



Positive Psychological Effects of School-Based Yoga and Mindfulness Programs for At-Risk Hispanic Adolescents

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Abstract

This quasi-experimental study investigates differences in the impact of school-based yoga interventions and mindfulness practices on psychological well-being impact factors in at-risk Hispanic adolescent high school students compared to similar students enrolled in traditional physical education classes. Due to the global COVID-19 pandemic, experimental conditions were delivered virtually. The BRUMS and PANAS-C were utilized to assess psychological well-being constructs of mood and affect. Statistical analyses included Friedman's test for nonparametric data, comparisons of pre post change scores between yoga and physical education classes, and longitudinal data trends for each subscale from the study's inception to conclusion. The findings show that school-based yoga participants exhibited higher levels of improved mood and affect with large effect sizes than those enrolled in a standard physical education (PE) class during the 12 weeks of the intervention. Implications and further directions are discussed.

Keywords Mindfulness practices · Hispanic adolescents · Psychological effects of school-based yoga interventions

Introduction

American educational institutions are seeking innovative, supportive approaches that cultivate mental skills and socioemotional dispositions to prepare and educate future generations. Global conditions, cultural diversity, technological influences, and growing knowledge-based communities demand new lenses from which to view educational systems. Specifically, research on adolescent development is evolving, documenting how positive socioemotional dispositions embedded within academic curricula promote and increase positive well-being, decrease negativity, support physical

health and wellness, support academic progress, and increase academic performance (Butzer et al., 2016; Davidson et al., 2012; Felver et al., 2015; Noggle et al., 2012; Zins et al., 2004). An overwhelming consensus exists that educational institutions need to provide more than academic guidance and instruction, such as cultivating skills to develop the whole child and ensure holistic success (Davidson et al., 2012; Durlak et al., 2011). High-stakes testing and college preparedness take precedence among the pressures of academic performance. According to the 2010 American Psychological Association Survey, stress significantly impacts adolescents' physical and emotional health. Mindfulness and students' social-emotional development is a secondary consideration across educational institutions with limited time and resources. However, ever-evolving knowledge-based and culturally expansive communities with diverse needs have called attention to the importance of incorporating social-emotional learning and mindfulness into school curricula. Furthermore, the impact of COVID-19 isolation on education has shed further light on the importance of mindfulness and social-emotional learning in academic institutions.

Adolescents with strong social emotional skills are better able to manage everyday challenges, which in turn can lead to improved functionality socially, professionally, and academically. Mindfulness, the practice of elements of social

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emotional skills, is defined as the ability to regulate one's emotions and focus on the present without judgment. These elements contribute to the narrative of the development of the holistically grounded adolescent. Across the USA, there has been growing interest in the integration of mindfulness/contemplative school-based yoga programs in school curricula that consist of these elements. Current mindfulness/contemplative school-based yoga programs vary by program and implementation but overall seem to focus on the same basic elements: self-regulation of emotions and behaviors, mindfulness practices, mental wellness, and physical movement. There is an overwhelming consensus in the research that any form of physical activity/movement can promote a positive platform for wellness and mobility. The research study focused on the hypothesis proposed by researchers in the field for embedding school-based yoga interventions into schools. The hypothesis model consists of three competencies, mind–body awareness, self-regulation, and physical postures, which establish a scientific rationale for improving social emotional skills, mental wellness, and healthy behaviors (Butzer et al., 2016). This study tests this hypothesis and compares the psychological effects of school-based yoga intervention practices on at-risk Hispanic adolescent high school students enrolled in yoga classes to students enrolled in traditional physical education (PE) classes. Overall, this study highlights the missing elements of mental skills and socioemotional dispositions in academia in preparing and educating future generations, focusing on the Hispanic adolescent population.

CASEL, Social Emotional Learning, and Contemplative Practices in Schools

In 1994, the organization CASEL emerged in response to nationwide increases in problematic student behaviors. The organization evolved as a collaboration among educators, psychologists, and public health professionals, all focused on positive youth development. These various groups developed goals and guiding principles for CASEL (2013, 2014) that now serve as the leading national guides for school-based social-emotional learning (SEL) practices. In theory, according to CASEL (2015b), social-emotional learning skills can be taught within daily teaching practices, embedded into curriculum frameworks, as policies or organizational structural strategies, or as free-standing lessons. The overarching goal of SEL programs is to ensure students develop core competencies in five key areas: self-management (the ability to regulate one's own thoughts, emotions, and behaviors under varying circumstances, including stress management and self-motivation), self-awareness (awareness of one's thoughts and emotions and how they impact one's behaviors), social awareness (appreciating the perspectives

of others with diverse backgrounds and demonstrating empathy), relationship skills (establishing and maintaining healthy positive relationships), and responsible decision-making (the ability to make positive choices regarding personal behavior and social interactions) (CASEL, 2015b).

There is strong evidence that the implementation and promotion of SEL improves student outcomes (Durlak et al., 2011). Collectively, SEL programs in some academic settings provide evidence that promoting positive youth behaviors and preventing violence and antisocial behaviors result in improvements in test performance, increased school attendance, and fewer disciplinary actions (Butzer et al., 2016; Durlak et al., 2011; Greenberg & Rhoades, 2008; O'Connell et al., 2009). Furthermore, a meta-analysis of 213 controlled studies on SEL programs, described in the *CASEL 2015 Guide for Middle and High Schools*, demonstrated that students receiving quality SEL instruction exhibited increased academic achievement, improved attitudes and behaviors, and decreased negative behaviors while reducing emotional distress and anxiety (Durlak et al., 2011).

CASEL guides (2013, 2015a) provide organized competencies and descriptive systematic evidence-based reviews of SEL programs across the country. CASEL (2015a) devised categories for organizing SEL programs: SELet programs, complementary programs, and SEL-related and promising programs. Criteria descriptors to determine category designation were based on (a) an overall solid program design that promotes student development across the five social and emotional competencies outlined, (b) a descriptive implementation process timeline of multiyear and ongoing training and support, and (c) research evaluations of program impact.

According to the *CASEL 2015 Guide for Middle and High Schools*, five programs fell under SEL-related approaches or were considered supplements to SEL. Of these, one program focused on managing anxiety and building self-esteem (Mindfulness in the Schools Program), two programs focused on breathing techniques and relaxation (Learning to Breathe and SKY Schools), and two programs incorporated yoga, breathing, and meditation techniques (Kripalu and Transformative Life Skills). Importantly, mindful awareness practices are not currently listed by name in the CASEL five competency clusters due to the early and limited progress of research and practice in this field.

While there is a growing movement in education to promote mindfulness practices or contemplative practices among students, there is minimal research in the field. Kabat-Zinn (1994) defines mindfulness as focusing on intention and the present moment and as maintaining an attitude of nonjudgment. Mindful school-based programs that promote student awareness may include one or more of the following components: yoga, breathing, brief meditations, and

other strategies designed to help students focus their attention and regulate their emotions. Correspondingly, contemplative practices are described as any form of meditation, breathing, and yoga postures that represent structured and socially scaffold activities that develop discipline for unregulated mental or physical habits (Davidson et al., 2012). School-based yoga programs are often referred to as mindfulness or contemplative practices. Mindfulness/contemplative school-based programs and SEL school-based programs appear to provide abundant benefits for students' social and emotional development, each in their own way. According to Weissberg et al. (2015) and Butzer et al. (2016), CASEL outlines four key descriptors for effective SEL programs. Effective SEL programs are sequenced and coordinated activities that foster skill development, are active forms of learning for new skill mastery, focus on developing social and personal skills, and provide explicit direct instruction targeting social and emotional learning. Butzer et al. (2016) make a strong argument that mindfulness/contemplative school-based yoga programs and SEL school-based programs appear to have similarities in the first three descriptors, and the only difference is the explicit direct instruction approach. Mindfulness/contemplative practices foster social and emotional learning competencies at an intrinsic level contrary to direct explicit instruction. Butzer et al. (2016) developed a hypothesis model that combines mind–body awareness, self-regulation, and physical fitness collectively at the intrinsic level. The difference delineated here suggests that social-emotional competencies are not only learned through in-class lessons, textbooks, or direct instruction lectures but can also be learned through implicit instructional methods when engaging in the process of breathing, meditation, yoga postures, and relaxation. These intrinsic-level practices provide an environment where students embody these skills and cultivate them when practicing. Furthermore, these forms of mental training, i.e., contemplative/mindful practices, can induce changes in brain activity and brain structure when incorporated in regulated mental and physical activities (Davidson et al., 2012; Siegel, 2015). The process by which brain changes occur in response to experiences is known as neuroplasticity (Siegel, 2015). The ability to trigger changes in brain activity and brain structure through social-emotional practices can be a powerful tool for student development and success.

