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Yoga in public school improves adolescent mood and affect

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Abstract

The purpose of the present study was to directly compare the acute effects of participating in a single yoga class versus a single standard physical education (PE) class on student mood. Forty-seven high school students completed self-report questionnaires assessing mood and affect immediately before and after participating in a single yoga class and a single PE class one week later. Data were analyzed using paired-samples t tests and Wilcoxon-signed ranks tests and by comparing effect sizes between the two conditions. Participants reported significantly greater decreases in anger, depression, and fatigue from before to after participating in yoga compared to PE. Significant reductions in negative affect occurred after yoga but not after PE; however, the changes were not significantly different between conditions. In addition, after participating in both yoga and PE, participants reported significant decreases in confusion and tension, with no significant difference between groups. Results suggest that school-based yoga may provide unique benefits for students above and beyond participation in PE. Future research should continue to elucidate the distinct psychological and physiological effects of participating in yoga compared to PE activities.

Keywords

yoga; mindfulness; students; schools; adolescence; youth; mood; affect; physical education; education context

Introduction

In recent years, contemplative practices have become increasingly common in school settings (White, 2009; Butzer et al., submitted), and there has been a corresponding increase in applied research exploring the benefits of mindfulness- and yoga-based interventions in education contexts (Davidson et al., 2012; Jennings, 2008; Khalsa et al., 2012; Noggle et al., 2012; Saltzman & Goldin, 2008; Serwacki & Cook-Cottone, 2012; Thompson & Gauntlett-Gilbert, 2008). Yoga can be defined as:

...a holistic system of mind-body practices for mental and physical health and typically incorporates four primary components: physical postures/exercises to promote strength and flexibility, breathing exercises to enhance respiratory functioning, deep relaxation techniques to cultivate the ability to physically and

mentally release tension and stress, and meditation/mindfulness practices to enhance mind-body awareness and improve attention and emotion regulation skills, (Butzer et al., submitted).

Emerging research suggests that yoga is generally effective at reducing stress and improving mood and well-being in adults (Chong, Tsunaka, Tsang, Chan, & Cheung, 2011; Kirkwood, Rampes, Tuffrey, Richardson, & Pilkington, 2005; Li & Goldsmith, 2012; Pilkington, Kirkwood, Rampes, & Richardson, 2005; Sharma, 2014), as well as improving physical and mental health in children and adolescents (Birdee et al., 2009; Galantino et al., 2008; Kaley-Isley et al., 2010), prompting calls for systematic exploration of the benefits of similar interventions in school contexts with youth (Greenberg & Harris, 2012; Felver et al., 2013; Davidson et al., 2012).

Research that has been done exploring the effects of yoga interventions on youth in educational settings has indicated potential benefits in several domains. In a recent literature review, 12 studies were evaluated that used yoga interventions for students in several school contexts, including interventions conducted as part of regular school programming, after school programming, and as an offering at a residential treatment school (Serwacki & Cook-Cottone, 2012). One third of these studies were conducted with students receiving special education services, and the remaining two thirds were conducted with typically developing or high-risk youth. This review concluded that although the yoga interventions surveyed appeared to be beneficial for students, significant methodological limitations existed in most studies, including quasi-experimental study designs, small sample sizes, and inconclusive quantitative results. Additional studies of school-based yoga interventions also suggest positive effects of these programs on several factors such as concentration, attention, anxiety, stress, mood, resilience, emotional arousal, self-esteem, and coping frequency (Bothe et al., 2014; Case-Smith et al., 2010; Conboy et al., 2013; Ehud et al., 2010; Khalsa et al., 2012; Klatt et al., 2013; Mendelson et al., 2010; Noggle et al., 2012; White, 2012; Sethi et al., 2013; Telles et al., 2013), however the majority of these studies also suffer from the methodological limitations described above.

