

# The Impact of Physically Active Brain Breaks on College Students' Activity Levels and Perceptions

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**Abstract** A majority of adults in the United States do not attain the recommended 2.5 hours of moderate-to-vigorous exercise each week. This is precipitated by an increased amount of time spent in environments that inhibit movement and promote sedentary behaviors — at work, at home, and in cars. College-aged students (18-29) also engage in a greater amount of sedentary behaviors as they encounter a transitional period in life where many begin making independent lifestyle choices for the first time. Despite the trend towards physical inactivity, higher education provides the ideal platform to develop and employ methods that can impact students' physical activity behaviors. Thus, this study compared the effect of physically active brain breaks in a college classroom on college students' physical activity levels to students who did not participate in physically active brain breaks. An embedded sequential mixed methods design was utilized wherein quantitative data was collected via pedometers during class, while student interviews provided qualitative data to assist the researchers in understanding participants' perceptions within the experimental intervention. Results indicated that participants ( $n = 65$ ) who participated in physically active brain breaks acquired a higher daily step count average, compared to participants ( $n = 52$ ) who did not participate in physically active brain breaks. Three themes emerged from the interviews that suggest students' experiences with physically active brain breaks were compellingly positive and their perceptions revealed that (1) experience is essential; (2) variety is key; and physically active brain breaks are (3) engaging for all.

**Keywords:** *physical activity, physically active brain breaks, pedometer, college students, pre-service teachers*

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## 1. Introduction

According to the American College Health Association, obesity rates of college-aged students have increased from 31.9% in 2008 to approximately 40.8% in 2015 [1]. Pope, Hansen, & Harvey [2] also found that the percentage of college students who were overweight or obese freshman to senior year rose from 23% to 41%. Perpetuating these rising statistics is an increase in sedentary behaviors and habits that develop as students move from adolescence into their formative years, wherein life patterns for adulthood are developed. Research indicates that college students spend approximately 30% to 50% of each day engaged in sedentary behaviors and have been identified as the age group with the largest increase in such behaviors over the past two decades [3,4]. Critical barriers to college students engaging in physical activity (PA) have been noted in the literature as sitting in class, studying outside of class, and smartphone use [5,6]. Thus, higher education should evaluate possible settings on campus, such as the college classroom, for students to engage in PA. More specifically, teacher preparation programs in higher education have the capacity to ensure pre-service teachers are aware of the health consequences associated with these trends for all ages. Sedentary behaviors are

associated with health risks across the life-span, inclusive of children and adolescents. Subsequently, teachers who will guide the next generation should be prepared to enter the classroom with methods that promote physical activity to help facilitate a paradigm shift towards a healthier generation.

### 1.1. The College Transition

#### 1.1.1. Weight Gain

Transitioning from high school to college is oftentimes accompanied by unhealthy behavioral changes. One such behavior is a decline in PA and an increase in sedentary behaviors [7]. Sedentary behaviors may include watching television, working or studying on a computer in the library, and/or sitting in class all day. Spending too much time sitting at work or home increases the risk of obesity, chronic disease and early death [8]. Weight gain has also been correlated with the aforesaid behaviors during this transitional phase. Evidence indicates that there is a tendency to gain weight in the first year of college, followed by a steady weight gain over the remainder of a student's time in college [9]. Wengreen & Moncur [4] found that 23% of participants gained more than 5% of their body weight during their first year in college. Participants in the study also slept for shorter durations

and reported being less physically active during their first year of college, compared to their high school years [4]. These sedentary behaviors coupled with technological advances that enable students to study in one place without having to leave the comfort of their own home have been a catalyst to increased physical inactivity among college students.

### 1.1.2. Autonomy

Another primary cause of sedentary behaviors in college students is their new found autonomy. During this transition, it is critical that students recognize their entrance into an unfamiliar established environment may lead to new habit development [3]. Lally and Gardner [10] defined habits as reactions to changes in an environment that result in behaviors elicited repeatedly in consistent contexts. While PA habits may be developed during formative years, college presents a different set of circumstances wherein students must take autonomous steps to create new habits. Lally and Gardner [10] note that four steps must occur as new habits are formed: (1) students must decide to take action; (2) the decisions must be put into action; (3) actions must be repeated and (4) behaviors must be repeated in such a way that it enables automaticity. Even though these steps may lead to behavioral changes in PA, it is ultimately up to each student to decide if those habits will positively or negatively affect their health. During such a pivotal transition period in a student's life, it is imperative to encourage positive habit development. Habits that students develop during this period of uncertainty have the potential to affect the rest of their life.