Research on School-Based Yoga Programs

Research on school-based yoga is relatively new, having started in 2005. Khalsa and Butzer (2016) describe the body of research as a “growing field of inquiry” (p. 45) and provide a systematic review of school-based yoga interventions. Khalsa and Butzer (2016) identified 47 peer-reviewed

journal articles, reporting that 50% of these studies were conducted in elementary school settings, and 85% were embedded within the school curriculum and implemented during school hours. For inclusion in this systematic review, studies were required to include mindfulness and meditation, breathing practices, and yoga postures. The researchers found a high degree of variability among the yoga interventions and implementations within school settings. Additionally, the studies collectively exhibited low to moderate methodological quality in research design (Khalsa & Butzer, 2016). Overall, the researchers recommended methodological rigor and systematic intervention characteristics with more connective attention to the social-emotional learning core competencies as part of a holistic system of practices. The collective research in this field shows improvements in behavior, mental, physical, and emotional health and well-being (Butzer et al., 2016; Felver et al., 2015; Khalsa & Butzer, 2016; Noggle et al., 2012).

Several studies have compared the effects of yoga to PE classes. Noggle et al. (2012) conducted a randomized controlled trial in a PE setting in a US high school. The study evaluated the psychological benefits of a school-based yoga program embedded in a high school curriculum for adolescents. The adolescent population ($N=51$) was representative of 11th and 12th graders, with 92% white students and 8% minority students. Participants were assigned to a yoga intervention session or a PE control group for a 10-week period. The 30-min yoga intervention was representative of a standardized Kripalu-based adolescent program (endorsed by CASEL) that was secular and consisted of the classical yoga elements of breathing practices, deep relaxation and meditation techniques, and yoga postures. Examining psychosocial well-being includes the primary factors of mood, affect, perceived stress, and positive psychology. The self-regulatory skills of anger expression, mindfulness, and resilience were also evaluated. Overall, PE students exhibited decreases in primary outcomes, while yoga students improved or remained steady in these outcomes. Mood disturbance positively increased in yoga students but seemed to decrease in PE students. Positive affect remained consistent and steady in both groups, while negative affect worsened in the PE group and improved in the yoga group. Generally, implementation seemed feasible, and adolescents reported that the yoga sessions were beneficial (Noggle et al., 2012).

Felver et al. (2015) compared the effects of adolescents participating in a PE class with those participating in a yoga class. The purpose was to determine whether school-based yoga in the public high school curriculum would improve adolescent mood and affect. The study population ($N=58$) was representative of ninth- and tenth-grade students enrolled in wellness classes. The participants were 91.1% white, and the remaining were minority students. To assess psychosocial well-being, mood, and affect, the BRUMS

and PANAS-C were used. The PE class consisted of a 35-min session taught by certified PE and health teachers. The experimental yoga session consisted of fifteen 30-min Kripalu yoga lessons embedded in the school's curriculum. The curriculum sequence included 5 min of mindful breathing, 20 min of yoga postures, and 5 min of meditation and remaining in stillness. The analysis strategy included paired sample *t* tests between groups to compare the effects of yoga to PE classes. Difference scores were calculated by subtracting preclass scores from postclass scores for all subscales. Additionally, difference scores for positive and negative affect variables were reported. Change scores from preclass to postclass were calculated using paired samples within group tests for yoga and PE classes. Effect sizes were included for an added perspective. Overall findings reported by Felver et al. (2015) suggest that adolescents showed improvements in mood and affect following both yoga and PE classes; however, a larger effect size was found among yoga participants than those enrolled in a standard PE curriculum. Specifically, yoga participants exhibited greater decreases in anger ($p=0.013$), depression ($p=0.028$), and fatigue ($p=0.034$) from before to after participating in yoga compared to the PE groups (statistically significant $p<0.05$). Notably, significant decreases in tension and confusion were reported in both groups, while yoga participants observed additional significant decreases in anger, depression, fatigue, and negative affect. The overall findings of this study indicated that school-based yoga opportunities for students may provide benefits for mental health and wellness beyond those of traditional PE, and future research should expand on the comparison between yoga and PE (Felver et al., 2015).

Each of the studies described represents distinct research in the field, replicated with moderate differences for evaluating school-based yoga interventions. Studies have consistently indicated positive overall outcomes of school-based yoga interventions. Importantly, there is a lack of research that specifically compares school-based yoga interventions to traditional PE programs focused on adolescent populations that are culturally linguistically diverse. The previous research reviewed involving adolescent yoga or mindfulness in the field predominantly reflects Anglo populations with small numbers of minority representation. This lack of cultural diversity highlights the importance of the present study.

Research Methods

The quasi-experimental design examine the effects of a school-based yoga program on mood, affect, and mental health on a sample of at-risk Hispanic students. Surveys were utilized to obtain data from participants. Implementation of the school-based yoga interventions in this study was based on the framework model (mind body awareness,

self-regulation, and physical) postures proposed by Butzer et al. (2016). The original intent and IRB study approval was for face-to-face delivery of the study; however, due to the global COVID-19 pandemic, all schools transitioned to online learning. Researchers were required to develop a virtual delivery plan of instruction for the 12-week study, which was approved by the IRB and school district.

Sampling

Participants were selected using convenience sampling of freshmen enrolled at a designated high school in South Texas. The freshman curriculum required enrollment in a college physical fitness class for 1 h of college credit. A total of 93 students enrolled in the course. The course is normally divided into sections offered two days per week (M/W or T/TH). The participants were randomly placed (based on the physical activity they selected) into one of two groups, with 56 adolescents in the yoga class and 37 adolescents in the PE class. The adolescents were divided into four course sections based on treatment (yoga) and control (PE) participation groups. The M/W sections consisted of one control group and one treatment group, scheduled at different morning timeslots. Similarly, the T/TH sections consisted of one control group and one treatment group, scheduled at different morning timeslots. Of the 56 adolescents who volunteered to participate in the treatment group, two students opted out of the yoga practice and were transitioned into the control groups of the PE class, leaving 54 total yoga participants for the study. One student from the control group withdrew from the high school. The final participant count for the control group was 38 PE students. The final total participant count was 92 students, of which 55 identified as female (45 in the yoga treatment group and 10 in the PE group) and 37 identified as male (nine in the yoga treatment group and 28 in the PE group).

Because the participants were minors, both parental consent and adolescent assent were needed. Participants were not compensated for their participation and were informed that they could withdraw from the study at any time without any penalty and would be transitioned into the control group class (physical fitness). The study proposal was reviewed and approved by the IRB and by the school district that opted to participate in the study pre-pandemic and was then modified for approval during the pandemic.

Participants

Participants are from a public high school that is partnering with a local university. All incoming freshman students (orientation) were informed of the option to sign up for yoga or physical education as their PE requirement. All students enrolled in this designated high school campus must

undertake dual university college enrollment as part of their 4-year high school curriculum. All participants must apply to this public high school, and the eligibility criteria include the following: first-generation college students, identified at-risk, lacking access to meet college readiness standards, and identified as limited English proficient. All students accepted into the high school are incoming freshmen, mostly from the district middle schools. A few students are from local private or charter middle schools. According to the district website, student demographics at this campus are 99.06% Hispanic, 0.47% Asian, 0.23% White, and 0.24% Multiracial.

Transparency and Openness

The researchers reported how sample size, data exclusions, and measures in the study were determined, following JARS (Kazak, 2018). All data, analysis code, and research materials are available upon request by emailing the corresponding authors. Data were analyzed using SPSS version 26. The study's design and analysis were not preregistered.

Measures

The researchers chose to assess mental well-being (psycho-social), mood, and affect, utilizing scales found in previous research on yoga practices within schools (Felver et al., 2015; Noggle et al., 2012). The BRUMS measures adolescent mood and is modeled after the Profile Mood States survey (POMS) (Lane & Lane, 2002; McNair et al., 2013). The BRUMS consists of 24 mood descriptors organized into six subscales: Anger, Confusion, Depression, Fatigue, Tension, and Vigor. Each subscale is associated with 4 mood descriptor items. The BRUMS is a 5-point Likert-type scale with a numerical rating of zero to four (0 = not at all; 1 = a little; 2 = moderately; 3 = quit a lot; 4 = extremely). Participants were asked to carefully read the items (words) listed that describe feelings and select what they believe best represents their present situation, using questions such as "How do you feel now in this present moment?" The mood descriptors were categorized accordingly: anger = annoyed, bitter, angry, bad-tempered; confusion = confused, muddled, mixed-up, and uncertain; depression = depressed, downhearted, unhappy, miserable; fatigue = worn out, exhausted, sleepy, and tired; tension = panicky, anxious, worried, and nervous; and vigor = lively, energetic, active, and alert.

Brandt et al. (2016) investigated the construct validity and internal consistency of the BRUMS instrument to determine its effectiveness in measuring mental health in diverse populations who are physically active and apparently healthy. The results indicated high internal consistency ($\alpha = 0.85$), with all subscale values validated by their alpha coefficients and factor loadings. These results were higher than those found in the validation studies for other instruments. Felver et al.

(2015) reported similar internal consistencies when applying BRUMS subscales, with Cronbach's alpha values ranging from 0.73 to 0.93.