An important research question in this area relates to whether yoga offers any unique benefits for student psychosocial well-being compared to standard school curricula such as physical education (PE) class. Studies in adult populations have suggested that yoga is superior to exercise in its ability to improve psychological outcomes (Ross & Thomas, 2010). The few studies that have directly compared the effects of participating in school-based yoga versus PE have generally found positive effects of yoga (e.g. Khalsa et al., 2012; Noggle et al., 2012). For example, a secular yoga curriculum developed specifically for students in public schools, Kripalu Yoga in the Schools (KYIS; Kripalu Institute for Extraordinary Living) was recently studied to evaluate the effects of yoga on psychosocial well-being in high school students (Noggle et al., 2012). This study randomly assigned students by class ($n = 3$), and compared the KYIS curriculum to a treatment-as-usual condition of PE class. Results suggest that the curriculum was acceptable and feasible in this population, and that yoga seemed to improve psychosocial well-being relative to the PE class, specifically in the domains of mood and affect. These results added to the burgeoning literature supporting the benefits of yoga practice for students in school settings, however

the authors noted that results should be interpreted with caution due to the fact that students were assigned by class, and thus their data may be confounded by clustering effects (i.e., students statistically nested within class group). It is also important to note that some studies have found very few (Telles et al., 2013) or no (Hagins et al., 2013) significant differences between groups when directly comparing yoga to PE.

Although the application of contemplative practices, such as yoga, in educational settings is an emerging field of scientific inquiry, there exist sound theoretical rationales for this integration. Davidson and colleagues (2012) recently reviewed the evidence supporting a framework whereby contemplative practice strengthen basic cognitive and emotional neural processes, which in turn result in improved psychological and behavioral functioning in the classroom. As described in this framework, a common shared characteristic among contemplative practices is that they include regular practice in maintaining attention on a particular sensory experience, such as the sensation of breathing or somatic experience such as during yoga. By maintaining this state of awareness, cognitive abilities to regulate attention and emotion are bolstered, as individuals develop the skills needed to disengage their attentional resources away from stimuli that elicit undesirable outcomes (e.g., negative affective states and patterns of behavior) while simultaneously cultivating desirable dispositions (e.g., positive affective states and increased activation of the parasympathetic nervous system). These Improvements in basic self-regulatory skills then lead to improvements in other aspects of functioning, such as student behavior and academics (Durlak et al., 2011; Tangney et al., 2004).

The rationale for this current study was to contribute to the existing literature by addressing methodological limitations noted in previous reviews, and by demonstrating the benefits of yoga practices to student mood and emotional well-being. To address methodological limitations, this study used an active control condition to evaluate the effects of yoga as compared to PE by contrasting student outcomes before and after a single class, examining within-group changes in students' psychosocial well-being relative to the class they were engaged in. We also chose to replicate and extend results found in a previous study (Noggle, et al., 2012) that explored the effects of a specific yoga intervention on a specific measurements of psychosocial well-being, thereby also addressing another methodological limitation noted in the literature. This work also aims to extend the literature supporting the benefits of contemplative practices to emotional wellbeing by empirically evaluating effects to mood and affect, in-line with theoretical conceptualizations of contemplative practices with youth in educational settings.

To our knowledge, this is the first study to examine the immediate effects of participating in a single yoga class versus a single PE class on student psychosocial well-being. Based on recent literature suggesting that school-based yoga and meditation programs may be particularly well-suited to improve psychosocial well-being in youth (Davidson et al., 2012), as well as the specific focus of the KYIS curriculum on enhancing students' ability to manage their stress and mood, we predict that students' mood and affective states will improve following yoga class, and that these improvements will be greater than what is observed in PE class.

Method

Research Design

To evaluate changes in mood and affect following a yoga class, student data was collected before and after a single yoga class that was taught during health class, a class that alternated weekly with PE class time. To compare these effects to an active control condition, data was also collected from the same students before and after a PE class approximately one week later.

Sampling

Students were eligible for participation if they were registered for their school's standard wellness programming during the spring of 2013, which alternated health and PE class weekly. No exclusion criteria were implemented. This programming included alternating weeks of PE with three weeks of the standardized KYIS curriculum included as part of the health curriculum. Passive consent procedures were used whereby parents were notified that their child would be participating in a yoga curriculum as part of their PE programming, and that they would be completing questionnaires before and after their PE class as part of a research project. Student assent was obtained during data collection. Students were not compensated for participation in the research. Data collection occurred during the second or third week of yoga class within the gymnasium or classroom in which the health class was typically held. This study's protocol was reviewed and approved by the Institutional Review Board of Brigham and Women's Hospital.

