November 28th, 2023

Classroom

- One wall has art supplies hanging on it
- The back wall has cabinets that are filled with art supplies and displaying student art work
- The front wall has a Smart Board and case for chrome books

Teacher: white, female teacher

Students: 28 9th - 10th grade

Class Time: 9:08am – 9:58am

Topic: Exacto Knife Blades

9:08-9:15 students complete the first survey and put on the accelerometers

Introduction

- Teacher says that students will continue to about exacto knife blades
- She goes over more history of exacto knife blades
- She again reviews the safety rules, how to use the cutting map, how to hold the blade, and how to cut with the blade
- She also says that after they are comfortable with using the blade that they will create a positive and negative project using the exacto knife blade, but they will go over it later

Activity 1

- After going over the history, safety, and how to cut with the blade, students get out a cutting mat, get a blade, get a sheet of paper, and ruler in they need one
    - All students have a blade, all students have a cutting mat, and all students have a ruler to use if needed
- With the cutting mat, blade, and sheet of paper the students practice cutting a perfectly straight line with the blade
- Teacher walks around, makes sure they are using the blade correctly, and helping them cut a straight line with the knife
    - She stops to help a couple of students line their sheet of paper and ruler up correctly so that they will be able to cut a straight line
- Once students are able to cut a straight line and the teacher approves, the students start on the second activity

Activity 2

- Exacto knife worksheet
    - Students practice cutting different shapes like squares, zig zags, circles, stars

- Students are not able to finish the worksheet and the teacher tells them that they will work on it the next day

9:50 students complete the second survey and turn in the accelerometers

Notes

- Task-oriented environment
    - Teacher really focuses on making sure students use the blade correctly and providing plenty of opportunities for students to practice
- Safe and secure learning environment where students are encouraged to succeed, but know it is ok if they do not get it right the first time
    - The teacher said students could get extra sheets of paper to practice cutting their straight line
- Respect between teacher and students and between students
- Students are able to interact with each other
- On top of going around and helping students, the teacher also has conversations with the students about what's going on in their lives

November 30th, 2023

Class Time: 9:08am – 9:58am

Topic: Exacto Knife Blades

9:08-9:13 students complete the first survey and put on the accelerometers

Introduction

- Teacher says that they will continue learning about exacto knifes
- Gives students some more history about positive and negative space
- After this, students continue to work on the assignments from the previous day

Activity

- If the teacher did not sign off on students being able to cut a straight line, then students continued to practice that until the teacher signed off
    - Once the teacher signed off, they moved on to the worksheet
- If students started working on the worksheet from the previous day, they continued working on it
    - Students were struggling with cutting a circle with the blade, so the teacher stopped them and demonstrated how to use the knife to cut the circle
    - She also gave them so tips on how to hold the blade and how to move the paper while cutting a circle
- While working on the worksheet, the teacher tells the students that it is ok to fail or make a mistake and that they could get a new worksheet if needed

9:52 students complete the second survey and turn in the accelerometers

December 1st, 2023

Class Time: 9:08am – 9:58am

Topic: Exacto Knife Blades

9:08-9:13 students complete the first survey and put on the accelerometers

Introduction

- Teacher goes over the positive and negative project in more detail
    - Notan-finding the shadow
    - Students will use the exacto knifes to create their positive and negative project
- After this, students continued to work on the exacto knife worksheet or they began to plan their project

Activity

- Students finished the exacto knife worksheet where they practiced cutting shapes with the exacto knife
- If/when students were done with the worksheet, they began working on their positive and negative space project
- Students used the chrome book to look at different types of positive and negative space art and to decide how they wanted to complete their project
- The teacher walks around helping students with the worksheet and helping them decide what they want to do for their project
    - A couple of students wanted to choose ideas that were too easy, so the teacher challenged them to pick something else

9:53 students complete the second survey and turn in the accelerometers

Notes

- Teacher interacts with the students; talks to them about more than what they are working on in class
- Students know they can make mistakes, especially when learning how to cut with the exacto knife
- Students are able to interact with each other as long as they work on their assignments

Appendix F.3 US History Field Notes

November 28th, 2023

Classroom
- One wall has cabinets
- Smart board that the teacher uses to lecture from
- Desks
- Books stay at each desk for the students

Teacher: white, female teacher

Students: 22 10th grade

Class Time: 12:23pm – 1:13pm

Topic: Amendments

12:23-12:38 students coming back from lunch, complete the first survey, and put on the accelerometers

Introduction
- The teacher tells the students they will continue talking about the amendments

Lecture
- Teacher has a PowerPoint prepared to go over with the students
- The teacher reviews the first two amendments and then they cover amendments 3-7
    - The students really found the double jeopardy clause in the 5th amendment interesting
- The teacher presents the amendments one by one so that she can ask students if they know what each amendment is or what it means before actually telling them
- Students are interactive with the lecture; they ask questions and can provide examples when the teacher asks
- At one point there were some students talking, but when the teacher tells them to be quiet they do

1:09 students complete the second survey and turn in the accelerometers

Notes
- Task-oriented environment
    - The teacher made sure the students understood each amendment
    - She made sure to provide examples and encouraged students to ask questions if they were not sure about something
- Good class discussion and student engagement

November 30th, 2023

Class Time: 12:23pm – 1:13pm

Topic: Amendments

12:23-12:32 students coming back from lunch, complete the first survey, and put on the accelerometers

Lecture

- Teacher continues covering the amendments
    - The cover the 16th-27th amendment
- The teacher presents the amendments one by one so that she can ask students if they know what each amendment is before actually telling them
    - Provides examples of how this applies to their everyday life
- Students are interactive with the lecture
- The teacher introduces the amendments project
    - Students were assigned an amendment and they are going to create a poster that includes what the amendment is and an illustration
- After going over the project, the teacher assigns students an amendment and then tells them they will start working on their project tomorrow

1:10 students complete the second survey and turn in the accelerometers

Notes

- The teacher makes sure that the students understand each amendment
- She also wants them to ask questions if they have them

December 1st, 2023

Class Time: 12:23pm – 1:13pm

Topic: Amendments

12:23-12:33 complete the first survey, and put on the accelerometers

Lecture

- After completing the first survey, students get a chrome book and start working on their project
- The teacher provides construction paper, markers, and color pencils for the students to use
- The students are also able to print out pictures or the full phrase of their amendment to use on their posters

- The teacher showed two examples of past amendment posters
    - They were about the first and 19th amendments
- The teacher walks around helping students and answering any questions they have
- Students were able to talk quietly while working on their project
- If students do not finish the project at the end of class, they take the project home to finish it over the weekend

1:10 students complete the second survey and turn in the accelerometers