### 1.1.3. Decline of Physical Activity

Understanding PA patterns in relation to college students' transition from high school to college is vital in the development of effective interventions. As recommended by the American College of Sports Medicine (ACSM), adults should obtain 150 minutes of moderate intensity aerobic PA a week or 75 minutes of vigorous intensity aerobic PA [11]. Participating in the recommended amount of PA beholds an innumerable amount of health benefits inclusive of the prevention of chronic diseases, diabetes, obesity, and some types of cancer. A reduction in symptoms of depression has also been associated with regular participation in PA [12].

Several studies have addressed the changes in behavioral patterns of PA that occur from high school to college and also from freshman to senior year of college. Bray and Born [13] examined the PA levels of students during the last two months of high school and their first two months of college. Results showed a decline in PA levels from 66.2% of students who were considered physically active during high school to 44.1% of students who were considered physically active during their first two months of college. These findings indicate a decline in PA of 22.1% when students transitioned from high school to college. A similar study examined the PA patterns of 402 college-aged females and males to determine if they achieved more PA during the week or weekend [14]. Results indicated that males achieved more total steps overall than females and participated in more moderate-to-vigorous PA than females. Males obtained

the recommended 10,000 steps per day on average, while females on average did not meet the 10,000 steps during the weekday or weekends [14]. A study by Doyle et al. [15] also examined recommended PA levels as correlated to weight management for college students. Findings revealed that 59% of females did not meet the requirement for daily PA and 47% of males aiming to maintain their weight did not meet the recommended daily PA guidelines. The aforementioned studies suggest that PA patterns in adolescence are not indicative of patterns in adulthood, which could be a result of habits formed during their college years. Additionally, males tend to acquire more PA on average than females during college.

## 1.2. Changing the Trajectory

There is a large body of evidence that focuses on the correlation between physical inactivity and childhood obesity. Thus, the scope of educational research and PA integration has remained in the K-12 classroom. However, it is important to note that meeting the PA recommendations decreases quickly in college students, ages 18-24. One study indicated that more than half of the participants self-reported that they do not meet the recommended daily PA guidelines [16]. While PA intervention programs such as Take 10!, Classroom Energizers, and CATCH have shown promising results at integrating PA into the K-12 classroom while simultaneously promoting both the wellbeing of children and their academics, [17,18,19] there is a deficiency in the literature surrounding PA interventions in the college classroom.

There are many programs that promote healthy lifestyle habits across college campuses [20]; however, the integration of PA into the college classroom has received less focus. One such study compared undergraduate Law School Admissions Test (LSAT) scores for students who took the exam while utilizing a stationary bike and compared scores to students who sat in a traditional seat. While there was no evidence to suggest that cycling improved test scores, it was stated that PA in an educational setting may aid in decreasing sedentary behavior without negatively affecting a students' ability to perform well on an assessment [21]. A recent systematic review was completed by Plotnikoff and colleagues [20] that analyzed 41 studies aimed at interventions for physical activity, diet, and weight loss for college students. A majority of the studies reported at least one significant health outcome, while those with a duration longer than 12 weeks were found to have more than one significant health outcome. Although results of this meta-analysis proved that interventions targeting college-aged students were successful, a majority of the studies were either university wide or had a sole focus on weight loss.

## 1.3. Theoretical Framework

While the aforesaid studies identified positive outcomes for integrating PA into the college setting, most studies did not utilize PA within the college classroom nor did they examine students' perceptions of the intervention. On the contrary, this study incorporated physically active brain breaks into two teacher preparation courses. Brain breaks are known as short mental and physical breaks

incorporated in intervals during classroom instruction. Short bouts of PA have been shown to benefit academics, focus in class, enjoyment in class, and increased PA [22,23,24]. However, the current body of research has focused on the effect brain breaks have on children and adolescents. Therefore, we sought to find out if brain breaks had a similar effect on college-aged students. Even though brain breaks have been associated with children in the literature, Levine [25] noted that sitting for long periods of time is detrimental to everyone's health. By incorporating physically active brain breaks that encouraged PA in the college classroom, this study sought to not only increase college students' PA levels by addressing one of the barriers to PA noted in the literature, but also provided pre-service teachers with a valuable method to employ in their future classrooms.