Participants

Participants included ninth- and tenth-grade students who came from one of three different wellness classes in a public high school in rural western Massachusetts. According to 2012–2013 data on this secondary school (Massachusetts Department of Elementary and Secondary Education, 2013), 337 students were enrolled grades 7 through 12, the graduation rate was 87.8%, 21.7% of students were identified as having a disability, 1.2% of students were English Language Learners, and 24.3% of students received free or reduced price lunch. The racial and ethnic composition of this school was 91.1% White, 3.6% Hispanic, 3% non-Hispanic Multi-Race, 1.2% Asian, 0.9% African-American, and 0.3% Native American Students.

Measures

To assess psychosocial wellbeing, we chose to measure the constructs of mood and affect, selecting two commonly used scales that have been utilized in previous research on yoga in schools (Noggle et al., 2012).

Brunel University Mood Scale (BRUMS; Lane & Lane, 2002)—The BRUMS is a brief measure of adolescent state mood derived from the Profile of Mood States (POMS) questionnaire (McNair, Lorr, & Droppleman, 1992). The BRUMS asks participants to indicate if they are currently experiencing a simple mood descriptor (e.g., “energetic” or “tired”) using a 5-point Likert-type scale ranging from “not at all” to “extremely.” The 24-items of the BRUMS yield 6 subscales of state mood each comprised of four descriptors:

Anger, Confusion, Depression, Fatigue, Tension, and Vigour. Internal consistency for the BRUMS subscales in this sample was acceptable, with Cronbach's alpha values ranging from 0.73 to 0.93.

Positive and Negative Affect Scale for Children (PANAS-C; Laurent et al., 1999)—The PANAS-C is a brief measure of child and adolescent affect based on a tripartite model of depression and anxiety (Clark & Wilson, 1991) that asserts the common superordinate dimensions of positive affect (PA) and negative affect (NA) inherent to internalizing disorders. Using the same instructions as the BRUMS, the PANAS-C asks participants to endorse their current experience of 27 simple mood descriptors (e.g., “interested” or “sad”), with 12 and 15 items combining to yield the PA and NA subscales respectively. Internal consistency for the PA and NA subscales was acceptable, with Cronbach's alpha values of 0.93 for PA and 0.89 for NA.

Experimental Conditions

The students' wellness programming included alternating weekly curricula of health class (i.e., three weeks of yoga, experimental condition) and PE class (i.e., active control condition). Wellness programming was offered daily Monday through Friday.

Yoga class – Kripalu Yoga in the Schools (KYIS) curriculum—The KYIS curriculum was developed by the Kripalu Center for Yoga and Health specifically for public schools and is completely secular in nature. The KYIS includes both traditional yoga training and elements that target social-emotional well-being. Traditional elements of yoga training include physical exercises to promote flexibility, muscular strength, balance, coordination, and somatic awareness, breathing exercises to improve respiratory function and reduce psychophysiological arousal, and mindfulness practices that focus on the ability to control attention and develop mind-body awareness. While the Kripalu Center does not have a formal relationship with the Collaborative for Academic, Social, and Emotional Learning (CASEL), the KYIS curriculum was developed to target the core CASEL social-emotional competencies of self-awareness, self-management, social awareness, relationship skills, and responsible decision-making (CASEL, 2013). Thematic elements in KYIS related to social-emotional skills include developing somatic self-awareness, introducing basic physiological response of stress (i.e., the fight-or-flight response), and cultivating compassion for self and others.

To implement KYIS, instructors complete the Kripalu Center for Yoga and Health 1-week (55 hour) training program.

The experimental yoga class utilized the KYIS curriculum. KYIS is a 24-lesson secular curriculum that is designed to be taught during a high school class, typically as a unit of health or PE. In the present study, the KYIS intervention occurred for 15-lessons, with five lessons per week for three nonconsecutive weeks that alternated weekly with PE class. All of the 35-minute KYIS classes followed a similar format, including a brief warm-up (e.g., 5 minutes of mindful breathing) and experiential activity, 20 minutes of moving through various yoga postures, and a brief relaxation activity (e.g., 5 minutes spent lying on back and focusing on somatic sensations of non-activity) to end the class. Each class also incorporates

a theme that is integrated into the yoga postures and group discussion (e.g., dealing with stress, non-judgmental self-awareness). The yoga class was delivered by the fourth author who is an experienced yoga practitioner with 8 years of yoga teaching experience and a master's degree in education, and who is co-author of the KYIS curriculum.

