

“My Best Memory Is When I Was Done with It”: PE Memories Are Associated with Adult Sedentary Behavior

Matthew A. Ladwig, Spyridoula Vazou, and Panteleimon Ekkekakis

ABSTRACT

The transition from childhood to adolescence is marked by a dramatic decrease in physical activity (PA). Physical education (PE) experiences may contribute to this change but remain underresearched. Using a retrospective survey, we examined whether memories of enjoyment or nonenjoyment of PE relate to present-day (adult) attitudes, intentions, PA, and sedentary behavior. An online questionnaire was completed by 1028 American respondents (18–45 yr). The participants rated their retrospective enjoyment of PE, present attitudes and intentions for PA, as well as present PA and sedentary behavior. In addition, participants responded with their best and worst PE memories in an open-ended fashion. Retrospective enjoyment of PE was associated with present-day attitude ($r = 0.37$, $P < 0.00001$) and intention ($r = 0.23$, $P < 0.00001$) for PA, as well as negatively associated with sedentary time on the weekend ($r = -0.14$, $P < 0.00001$). The best memories related to enjoyment of the activities in class (56%), experiencing feelings of physical competence (37%), and, interestingly, 7% were not having to take PE class any longer or skipping the class. Of the worst memories, 34% related to embarrassment, 18% to lack of enjoyment, 17% to bullying, 14% to social-physique anxiety, 16% to injury, and 2% to being punished by the PE teacher. Childhood memories of PE are associated with PA attitude, intention, and sedentary behavior in adulthood. Intensified research efforts should be directed toward understanding the factors and processes that lead to the formation of memories of PE.

INTRODUCTION

Physical activity (PA), mostly in the form of play, is ubiquitous during childhood (1). However, during the transition from childhood to adolescence, an inflection occurs, with a marked decrease in the proportion of individuals who meet minimum PA recommendations (i.e., from 42% to 8%; [2]). Although this decrease is mediated by many factors, one of the most potentially influential is the exposure to, and the experiences associated with, physical education (PE) during

primary and secondary school (3). For some children and adolescents, PE represents the only opportunity for regular PA, making it essential that it is delivered in a manner that encourages lifelong PA. However, it is unclear whether PE is achieving this objective.

Nevertheless, some empirical data suggest considerable variability in PE experiences among children and adolescents. For example, especially during elementary school, PE is often rated as the favorite subject among children in cities around the world (4). Yet, for many children, around the primary to secondary school transition, their attitudes toward PE begin to become more negative (5), along with concomitant decreases in PA. Although the mechanisms remain unclear and the pattern may not be universal, these data suggest that, for many children, their experiences, and subsequent memories of PE, may shift systematically from positive to negative from primary to secondary school.

Arguments regarding the importance of psychological experiences in PE have periodically resurfaced in the literature over the past century (6). More recently, Portman (7) interviewed low-skilled sixth-graders about their experiences in PE. Many of the students indicated that sport-based PE was not positively contributing to their feelings toward PA. Additional interviews have suggested that many children and adolescents do not understand why they are required to complete certain activities, such as fitness testing (8). Ennis (9) further expounded on the potential negative consequences of a PE zeitgeist in which the focus is on sport and fitness outcomes. Because of the difference in achievement-goal orientations, some children may simply not enjoy the competitive aspects that accompany sports and some games within PE. Despite these concerns, the debate over the content of PE continues.

Although it seems that PE can be a source of intensely pleasant and unpleasant experiences, to our knowledge, little empirical research has investigated the long-term implications of these experiences. In possibly the first study to address this

Department of Kinesiology, Iowa State University, Ames, IA

Address for correspondence: Panteleimon Ekkekakis, Ph.D., F.A.C.S.M., Department of Kinesiology, Iowa State University, 237 Forker Building, Ames, IA 50011 (E-mail: ekkekaki@iastate.edu).

2379-2868/0316/0119-0129

Translational Journal of the ACSM

Copyright © 2018 by the American College of Sports Medicine

question, Cardinal et al. (10) asked 293 undergraduate students about their sport and PE memories as children and their current level of PA, measured in weekly MET units. The only childhood memory that was significantly related to present-day PA was being chosen last for a team in PE or sports. Being chosen last for a team was associated with the expenditure of an average of 8 MET units less per week among men and women compared with those who did not report being chosen last.

There are various hypotheses as to why PE experiences during childhood and adolescence may influence adult PA attitudes and behavior. For example, according to Hausenblas et al. (11), the most reliable predictor of exercise intention and, subsequently, behavior is the attitude one has toward exercise. More specifically, the affective component of attitude (i.e., whether exercise is evaluated as pleasant versus unpleasant) has been shown to be a stronger predictor of exercise participation than the cognitive component of attitude (i.e., whether exercise is evaluated as healthy or beneficial versus unhealthy or useless). Such findings suggest that strongly valenced emotional experiences, such as embarrassment from being chosen last for a team due to lack of skill or pride from being chosen first, may have powerful, long-lasting effects on attitudes and behavior.

Furthermore, affective responses *during* PA have received increasing attention as possible determinants of subsequent PA behavior (12). An examination of the natural movement patterns of children would suggest that many PE activities represent potentially unpleasant deviations from the ways that children naturally engage in PA when allowed to “roam free.” For instance, Bailey et al. (1) studied the naturally occurring movement patterns of children in a naturalistic study using continuous observation. These researchers coded movements based on their metabolic expenditure in relative oxygen uptake. Their results showed that children generally gravitate toward intermittent, low- to moderate-intensity PA, with only short bursts of moderate- to vigorous-intensity PA lasting between 3 and 15 s. Therefore, it could be argued that requiring children to participate in prolonged and sustained-intensity activities (e.g., distance running) represent potentially unpleasant deviations from their natural movement propensities. Moreover, Benjamin et al. (13) showed that children frequently choose to end graded-exercise tests long before reaching true physiological maximal capacity and tend to report less pleasure or more displeasure during moderate-intensity PA, whereas adults ordinarily report stable or increasing pleasure (14). Therefore, by introducing children to incremental forms of exercise through fitness testing in PE (such as the Progressive Aerobic Cardiovascular Endurance Run [PACER]), the likelihood of deriving unpleasant experiences among many children might be increased.