## 2. Methods

### 2.1. Study Design

The present study employed a mixed methods design to collect both quantitative and qualitative data in response to the following research questions: (1) Do college students who participate in physically active brain breaks in a teacher preparation course have higher levels of PA, as measured by step counts, compared to college students in a teacher preparation course who do not participate in physically active brain breaks? (2) What are the perceptions of college students who participate in physically active brain breaks?

As a relatively new approach to research, the use of mixed methods research has increased through such "indicators as federal funding initiatives, dissertations, and through discipline-specific discussions about mixed methods found in journals across the social and health sciences" [26], p. 266]. While mixed methods can be employed for a multitude of reasons, the researchers recognized that applying a mixed methods design to this study aided in developing a better understanding of the need for and impact of the PA intervention within the quantitative findings. For the purpose of this study, quantitative data was collected for 11 weeks in both the experimental and control groups through pedometers that measured step counts during each class session, while qualitative data was collected after the 11 week intervention through student interviews. Thus, an embedded sequential mixed methods design was implemented to assist the researchers in understanding the participants perceived experiences within the context of an experimental intervention [27].

### 2.2. Participants and Setting

Participants in the study consisted of college students who ranged in age from 18 to 25 ( $n = 117$ ). All participants were enrolled in the same required teacher education course at a public university in the Southeastern United States. Thus, a non-purposive convenience sample was utilized for the present study. The experimental group consisted of two teacher preparation courses ( $n = 65$ ) who received physically active brain breaks during class sessions twice a week from September 5, 2017 - November 16,

2017. Two physically active brain breaks were implemented during each 75 minute class for a total of four physically active brain breaks each week. The control group also consisted of two teacher preparation courses ( $n = 52$ ). These classes did not receive the intervention. Students were either enrolled as sophomores or juniors in the teacher education course for the duration of the study. The experimental group was inclusive of 58 females and 7 males, while the control group consisted of 40 females and 12 males. Three instructors participated in the study, all of whom worked in the same department at the University and had been previously trained on physically active brain breaks.

### 2.3. Measures

#### 2.3.1. Pedometers

Previous studies have focused on the utilization of accelerometers to collect PA data. This is primarily due to their technological ability to produce detailed and accurate information on one's intensity and duration of PA. While accelerometers are widely used in research focused on PA [28,29], pedometers have become a more common means of measuring physical activity that senses motion as opposed to spring-loading, which does not permit as much accuracy. Participants wore Gopher FITstep Pro (GFSP) pedometers during this study. The GFSP is described as being accurate even when the pedometer is not exactly upright [30]. It also provides a delayed-counting feature that does not inflate the counts.

Prior to wearing the pedometers a script was read to potential participants in all four classes outlining their role as participants in the study. Consent forms approved by the University's Institutional Review Board were signed and collected from both the students and instructors preceding implementation of the physically active brain breaks and pedometer data collection. An orientation was also provided by the researchers to ensure ample practice time. Additionally, a pedometer "How To" document was supplied for all instructors that explained essential technical information on how to position and utilize the pedometers in order to obtain the most valid output.

The duration of pedometer data collection was 11 weeks, from September 5, 2017 to November 16, 2017. Students in the two experimental groups had class on Tuesday and Thursday, and students in one control class met on Mondays, while students in the second control class met on Tuesday and Thursday. Three classes (2 experimental, 1 control) were 75 minutes and one control class was 150 minutes. When students entered class they obtained the pedometer by picking up their assigned numbered pedometer from a pedometer cart. During each class session, students in the experimental group participated in two physically active brain breaks determined by the instructor that ranged in duration from 2-5 minutes. A list of pre-determined breaks were provided by the researcher in a brain break bucket (See Figure 1) and selected breaks were up to instructor discretion. Instructors recorded in a journal the brain break they utilized during each session. Students wore their assigned pedometer the entire class period and placed it back onto the cart when exiting the class. The researchers

then hand recorded all of the step counts in a spreadsheet after each class period and reset the pedometers.



