Investigating the Relationship Between Physical Activity and Academic Performance Among Non-Traditionally Aged Undergraduate Students

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ABSTRACT

Background: Non-traditionally aged undergraduate students (NTAS) represent the fastest growing undergraduate enrollment segments among US higher education institutions. To date, minimal research has been devoted to elucidate the relationship between physical activity and academic performance (AP) of this demographic.
Aim: The aim of this study was to determine a relationship between physical activity behavior, differentiated as frequency of participation in vigorous physical activity (FVPA), frequency of participation in moderate-intensity physical activity (FMPA), walking days per week (WALK), and sitting time per weekday in hours per day (SIT) and academic performance denoted by grade point average (GPA).
Methods: An online survey comprising a modified version of the International Physical Activity Questionnaire Short Form (IPAQ-SF) accompanied by a brief battery of demographic items was disseminated to NTAS at a large private research university in the MidAtlantic US. Data analyses include descriptive statistics and correlation.
Results: Strong, positive relationships between frequency of participation in vigorous physical activity (FVPA) and GPA ($r = .869$, $p < 0.01$), frequency of participation in moderate physical activity (FMPA) and GPA ($r = .909$, $p < 0.01$), walking days per week (WALK) and GPA ($r = .919$, $p < 0.01$), and sitting time per weekday in hours per day (SIT) with GPA ($r = .917$, $p < 0.01$) were established
Conclusion: The study findings provide valuable insights for institutions related to attracting, retaining, and supporting an underserved population of students and warrant further research.

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BACKGROUND

While a gamut of studies has elucidated the correlation between physical activity (PA) and academic performance (AP) (Shantakumar et al., 2022; Osipov et al., 2021; Keating et al., 2013), there has been a comparative dearth of studies involving non-traditionally aged undergraduate students (NTAS). However, much of the research has revolved around traditionally aged undergraduate students (TAS) (aged 18 to 24) who most often live on or near campus, maintain a full-time course load (12 credits per semester or more), and are more financially dependent on their parents or other family members (Adams & Corbett, 2010). In contrast to traditionally aged college students, NTAS are older

(ordinarily 25 and older) and may be defined by one or more of the following characteristics: a) delayed or deferred enrollment following high school completion, b) part-time course load (fewer than 12 credit hours per semester), c) are financially responsible for themselves and others, including other family members and dependents, d) being a single parent, e) concurrent full- or part-time employment while enrolled, and f) did not receive a high school diploma (Remenick, 2019). In comparison to TAS, NTAS spend significantly more time studying and working off campus (Woods & Frogge, 2017). Among NTAS, environments, social structures, and occupational settings have been shown to be more influential in impacting health behaviors than campus resources, due to the time spent off campus (Quintiliani et al., 2012).

Enrollment growth among NTAS within the US over the past few years has been rampant. First year undergraduate enrollment of the 25- to 29-year-old and 30 or older subsegments has increased by 28% since the 2021-22 academic year, surpassing the growth of traditionally aged 18- to 20-year-old and 21- to 24-year-old subsegments (9%) (National Student Clearinghouse Research Center [NSCRC], 2024). Since the 2022-2023 academic year, total undergraduate enrollment of both 25- to 29-year-old and 30 or older subsegments has increased 3.9%, surpassing the growth of traditionally aged 18- to 20-year-old and 21- to 24-year-old subsegments (2.9%) (NSCRC, 2024). Increased enrollment of the 25- to 29-year-old and 30 or older subsegments were observed among private non-profit four-year institutions (9.5%), private for-profit institutions (10.6%), public primarily associate degree granting baccalaureate institutions (9.2%), and public two-year institutions (6.5%) (NSCRC, 2024).