To measure affect, the PANAS-C was employed and is one of the most widely used scales to measure mood or emotion (Laurent et al., 1999; Watson et al., 1988). The PANAS-C measures adolescent affect using a multilateral model of anxiety and depression with dimensions of positive affect (PA) and negative affect (NA) mood descriptors (Felver et al., 2015; Watson et al., 1988; Wróbel et al., 2019). PA refers to the propensity to experience positive emotions and interact with others, including life's challenges, in a positive way. NA corresponds to perceiving the world in a more negative way, including feelings of negative emotions in relationships and surroundings. The scale comprises 27 items, with 12 items measuring positive affect (e.g., excited, joyful) and 15 items measuring negative affect (e.g., lonely, afraid). Each item is rated on a five-point Likert-type scale, with 1 = not at all; 2 = a little; 3 = moderately; 4 = quite a bit; and 5 = extremely. According to Watson et al. (1988) and Laurent et al. (1999), the PANAS-C is based on psychometric and theoretical grounds that demonstrate good convergent and discriminant validity with existing self-report measures of childhood anxiety and depression. Internal consistency reliability alphas ranging from 0.86 to 0.90 for PA and 0.84 to 0.87 for NA were reported by Watson et al. (1988). This instrument is effective in measuring and tracking changes from the present time to week-to-week positive and negative emotions while engaging in psychological interventions or activities (Magyar-Moe, 2009). Felver et al. (2015) reported similar internal consistencies for applying PANAS-C subscales, with acceptable Cronbach's alpha values of 0.93 for PA and 0.89 for NA.

Experimental Conditions

Quantitative data collection began with the first active session and lasted 12 weeks (total of 24 sessions). Student surveys were collected weekly before and after yoga sessions. Student surveys were also collected weekly before and after traditional PE sessions to serve as a control. The student surveys were provided in English and were translated into Spanish as needed for participants who requested additional support to understand the expectations. Butzer et al.'s (2016) framework was used as the hypothesis model (mind body awareness, self-regulation, and physical postures) for the school-based yoga interventions in this study.

The research design included a total of four course sections, each meeting 2 days a week (Monday/Wednesday or Tuesday/Thursday), for 60 min per session. Two sections were yoga classes (treatment), and two sections were PE classes (control). Yoga participants were assigned to one of two courses offered. Participants who opted out of yoga were

assigned to one of two PE courses. The study duration was 12 weeks, with a total of 24 classes for both the yoga and physical fitness groups. As mentioned, the original research design was intended for face-to-face instruction. However, due to the COVID-19 pandemic, only online instructional delivery was permitted in accordance with the IRB, university, and school district policies. A two-way interactive live (synchronous) virtual delivery method of instruction using multiple cameras via the Zoom platform was used.

Yoga Classes

A 24-lesson curriculum was developed by the researchers to reflect adolescent yoga research in the field, Kripalu Yoga Philosophy, and the CASEL SEL core competencies of self-management, self-awareness, social awareness, relationship skills, and responsible decision-making. The design also reflects Best Practices for Yoga in Schools (Childress & Harper, 2015) and mirrors previous yoga-in-the-schools interventions (Butzer et al., 2016; Felver et al., 2015; Noggle et al., 2012). The curriculum was also reviewed by an external expert in adolescent yoga. The consultant is certified by the International Association of Yoga Therapists and the National Ayurvedic Medical Association and is a Yoga Alliance Continuing Education Provider and a 500-h trained, experienced, registered yoga teacher (E-RYT500), who holds a 1,000-h Kripalu Yoga Teaching credential and serves as a lead faculty member and curriculum developer at Kripalu Center for Yoga & Health in Stockbridge, MA.

The 60-min class consisted of traditional mind and body yoga practices inclusive of breathing exercises (5 min), yoga postures and stretching exercises (40 min), and deep relaxation and meditation techniques (5 min). The remaining 10 min were utilized for connecting with students virtually (Q&A), attendance purposes, checking in with students, and allowing students downtime before their next online course. Food rules on healthy eating and making better food choices were embedded into the weekly sessions. For example, avoiding sodas, sugar dinks, and fatty snacks and limiting food proportions were some of the food rules shared. Additionally, different positive affirmation themes were embedded into the breathing and meditation timeframe: gratitude, mind–body connections, self-worth (self-esteem), positive behaviors, positive relationships, empathy, compassion, healthy choices, abandonment of negativity, challenges are there to help us grow, focus and concentration, nonjudgment, and healthy thoughtful responses determine outcomes.

The yoga classes were delivered by the primary researcher and coinstructor. The researcher has 26 years of experience in the education field teaching elementary through high school and university and holds a Ph.D. in Curriculum and Instruction. The researcher has practiced and taught yoga for 8 years. She is a 200-h registered yoga teacher with Yoga

Alliance and has earned additional training hours with the Kripalu Center for Yoga and Health. The co-instructor holds a Master's of Education in Kinesiology and has taught kinesiology at the community college and university levels for over 17 years and has 24 years of overall fitness instruction experience. The coinstructor is a certified group exercise instructor with the American College of Sports Medicine and a certified personal trainer by the National Strength and Conditioning Association. She is a 200-h registered yoga teacher with Yoga Alliance and holds additional 200-h certification with YOGAFIT.

The researcher taught the yoga curriculum using Zoom. The coresearcher provided visual oversight of adolescent engagement of all aspects of the course from breathing techniques to postural alignment and made recommendations and adjustments as needed as students transitioned from one posture to another to prevent injury and encourage active engagement. Technology was supported and provided by the school district and the university to facilitate virtual instruction.

Physical Education Class

The coinstructor taught the two sections of PE (control) classes online via Zoom. The course included a variety of activities to strengthen the heart, lungs, and vascular system. The objectives of the course were to demonstrate an understanding of motor skill development inclusive of the components of health-related fitness and to provide an understanding of the multidimensional nature of kinesiology, health, and wellness. The 60-min class consisted of a 10-min warm up, 30 min of aerobic and muscular endurance exercise, and 10 min of core and stretching. The remaining 10 min of the course were utilized for connecting with students virtually (Q&A), attendance purposes, checking in with students, and allowing students downtime before their next online course.

Data Analysis

To assess psychological well-being (quantitative data), constructs of mood and affect were measured by employing two commonly utilized questionnaires: BRUMS and PANAS-C. The surveys were collected online via Survey Monkey through weekly emails. Data were coded and analyzed using SPSS version 26. Data were double-coded and verified to ensure accuracy. Kolmogorov–Smirnov and Shapiro–Wilk tests and a visual review of the Q-Q plots and histograms were conducted to determine if the data were normally distributed. As the data were not normally distributed, the Wilcoxon signed rank test was used rather than the paired sample *t* test approach employed by previous studies. These statistical analyses

were conducted between groups to compare the effects of yoga classes and PE classes. Difference scores were calculated by subtracting preclass scores from postclass scores for all subscales (Anger, Confusion, Depression, Fatigue, Tension, and Vigor). Additionally, difference scores for positive affect and negative affect variables were reported. Next, change scores from pre- to post-classes were calculated using paired samples within group tests for the yoga and PE classes.

Results

To investigate the longitudinal results and given that the data are not normally distributed, Friedman’s test (Table 1) was conducted to detect any statistically significant differences due to treatments across the twelve measurement events. Friedman’s test was used to compare differences in pre/post results among and between groups for each of the eight subscale pairs across all 12 repeated testing events throughout the study. The results show a statistically significant difference for the experimental group compared to the control group in all subscales for both the BRUMS and the PANAS-C, each with medium to large effect sizes, indicating that the treatment and control groups generally interpret the subscale items for both the pre- and posttests similarly and consistently across the study. The only nonsignificant result was for the Fatigue posttest subscale.

Comparison of Pre-Post Change Scores between Yoga and Physical Fitness classes

Investigating further, Tables 2 and 3 provide a visual comparison of pre-post mean scores of week 1 and week 12 for both the yoga and PE classes. In week 1, the experimental (yoga) group metrics all increased at a greater rate than those of the control (PE) group. The Depression subscale score improved more for the experimental group, showing a 20% decrease in depression compared to a 4% decrease for the control group. Comparing week 1 to week 12 between groups shows that compared to the control group, the experimental group experienced overall increases in the positive affective domain scores. Consistent patterns of change began to develop early in the analysis.

