

The Correlation Between Physical Activity and Academic Achievement

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INTRODUCTION

There has been much debate throughout recent years regarding the delegation of physical activity requirements in public schools. With the considerable rise in childhood obesity rates, it is important to maintain efforts toward increasing their energy expenditure. Whether it be children or adults, physical activity is often associated with preventing chronic ailments such as cardiovascular disease, hypertension, diabetes, osteoporosis and various forms of cancer (Warburton, Nicol, & Bredin, 2006). Many studies focus on this strong, direct correlation between physical activity and decreased risk of physical health problems, but there could be other underlying benefits as well. Instead of focusing on the benefits of increased exercise from a physical health standpoint, we examined its effects on cognitive performance and academic achievement. We conducted a correlational study to examine the relationship between physical activity and academic achievement, specifically GPA, in college students.

One particular study by Grissom (2005) established evidence of covariation between physical activity and academic performance. This study utilized 884,715 fifth, seventh, and ninth grade students from public schools in California. These student's individual math and reading scores collected from the Stanford Achievement Test were compared to their scores on the Fitnessgram, a physical fitness test. There was a consistent positive correlation between physical activity and academic achievement. Additionally, this relationship was stronger for females than for males, and stronger for those of higher socioeconomic status.

Another study reported similar findings of a positive association between physical activity and academic achievement (Fox, Barr-Anderson, Neumark-Sztainer, & Wall, 2009). This study focused on two variables in relation to academic achievement: physical activity and sports team participation. Data was collected from 4746 middle and high school students involved in an

organization called Project EAT (Eating Among Teens). The participants reported how many hours each week they participated in sports teams, physical activity, as well as their academic letter grades. This study utilized two research methods to analyze their data. First, two separate regression analyses were used in which the two predictor variables, physical activity and sports team participation, were examined independently in relation to the outcome variable, GPA. Second, both of the predictor variables were used in a single regression analysis to examine their simultaneous effect on GPA. This study also found the results to vary based on gender. Their findings demonstrated an individual positive correlation between both physical activity and sports team participation with GPA for high-school girls. Only sports team participation was independently correlated to higher GPA for high-school boys. They were not able to separate the two predictor variables for middle school students to analyze the correlation to GPA.

A study by Castelli, Hillman, Buck, & Erwin (2007) examined the relationship between physical fitness and academic achievement as well. This study included 259 public school third and fifth grade students. Each of the participant's scores for academic achievement were measured through the reading and math tests included in the Illinois Standards Achievement Test. Their scores were then compared to their scores on the Fitnessgram, "A valid and reliable battery of assessments used to identify muscle fitness, aerobic capacity, and body composition" (Castelli, et al. 2007). The Fitnessgram consisted of various tests to determine scores for each of the three elements. There was a correlation between physical fitness and academic performance. While aerobic fitness was found to be positively associated with academic achievement and BMI was negatively associated, muscle strength and flexibility were found to be unrelated.

The previous research serves to exemplify the relationship between physical activity and academic achievement, yet it primarily focuses on this trend in children and adolescents. It was

not ascertained that these findings could be generalizable to other age categories, such as college-aged students or older adults. We conducted a correlational study to determine the presence of covariation between physical activity and academic achievement in college students at Clemson University. With academic excellence in college being of such high importance for students, it is valuable to determine any underlying causes for improvement. We utilized the Rapid Assessment of Physical Activity (RAPA) questionnaire, to categorize participants into physical activity levels according to their responses (University of Washington, 2006). We hypothesized that there would be a positive correlation between physical activity and academic achievement (i.e., GPA). Additionally, we examined male and female participants individually to look for variance between sexes. This hypothesis was based on the review of previous literature and their findings, as we believed the positive covariation between physical activity and academic achievement would be generalizable to college students.

METHODS

Participants

The data for this research study was collected from a sample of undergraduate Clemson University students. In attempt to reach a balanced sample of participants with equivalent proportion of gender and grade level, a survey was administered through a social media platform and via email. This survey was posted to the four different Clemson University Facebook pages for freshmen, sophomores, juniors, and seniors. At the end of data collection, we obtained a sample of 46 participants with 33 females and 13 males. They ranged in age from 18 to 26 years old.