At present, there is little empirical examination of the relationship between childhood PE experiences and adult PA attitudes and behavior. As a first step in this direction, we conducted a retrospective survey, collecting open-ended responses of “best” and “worst” memories from PE, as well as the grade levels at which these occurred. We hypothesized that childhood PE memories would be associated with (i) present-day (adult) attitudes and intentions for PA, (ii) present-day self-reported PA, and (iii) present-day self-reported time spent being sedentary (i.e., sitting).

METHODS

Participants

After receiving approval from the Institutional Review Board, we recruited participants through Amazon™ Mechanical Turk (mTurk), an Internet service where members complete Human Intelligence Tasks for modest monetary compensation. Multiple comparative validation studies have shown that mTurk is a source of satisfactory-quality data for social science research (15,16). Importantly, mTurk surveys offer the advantage of more diverse sampling compared with surveying the student population at most college campuses, leading to improved generalizability of the findings. In addition, data obtained through this service have been found to be consistent with those collected in a laboratory setting (16). Qualifying mTurk users were directed to a web-based survey platform (Qualtrics™, Provo, UT), which was used for data collection. The participants were deemed eligible if they were English-speaking U.S. citizens who were between 18 and 45 yr of age and had graduated from high school. Participants were paid \$0.40 for completing the approximately 15-min survey. After following quality control recommendations for data screening, including attention-checking questions that were interspersed throughout the survey (e.g., “The sun rotates around the earth” [strongly agree–strongly disagree]) and the removal of duplicate Internet protocol addresses (15,16), the final sample consisted of 1028 participants with usable data for analyses ($n_{\text{male}} = 392$, $n_{\text{female}} = 636$, $\text{mean}_{\text{age}} = 30.9 \pm 7.0$ yr). Of them, 59% had at least a 4-yr college degree. The racial composition of the sample was similar to the current racial stratification of the United States (17) (see Table 1). The sample included participants from 46 of the 48 states in the contiguous United States (see Figure, Supplemental Digital Content 1, Heat-map of study participants using Internet protocol addresses, <http://links.lww.com/TJACSM/A23>).

Measures

BEST AND WORST PE MEMORIES

In the open-ended response section of the questionnaire, we asked participants to recall and describe their best and worst memories from PE, if any. In addition, if they reported a memory, we asked participants to indicate the grade level(s) at which their memories occurred.

CURRENT LEVEL OF PA

PA was measured with the long form of the International Physical Activity Questionnaire (18), a 31-item questionnaire designed to collect PA information across four domains: work-related, transportation, housework/gardening, and leisure-time PA. For the purposes of the present study, we focused on leisure-time PA. In addition, two questions inquire about time spent sitting; these were used as an index of sedentary behavior.

RETROSPECTIVE PE ENJOYMENT

The Physical Activity Enjoyment Scale (PACES [19]) is an 18-item questionnaire, in which respondents rate their enjoyment of exercise on seven-point bipolar scales. A higher score indicates greater levels of enjoyment. Because the original PACES was designed to refer to a preceding session of PA, we modified the stem of the questions to target childhood enjoyment of PE. Specifically, the phrase “Think about the exercise you have been doing...” was modified to “For me, physical education (PE) class was...” (e.g., “something I liked–something I disliked”). The internal consistency of this modified version of PACES in the present sample was excellent (Cronbach's $\alpha = 0.93$).

TABLE 1.
Demographic Characteristics of the Sample.

| Anthropometric | Mean | SD |
|-------------------------------------|-------------|------------------|
| Height (cm) | 169.51 | 10.30 |
| Weight (kg) | 78.20 | 23.50 |
| Body mass index | 27.1 | 7.53 |
| Education | Frequency | Pct. |
| High school | 192 | 18.7 |
| Vocational | 58 | 5.6 |
| College | 375 | 36.5 |
| University | 241 | 23.4 |
| Master's | 136 | 13.2 |
| Doctorate | 26 | 2.5 |
| Total | 1028 | 100 |
| Race | | |
| Black | 95 | 9.3 |
| White | 784 | 76.3 |
| Asian | 94 | 9.2 |
| American Indian | 30 | 3.0 |
| Total | 1028 | 100 |
| Ethnicity | | |
| Hispanic | 82 | 8.0 ^a |
| Native Hawaiian or Pacific Islander | 4 | 0.4 ^a |
| Other | 21 | 2.0 ^a |

^aPercentage of the full sample.

COGNITIVE AND AFFECTIVE ATTITUDES

Cognitive and affective attitudes for PA were measured in accordance with the recommendations for scale construction by Ajzen (20). Eight questions measured affective attitude and seven questions measured cognitive attitude toward PA. An example of an affective-attitude item was as follows: "For me, exercising at least 30 minutes per day on at least 5 days over the next week would be: [pleasant-unpleasant]." An example of a cognitive attitude item was as follows: "For me, exercising at least 30 minutes per day on at least 5 days over the next week would be: [harmful-beneficial]." The participants rated their attitudes using seven-point bipolar scales. The scores were summed to form an overall attitude score, as well as separate cognitive-attitude and affective-attitude scores. Nine of the 15 items were reverse scored. The internal consistencies for these scales in the present sample were excellent (for both, Cronbach's $\alpha = 0.93$).

INTENTIONS FOR PA

Intentions for PA over the subsequent week were also measured according to recommendations (20). We used five items rated on

seven-point bipolar scales. An example was "I will [not try at all-try my best] to exercise at least 30 minutes on at least 5 days over the next week." Three of the five items were reverse scored. The internal consistency of this scale in the present sample was excellent (Cronbach's $\alpha = 0.92$).

ADDITIONAL ITEMS

On the basis of previous work (10), we investigated the relationship between being chosen first or last for teams as a child in PE with current PA attitudes, intentions, and behavior. Therefore, we included two items inquiring about the perceived frequency with which the respondent was chosen first or last for teams in PE class. Finally, we added an item that measured the perceived frequency of feeling embarrassed in the PE environment. All questions were answered using seven-point bipolar rating scales.