Tables 2 and 3, corresponding to weeks 1 and 12, respectively, represent the initial entry data and the final or summative impact entry data. The tables indicate statistically significant pre-post changes, showing the overall shift in subscale results between the first and last weeks of the study. Initially, both the treatment (yoga) and the control (PE) groups showed increases in positive impacts and decreases in negative impacts, with the treatment group showing greater improvement than the control group (ranging from 9% better for reducing tension to 400% better for reducing depression). By the end of the 12-week study, the treatment group continued to see high improvements, whereas the control group saw high improvements in two areas only (vigor and positive affect) and saw a decline in three areas (anger, confusion, and tension) based on week 12’s pre- to-posttest

Table 1 Summary of Friedman’s test: experimental group compared to control

Subscale	Version	Significance	F _r Statistic	DoF	Kendall’s W	Effect Size
BRUMS						
Anger	Pretest	.001	12.000	1	1.000	Large
	Posttest	.035	4.455	1	.371	Small to medium
Confusion	Pretest	.004	8.333	1	.694	Medium to large
	Posttest	.004	8.333	1	.694	Medium to large
Depression	Pretest	.001	12.000	1	1.000	Large
	Posttest	.001	12.000	1	1.000	Large
Fatigue	Pretest	.001	12.000	1	1.000	Large
	Posttest	.248	1.333	1	.111	Small
Tension	Pretest	.001	12.000	1	1.000	Large
	Posttest	.001	12.000	1	1.000	Large
Vigor	Pretest	.004	8.333	1	.694	Medium to large
	Posttest	.004	8.333	1	.694	Medium to large
PANAS-C						
Positive	Pretest	.004	8.333	1	.694	Medium to large
	Posttest	.001	12.000	1	1.000	Large
Negative	Pretest	.001	12.000	1	1.000	Large
	Posttest	.001	12.000	1	1.000	Large

Table 2 Week 1: experimental and control means change comparison

Subscale	Yoga (N=42)			PE (N=30)		
	Pre	Post	Change	Pre	Post	Change
BRUMS						
Anger	6.17	5.12	−17%**	5.47	4.7	−14%**
Confusion	7.4	5.86	−21%**	6.2	5.37	−13%
Depression	6.9	5.5	−20%***	5.27	5.07	−4%
Fatigue	10.17	9.02	−11%	8.97	8.37	−7%
Tension	8.79	6.86	−22%***	6.93	5.53	−20%***
Vigor	8.79	10	14%*	11.13	11.87	7%
PANAS-C						
Positive	28.19	31.38	11%*	34.87	36.73	5%
Negative	25.43	21.38	−16%***	19.93	18.7	−6%*

* $p < .05$. ** $p < .01$. *** $p < .001$ **Table 3** Week 12: experimental and control means change comparison

Subscale	Yoga (N=44)			PE (N=31)		
	Pre	Post	Change	Pre	Post	Change
BRUMS						
Anger	5.48	4.57	−17%*	4.45	4.65	4%
Confusion	5.73	4.98	−13%	4.74	4.84	2%
Depression	5.93	5.07	−15%	4.97	4.74	−5%
Fatigue	8.34	6.41	−23%***	6.68	6.71	0%
Tension	6.16	5.48	−11%	5.03	5.29	5%
Vigor	8.66	10.09	17%***	9.06	10.77	19%**
PANAS-C						
Positive	27.95	33.2	19%***	30.26	35.68	18%***
Negative	20.73	18.75	−10%	18.65	18.42	−1%

* $p < .05$. ** $p < .01$. *** $p < .001$

differences. While the percent changes from pre- to post-tests generally remained consistent for the treatment group and approximately half of the control group subscales, the pretest and subsequent posttest scores of the negative subscales (Anger, Depression, etc.) decreased over the 12-week study. The positive subscales (Vigor, Positive) generally remained at approximately the same level or increased over the 12-week study period. Examining the three subscales that saw a decline in the control group (Anger, Confusion, and Tension), the pretest scores for week 12 averaged 24.2% lower for these areas than the pretest scores for week 1, indicating that even though there was no improvement during the week, there was a long-term positive impact from participating in some form of exercise.

Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16 show longitudinal trends for each subscale pre- and postmean score paired with the subscale pre-post difference value, from the study's inception to conclusion. The first graph in each pair of figures represents weekly mean values for each pre- and postscore for both the experimental (Exp-Pre, Exp-Post) and control groups (Ctrl-Pre,

Ctrl-Post). The second graph in each pair represents the weekly pre-post difference value for the two groups, Delta Exp for the experimental group and Delta Ctrl for the control group. The six BRUMS Test subscales (Figs. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12) and the two PANAS-C Tests *Positive and Negative Affect* scores (Figs. 13, 14, 15 and 16) provide representations of the data analysis reported in the 12 comparison tables.

The BRUMS negative-trait subscales (Anger, Confusion, Depression, Fatigue, and Tension) show a similar trend of decreasing mean scores over time for both the experimental and control groups (Figs. 1, 3, 5, 7, and 9), with the experimental group having a greater starting mean score but also showing the greatest reduction in negative trait scores (Figs. 2, 4, 6, 8, and 10). The BRUMS positive-trait subscale (Vigor) results (Fig. 11) show an increasing trend for the experimental group and a decreasing trend for the control group, which is counter to the results found with the BRUMS negative-trait subscales. The pre-post differences (Fig. 12) are very similar, except that the experimental group is trending toward a greater

Fig. 1 BRUMS anger subscale trends

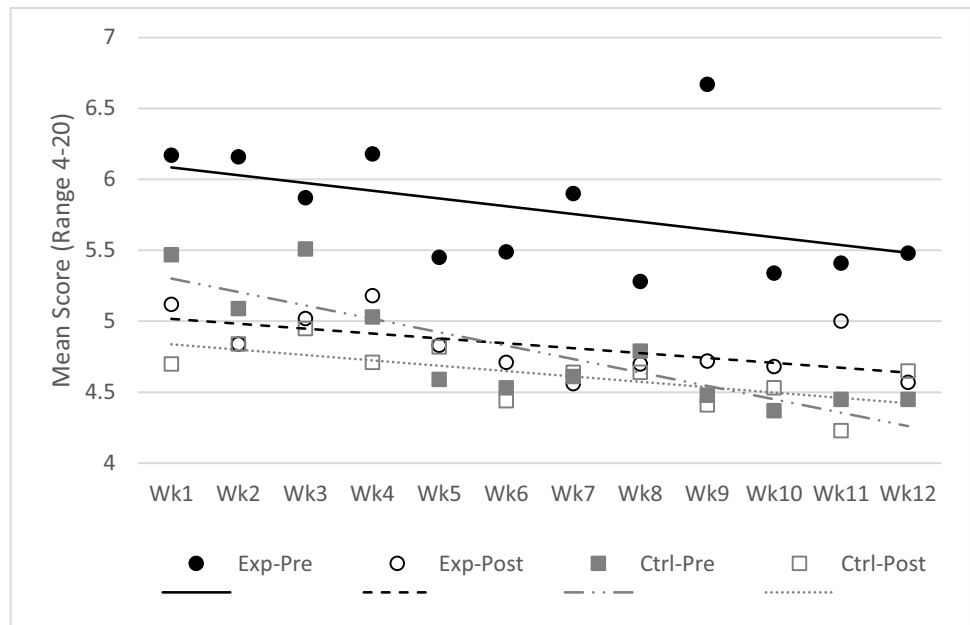
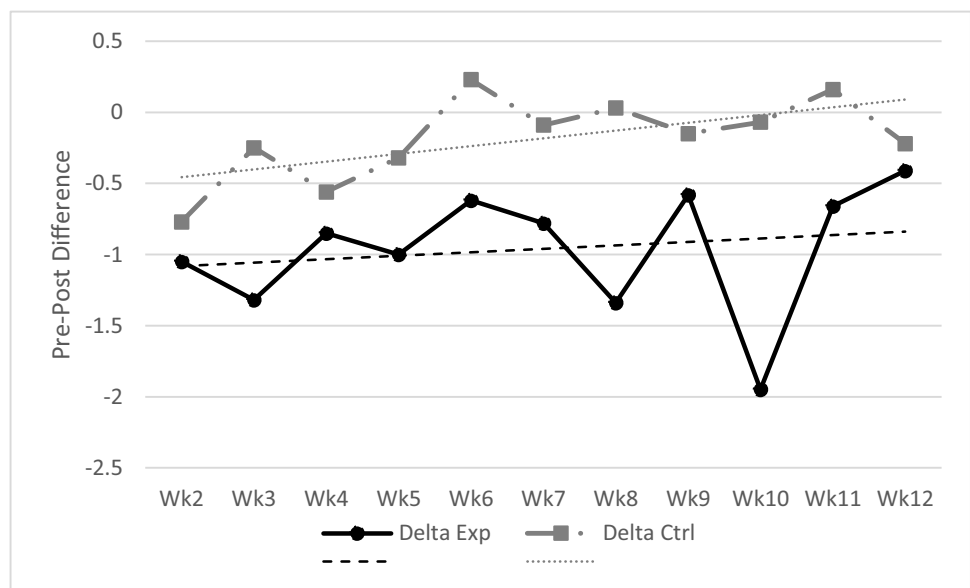


Fig. 2 BRUMS anger subscale pre-post difference trends



difference each week and the control group is trending toward a lesser difference.