Design

In this correlational study, the predictor variable was defined as physical activity and the outcome variable was academic achievement.

Materials and Tasks

This study utilized the RAPA questionnaire along with a short list of demographic questions, including GPA. The RAPA initially defined and provided examples of three physical activity intensity levels and then proceeded with a short list of yes or no questions accordingly. The three levels it defined were light activities, moderate activities, and vigorous activities. For instance, one question was “I do some light physical activity every week.” The response would either be yes or no. Following the questionnaire, participants scores were calculated based on their responses. Their scores defined their physical activity category as sedentary, under-active, under-active regular-light activities, under-active regular, or active. To convert these categories into a numerical scale the RAPA uses a range of 1-10, with a score of 10 being the highest level of physical activity. The breakdown of the total RAPA score included a possible 7 points for aerobic activity, 1 for strength, and 2 for flexibility.

Procedure

The participants were recruited through Clemson Facebook groups and via email and voluntarily consented to be in our study. By clicking on the anonymous link provided to them, they were directed to our survey in Qualtrics. The participants initially filled out some demographic questions and reported their GPA. Following their completion of those questions, they then moved onto the RAPA questionnaire to determine their physical activity level.

RESULTS

The participants' responses to yes or no questions on the RAPA questionnaire determined their physical activity level on a scale from 1-10, with 10 being the highest possible score. Their total RAPA score is calculated based on their scores from three separate components, aerobic activity, strength, and flexibility. Each component was weighted a possible 7, 1, and 2 points accordingly. Therefore, in order to achieve the highest possible RAPA score for physical activity of 10, the participant would need to score 7 points for aerobic activity, 1 point for strength, and 2 for flexibility. Each of these components were determined by responses to certain questions on the survey. The outcome variable in our study, academic achievement, was simply determined by the participants' self-reported GPA. The data from the male participants and female participants was analyzed separately in order to determine a potential difference in covariation depending on sex.

The hypothesis was that physical activity would be positively correlated with academic achievement, defined as GPA, in college students. Table 1 displays the descriptive statistics for these variables. The participant's mean GPA (n=46) was 3.55 with a standard deviation of .43. On average their total RAPA score was 7.78 and varied with a standard deviation of 2.41. Since the mean for sex was 1.74 with a standard deviation of .44 it is evident that the study had a larger percentage of female participants than males. During data analysis males were coded as the number "1" and females as "2."

Table 1. Descriptive Statistics for Predictor and Outcome Variables

Descriptive Statistics			
	Mean	Std. Deviation	N
GPA	3.5472	.43193	46
RapaTotal	7.78	2.412	46
Sex	1.74	.444	46

In order to test for a correlation between the predictor variable, physical activity, and the outcome variable, GPA, a linear regression was conducted using the statistics software SPSS. The Pearson correlation coefficient for the regression between these two variables was found to be $R = .186$. This indicated a low degree of correlation between physical activity and GPA. The effect size value $R^2 = .035$ suggested that 3.5% of the variance in GPA can be explained by variance in physical activity. At $p = .107$ the relationship between physical activity and GPA was not statistically significant and therefore didn't support the hypothesis. These inferential statistics are presented below in both Table 2 and Table 3.