Statistical Analyses

Two researchers, working independently, analyzed the open-ended data using NVivo 9 software (QSR International, London, UK). We used a combination of inductive and deductive content analysis, organizing the responses into higher- and lower-order themes and frequency counts. In addition, we used Pearson product-moment correlations to examine the relationship between PE memories (measured by the modified PACES, team selection items, and the embarrassment item) and present-day (adult) attitudes, intentions, leisure-time PA, and time spent sitting. Because we conducted 45 tests of significance, after Bonferroni correction, the family-wise adjusted level of α was set at 0.001.

RESULTS

Open-Ended Questions

An approximately equal number of "best" ($n = 592$) and "worst" ($n = 599$) PE memories were reported. After content analysis, two researchers agreed on six higher-order themes for "worst" and three for "best" memories. From there, each higher-order category was subdivided into 17 and 13 lower-order themes for "worst" and "best" memories, respectively. Finally, we tallied frequency counts for each of the higher- and lower-order themes.

WORST MEMORIES

For the worst memories (see Table 2; see Table, Supplemental Digital Content 2, For all "worst" memory responses, <http://links.lww.com/TJACSM/A24>), the most frequently reported experience was embarrassment ($n = 203$, 34% of responses). Embarrassment was attributed to many causes, including being chosen last for teams, lacking perceived competence in the activity or sport, being made to feel incompetent by the PE instructor or other classmates, or embarrassment from injury. The second most frequent theme was a reported lack of enjoyment for the activities in PE, including sports and fitness testing ($n = 107$, 18%). In addition, many participants reported that changing clothes in the locker room was unpleasant, as they felt that their bodies were on display and were being judged by others ($n = 86$, 14%). Another common negative memory from PE was either experiencing an injury or witnessing one ($n = 97$, 16%). Alarming, there were several reports of bullying within the PE class or while in the locker room ($n = 100$, 17%). The distribution of worst memories showed that these memories became more common around sixth grade and peaked between seventh to ninth grades (see Fig. 1).

BEST MEMORIES

The most frequently cited best memories from PE (see Table 3; see Table, Supplemental Digital Content 3, For all "best" memory

TABLE 2.
Themes and Frequency Counts for “Worst” Memory Responses.

| Higher-Order Theme | <i>n</i> (%) | Lower-Order Theme | <i>n</i> | Example Response |
|--------------------|--------------|---|----------|--|
| Embarrassment | 203 (34%) | Embarrassed by lack of competence for the activity or sport | 132 | “Being horrible at basketball even though everyone else was pretty good. I was so bad it was embarrassing.”—Female, 35 years old |
| | | Embarrassed over poor performance | 40 | “During the physical challenge tests, we each had to perform the action alone in front of the teacher and the rest of the class and I almost always did horribly. Very embarrassing.”—Male, 27 years old |
| | | Embarrassed by teacher | 38 | “When it was the last day of gym in 8th grade, I had run the mile every Friday that year, but because school was about to end I sat out. My teacher made fun of my weight in front of everyone and said it was something I needed.”—Male, 18 years old |
| | | Chosen last for teams | 29 | “I remember being picked last for a dodgeball team and feeling really bad about that. It isn't a good feeling to not be wanted.”—Female, 30 years old |
| | | Embarrassed over injury | 21 | “I was hit in the face with a basketball that someone purposely through [threw] at me and my nose started bleeding all over the floor and the coach made me clean it up before he let me wash myself up and go to the nurse and everyone was laughing at me and I wanted to kill myself.”—Female, 25 years old |
| Lack of enjoyment | 107 (18%) | Did not enjoy fitness testing | 43 | “When we had to run a mile for time. It was such unnecessary stress on so many kids, as the athletic kids ran laps around those of us who weren't athletic.”—Female, 30 years old |
| | | Did not enjoy chosen activity | 36 | “All the times we played dodgeball or wall ball and most of the girls (myself included) would intentionally get hit with a ball so that we could sit out of the game.”—Female, 29 years old |
| | | Did not enjoy sports | 29 | “Group sports in general were always the worst. I'm not good at sports, I don't like them, and I have no desire to be involved in them, so therefore I hated PE.”—Female, 33 years old |
| Bullying | 100 (17%) | Experienced bullying during class activities | 74 | “Being the last one picked at dodgeball and then being singled out and bullied. I was embarrassed and hit very hard with the balls. I was picked on and teased.”—Female, 34 years old |
| | | Bullied by teacher regarding physical competence | 17 | “Our coach was always hounding me in PE. She would call me lazy and make me run laps around the gym. I never did anything to deserve this. I participated just as much as all the other students.”—Female, 28 years old |
| | | Witnessed bullying of peers | 2 | “I was friends with a girl that everyone hated. Because of that, everyone treated me only a step above her. At that point in my life, I still felt the need to be accepted, so I hated going to PE every single day. I wasn't brave enough to stand up for her, so I had to watch people torture my friend, and feel horrible for not saying anything.”—Female, 28 years old |

TABLE 2.
(Continued)

| Higher-Order Theme | <i>n</i> (%) | Lower-Order Theme | <i>n</i> | Example Response |
|-------------------------|--------------|--|----------|---|
| Injury | 97 (16%) | Experienced injury | 91 | “This same teacher told me to ‘shake it off’ when I injured my finger playing basketball in PE class. Turns out it was broken.”—Female, 33 years old |
| | | Witnessed injury | 6 | “We were doing suicide runs. My group was sitting waiting for our turn. A girl from my class was up with her group. After doing a few runs she slipped and fell onto her arm. Her arm broke bone popping up and everything. She screamed obviously but also vomited and passed out. I will never forget that day.” —Male, 30 years old |
| Social physique anxiety | 86 (14%) | Body evaluated in front of peers | 55 | “Having to be weighed and my weight announced to the entire class.” —Female, 44 years old |
| | | Concerns over weight or appearance | 53 | “I was ashamed of my body. I’m male, and I felt I had larger breasts than normal, so I’d hold my shirt when I ran, in hopes they wouldn’t be seen through my shirt. People also made fun of my attire, because I’d often wear sweats, even in warm weather.”—Male, 29 years old |
| | | Anxiety from changing in front of others | 42 | “Dressing out in locker rooms. I was always chubby and seeing girls around me who didn’t have to shimmy into their pants or shorts made me feel like crap when I jiggled around to do it. I also wanted to shower on most days, but we did not get enough time to dress back in after class and the stalls were not private at all.”—Female, 28 years old |
| Punishment | 10 (2%) | Punished with PA for poor performance/ misbehavior | 10 | “Having to run laps because a certain student or two decided to misbehave. Also having to do difficult spelling tests on proper muscle names and if you got below an 85% you’d have to run a mile.”—Male, 30 years old “During basketball, I failed to make a basket three times in a row and this reduced my grade.” —Female, 34 years old |