PE class—The active control condition was a standard PE class that occurred 5 times per week for 35 minutes during alternating non-yoga class weeks. The PE class was taught by Massachusetts state certified PE and health teachers. A typical week of PE included learning the history and rules of a sport or activity as well as practicing the sport or activity. The practice of, or any information relating to yoga was not included in the standard PE curriculum at this school. The specific content of the PE class during the week of data collection involved students playing “capture-the-flag” as an outdoor activity.

Data analysis

Data were coded and analyzed using SPSS version 16.0 (SPSS, Chicago, IL). Data was double coded and verified to ensure accuracy. To compare the effects of yoga to PE, difference scores were calculated on all subscales by subtracting pre-class scores from post-class scores. Paired sample statistical analyses were used to compare yoga and PE. Normally distributed data were compared using paired-sample *t*-tests and non-normally distributed data were compared using the Wilcoxon signed rank tests, a non-parametric paired sample test commonly used when assumptions of normality are violated (e.g., data having significant skew or multiple outliers).

Results

Recruitment and Demographics

No eligible students or parents declined to participate. Overall, 58 students from three wellness classes participated (*n*'s = 21, 13, and 13 respectively). Of these students, three attended the yoga class but were absent from the standard-PE class, and 8 attended the standard-PE class but not the yoga, yielding 11 students total who were not available for analysis at both time points. Student participants (*N* = 47) had approximately equal gender distributions (48% male) and the average student age was 15 years and 9 months (*SD* = 9 months). Disability status and racial/ethnic identify data were not collected.

Baseline Data Characteristics

Descriptive characteristics of each dependent variable were analyzed individually to determine if assumptions of normality were met. For the change score dependent variables (i.e., pre-class score subtracted from post-class score), the BRUMS subscales of Anger, Confusion, Depression, and Tension, and PANAS-C subscale Negative Affect were not normally distributed (i.e., negative skew and outliers). For individual yoga- and PE classes, the BRUMS subscales of Anger, Confusion, Depression, Fatigue and Tension, and the PANAS-C subscale of Negative Affect were not normally distributed (i.e., negative skew and outliers).

Baseline scores on the BRUMS and PANAS-C were compared for the yoga and PE class time points to determine if there were any differences in subject's mood or affect before class (i.e., at pre-intervention times only). Normally distributed variables (i.e., BRUMS subscales Fatigue and Vigor) and PANAS-C subscale of Positive Affect, were compared using a paired-sample *t*-tests. The non-normally distributed variables were compared with Wilcoxon signed rank test. Pre-class data were significantly different for BRUMS subscales Anger, Depression, and Fatigue, and PANAS-C Negative Affect ($p < .05$), with students reporting higher scores before yoga class than before PE class (see Table 2 for details).

Analysis strategy

To compare the relative effects of yoga to PE class, two series of analyses were employed. In the first more stringent analysis, change scores between the two classes were compared using paired-sampling between group tests (i.e., paired-sample *t*-test for normally distributed data, or Wilcoxon signed rank test for non-normally distributed data). In the second analysis, change scores from pre- to post-class were examined for yoga and PE classes independently using paired-sample within group tests. Because of the small sample size and preliminary nature of this research, statistical significance level was not adjusted for multiple comparisons. We also calculated effect sizes for each analysis to add an additional dimension of data analysis independent of statistical significance.

Comparison of Pre-Post Change Scores between Yoga and PE Classes

To compare the relative effects of yoga and PE classes, change scores from before to after class were analyzed. Effect sizes were also calculated by dividing the differences between the class means by the average standard deviation. Results can be found in Table 1 and Figure 1. Students reported improved mood and affect after the yoga class relative to the PE class, however only the BRUMS Anger ($Z = 2.48, p = .013$), Depression ($Z = 2.20, p = .028$) and Fatigue ($T = 2.20, p = .034$) variables were statistically significant ($p < .05$). These three variables also had the three largest relative effect sizes. Using standard classifications set forth by Cohen (1992), students in the yoga class reported small effect sizes for BRUMS Anger ($d = .24$) and Depression ($d = .27$) mood variables, and a nearly medium effect size for BRUMS Fatigue mood variable ($d = .48$).