Table 2. Inferential Statistics for Linear Regression

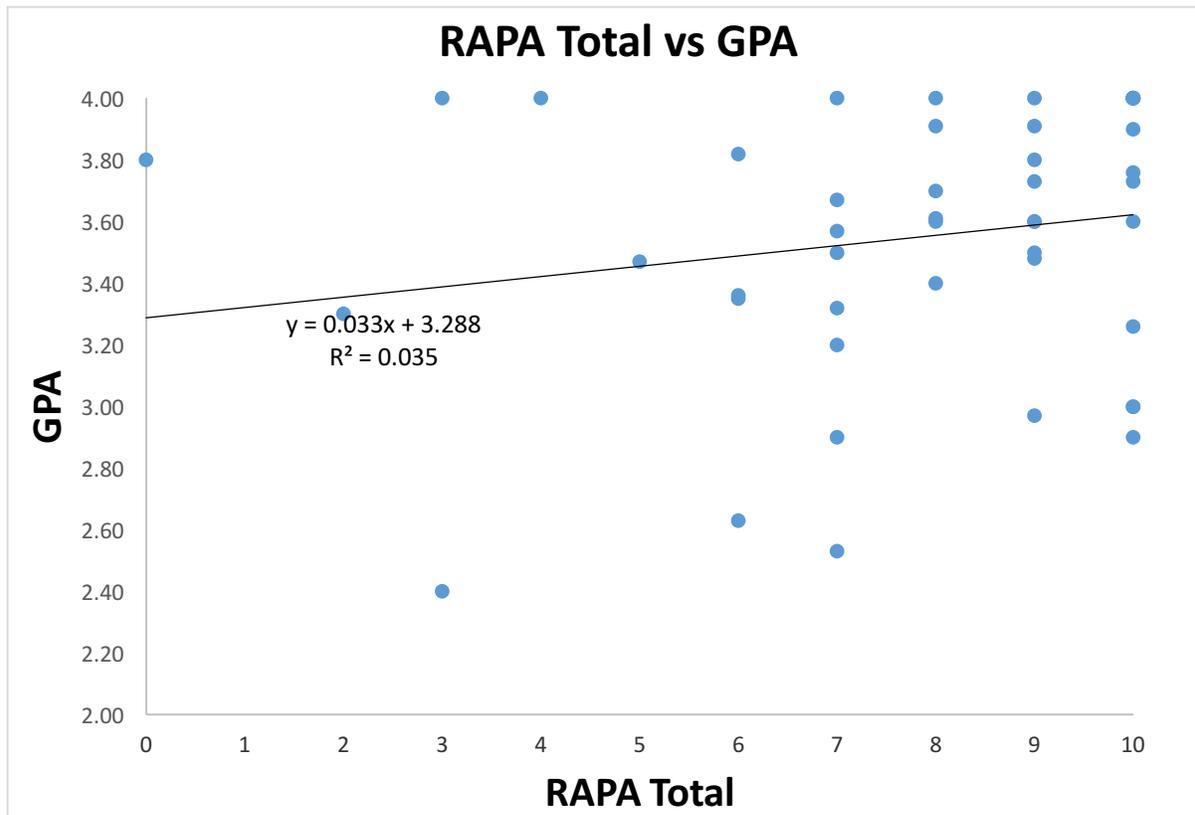
Model Summary							
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics		
					R Square Change	F Change	df1
1	.186 ^a	.035	.013	.42916	.035	1.585	1
2	.215 ^b	.046	.002	.43150	.012	.523	1

Table 3. Inferential Statistics for Linear Regression

Correlations				
		GPA	RapaTotal	Sex
Pearson Correlation	GPA	1.000	.186	.093
	RapaTotal	.186	1.000	-.075
	Sex	.093	-.075	1.000
Sig. (1-tailed)	GPA	.	.107	.268
	RapaTotal	.107	.	.310
	Sex	.268	.310	.
N	GPA	46	46	46
	RapaTotal	46	46	46
	Sex	46	46	46

With the low R-value of 0.186 falling between 0 and 0.3 it indicated a weak positive linear relationship between physical activity and GPA, although still not statistically significant to support the hypothesis. This regression had an effect size of 3.5% and this was considered small to medium by Cohen's levels since it falls between 1% and 6%. Graph 1 below displays a scatterplot of the data that demonstrates the weak linear relationship between physical activity and academic achievement as well as the regression equation.