responses, <http://links.lww.com/TJACSM/A25>) related to enjoyment of the class activities or sports, competitive or noncompetitive PE classes, time spent with friends or outside, or being allowed to move after sitting in class all day ($n = 334, 56\%$). In addition, some best memories related to physical competence and receiving recognition from friends or the PE instructor ($n = 218, 37\%$). Interestingly, 41 (7%) participants responded that skipping PE class or no longer being required to take it was their best memory. The positive memories peaked during ninth grade and declined thereafter (see Fig. 2).

Correlations

Memories of enjoyment of PE via the modified PACES were the most substantial correlates of present-day attitudes and intentions for PA (see Table 4). In addition, being chosen first infrequently was most strongly related to the amount of time spent sitting on weekdays and on the weekend.

Specifically, Pearson correlations showed that retrospective reports of PE enjoyment as a child were significantly related to

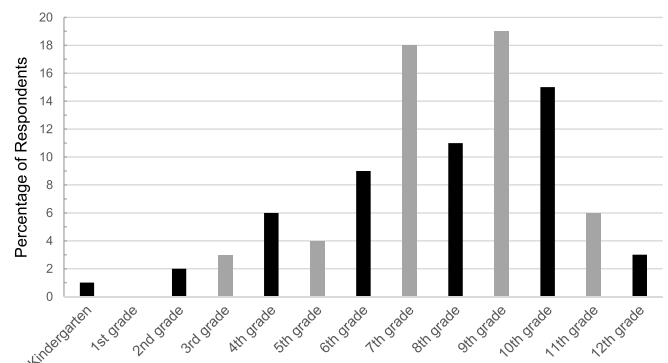


Figure 1: Distribution of “worst” memories of PE across grade levels. Note: 30% of respondents did not report a “worst” memory.

TABLE 3.
Themes and Frequency Counts for “Best” Memory Responses.

| Higher-Order Theme | <i>n</i> (%) | Lower-Order Theme | <i>n</i> | Example Response |
|---------------------|--------------|---|----------|--|
| Enjoyment | 334 (56%) | Enjoyed the chosen activity | 149 | “When I was in middle school, one of the PE activities we did involved scooters—little blue platforms with wheels you sit on. We would play sports and games on these scooters, and I fondly remember these classes. My heart rate was definitely elevated but I really enjoyed myself, which was not always the case during cardio exercise.”—Male, 29 years old |
| | | Enjoyed the sport that was played | 115 | “I loved when we played games like dodgeball or a basketball game. Those were always fun.”—Female, 34 years old |
| | | Liked time spent with friends | 49 | “Probably the friends I made during the class. It had nothing to do with the class or what we were doing, but my best memories of my PE classes are the people. (Also some of the worst, go figure.) If I had to pick one specific day, it was probably when we were running the mile and our newly formed group of friends stuck with each other, encouraging each other and just being positive. That was very pleasant.”—Female, 27 years old |
| | | Enjoyed Competition | 13 | “We played floor hockey in the gym and it was actually super fun and I really enjoyed the competitive spirit.”—Male, 20 years old |
| | | Enjoyed noncompetitive activities | 8 | “Finding myself, one year, assigned to a phys. Ed. class volleyball [volleyball] team which consisted entirely of students who weren't very competitive about it, and who didn't really care if they won or lost any given round. It allowed me to relax quite a bit, which I wasn't used to in those classes, which naturally also allowed me to have fun and to perform better at the sport itself. It turned something I especially dreaded—competitive team sports—into something unexpectedly gratifying.”—Female, 37 years old |
| | | Enjoyed fitness tests | 3 | “Presidents Physical Fitness challenge every year.”—Female, 40 years old |
| | | Enjoyed time outside | 3 | “Getting some fresh air outside of the classroom on days when the weather was nice.”—Male, 35 years old |
| | | Enjoyed getting the chance to move rather than sitting in class | 2 | “Being able to get up and move and play rather than sitting in a classroom for hours”—Female, 30 years old |
| Physical competence | 218 (37%) | Proud of accomplishment in class | 196 | “Most of my memories of PE are good. If I had to pick one, it would have to be the day that I was finally able to swim the full length (25 m) of the swimming pool. I think that this would be the best memory because it is something that I had to work at to be able to accomplish.”—Male, 38 years old |
| | | Acknowledgment from teacher | 14 | “I won many awards and made many school records in elementary school. The instructor would put your name up on the gym wall. My name was still there for a few of the records when I went back to see my brothers 10 years later.”—Female, 39 years old |

TABLE 3.
(Continued)

| Higher-Order Theme | <i>n</i> (%) | Lower-Order Theme | <i>n</i> | Example Response |
|--------------------|--------------|----------------------------------|----------|---|
| | | Praise from peers | 8 | “Playing dodgeball and I was the last person on my team still in the game. There was four people on the other team. I managed to take out all four people while my team was cheering.”—Male, 28 years old |
| Nonparticipation | 41 (7%) | Happy to skip PE | 32 | “The day the doctor excused me from gym at all was the best day of my life. I didn't have to deal with the teasing for at least 40 minutes out of the day” —Female, 44 years old |
| | | Happy when PE no longer required | 9 | “The day I finished my P.E. credits and transferred to study hall.”—Male, 40 years old |