The PANAS-C positive subscale mean trend results (Fig. 13) are similar to the BRUMS Vigor subscale results (Fig. 11) in that the positivity trend increases for the experimental group and decreases for the control group. The pre-post difference trend was stable for the experimental group, while the control group trend was increasing (Fig. 14). The PANAS-C negative subscale mean trend results (Fig. 15) correspond with the BRUMS negative-trait subscales in that they decrease over time. Similar to

the BRUMS negative-trait results, the pre-post difference values trended to a reduced difference.

Discussion

This study was designed to replicate and extend previous research on the psychosocial benefits of incorporating yoga into public education and to contribute to the field by comparing a school-based yoga program with a PE class. A unique variable is that 99% of the participant population

Fig. 3 BRUMS confusion subscale trends

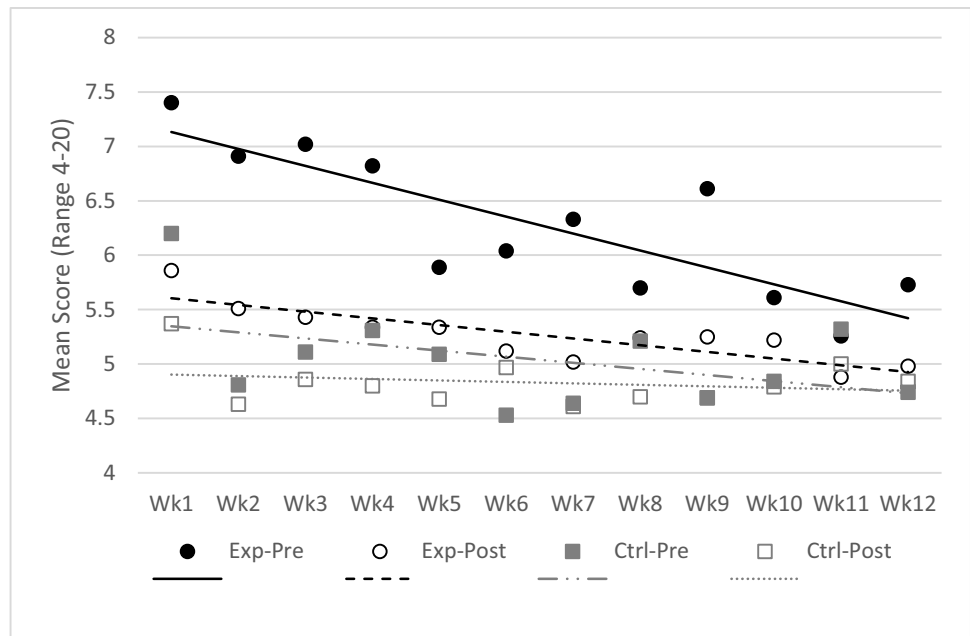
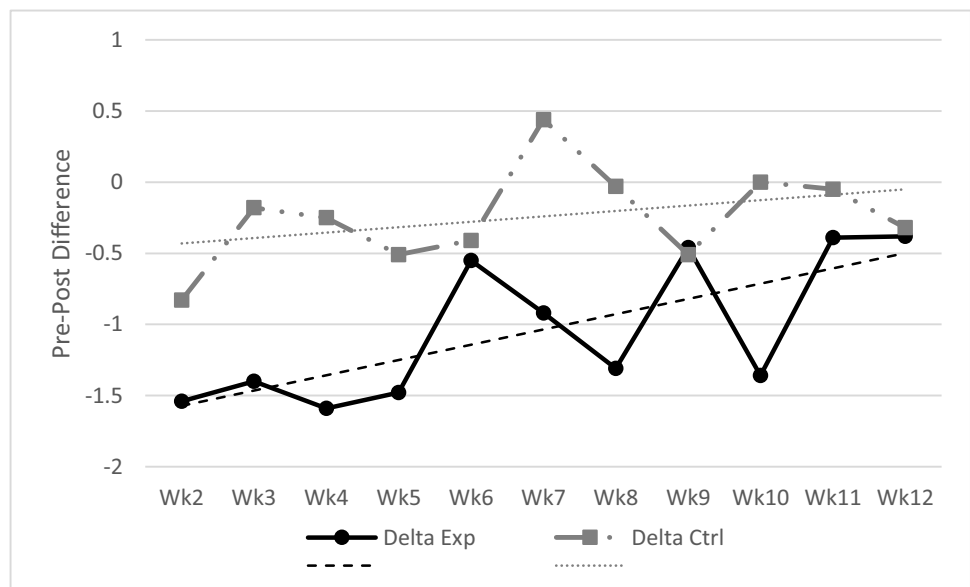


Fig. 4 BRUMS confusion subscale pre-post difference trends



in this study was Hispanic, whereas previous literature in the field focused on White populations. Importantly, mindfulness and yoga practices seem to have impactful benefits regardless of the population.

Consistent with previous research (Butzer et al., 2016; Felver et al., 2015; Khalsa & Butzer, 2016; Noggle et al., 2012), the overall findings suggest that adolescents reported immediate improvements in mood and affect when participating in a wellness class (yoga or PE); however, the yoga treatment class had a larger effect on adolescents than the PE class. Table 1 results reported in the data analysis show statistical significance for the treatment group in all subscales

for both the BRUMS and the PANAS-C, each with medium to large effect sizes. The only nonsignificant result was for the Fatigue posttest subscale. Findings from this study directly align with those of Felver et al. (2015) in that the yoga participants led to larger effect sizes than did those enrolled in a standard PE curriculum; more specifically, significantly larger effect sizes were reported for Depression and Negative Affect, as reported in Felver et al. (2015) as well. Collectively, there are similar findings in the literature indicating the benefits of mindfulness and yoga practices.

The Centers for Disease Control and Prevention (2021) highlight the importance of physical activity in general for

Fig. 5 BRUMS depression subscale trends

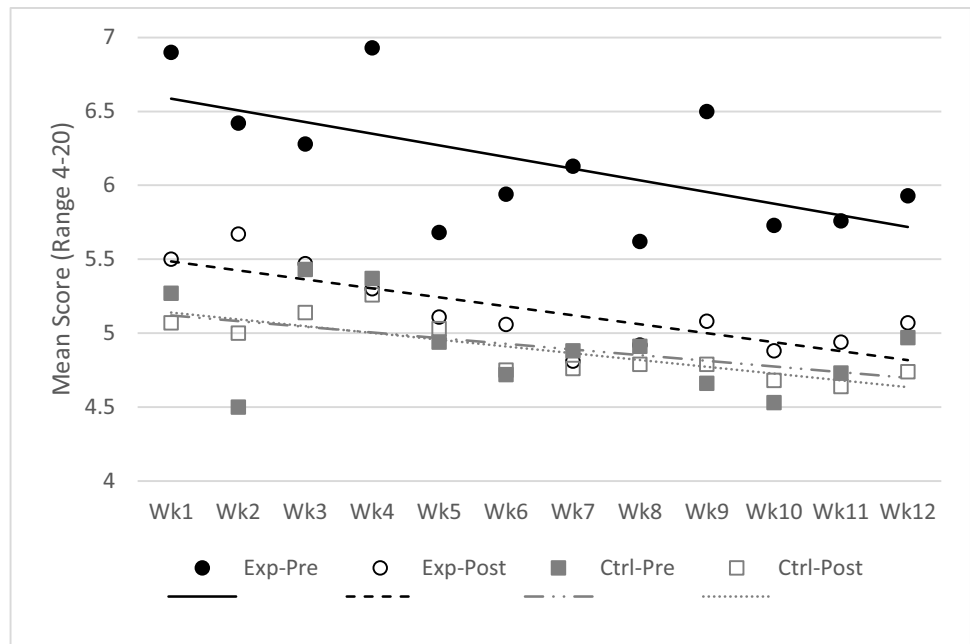
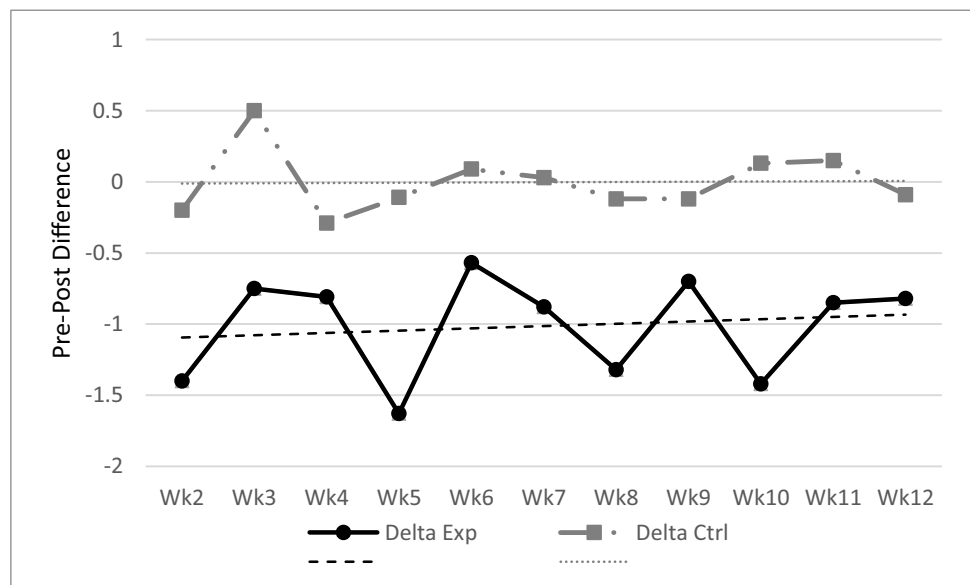


Fig. 6 BRUMS depression subscale pre-post difference trends



adolescents and suggest that it helps them feel better, function better, sleep better, and reduces anxiety. Tables 2 and 3 clearly showcase the mental health and wellness benefits of movement and physical activity in a general sense. Previous research (Janssen & LeBlanc, 2010; Siegel, 2006) has reported mental health benefits and wellness from general physical activity.