Ultimately, long-term success and viability of higher education institutions is predicated upon sustained enrollment. Nationally, enrollment is down 8.5% since 2010, with the most prominent reductions in enrollment observed among for-profit institutions (59%) and two-year public colleges (38%) (Conley, 2024). Though reports have shown increased enrollment at four-year public colleges between 2010 and 2021 (15.1%), significant reductions in enrollment have been reported at numerous public colleges and universities, specifically in Pennsylvania where hemorrhaging enrollments (a reduction of 29% since 2010) at state institutions, including branch campuses of research flagships, Pennsylvania State University and University of Pittsburgh, have necessitated consolidation efforts, including the elimination of academic programs and associated institutional resources (Schnacker, 2023). Enrollment at higher education institutions has also been splintered by student attrition, particularly among first-time undergraduate students, where 12-month dropout rates ranging from 24.1% for full-time students to 58.2% for part-time students have been reported (Hanson, 2022). A recent regression analysis comparing non-traditionally aged and traditionally aged undergraduate students revealed a substantially higher dropout rate among the former group, especially among those maintaining full-time employment (Carreira & Lopes, 2020).

Undergraduate enrollment is expected to decline due to lower birth rates throughout the past two decades, specifically between 2007 and 2020 (Kearney et al., 2022). Projections of enrollment shrinkage of incoming freshman, or first year students, is indeterminable, but predicted to be substantial and is expected to eventuate in 2025 (Joyce, 2024). This phenomenon, known in higher education circles as the "enrollment cliff", intensifies the need for innovative recruitment and retention efforts of NTAS at a multitude of institution types.

NTAS are encumbered by a confluence of challenges, including familial and occupational commitments, lessened social support, greater financial strain, and less available time to engage in both PA and academic preparation. These factors have been implicated in increased undergraduate student attrition risk (Nieuwoudt & Pedler, 2023), which has been shown to be influenced by AP (Kocsis & Molnár, 2024). AP was established as a leading cause of attrition risk

according to a landmark regression analysis comprising 75,830 students across 27 academic programs (Araque et al., 2009). The analysis demonstrated a strong correlation between AP, specifically grade point average (GPA) and likelihood of dropping out or abandonment. In fact, a decrease in GPA of just 0.2 points was shown to increase the likelihood of dropping out or abandonment by 2.5 times (Araque et al., 2009). Another regression analysis culled from one of the largest higher education institutions in Chile revealed that students who meet one of more criteria of NTAS presented by Remenick (2019) are more likely to drop out during their first year of college (Venegas-Muggli, 2019).

Regular participation in PA has been shown to profoundly improve health throughout the lifespan. Reductions in cardiovascular disease risk and mortality, decreased incidence of hypertension, high cholesterol, and type 2 diabetes mellitus (Piercy et al., 2018), incidence of cardiovascular events, such as heart attack and stroke (Thompson, 2020; Tian et al., 2019), decreased risk of cancer (Thompson et al., 2020; McTiernan et al., 2019), and reduced musculoskeletal injuries, including osteoarthritis (Hunter & Eckstein, 2009) are associated with regular PA. Regular participation in PA has also been shown to confer substantial improvements in depression, anxiety, and temper the severity of symptoms accompanying mood disorders (Thompson et al., 2020; Giandonato et al., 2021; Hearing et al., 2016). The American College of Sports Medicine (ACSM) and the Centers for Disease Control and Prevention (CDC) recommend for adults aged 18-65: a minimal weekly accumulation of 150 minutes of moderate intensity PA (≥3.0 and <6.0 metabolic equivalents of task [MET]) or alternatively, a weekly accumulation of 75 minutes of vigorous intensity PA (≤6.0 MET) in conjunction with resistance training performed twice weekly, preferably on nonconsecutive days (Piercy et al., 2018). There is also evidence suggesting that multiple intermittent bouts of PA can elicit similar improvements in cardiorespiratory fitness as longer continuous bouts (McFarlane et al., 2006). Throughout the lifespan, decrements in PA behavior have been well documented, initiating with decreases of -7.04 min/day of moderate to vigorous intensity PA (MVPA) upon completing high school (Winpenny et al., 2020) and progressively lowered PA levels during midlife and during older adulthood (Varma et al., 2017). Life events, such as marriage and childbirth, increasing occupational demands and familial obligations, such as dependent and parental care can adversely affect PA behavior (Brown et al., 2009) and dietary intake quality (Wickramasinghe et al., 2020). Diminished PA throughout the lifespan is implicated as a key contributor to $117 billion in annual health care costs in the United States and represents 10% of all premature deaths (Piercy et al., 2018). Across the population, just 26% of men and 19% of women meet the ACSM/CDC PA recommendations (Piercy et al., 2018).