Figure 1. Physically active brain breaks used by instructors

### 2.3.2. Participant Interviews

Semi-structured interviews were conducted by the researchers with four participants in the experimental group after implementation of the physically active brain breaks occurred. Six interviewees were initially selected based on purposive sampling. However, the appropriate number was guided by interview data saturation [26]. To gather a broad perspective from interviewees, a participant from each education major (elementary, secondary, and special education) was chosen for the interviews from each experimental class. An interview guide was created that enabled the researchers to ask both open-ended and theoretically driven questions [31]. Interviews took place in the same building that the brain breaks occurred to provide a level of comfort for the participants. Interviews were informal in style and while there was a script, the researchers allowed the interview to change directions if the student wanted to expand on an answer or another question arose. Follow up questions were asked to clear up any misunderstandings and/or clarify what the participant was sharing. Corbin and Strauss [32] note this quality in an interview as having theoretical sensitivity, in the capacity that the interviewer is able to focus on the nuances that are elicited from data during the interview process.

## 2.4. Data Analysis

Data was quantified through pedometers in both the experimental and control group for 150 minutes each week over a duration of 11 weeks. Total step counts for each participant were calculated first. Next, descriptive statistics comprised of means and standard deviations for both the experimental and control groups' average daily step counts were determined. Step counts were also categorized into step-defined activity levels [33]. To test for normal distribution among the interval dependent variable between the two independent groups, a Shapiro-Wilk test was conducted. After normal distribution was verified, an independent samples *t*-test was performed through SPSS

statistical software to determine if there was a significant difference between the two groups' means.

Analysis of the interview data began with transcription of the data from audio recordings into a word document. After transcription, the researchers analyzed the data by reading through the entire transcript first and then coding the broad themes and concepts that came from the data. Coding was complete when data met the coding saturation point [34]. Once themes were determined, they were placed into a spreadsheet and the researchers met several times to compare their findings. Thus, the constant comparison method was employed to enable the researchers to compare and contrast findings multiple times until the researchers developed thematic categories that aligned with the emerging themes from the study [35].

## 3. Results

The total sample of participants ( $n = 117$ ) in the present study was composed of an experimental group ( $n = 65$ ) and a control group ( $n = 52$ ). Initial descriptive statistics indicated that the average daily step count for the experimental group was 149.47 ( $SD = 87.90$ ) and the control group's average daily step count was 132.67 ( $SD = 39.03$ ). A Shapiro-Wilk test was completed on the data sets to test for normal distribution prior to analysis. Results showed that the data was normally distributed ( $p > .05$ ).

Before step counts were analyzed, the researchers also disseminated the average step counts between the groups and compared the averages to the graduated step index [33]. According to the step index, adults who obtain  $< 2,500$  steps per day are at the basal activity level, 2,200-4,900 (limited activity), 5,000-7,499 (low active), 7,500-9,999 (somewhat active), 10,000-12,400 (active), and  $> 12,500$  (highly active). When divided per hour of the day, the experimental and control group were both in the limited activity group when examining the 75-minute time frame of data collection. This accounted for approximately 4% or 1.25 hours of each student's 24-hour day. On average, students in the experimental group obtained 149.47 steps in 75 minutes, placing them into the mid-range of the limited activity category. The control group acquired on average 132.67 steps per 75 minutes, placing them into the lower end of the limited activity category.

Lastly, an independent samples *t*-test was conducted to determine if there was any statistical significance between the experimental and control groups' mean daily step counts. The *t*-test revealed a non-significant trend in the predicted direction (See Table 1). Findings showed that the experimental group step count average ( $M = 149.47$ ,  $SD = 87.90$ ) was not statistically significant when compared to the control group step count average ( $M = 132.67$ ,  $SD = 39.03$ ),  $t = 1.25$ ,  $p = .11$ .

Table 1. Results of *t*-Test Results Comparing Step Count Means

		N	M	SD	<i>t</i>	<i>p</i>
Experimental	Break	65	149.47	87.90	1.2	.11*
Control	No Break	52	132.67	39.03		

\* $p > .05$ .

Even though the pedometer step count data collected during this study did not indicate a significant increase in PA levels compared to the control group during the short duration students were in class, the data did reveal that students were in the mid-range of the low activity step index. While this is not ideal, it does signify that students were not at the basal or sedentary rate and that students who participated in the physically active breaks did obtain more steps on average than the control group while in class.