A closer examination of Table 2 comparing pre-post change scores between yoga and PE classes shows that the treatment (yoga) group increased at a greater rate within each subscale than the control (PE) group. Notably, Table 2 shows that the Depression subscale score improved more

for the yoga group, showing a 20% decrease in depression compared to a 4% decrease in the control group. This large decrease for the yoga group may be artificially inflated due to depressive factors that emerged as adolescents were isolated and engaged in online learning. The COVID-19 environment may have had a direct impact on this subscale, and additional research in an educational context post-COVID-19 is needed to substantiate these findings. Upon further examination, the percent changes from pre- to post-tests generally remained consistent, whereas the pretest and subsequent posttest scores of the negative subscales (Anger, Depression, etc.) decreased over the 12-week study. While

Fig. 7 BRUMS fatigue subscale trends

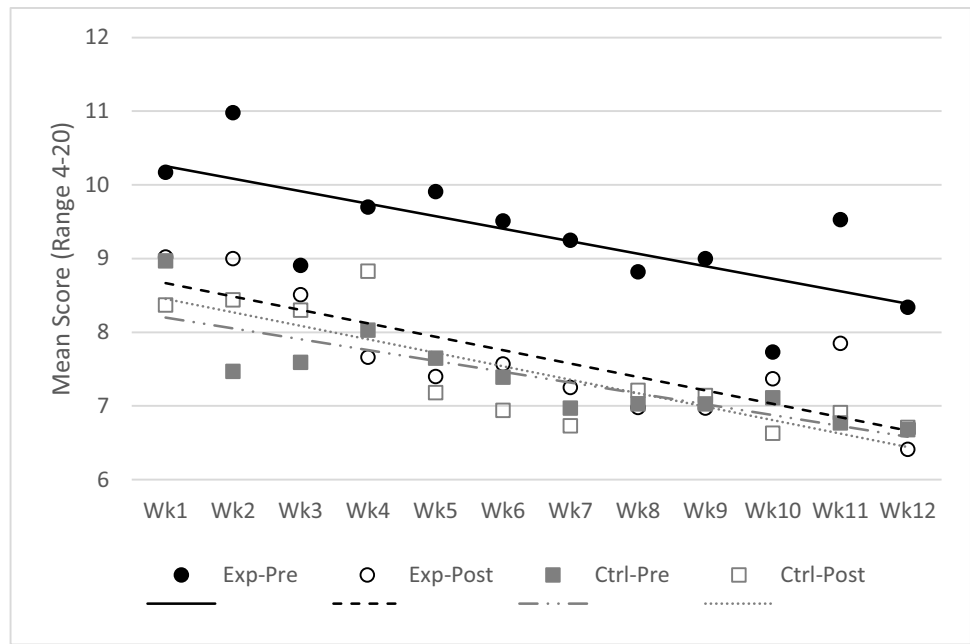
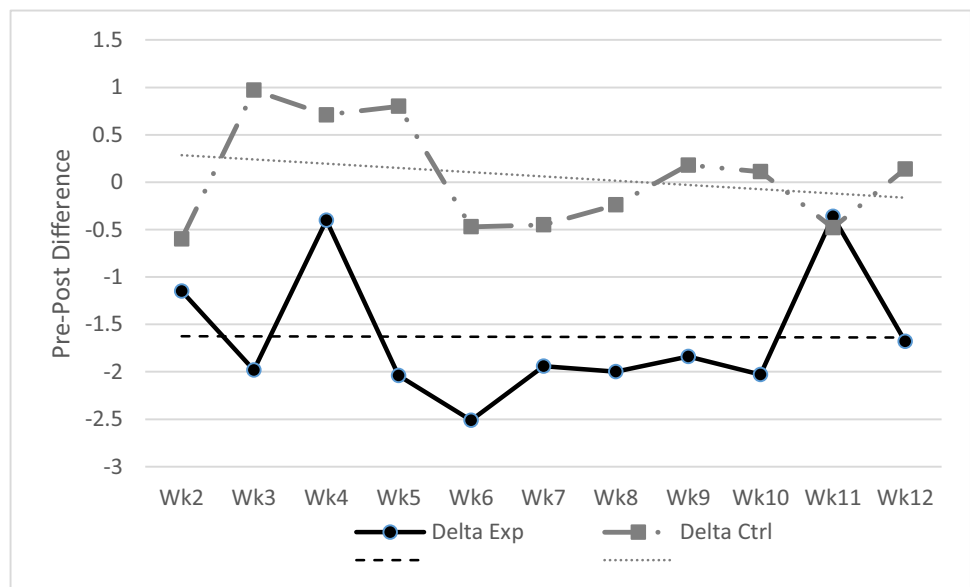


Fig. 8 BRUMS fatigue subscale pre-post difference trends



this result may also be attributed to COVID-19, research on engagement in mindfulness and yoga (Felver et al., 2015; Noggle et al., 2012) practices has shown consistent decreases in these areas, as reflected here.

Comparing week 1 to week 12 between groups (Tables 2 and 3) shows that the yoga group experienced overall increases in positive affective domain scores than the control group. A possible reason behind these improved changes in the yoga group is found in Butzer et al.’s (2016) theoretical framework model of the tripod of competencies: mind–body awareness, self-regulation, and physical postures. The study embodied all three competencies through implicit

instructional, socially scaffolded activities of engagement in contemplative practices, including breathing, meditation, yoga postures, and relaxation mindfulness practices, inclusive of SEL descriptors. The mindfulness yoga approach led to larger increases in the experimental group than did physical activity. More research in the field of mindfulness yoga with SEL descriptors among Hispanic adolescents is needed to expand and validate these patterns of impact that are consistent with the literature.

Figures 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16 report longitudinal trends for each subscale from the study’s inception to conclusion. Notable differences

Fig. 9 BRUMS tension subscale trends

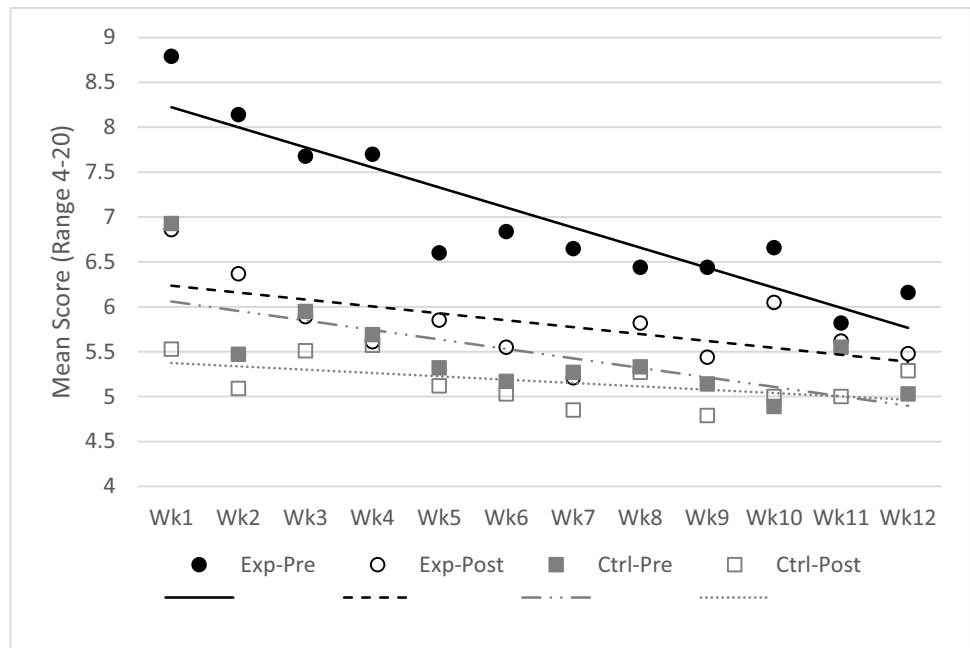
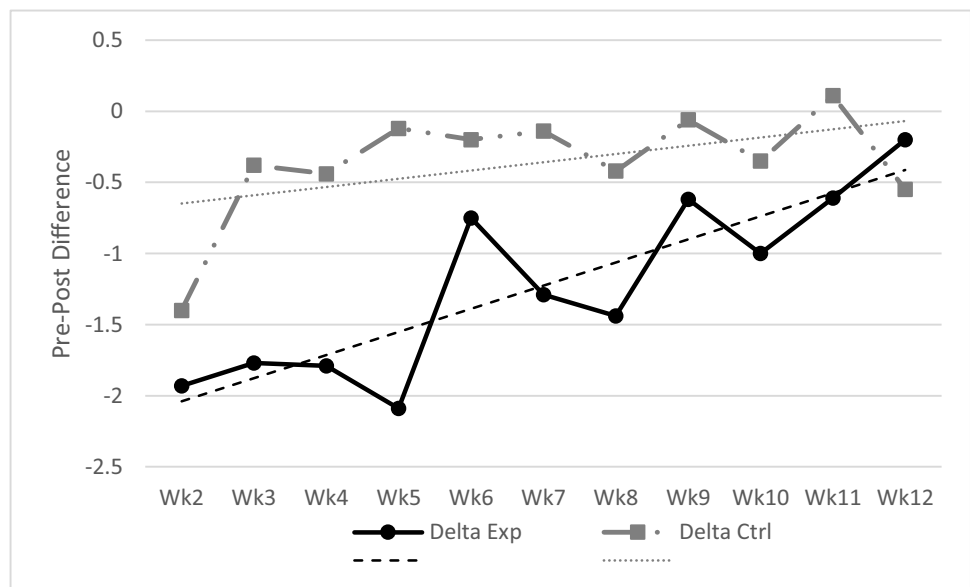