current overall attitude ($r = 0.37$, $P < 0.00001$), affective attitude ($r = 0.40$, $P < 0.00001$), cognitive attitude ($r = 0.23$, $P < 0.00001$), intention ($r = 0.23$, $P < 0.00001$), and sedentary time on the weekend ($r = -0.14$, $P < 0.00001$), but not time sitting on the weekdays ($r = -0.08$, $P = 0.007$). In addition, embarrassment in PE as a child was significantly related to current attitudes ($r = 0.26$, $P < 0.00001$) and intentions ($r = 0.18$, $P < 0.00001$), but not sedentary time on either weekdays ($r = -0.10$, $P = 0.09$) or the weekend ($r = -0.11$, $P = 0.01$). Being chosen first for teams infrequently was negatively associated with current attitude ($r = -0.25$, $P < 0.00001$) and intention ($r = -0.21$, $P < 0.00001$) and was positively associated with time spent sitting on the weekends ($r = 0.16$, $P < 0.00001$), although not on weekdays ($r = 0.10$, $P = 0.002$). In addition, being chosen last for teams often was negatively associated with current attitudes ($r = -0.25$, $P < 0.00001$) and intentions ($r = -0.14$, $P < 0.00001$), although not time spent sitting on the weekend ($r = 0.10$, $P = 0.002$) or during the week ($r = 0.14$, $P = 0.007$). Finally, there were no significant differences in present-day memories of PE, attitudes, intention, or embarrassment when the sample was divided (by median split) into those participants below 30 years of age ($n = 517$) and those older than 30 years ($n = 511$; $P > 0.001$).

DISCUSSION

PE has the potential to foster lifelong enjoyment and motivation for PA. However, the present results indicate that, in many cases, the memories of PE reported by adults are less than ideal, with negative memories spiking during the period of transition to middle school until high school. Within many U.S. school systems, the period proximal to the secondary school transition is marked by an increase in the level of sport-based PA (9), as well as the introduction of fitness testing in PE (21), both of which were reported by some of the respondents in the present survey as their worst memory. The best memories for PE displayed an increase in ninth grade, followed by a decline, whereas the worst memories exhibited an increase around sixth grade, with a peak during middle school and a decrease around tenth grade. Interestingly, these decreases coincide with the age at which many U.S. children are no longer required to participate in PE (22). Therefore, the best-memory peak in ninth grade may represent those who elected to enroll in additional high school PE, presumably because they enjoyed the class. In addition, the data reported here suggest that PE memories from childhood and adolescence have small-to-moderate associations with attitudes, intentions, and time spent being sedentary years later, as an adult.

The worst memories reported in this survey may have important implications because memories for negative experiences, especially those with a strong ego-related emotional component, are typically more salient than memories for positive experiences when engaging in decision making (23). This tendency, known as “negativity bias,” is theorized to be an evolutionary adaptation due to the relatively more severe consequences of failing to avoid dangerous situations (i.e., those associated with displeasure or pain) than failing to approach situations that may entail utility (i.e., those associated with pleasure). Although in modern life humans no longer need to rely on this bias to avoid becoming prey, this adaptational mechanism has remained operational and might explain the strong salience of negative affective and emotional experiences. The responses listed on Tables 2 and 3 illustrate that adults hold remarkably vivid positive and negative memories of PE from their childhood, which may, to some extent, continue to influence their present-day attitudes, intentions, and behavior.

Because negative affective and emotional memories tend to be most salient during decision making, it is concerning that some of the most oft-cited worst memories from PE were embarrassment in front of peers because of lackluster performances during class activities, sport, or fitness tests; evaluations of weight or body composition in front of the class; and, perhaps most unfortunately, criticism being directed at the student by the PE teacher. Worrying that the body is being evaluated by critical observers is the essence of the concept of social physique anxiety, repeated experiences of which are

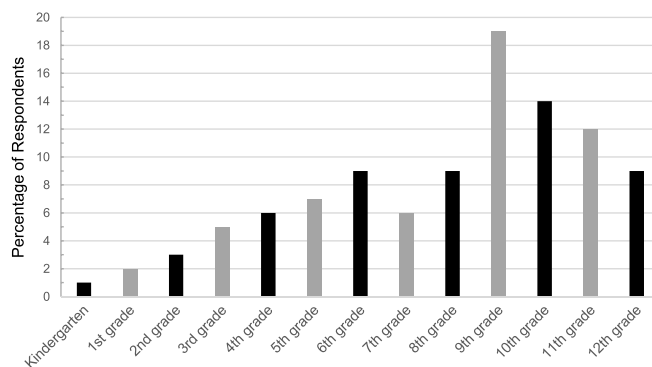


Figure 2: Distribution of “best” memories of PE across grade levels. Note: 35% of respondents did not report a “best” memory.

TABLE 4.
Pearson Product–Moment Correlations.

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------------------------------------|---------|--------|---------|---------|---------|---------|--------|-------|------|----|
| 1. Total PE enjoyment | | | | | | | | | | |
| 2. PE level of embarrassment | −0.75** | | | | | | | | | |
| 3. Chosen first not often for teams | −0.61** | 0.61** | | | | | | | | |
| 4. Chosen last often for teams | −0.45** | 0.56** | 0.49** | | | | | | | |
| 5. Attitude | 0.37** | 0.26** | −0.23** | −0.25** | | | | | | |
| 6. Intention | 0.23** | 0.18** | −0.20** | −0.14** | 0.65** | | | | | |
| 7. Days of moderate leisure-time PA | 0.13* | −0.17* | −0.09 | −0.02 | −0.12* | −0.13 | | | | |
| 8. Days of vigorous leisure-time PA | 0.11* | −0.12* | −0.12* | −0.09 | −0.03 | 0.03 | 0.71** | | | |
| 9. Hours spent sitting on weekdays | −0.08* | 0.10 | 0.16** | 0.05 | −0.12** | −0.16** | −0.08 | −0.08 | | |
| 10. Hours spent sitting on weekend | −0.14** | 0.11* | 0.19** | 0.09* | −0.17** | −0.20** | −0.09 | −0.07 | 0.67 | |

** $P < 0.001$.

* $P < 0.05$.

negatively associated with PA in adolescence and adulthood (24). These experiences reportedly occurred most often in the locker room environment, where most secondary school children are expected to “dress out,” a colloquial term for changing into athletic apparel, before and after class. Disturbingly, some PE teachers reportedly brought attention to individual physical appearance by publicly scolding students about the need to lose weight or by assigning extra PA during lessons because, allegedly, some students “needed it.” On the other hand, many of the best memories related to experiencing perceived competence for PA and/or receiving positive recognition from peers or the teacher regarding performances. Ironically, 7% of the best memories included PE being over with or having the opportunity to skip the class. On the other hand, no participant reported canceled PE or skipping PE as being a worst memory.