Within-Group Pre-Post Change Scores for Yoga and PE Classes

To further evaluate the relative effects of yoga and PE classes, the change scores from before to after class were analyzed separately for each class type. Effect sizes were calculated by dividing the differences between pre- and post-class measurement by the average standard deviation. Results can be found in Table 2 and Figure 2. Students reported improved mood and affect after both yoga and PE classes, however the magnitude of the difference was generally greater after participating in the yoga class. After participating in the yoga class, students had statistically significant ($p < .05$) improvements in five mood variables (i.e., BRUMS Anger, Confusion, Depression, Fatigue, and Tension) and one affect variable (PANAS-C Negative affect), whereas only two mood variables (i.e., BRUMS Confusion and Tension) showed significant improvement after participating in the PE class. Using standard classifications set forth by Cohen (1992), effect sizes were also consistently

larger for students in the yoga class, with small effect sizes for two mood variables (i.e., BRUMS Depression and Vigor) and one mood variable (i.e., PANAS-C Negative affect), and medium effect sizes for four mood variables (i.e., BRUMS Anger, Confusion, Fatigue, and Tension).

Discussion

This study was designed to extend and replicate previous research exploring the psychosocial benefits of yoga implemented as part of standard public education programming. We chose to extend the existing literature by using a paired-sample research design, whereby students' change following a yoga class was compared to their own change following a PE class, thus incorporating an active control condition. The results suggest that students had immediate improvements in their mood and affect following both types of wellness class, however the yoga class had a larger effect than the standard PE programming. Given that mood and affect in school-aged youth have been shown to predict later psychosocial functioning, such as psychopathology (Rothman et al., 2009), substance use (Weinstein & Mermelstein, 2013), and academic achievement (Gumora & Arsenio, 2002), interventions that may boost mood and affect, such as yoga, should be considered for use in school settings. These results contribute to the literature suggesting that school-based yoga interventions may improve youth psychosocial well-being above and beyond typical school programming, which may be important to promoting beneficial long-term outcomes for youth. However, more research is needed to empirically evaluate if the short-term benefits of yoga translate to improved long-term outcomes.

Comparing our results to the previous study implementing this particular yoga curriculum (KYIS), similarities and differences emerge in the results obtained. As in the previous study (Noggle et al., 2012), students reported improved aspects of mood and affect following yoga class compared to PE programming. These results suggest that yoga should be considered as a viable alternative curriculum for schools to utilize in PE, or at least as an addition to the PE curriculum, as yoga may have additional benefits for psychosocial well-being above standard PE. The pattern of benefits to student's mood and affect was in some ways different from results obtained by Noggle and colleagues (2012), as students reported improvements in different aspects of mood between the two studies, but did consistently endorse better Negative Affect. This discrepancy could be the result of methodological differences between the two studies, as our current study assessed immediate benefits following PE programming and used a paired-sample research design, whereas Noggle and colleagues (2012) used a longer time period (approximately 10 weeks) from pre- to post-assessment and used an independent-sample design. Future research should consider using similar study designs for replication, and the use of more stringent methodologies (e.g., randomized controlled trials) to better understand the more specific effects on mood and affect following school-based yoga interventions. Taken as a whole however, this research does suggest that yoga curricula in general, and the KYIS curriculum in particular, do benefit youth's psychosocial well-being.

To our knowledge, this is only the second study to document the effects of a yoga intervention to student emotional state among a group of typically developing students (the

other study being Noggle et al., 2013), however, there are documented intervention effects to student's emotional well-being in other studies of contemplative interventions. In a study exploring the effects of a school-based mindfulness intervention for students (Broderick & Metz, 2009), following 42 approximately thirty minute interventions sessions, high school students demonstrated significant reductions in negative affect as measured by the PANAS relative to a control group. Similarly, this research found significant reductions in negative affect on the PANAS immediately following a yoga intervention, suggesting that negative emotional states may be sensitive to intervention effects following contemplative interventions. Although not using the PANAS to measure student emotional states, other researchers have found similar effects following mindfulness-based interventions, including reductions in affective disturbance (Britton et al., 2014) and depression (Joyce et al., 2010). Taken as a whole, it seems that contemplative interventions, such as yoga and mindfulness-based interventions, appear to improve dimensions of negative mood and affect, and future research should consider including these variables as dependent outcomes as they appear to be sensitive to intervention effects.