Improvements in AP resulting from PA have been observed among college student populations (Kljajević et al., 2022; Wunsch et al., 2021; Wald et al., 2014); however, a disproportionate amount of research has been centered on TAS. A cross-sectional observational study with a linear regression analysis of 16,095 undergraduate students (aged 18-24 years) revealed that GPA was associated with the amount of moderate to vigorous physical activity (MVPA). On average, GPA was improved by 0.03 points, if MVPA recommendations were met (Wald et al., 2014). A meta-analysis of 42 studies uncovered a bidirectional relationship between physical activity and academic performance, showing that more active students perform better, revealing a link between walking and GPA and total physical activity accumulation and GPA (Wunsch et al., 2021). Weekly accumulation of physical activity quantified as metabolic equivalents of task (MET) has been shown to be correlative with academic performance. Two-hundred-eighty-four subjects from three academic institutions participated in a study consisting of reporting their physical activity behaviors via completion of the International Physical Activity Questionnaire (IPAQ) assessment, which enabled differentiations among low physical activity (≤1000 MET/week), moderate physical activity (1,000 to 2,500

MET/week), and high physical activity (≥2,500 MET/week). Pairwise correlations revealed greater academic performance among high and moderate physical activity groups in comparison to the low physical activity group (Morales et al., 2011). Intermittent physical activity, described as brief, incidental bouts of physical intensity, often of vigorous intensity (≤6.0 MET) performed during activities of daily living (ADL) (Stamatakis et al., 2021), elicited better academic performance among undergraduate students in comparison to lesser active peers (Currie et al., 2012). A total of 120 subjects from a single academic institution had their physical activity measured throughout the semester. The subjects who interspersed sedentary time every 10-20 minutes with activity reported higher grade point averages than their peers who did not engage in as much intermittent physical activity. Brief, but regular bouts of PA were shown to improve academic performance and perceptions of academic performance while attenuating stress load and dysfunctional stress and enhancing cognitive recovery between study sessions (Teuber et al., 2024). Earlier research has established that intermittent physical activity is capable of tendering improvements in cardiovascular health and body composition, provided the intensity and accumulation of activity are sufficient (McFarlane et al., 2006).

Frequency of physical activity has been shown to be closely correlated with GPA. Students who were enrolled in a general health education course were surveyed on their physical activity behavior. Thirty-five percent of students with a GPA < 2.0 reported no weekly participation in moderately intense physical activity in contrast to 21.7% of students reporting no weekly participation in moderately intense physical activity (Curtis et al., 2015). Students who regularly participated in institution-sponsored fitness classes twice per week reported higher GPAs than physically inactive control group members (Mull & Tietjen-Smith, 2014). The duration and mode of PA have also been shown to mediate academic performance among undergraduate students. A cross-sectional study comprised of 150 subjects from an undergraduate medical education program, revealed that students participating in one hour of physical activity daily reported greater confidence on academic assessments than students participating in 30 minutes of physical activity daily (Shantakumar et al., 2022). The study also gleaned preferences from subjects, revealing that jogging, brisk walking, and racquet sports, all classified as modes of moderate to vigorous intensity physical activity (MVPA), were most prevalent. These findings are consistent with prior research showing a correlation between accumulation of MVPA and academic assessment performance (Booth et al., 2014). A secondary analysis of data previously collected by the American College Health Association (ACHA) involving 1125 subjects established a correlation between resistance training frequency and grade point average (Keating et al., 2013). Greater frequency of physical activity and its impact on academic performance was corroborated in a data mining review consisting of 2,219 undergraduate students for a period of 12-weeks (Du et al., 2023). The review reported that students who engaged in physical activity at least once per week reported greater academic performance than students who engaged in physical activity less frequently. Bouts of physical activity ranging from 16 to 26 minutes were also found to enhance academic performance, however, facilitating improvements in individual fitness qualities and biomotor skills may be contingent on greater frequency and longer durations.