Recurring instances of children being made to feel embarrassed about their performance could have deleterious consequences for self-efficacy, an important predictor of both adoption and adherence to exercise and PA (25). In particular, these episodes may create negative past performance experiences, the factor regarded as the most powerful determinant of self-efficacy. In addition, these experiences could reduce perceptions of competence and relatedness, two of the basic psychological needs posited in self-determination theory (26). In turn, both competence and relatedness are instrumental for developing autonomous intrinsic motivation for PA, a reliable correlate of PA participation and adherence (27).

Consistent with Cardinal et al. (10), our findings suggest that the perceived frequency at which students are chosen first

or last for teams is associated with their PA behavior during adulthood. It is recommended by organizations such as the Society of Health and Physical Educators (SHAPE [28]) that teams be chosen at random. Perhaps attesting to the influence of such recommendations, our results showed a nonsignificant trend toward younger respondents (i.e., those up to 30 years of age) reporting being chosen last for teams less often ($M = 3.8$ vs 4.1 ; $P = 0.029$) and first more often ($M = 3.2$ vs 2.9 ; $P = 0.013$) than older respondents (i.e., those over 30 years). However, we found no differences in PE enjoyment, embarrassment in PE, attitudes, or intentions between age-groups (see Table, Supplemental Digital Content 4, Significance tests for outcomes after median-split, <http://links.lww.com/TJACSM/A26>), suggesting that there is still room for improvements in this regard.

Translating Results to Practice

Given that many participants in the present sample reported vivid and emotionally charged memories of events that had transpired many years, even decades, earlier, we submit that it may be time to crystallize the promotion of pleasure and enjoyment, and the establishment of an implicit association between movement and pleasure, as one of the overarching objectives of PE (29). This suggestion is consistent with recent calls in the field of exercise science for increased attention to the link between PA and pleasure as a potential driver of subsequent behavioral decisions. For example, national scientific organizations and government agencies tasked with issuing evidence-based exercise prescription guidelines and PA recommendations are urged to transition to a “tripartite” rationale, supplementing the traditional emphasis on effectiveness (i.e., maximization of fitness and health gains) and safety with a stronger focus on the

promotion of pleasure (30). Because, for many, PE is arguably a major contributor to critical early experiences with PA, it seems reasonable to suggest that the promotion of pleasure through PE should become an integral component of this ongoing paradigmatic shift.

In our survey, many of the worst reported memories involved negative affect experienced during fitness testing, an element of PE that has frequently been a source of controversy among physical educators, pedagogy experts, and exercise psychologists (6,8). Therefore, an interesting question for applied research would be to evaluate the implications of fitness testing, as well as training for fitness testing, for the formation of memories from PE. Theoretically (e.g., 26,27), encouraging self-regulation and self-comparisons, as opposed to externally imposed goals (e.g., keeping up with the recorded pace during the PACER test) or social comparisons to more skilled peers, should help foster more pleasant affective experiences and a higher degree of self-determined motivation. Furthermore, data suggest that children may have difficulty cognitively regulating their affective responses during sustained PA, as well as PA that becomes increasingly more difficult (13), such as during the mile run and the PACER fitness test. Difficulties with controlling negative affect during such activities could be related to the fact that their pattern (i.e., sustained vigorous intensity) deviates from the propensity of children to gravitate toward intermittent PA characterized by only occasional and very brief bursts of vigorous-intensity PA. If these theoretical predictions are supported by empirical evidence, it may be appropriate for physical educators and interventionists to devise activities that more closely mimic the natural movement patterns of children, thereby possibly facilitating more positive affective experiences and a higher level of intrinsic motivation.

Drawing on concepts from cognitive behavioral therapy and sport psychology, strategies such as mindfulness training (31) may be translatable to PE, thereby encouraging children and adolescents to focus attention on their interoceptive responses to PA and instructing them to maintain pleasure by regulating the intensity of their effort. In this approach, students who seem to be decreasing the intensity of their physical effort to maintain pleasure should not be reprimanded, because, as in adults, children and adolescents exhibit large individual differences in the levels of intensity they perceive as “feeling good” and “bad” (32). Recent work (33) has demonstrated that affective responses during PE can be monitored with relative ease, using single-item rating scales, such as the child adaptation of the 11-point bipolar Feeling Scale (34).

Of particular cross-disciplinary interest, the brain regions (i.e., dorsolateral and medial prefrontal cortex) that may be involved in the cognitive regulation of affect during PA and exercise (35) are the same regions theorized to underlie general executive functions, such as inhibiting distracting stimuli or inappropriate behaviors (36). Therefore, encouraging self-monitoring and self-regulation of affect during PA and exercise may have implications for other situations in which these skills are instrumental. For example, in the classroom, improved self-monitoring and self-regulatory skills could help reduce inappropriate classroom behaviors (e.g., interrupting others, not thinking before speaking). In addition, emerging evidence points to the intriguing possibility that the experience of pleasure during PA may be a prerequisite for PA-induced neuroplasticity and learning (37). These novel ideas suggest that cultivating a culture of pleasure-promoting PE could prove to be conducive, rather than detrimental, to disciplined school behavior and academic performance.

Research on methods of enhancing the affective experience of PA and exercise among adults is proliferating but remains relatively limited. Among children, research on this topic is still at a nascent stage and warrants greater attention than it has received

thus far. Nonetheless, emerging evidence suggests that some interventions demonstrate promising efficacy, are easily scalable, and could help inform current practice. Specifically, the use of motivational music and video is a widely popular and evidence-supported strategy for increasing pleasure during PA (38).