Figure 1. Scatterplot Displaying Regression Between Physical Activity and GPA



In order to determine if there was a difference in the relationship between academic achievement and physical activity within males and females, an individual linear regression analysis was conducted for each. The results for males showed the Pearson correlation coefficient $R = .004$ with effect size $R^2 = .00$. This implied that 0% of the variance in GPA scores could be accounted for by variance in physical activity in males. According to Cohen's levels, this effect size was considered negligible. Additionally, at $p = .495$ the relationship was not statistically significant. The results for females showed $R = .291$ with effect size of $R^2 = .085$. This implied that 8.5% of the variance in GPA scores could be accounted for by variance in physical activity in females. According to Cohen's levels, this effect size was considered medium to large as it falls between 6% and 15%. While the relationship between physical activity and GPA was stronger in females than males, at $p = .05$ it was still not statistically significant. Table 4 shows the results for the linear regression between physical activity and academic achievement for the male participants while Table 5 shows the results for the females. Graph 2 depicts a scatterplot of the data with opposing colors to signify male or female.

Table 4. Inferential Statistics for Linear Regression Between RAPA and GPA (Males)

Correlations^a

		GPA	RAPATotal
Pearson Correlation	GPA	1.000	.004
	RAPATotal	.004	1.000
Sig. (1-tailed)	GPA	.	.495
	RAPATotal	.495	.
N	GPA	13	13
	RAPATotal	13	13

a. Selecting only cases for which Sex = Male

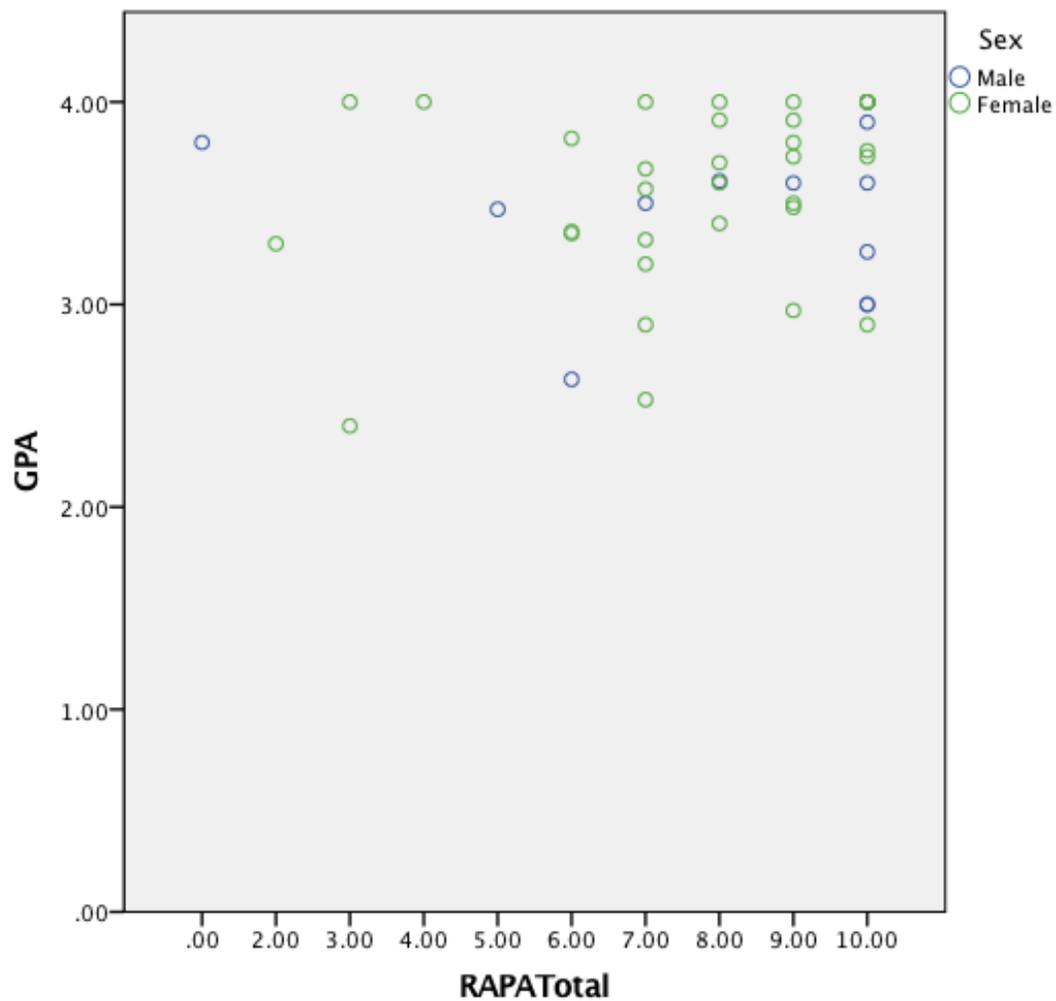
Table 5. Inferential Statistics for Linear Regression Between RAPA and GPA (Females)