Although the results from this study supported our hypothesis that a yoga curriculum would benefit student psychosocial well-being, this research does have several limitations. Some of our data were not normally distributed, which may have affected the statistical results. Although we implemented non-parametric analytic procedures to adjust for this, it could be that the results were influenced by data quality or other unaccounted variables. This study was limited by the sample size, which also may have affected the results as our data may be more susceptible to undue influences of statistical outliers. Some of the measured variables did have baseline differences in pre-class levels, which may have also influenced the findings. Given that we essentially collected data during two measurement periods, it could be that differences in the groups on these specific days could have influenced the results obtained. Data regarding more detailed student characteristics including disability status, psychiatric diagnoses, and family and peer relationships were not collected; this information may have been useful in providing richer contextual details to help interpret the results or may have provided an additional avenue for quantitative analysis. Future research exploring the benefits of yoga interventions in schools and the KYIS curriculum should seek to remediate these limitations.

Contemplative research among youth, particularly studies that utilize yoga interventions in school-based settings, is largely in its infancy. This research contributes to a burgeoning body of work suggesting that contemplative practices in youth may be beneficial for psychosocial well-being, although more research is needed. Specifically, future research that incorporates gold-standard research designs, long term measurement periods, and broader assessment of psychosocial and educational outcomes is needed. There is compelling evidence to continue this line of research, as yoga appears to be a viable practice for supporting the psychosocial needs of youth in today's classrooms.

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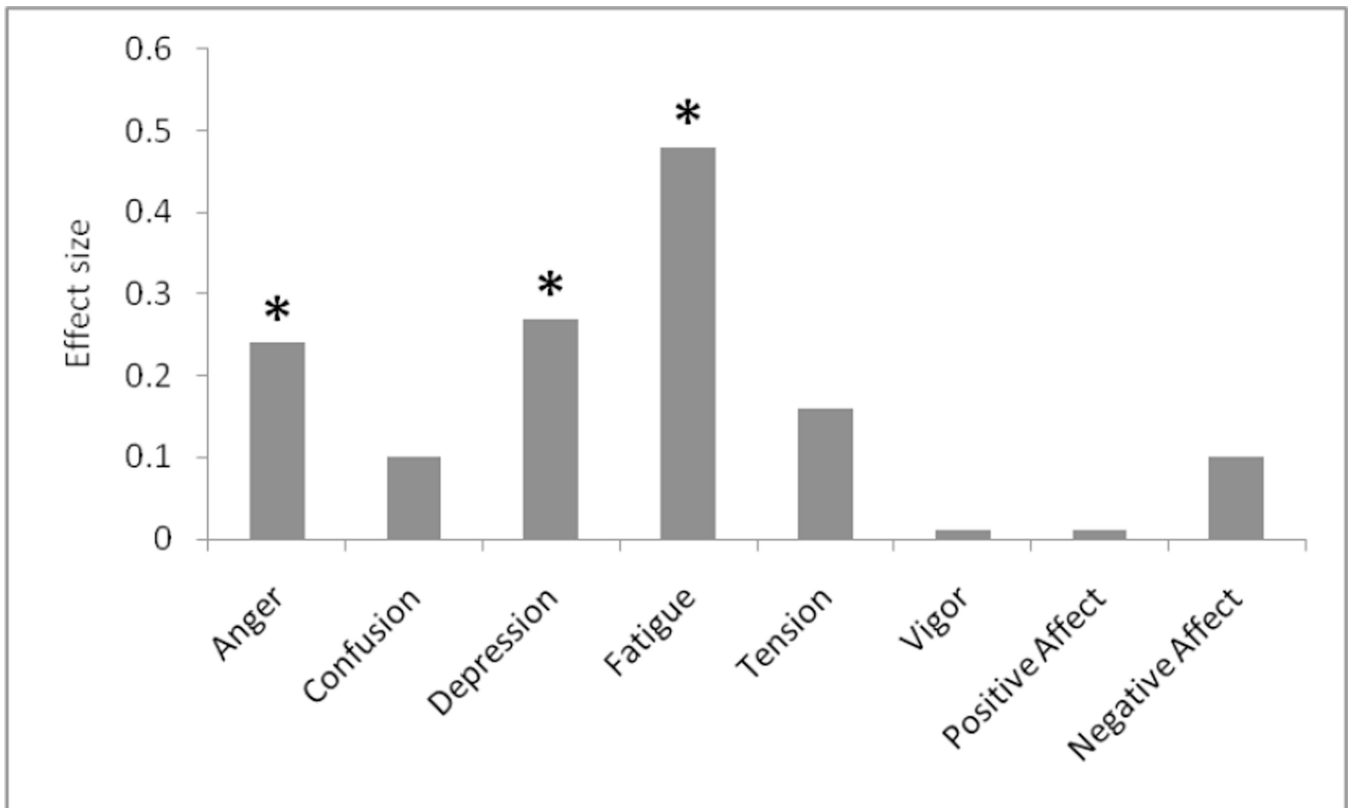