Among the strongest moderators of PA-associated pleasure and enjoyment in studies of adults is the sense of autonomy (27). Although logistical constraints may preclude offering multiple options for students interested, for example, in sport-oriented activities versus noncompetitive, PA-oriented activities, PE classes structured to accommodate individual preferences should prove advantageous over traditional one-size-fits-all approaches (39). For example, students with high task orientation should be afforded opportunities to experience reaching their individual goals. Likewise, some children may derive the most pleasure and enjoyment from classes in which the focus is on “general” PA behaviors, such as those “foundational movement skills” (40) that have applications for everyday life (e.g., walking, squatting to lift heavy objects while reducing injury risk).

Finally, SHAPE America (41) has advocated that, during primary school, the development of physical literacy, namely, “the ability to identify, understand, interpret, create, respond effectively and communicate, using the embodied human dimension, within a wide range of situations and contexts,” be among the most important goals of PE. The present results suggest that the focus on physical literacy may require careful consideration, especially after the primary-school level, as it seems that some children may not have developed physical literacy before adolescence. Because the emphasis often shifts to sport and more structured forms of exercise in PE during adolescence, these activities may be experienced as unpleasant by students lacking physical literacy (6–9). Nevertheless, teachers must use caution to avoid situations in which the noble aim of developing physical literacy is implemented in such a fashion as to result in children experiencing embarrassment due to performing “poorly” in front of peers or the instructor, or by grading motor skill competencies. In line with our previous translational recommendations, researchers and educators should not assume that all children derive positive affective experiences through the process of developing their physical literacy. Allowing for custom tailoring of activities to individual student preferences for PA may be necessary and doing so may facilitate more positive affective experiences along with improved physical literacy.

Limitations and Summary

The present study is the largest known survey of adult memories of PE enjoyment and their associations with present-day PA attitudes, intentions, and behavior. Although the results may reiterate long-standing concerns about the implications of PE experiences, the inherent limitations of this survey should be considered. Specifically, this study was limited by its retrospective nature, its cross-sectional and correlational design, and the use of self-report to measure PA. Although retrospective recall is prone to various errors and biases, the high level of detail provided in the open-ended responses (especially among the worst memories) is remarkable and points to the type of memory consolidation typically associated with transformative life events. The vividness and emotionality of the reported worst memories underscores the necessity of fostering pleasure and enjoyment from human movement as a fundamental goal of PE, in accordance with current standards (41).

Although the correlational design of the study precludes inferences about the causal influence of PE experiences on present-day attitudes, intentions, and behavior, the pattern of correlations demonstrated consistency in the predicted directions, warranting follow-up studies, including future experimental interventions. The survey respondents were largely representative of the U.S.

population for race, ethnicity, and educational attainment, supporting the generalizability of these results to the U.S. adult population at-large. Although it is possible that recruiting through mTurk may have reduced external validity (e.g., to individuals with Internet access, those willing to participate in surveys for modest monetary compensation), a growing literature has shown that mTurk participants do not differ significantly from research participants who volunteer for laboratory studies (15,16).

The open-ended responses from the present study, in particular, should be concerning to those interested in improving the quality of PE, including individual educators and national organizations (e.g., SHAPE America). Because of the clear dose-response effect of PA frequency on health (42), if improvements in PE experiences could inspire even small increases in PA behavior, millions could derive additional health benefits. However, just as with negative experiences in other domains of development, the long-term consequences of poor experiences during PE may negatively influence the behaviors and, subsequently, the health and longevity of children in the United States and around the world. Although we have offered translational recommendations, implementing these on a large scale will be difficult, as the required changes amount to a substantial paradigmatic shift compared with current practice norms. It seems clear, however, that decades-old arguments concerning the focus on sport in PE programs (7,9) and the pros versus the cons of fitness testing (6,8) should be revisited. With more methodologically rigorous and theory-driven interventions, it may be possible to transform PE into a professional field that closely adheres to the continuously developing evidence-base and one that welcomes psychological best practices for the benefit of children and public health.

No sources of support were used in the preparation of this work. The authors report no conflicts of interests. The results of this study do not constitute endorsement by the American College of Sports Medicine.