Correlations^a

		GPA	RAPATotal
Pearson Correlation	GPA	1.000	.291
	RAPATotal	.291	1.000
Sig. (1-tailed)	GPA	.	.050
	RAPATotal	.050	.
N	GPA	33	33
	RAPATotal	33	33

a. Selecting only cases for which Sex = Female

Figure 2. Scatterplot Displaying Differences Between Sexes



DISCUSSION

The primary purpose of this study was to examine the question of whether there was a positive correlation between physical activity and academic achievement in college students. Additionally, we analyzed males and females separately to see if there would be a difference within the correlation. Previous research established evidence of covariation between these two variables in a sample of fifth, seventh, and ninth grade students using scores from the Fitnessgram and SAT (Grissom, 2005). Additionally, this study indicated the relationship between these two variables was stronger for females than males. Various other relevant studies utilized similar measures for each variable, implying that they did not entirely rely on self-reported data as we did. For instance, one study also used the Fitnessgram to determine physical activity but used reading and math scores from the Illinois Standard Achievement test to measure academic achievement (Castelli et al., 2007). Although there were a variety of related studies that compared the relationship between physical activity and academic achievement in children and adolescents, there seemingly was a lack of research regarding this trend in college students. Therefore, our study is meaningful as it served as a basis for research in this field and potentially could instigate further studies.

This study was conducted by gathering data from Clemson students recruited from Facebook groups and via email. They voluntarily participated in this study by taking a Qualtrics survey that consisted of a few demographic questions as well as the RAPA questionnaire. Their self-reported GPA and total scores for physical activity from the RAPA were then analyzed using a linear regression to test for correlation. The hypothesis that there was a positive correlation between physical activity and GPA was not supported by the data in this study. The

results were not statistically significant and effect size was small, suggesting that physical activity had little or no effect on GPA.

The individual linear regression analyses for both male and female participants provided varied results which could be considered an unexpected finding. The results from the male participants showed a much weaker linear relationship between physical activity and academic achievement than those for females. While for males, the effect size was negligible, females had a medium to large effect size. Essentially, for male college students, the findings suggested that physical activity had little to no effect on academic achievement. For females, the p-value is exactly on the borderline of being statistically significant at $p=.05$. Previous studies that examined physical activity and academic achievement with the inclusion of gender variance, actually found the relationship to be stronger for females as well. A potential limitation of this finding in our study was not only that the relationships were not statistically significant, but there were also many more females participants than males, which could have skewed the data.

It is evident that the results from this study were not consistent with those found in previous ones. The vast majority of previous research studies found significant supporting evidence to suggest a positive correlation between physical activity and academic achievement. Although these studies examined the correlation between the same variables, findings may be dissimilar due to differences in methods and sample size. While many previous studies used scores from administered tests for both physical activity and academic achievement, our study relied solely on self-reported data. This could have potentially allowed participants to skew the data by not reporting their GPA accurately or taking the RAPA survey honestly. Additionally, previous studies obtained much larger sample sizes ranging from hundreds to thousands of participants. We were only able to recruit 46 participants, therefore this small sample size may

have limited the statistical power of the study and potentially skewed the data. We also obtained a much larger percentage of female participants than males, which could have affected the data as well.