Figure 1.

Effect Sizes of Change Scores between Yoga and PE Classes

Note: PE, physical education; Anger, Confusion, Depression, Fatigue, Tension, and Vigor are mood variables from the BRUMS; Positive Affect and Negative Affect are affect variables from the PANAS-C. Effect sizes classified as .20 as small, .50 as medium, and .80 as large. Statistical significance ($p < .05$) denoted with an asterisk above.

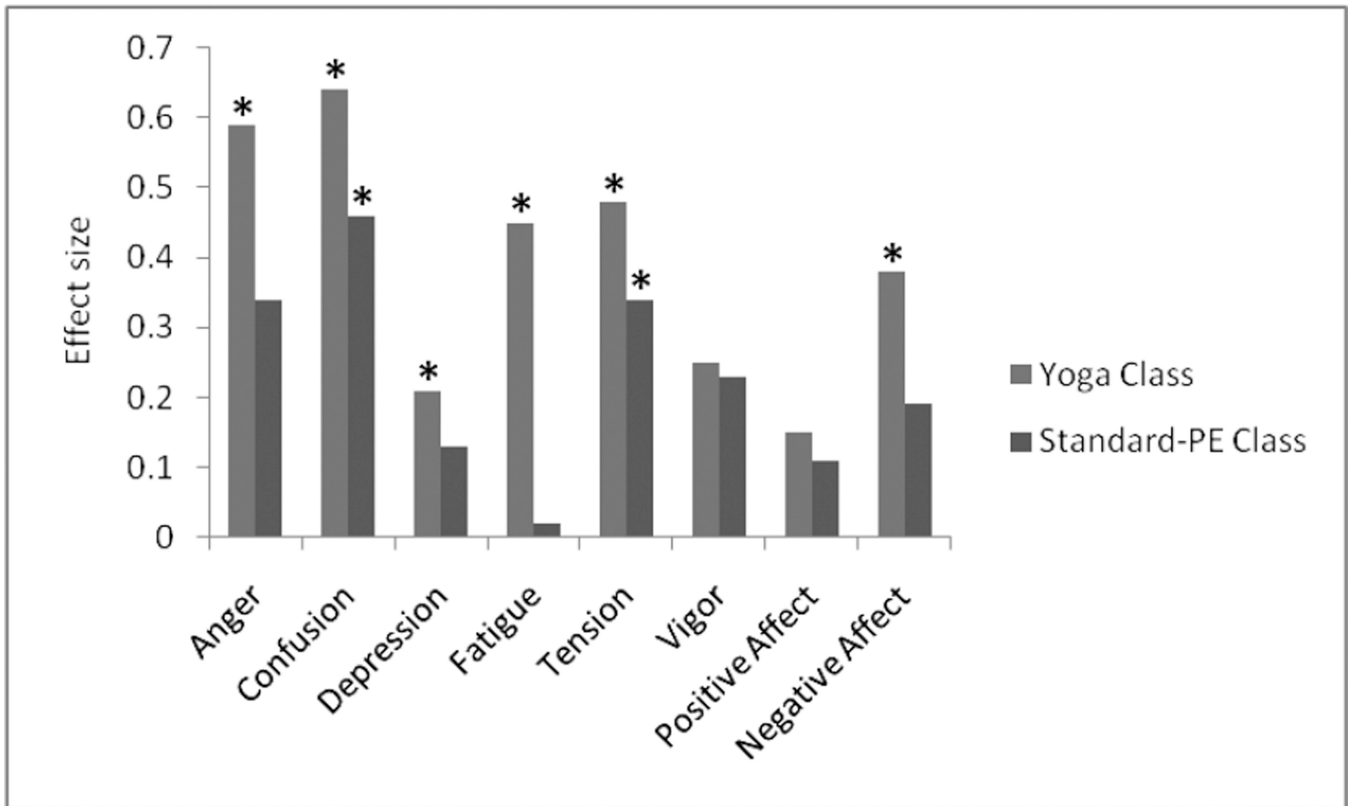


Figure 2.

Effect Sizes for Pre-class to Post-class Scores for Yoga and PE Classes

Note: PE, physical education; Anger, Confusion, Depression, Fatigue, Tension, and Vigor are mood variables from the BRUMS; Positive Affect and Negative Affect are affect variables from the PANAS-C. Effect sizes classified as .20 as small, .50 as medium, and .80 as large. Statistical significance ($p < .05$) denoted with an asterisk above.

Table 1

Comparison of Change Scores from Pre-class to Post-class between Yoga and PE Classes

Measure	Yoga		PE		T- or Z-Statistic	p	d
	Mean	SD	Mean	SD			
Mood – BRUMS							
Anger	-.87	1.75	-.45	1.80	2.48	.013	.24
Confusion	-.99	1.75	-.80	2.08	1.32	.188	.10
Depression	-.52	.97	-.19	1.44	2.20	.028	.27
Fatigue	-2.02	4.05	-.09	3.93	2.20	.034	.48
Tension	-.92	1.56	-.63	1.99	1.51	.132	.16
Vigor	.88	3.42	.92	3.83	.05	.957	.01
Affect – PANAS-C							
Positive affect	1.44	8.25	1.34	7.89	.08	.939	.01
Negative affect	-1.55	3.76	-1.03	6.50	1.17	.241	.10