REFERENCES

- Bailey RC, Olson J, Pepper SL, Porszasz J, Barstow TJ, Cooper DM. The level and tempo of children's physical activities: an observational study. *Med Sci Sports Exerc.* 1995;27(7):1033-41.
- Troiano RP, Berrigan D, Dodd KW, Mâsse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* 2008;40(1):181-8.
- Mura G, Rocha NB, Helmich I, Budde H, Machado S, Wegner M, et al. Physical activity interventions in schools for improving lifestyle in European countries. *Clin Pract Epidemiol Ment Health.* 2015;11(Suppl 1M5):77-101.
- Benesse Educational Research and Development Center. *Preliminary Report: Basic Research on Academic Performance, International Survey of Six Cities* [Internet]. Tokyo: Benesse Educational Research and Development Center; 2007 [cited 2018 Jan 23]. Available from: http://www.childresearch.net/data/pdf/international_2007_01_1.pdf.
- Mercier K, Donovan C, Gibbone A, Rozga K. Three-year study of students' attitudes toward physical education: grades 4-8. *Res Q Exerc Sport.* 2017;88(3):307-15.
- Cale L, Harris J, Chen MH. More than 10 years after "the horse is dead . . .": surely it must be time to "dismount"? *Pediatr Exerc Sci.* 2007;19(2):115-123.
- Portman PA. Who is having fun in physical education classes? Experiences of sixth-grade students in elementary and middle schools. *J Teach Phys Educ.* 1995;14:445-53.
- Hopple C, Graham G. What students think, feel, and know about physical fitness testing. *J Teach Phys Educ.* 1995;14:408-17.
- Ennis CD. What goes around comes around . . . Or does it? Disrupting the cycle of traditional, sport-based physical education. *Kinesiol Rev (Champaign).* 2014;3(1):63-70.
- Cardinal BJ, Yan Z, Cardinal MK. Negative experiences in physical education and sport: how much do they affect physical activity participation later in life? *J Phys Educ Recreat Dance.* 2013;84(3):49-53.
- Hausenblas HA, Carron AV, Mack DE. Application of the theories of reasoned action and planned behavior to exercise behavior: a meta-analysis. *J Sport Exerc Psychol.* 1997;19:36-51.
- Williams DM, Dunsiger S, Ciccolo JT, Lewis BA, Albrecht AE, Marcus BH. Acute affective response to a moderate-intensity exercise stimulus predicts physical activity participation 6 and 12 months later. *Psychol Sport Exerc.* 2008;9(3):231-45.
- Benjamin CC, Rowlands A, Parfitt G. Patterning of affective responses during a graded exercise test in children and adolescents. *Pediatr Exerc Sci.* 2012;24:275-88.
- Ekkekakis P, Parfitt G, Petruzzello SJ. The pleasure and displeasure people feel when they exercise at different intensities: decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Med.* 2011;41(8):641-71.
- Mason W, Suri S. Conducting behavioral research on Amazon's Mechanical Turk. *Behav Res Methods.* 2012;44(1):1-23.
- Thomas KA, Clifford S. Validity and Mechanical Turk: an assessment of exclusion methods and interactive experiments. *Comput Hum Behav.* 2017;77:184-97.
- United States Census. *Quick Facts* [Internet]. Washington (DC): United States Census Bureau; 2016 [cited 2018 Jan 23]. Available from: <https://www.census.gov/quickfacts/fact/table/US/PST045216>.
- Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc.* 2003;35(8):1381-95.
- Kendzierski D, DeCarlo KJ. Physical Activity Enjoyment Scale: two validation studies. *J Sport Exerc Psychol.* 1991;13(1):50-64.
- Ajzen I. *Constructing a theory of planned behavior questionnaire* [Internet]. Amherst Center; 2006 [cited 2018 Jan 23]. Available from <https://people.umass.edu/ajzen/pdf/tpb.measurement.pdf>.
- Ernst M, Beighle A, Corbin CB, Pangrazi RP. Appropriate and inappropriate uses of FITNESSGRAM: a commentary. *J Phys Act Health.* 2006;3(Suppl 2):90-100.
- Lowry R, Wechsler H, Kann L, Collins JL. Recent trends in participation in physical education among US high school students. *J Sch Health.* 2001;71(4):145-52.
- Vaish A, Grossman T, Woodward A. Not all emotions are created equal: the negativity bias in social-emotional development. *Psychol Bull.* 2008;134(3):383-403.
- Sabiston CM, Pila E, Pinsonnault-Bilodeau G, Cox AE. Social physique anxiety experiences in physical activity: a comprehensive synthesis of research studies focused on measurement, theory, and predictors and outcomes. *Int Rev Sport Exerc Psychol.* 2014;7(1):158-63.
- Higgins TJ, Middleton KR, Winner L, Janelle CM. Physical activity interventions differentially affect exercise task and barrier self-efficacy: a meta-analysis. *Health Psychol.* 2014;33(8):891-903.
- Ryan RM, Deci EL. Intrinsic and extrinsic motivations: classic definitions and new directions. *Contemp Educ Psychol.* 2000;25:54-67.
- Teixeira PJ, Carraça EV, Markland D, Silva MN, Ryan RM. Exercise, physical activity, and self-determination theory: a systematic review. *Int J Behav Nutr Phys Act.* 2012;9:78.
- SHAPE America. *Appropriate Instructional Practice Guidelines, K-12: A Side-by-Side Comparison* [Internet]. Reston (VA): SHAPE America; 2009 [cited 2018 Jan 23]. Available from: <http://www.shapeamerica.org/standards/guidelines/loader.cfm?csModule=security/getfile&pageid=5246>.
- Pringle R. Finding pleasure in physical education: a critical examination of the educative value of positive movement affects. *Quest.* 2010;62(2):119-34.
- Ladwig MA, Hartman ME, Ekkekakis P. Affect-based exercise prescription: an idea whose time has come? *ACSMs Health Fit J.* 2017;21(5):10-5.
- Napoli M, Krech PR, Holley LC. Mindfulness training for elementary school students. *J Appl Sch Psychol.* 2005;1:99-125.
- Schneider ML, Graham DJ. Personality, physical fitness, and affective response to exercise among adolescents. *Med Sci Sports Exerc.* 2009;41(4):947-55.
- White DA, Rothenberger SD, Hunt LA, Goss FL. Comparison of affect and cardiorespiratory training responses between structured gym activities and traditional aerobic exercise in children. *Int J Exerc Sci.* 2016;9(1):16-25.
- Hulley A, Bentley N, Clough C, et al. Active and passive commuting to school: influences on affect in primary school children. *Res Q Exerc Sport.* 2008;79(4):525-34.
- Ekkekakis P. Illuminating the black box: investigating prefrontal cortical hemodynamics during exercise with near-infrared spectroscopy. *J Sport Exerc Psychol.* 2009;31(4):505-53.
- Pessoa L. A network model of the emotional brain. *Trends Cogn Sci.* 2017;21(5):357-71.

37. Ekkekakis P, Hargreaves EA, Parfitt G. Envisioning the next fifty years of research on the exercise–affect relationship. *Psychol Sport Exerc.* 2013;14(5): 751–8.
38. Deforche B, De Bourdeaudhuij I. Attentional distraction during exercise in overweight and normal-weight boys. *Int J Environ Res Public Health.* 2015; 12(3):3077–90.
39. Lubans DR, Lonsdale C, Cohen K, et al. Framework for the design and delivery of organized physical activity sessions for children and adolescents: rationale and description of the 'SAFE' teaching principles. *Int J Behav Nutr Phys Act.* 2017;14(1):24.
40. Hulteen RM, Morgan PJ, Barnett LM, Stodden DF, Lubans DR. Development of foundational movement skills: a conceptual model for physical activity across the lifespan. *Sports Med.* 2018: 1–8.
41. SHAPE America. *The Essential Components of Physical Education* [Internet]. Reston (VA): SHAPE America; 2015 [cited 2018 Jan 23]. Available from: <http://www.shapeamerica.org/upload/TheEssentialComponentsOfPhysical-Education.pdf>.
42. Manson JE, Greenland P, LaCroix AZ, et al. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. *N Engl J Med.* 2002;347(10):716–25.