Considering that we only recruited participants from the Clemson undergraduate student body for our study, it would be reasonable to generalize the findings to other undergraduate college students in the United States. The participants we recruited were representative of our research question since it focused on the relationship between physical activity and academic achievement in college students. Since the findings of this research study were not consistent with previous literature, it is difficult to determine the application to everyday behavior. By referring only to the results of our study, it could be possible that physical activity is not significantly related to academic achievement in college students, as it is in elementary, middle, and high school students. In previous studies, findings implicate that being physically active is positively correlated with higher GPA and test scores, but this may not be true for older students. There definitely needs to be more research done regarding this relationship in college students, potentially ones that do not rely on self-reported data, in order to limit bias. For instance, if the Fitnessgram were administered to determine physical activity levels of college students and then their GPA's were able to be obtained more securely, the results may differ. If this study was to be continued using the same measures of data collection, it should be expanded to include students from other colleges as well as a larger sample size to yield more statistical power.

REFERENCES

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APPENDIX**-Demographic Survey-**

1. How old are you? _____

2. What is your gender? Male _____

Female _____

Other _____

3. What is your ethnicity? Caucasian _____

African American _____

Hispanic _____

Asian _____

Other _____

4. What is your GPA? _____

5. Please read the information on the next page that defines intensity levels of physical activity and then answer the following questions accordingly.

Rapid Assessment of Physical Activity

Physical Activities are activities where you move and increase your heart rate above its resting rate, whether you do them for pleasure, work, or transportation.

The following questions ask about the amount and intensity of physical activity you usually do. The intensity of the activity is related to the amount of energy you use to do these activities.

Examples of physical activity intensity levels:

<p>Light activities</p> <ul style="list-style-type: none"> • your heart beats slightly faster than normal • you can talk and sing 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Walking Leisurely</p> </div> <div style="text-align: center;">  <p>Stretching</p> </div> <div style="text-align: center;">  <p>Vacuuming or Light Yard Work</p> </div> </div>
<p>Moderate activities</p> <ul style="list-style-type: none"> • your heart beats faster than normal • you can talk but not sing 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Fast Walking</p> </div> <div style="text-align: center;">  <p>Aerobics Class</p> </div> <div style="text-align: center;">  <p>Strength Training</p> </div> <div style="text-align: center;">  <p>Swimming Gently</p> </div> </div>
<p>Vigorous activities</p> <ul style="list-style-type: none"> • your heart rate increases a lot • you can't talk or your talking is broken up by large breaths 	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Stair Machine</p> </div> <div style="text-align: center;">  <p>Jogging or Running</p> </div> <div style="text-align: center;">  <p>Tennis, Racquetball, Pickleball or Badminton</p> </div> </div>

How physically active are you? (Check one answer on each line)

Does this accurately describe you?

R A P A 1	1	I rarely or never do any physical activities.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	2	I do some light or moderate physical activities, but not every week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	3	I do some light physical activity every week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	4	I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	5	I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	6	I do 30 minutes or more a day of moderate physical activities, 5 or more days a week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	7	I do 20 minutes or more a day of vigorous physical activities, 3 or more days a week.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
R A P A 2 3 = Both 1 & 2	1	I do activities to increase muscle strength , such as lifting weights or calisthenics, once a week or more.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
	2	I do activities to improve flexibility , such as stretching or yoga, once a week or more.	Yes <input type="checkbox"/>	No <input type="checkbox"/>

ID # _____

Today's Date _____

Scoring Instructions

RAPA 1: Aerobic

To score, choose the question with the highest score with an affirmative response. Any number less than 6 is suboptimal.

For scoring or summarizing categorically:

Score as sedentary:

1. I rarely or never do any physical activities.

Score as under-active:

2. I do some light or moderate physical activities, but not every week.

Score as under-active regular – light activities:

3. I do some light physical activity every week.

Score as under-active regular:

4. I do moderate physical activities every week, but less than 30 minutes a day or 5 days a week.
5. I do vigorous physical activities every week, but less than 20 minutes a day or 3 days a week.

Score as active:

6. I do 30 minutes or more a day of moderate physical activities, 5 or more days a week.
7. I do 20 minutes or more a day of vigorous physical activities, 3 or more days a week.

RAPA 2: Strength & Flexibility

I do activities to increase muscle strength, such as lifting weights or calisthenics, once a week or more. (1)

I do activities to improve flexibility, such as stretching or yoga, once a week or more. (2)

Both. (3)

None (0)