To add to the results and discussion pertaining to physically active brain breaks in the college classroom, a sample of participants were interviewed from the experimental group. Each of the participants who were interviewed elicited overwhelmingly positive experiences. After analysis of the interviews, three themes emerged that are critical to the discussion of college students' perceptions of physically active brain breaks: (1) experience is essential; (2) variety is key; and (3) brain breaks are engaging for all.

### 3.1. Experience is Essential

The researchers asked participants to share their thoughts about participating in the physically active brain breaks during the interview. While many participants in the study knew about brain breaks and explained that they were "really great" and "very important," very few had actually participated in them. In addition, most perceived incorporating brain breaks to be "only for children, not adults." Until participants experienced brain breaks, they did not realize how feasible it would be to incorporate them into their own teaching and how beneficial brain breaks could be to their own health and learning. By participating in this study and in the daily brain breaks, students noted that they felt "refocused," "more energy," "engaged," and "more awake." Even more, one participant described that she was able to "keep up with the class content" more effectively after engaging in a brain break.

One central misconception that participants had was that incorporating movement in the classroom would create chaos. However, by participating in this study, one participant recognized that structured brain breaks enabled on-task learning: "... everybody still stays on task and you can get back to what you were working on." The instructors modeling how easy it is to incorporate PA into the classroom was the driving force to why these future teachers will now add physically active brain breaks into their own classroom. They experienced how brain breaks are "easy to use" and are confident in their own efforts to "definitely include them every day." Finally, one participant described brain breaks as making "a lot bigger difference than you would ... than I would have ever thought it would." By engaging in brain breaks, these participants not only know the benefits of them, but also *experienced* the benefits: "I would definitely use them in a classroom now that I know what the experience feels like versus I just kind of heard about them before." Because of this, participants' own teaching will be more effective in their future classroom and their ability to impact the health of the future generation much greater.

### 3.2. Variety is Key

Favorite brain breaks varied among the participants. This is important to note, because as these future teachers experienced their own personal favorites, or lack thereof, they also realized that in their future classroom all students will have different likes and dislikes regarding PA. For rigorous academic subjects such as an "AP Chemistry course ... with double block period," incorporating brain breaks just for fun or a "scientific brain break" is needed to keep students awake and engaged, while also keeping them from feeling "overwhelmed." Likewise, elementary students also need breaks to "get their energy out." Participants realized that based on the grade and content level, brain breaks will *vary*: some should be content-based while others are "just for fun" and "some planned and not."

The variety in timing of brain breaks was another area of focus for participants. All agreed that PA at the very beginning of the day and/or class is beneficial. By incorporating one at the very start of the day, it allows students to "wake up and actually focus on something" and even made some participants "want to go to class more." Some felt like the middle of the day/class would be another effective time to incorporate the brain breaks because it would allow for a "physically active break" in the middle and allow students to "stay engaged." In addition, some participants felt that allowing brain breaks in "transition" times was a good classroom management tool. Some experienced brain breaks at the end of class, but some felt that time was ineffective compared to other times of the day/class.

### 3.3. Engaging for All

The social engagement and laughter that occurred during the physically active brain breaks was a constant theme throughout the interviews. One participant even considered it "play time" and "not all about ... the grades and stuff. It is about learning and enjoying it." Brain breaks allowed *all* students to participate and even provided opportunities for students to take leadership roles: "one person who was a music education major had his baton sticks" and another person "did clapping patterns and he was a percussion person." Another participant even suggested allowing students to make up their own brain break at the beginning of the year and do those throughout. With this, students will be even more engaged, excited, and take ownership in the PA. Leading and participating in physically active brain breaks allowed for both the teacher and students to get to know each other better. As one participant explained:

*There was a dance one. I don't remember what it was called, but that was the all-time favorite one because it was fun! When we did it our instructor had a song that she remembered and we were trying to show her the new songs and it was funny!*

Brain breaks enabled the experimental classes to develop a deeper level of social interaction that went beyond the classroom. As many participants pointed out, typically in college classes, you sit down, listen to the professor, take notes, and leave without knowing many people in the

class. However, by participating in brain breaks, they felt “a lot closer to my classmates” and knew each other on a personal level. By experiencing the social gains from brain breaks in their college class, these future teachers will hopefully incorporate brain breaks not only for the academic and physical gains, but also for developing a positive social community.