Fig. 10 BRUMS tension subscale pre-post difference trends



in slope are visually represented in these graphs, showing that the starting point for most weeks decreases over time and that the pre-posttest difference with the study week also decreases over time. A significant finding shown in the graphs is a longitudinal decrease in the negative affect pretests. Each subsequent week, the participants became slightly less negative in the negative domains and slightly more positive in the positive domains, indicating the long-term positive impacts of continual yoga practice across a semester. A large effect size for the yoga group is evident. Another interesting finding is a longitudinal change in the delta trend, indicating that as longitudinal improvement

occurred, the pre-post benefit each week decreased. This finding could be a function of participants' subscales' continual improvement, approaching the positive (lower) end of the scale, which will tend to mute the pre-post benefit comparisons. Surprising results were found in the BRUMS Vigor subscale mean scores (Fig. 11) and the PANAS-C positive subscale results (Fig. 13). The yoga group experienced an increase over time in these positive traits, which corresponds to a similar decrease over time on the negative-trait subscales. However, the control group's scores on these positive-trait subscales decreased over time. These counterintuitive results suggest that whereas yoga

Fig. 11 BRUMS vigor subscale trends

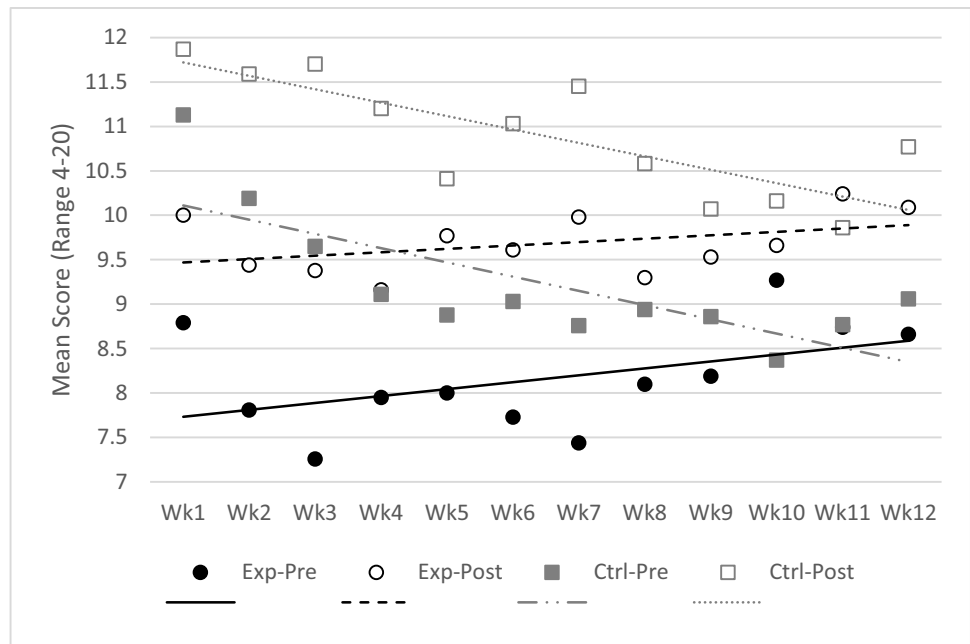
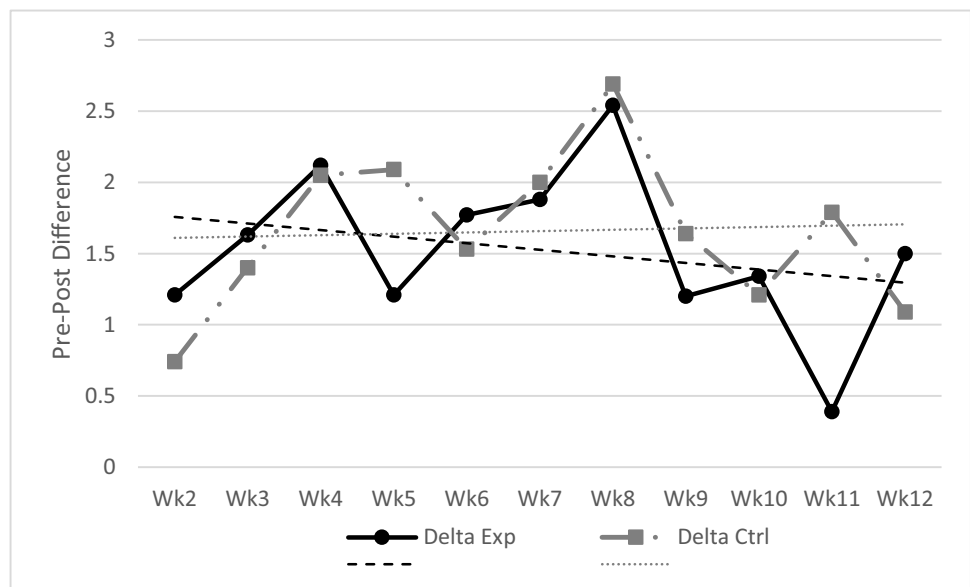


Fig. 12 BRUMS vigor subscale pre-post difference trends



increases participants’ vigor and positivity, traditional PE courses decrease participants’ vigor and positivity.

Overall, the graphs indicate the improved mental health and well-being of participants engaged in mindfulness yoga practices. From a larger, more universal standpoint, the results contribute to the literature by suggesting that school-based yoga programs may improve adolescent psychosocial well-being beyond that of the traditional school curriculum. A school-based yoga program is an innovative approach that supports and cultivates mental skills and socioemotional dispositions in preparing and educating future generations and should be considered a viable option in addition to a

PE curriculum due to the potential added benefits. More research is needed to empirically evaluate any short- and long-term effects.

Limitations and Future Recommendations

As with any study, limitations factor in and should be identified. This study was limited by the sample size made available to researchers, and the results are generalizable only to the convenience sample population that was afforded to researchers by school district guidelines due