Note: PE, physical education; BRUMS, Brunel University Mood Scale; Positive and Negative Affect Scale for Children, PANAS. Change scores calculated by subtracting pre-PE score from post-PE score. Test statistics for scores for Fatigue, Vigor, and Positive Affect computed with a two-tailed paired sample t-test; all other scores computed with Wilcoxon signed ranks test. Statistically significant when p < .05.

Table 2

Pre-class to Post-class Scores for Yoga and PE

Measure	Yoga			PE			T- or Z-Stat.	p	d
	Pre Mean (SD)	Post Mean (SD)	d	Pre Mean (SD)	Post Mean (SD)	d			
Mood - BRUMS									
Anger	1.35 (2.07)	0.40 (1.13)	.59	.80 (1.82)	.35 (0.81)	.59	1.89	.059	.34
Confusion	1.65 (2.11)	0.60 (1.17)	.64	1.15 (2.40)	0.35 (1.07)	.64	2.67	.008	.46
Depression	0.97 (2.30)	0.48 (2.26)	.21	.53 (1.76)	.35 (1.07)	.21	.57	.572	.13
Fatigue	6.35 (4.75)	4.30 (4.27)	.45	2.95 (3.90)	2.86 (3.43)	.45	.32	.746	.02
Tension	1.74 (2.13)	0.86 (1.54)	.48	1.35 (2.33)	.72 (1.33)	.48	2.21	.027	.34
Vigor	5.49 (3.18)	6.42 (4.36)	.25	5.90 (3.24)	6.79 (4.51)	.25	1.55	.128	.23
Affect - PANAS-C									
Positive affect	18.09 (8.57)	19.57 (11.54)	.15	16.72 (10.16)	17.95 (12.56)	.15	1.05	.300	.11
Negative affect	3.83 (4.52)	2.20 (4.02)	.38	3.32 (6.14)	2.31 (4.26)	.38	1.59	.112	.19

Note: PE, physical education; BRUMS, Brunel University Mood Scale; Positive and Negative Affect Scale for Children, PANAS. Test statistics for scores for Vigor and Positive Affect computed with a two-tailed paired sample t-test; all other scores computed with Wilcoxon signed ranks test. Statistically significant when $p < .05$.