## 4. Discussion

The present study examined the effect of physically active brain breaks on college students’ PA levels compared to those students who did not participate in physically active brain breaks. Results indicated that students who participated in physically active brain breaks acquired a higher step count compared to students who did not participate in the physically active brain breaks. Although the quantitative findings were not statistically significant, participant interviews suggest that students’ perceptions were compellingly positive and had an impact on their engagement during class, confidence to implement PA in their future classroom, and understanding of the social development PA can foster in the classroom.

Physically active brain breaks increased more than just step counts; interviews indicated students’ self-report of more engagement in class. In congruence with previous research, participants expressed higher engagement levels during class as well as being more focused on the content [36,37]. Participants felt that by engaging in physically active breaks, they were more focused and “ready to start the day.” Many believed that starting the class with an activity set the tone for the day and allowed them to be focused and prepared for the class.

Not only did students learn and experience the physical benefits of physically active breaks, they also experienced the social and emotional benefits. Our hope is that this will translate into the overall health benefits for children in their future classrooms. Aligned with previous research [36], participants in the current study were somewhat knowledgeable about the physical health benefits of PA in the classroom, but did not realize the emotional and social benefits that would also occur. Participants constantly talked about how “fun” and “exciting” the breaks were in addition to how much they “enjoyed getting to know their classmates more.” By participating in physically active breaks, students gained more than just the content being taught; they were actually learning from and learning about one another as well. Physically active breaks allowed participants to increase their enjoyment in the lesson, motivation for learning, and their focus in the classroom [38]. These breaks provided an opportunity to develop a cheerful and joyous spirit among individuals [39]. This created a positive climate and one in which the participants will hopefully provide for their future classroom.

Similar to previous research, participants in this study understood the importance of physical activity in the classroom, but did not feel confident or well prepared in their own efforts to incorporate physically active breaks in their own classroom [40]. Because of the participants’ experience and exposure to the physically active breaks,

hopefully they will feel more confident in the possibility of leading physically active breaks in their own classes and/or in their daily life. Aligned with recent research [41], students realized that incorporating PA breaks in the classroom was relatively easy once they “experienced” the breaks and became more knowledgeable on how to incorporate the breaks into a class. Additionally, participants felt the immediate benefits of being physically active in the classroom: engaged, focused, attentive, and energized. This personal experience is essential in the learning and implementation process for pre-service teachers [37]. The more exposure teachers have and the more they participate in physically active breaks, the more confident they will become in presenting activity breaks [36]. One finding that is contrary to some teachers’ beliefs [42] was that the physically active breaks did not interfere with student learning. This is important to recognize as some of the participants’ preconceived notions were that PA breaks create chaos in the classroom.

While this study is novel in its focus on physically active breaks on college students’ PA levels and perceptions, it is not without limitations. Time constraints, both the time of day and length of the daily class meeting could be considered limitations as well as the length of the study. Both control classes occurred later in the day, allowing students to possibly be “focused” and “energized” already, while the experimental classes occurred earlier in the morning. Finally, one last limitation is the fact that this study involved only one course, in which sophomores and juniors were enrolled.

Future research might utilize the design of this study to branch out to a larger sample size that includes more than one course in addition to investigating possible differences between freshman vs. junior level entry students. Moreover, attaining the instructors’ perceptions on teaching physically active brain breaks and their perceptions of student responses could also prove to be a beneficial study for the future.

## 5. Conclusion

While physically active brain breaks are a growing trend in the research for children and adolescents, very little research has examined the influence of these physically active breaks on college students physical activity levels, in particular, pre-service teachers. As facilitators of the next generation of adults and more specifically, teachers, teacher educators have an important role in effectively modeling healthy behaviors. Hall, Little, and Heidorn [37] believe that teacher educators should be “responsible for giving preservice teachers knowledge they need to become advocates for physical activity” [p. 42]. Unfortunately, most college classrooms do not include the use of PA within their courses [43,44]. However, this study indicated that incorporating short bouts of physical activity into the college classroom does not hinder students’ physical activity. On the contrary, it produced pre-service teachers who will incorporate physically active brain breaks into their teaching because they have actually “experienced the benefits” themselves; our hope is that this trend will become a norm for all college classrooms.

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