Fig. 13 PANAS-C positive subscale trends

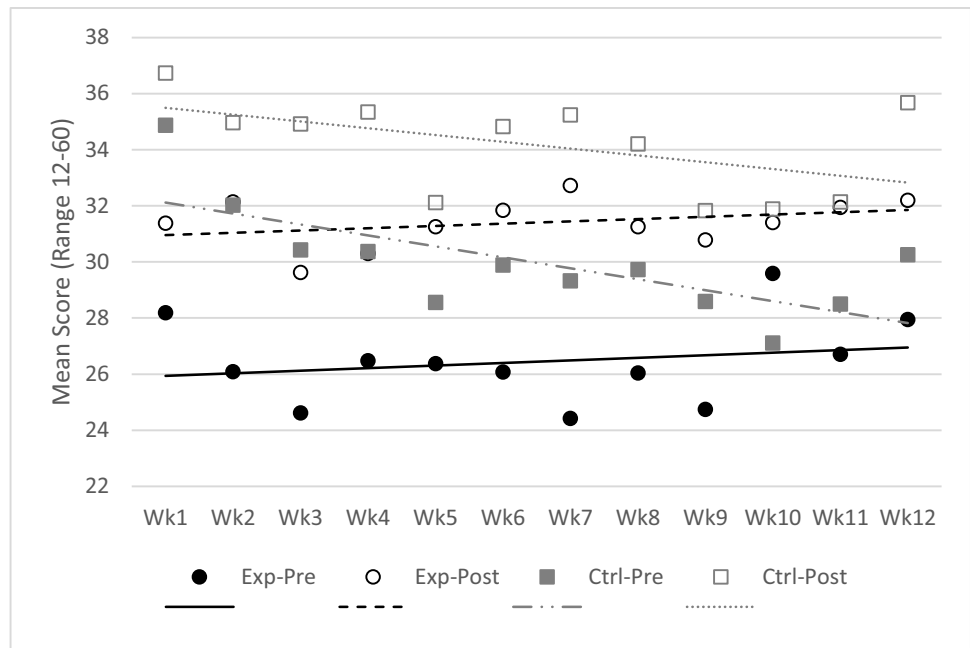
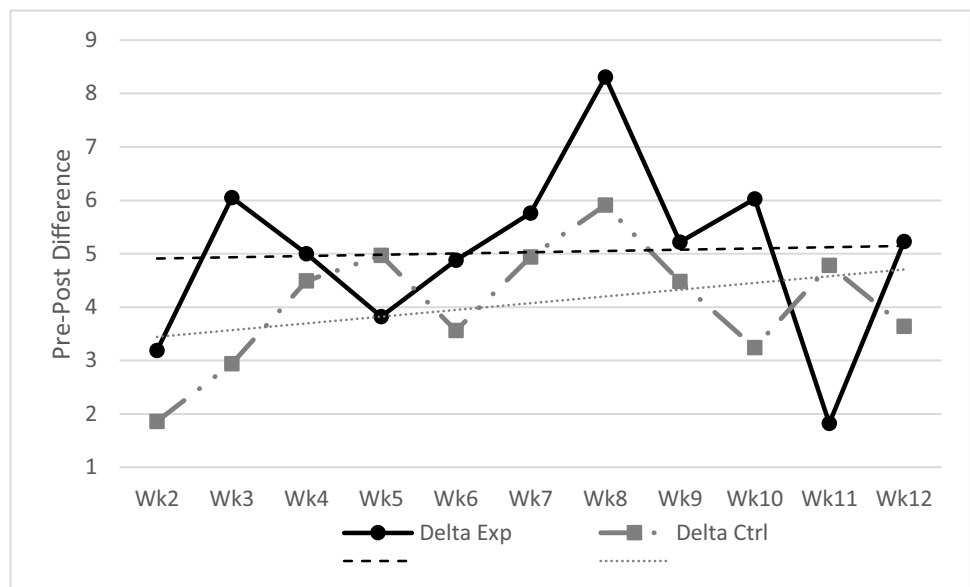


Fig. 14 PANAS-C positive subscale pre-post difference trends



to COVID-19 restrictions. Future studies should focus on larger, randomly sampled populations that reflect different schools and regions. One potential limitation was that some, not all, students described English as their second language and Spanish as their first language; nevertheless, all participants were fluent in English. A small number of participants asked for verbal translation of surveys at the onset of the study and were provided that information by the researchers. Another option, depending on the language proficiency of participants, may be providing a written Spanish translation survey alongside the written English survey for each week, which might benefit students

who are bilingual. Another potential limitation was that participants engaged in practice state-level assessments during the last 3 weeks of data collection, which may have impacted their participation or experience overall (mood/affect). The overall main limitation identified during the duration of the 12-week study would be the impact of COVID-19 given online home schooling and positive COVID-19 cases and deaths within participants’ own families and/or communities. Multiple efforts were made by the researchers to minimize such impacts by utilizing Zoom software and technology, including modern cameras, to provide the most interactive online delivery of instruction

Fig. 15 PANAS-C negative subscale trends

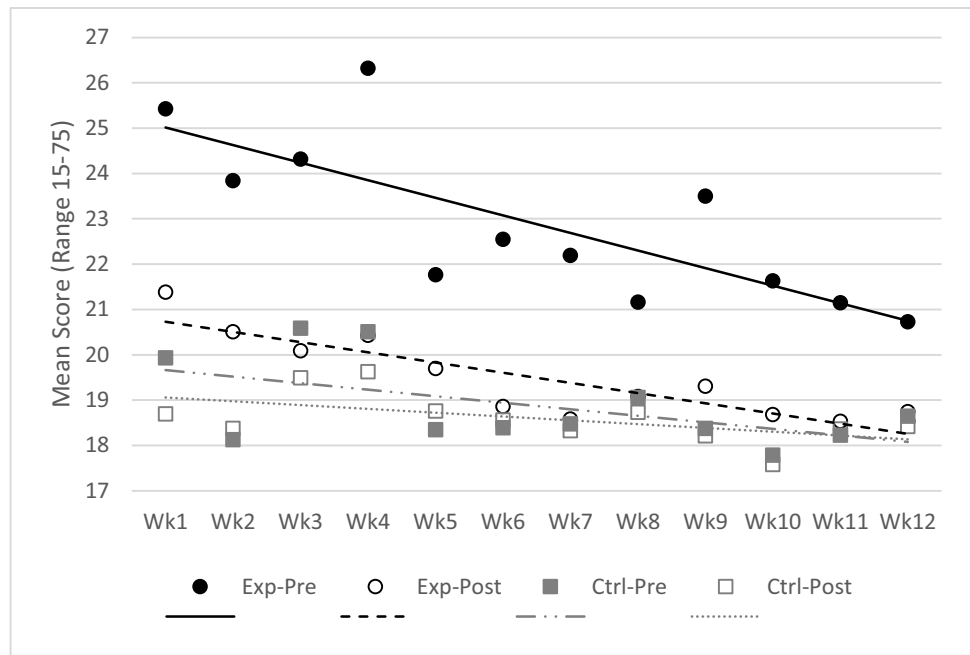
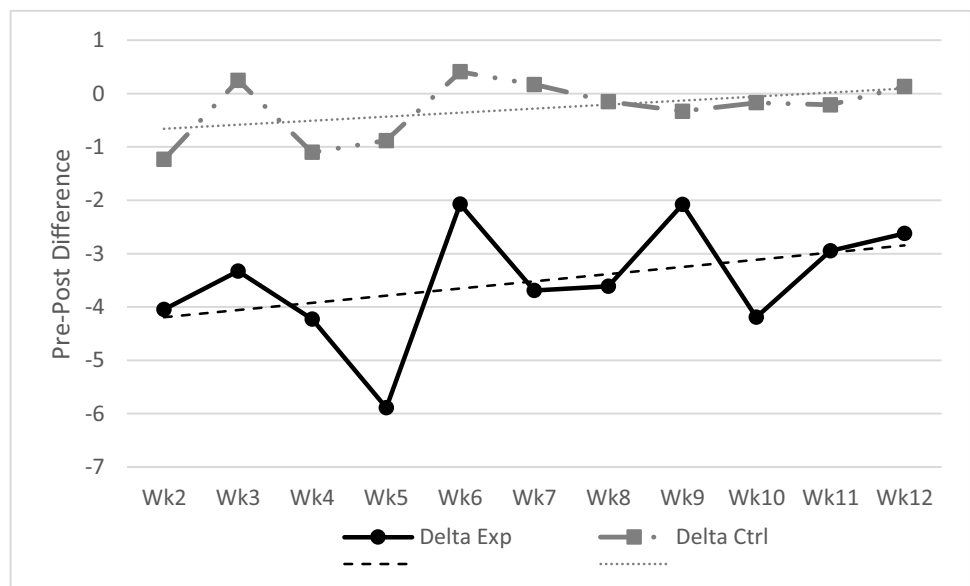


Fig. 16 PANAS-C negative subscale pre-post difference trends



for both groups. Due to the state of the pandemic, adolescents were forced into an online world, and thus, this study might yield different results when conducted in a face-to-face environment. The recommendation is to replicate the same study in a face-to-face environment. Future in-person studies examining the potential benefits of yoga in school programs should attempt to remediate these or any other confounding variables. Despite these limitations, this quasi-experimental study provides critical evidence of the benefits of school-based yoga programs in schools with

at-risk adolescents, a group that is understudied in this field. Future research in this field must continue to study this particular group of adolescents.

Data Availability The materials, analysis code, and data that support the findings of this study are available on request by emailing the corresponding authors. The data are not publicly available due to restrictions (e.g., the information could compromise the privacy of research participants, data from minors). The study’s design and analysis were not preregistered.

Declarations

The research team did not receive grant funding for this project. There are no conflicts of interest/competing interests to disclose, on behalf of any members of the research team regarding this study. APA ethical standards were followed in conducting the study, and the proposal was reviewed and approved by the Institutional Review Board and by the school district that opted to participate in the study.

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Educational Impact and Implications The results of this study demonstrate promising improvements in the mental health and well-being of students engaged in mindfulness yoga practices at school. A school-based yoga program is an innovative approach that supports and cultivates mental skills and socioemotional dispositions in preparing and educating future generations and should be considered a viable option for a traditional PE curriculum due to the potential added benefits.

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