Though the association between PA and AP has been explored among similarly aged graduate and professional students, this population is dissimilar to undergraduate students in degree of immersion, motivation, resilience, and coping strategies (Illovsky, 2010; Ickes et al., 2015; Cao, 2012). Stark sociodemographic differences exist between graduate students and NTAS, such as educational attainment, employment status, marital status and family, housing, and income. Additionally, a greater prevalence of mental illness and negative effects on academic performance have been reported among undergraduate students in comparison to graduate students (Wyatt & Oswalt, 2012) plausibly

explained by lower resilience and inferior coping strategies. Ostensibly, stress reported by undergraduate and graduate students differed substantially per a Cramér's V analysis with undergraduate students reporting greater stress (V = .061) in comparison to graduate students (V = .045). It could be posited that graduate students may also possess greater health literacy as the analysis revealed a greater propensity among graduate students (74%) to supplicate mental health support services than their undergraduate student counterparts (64.8%) (Wyatt & Oswalt, 2012). Though health literacy has been shown to be influenced by academic program, course of study, and educational attainment (Dauletkaliyeva et al., 2025), confounding factors such as socioeconomic, sociodemographic, and behavior aspects also influence health literacy.

Correlations between physical activity participation and academic performance among graduate and professional students have been equivocal. Though graduate health science students reported MVPA levels exceeding ACSM/CDC recommendations, there was no relationship between physical activity and GPA (Gonzalez et al., 2014). Similarly, no relationship between physical activity and GPA could be ascertained among a cohort of medical students, who overwhelmingly reported being physically inactive (66.2%) (Zain et al., 2021). However, analysis of a random sample consisting of 1350 medical students from 22 medical schools reporting that 40% of respondents were inactive, revealed a correlation between higher PA levels and improvements in QOL (Peleias et al., 2017). Physical inactivity among medical students is not uncommon as recent analyses reporting between 60-70% of students being classified as having low weekly PA participation (Fadul et al., 2023; Nishanthi et al., 2024). Similar observations have been made among dental (Serdar Eymirli et al., 2024) and graduate nursing students (Graves et al., 2020) which are in alignment with perceptions of reduced PA among graduate students in comparison to undergraduate years (Jett et al., 2024). More research on the relationship between physical activity participation and academic performance among professional and graduate students is certainly warranted, but it is insufficient and contextually inappropriate to use findings to explicate a relationship between physical activity and academic performance among non-traditionally aged students of the same age. Therefore, a separate exploration of PA and AP concentrating on NTAS was warranted.

Study Objectives

The primary objective of this study was to determine the relationship between physical activity and academic performance among non-traditionally aged undergraduate students by assessing the strength of predictor variables of frequency of participation in vigorous physical activity (FVPA), frequency of participation in moderate physical activity (FMPA), walking days per week (WALK), and sitting time per weekday in hours per day (SIT) and the criterion variable of GPA.

METHODS

Research Design

A quantitative correlational study was deployed to address the aims of the study. Demographic data was also culled to enable reporting of descriptive statistics. The strength of relationships among variables was examined through the computation of Spearman's rank correlation coefficients (Spearman's rho).

Participants and Setting

The study was conducted at a large private research university located in the MidAtlantic US. Students were invited to participate in the study via multiple methods of communication, including recruitment e-mails that were disseminated by academic departments and posts on various social media platforms. Inclusion criteria for the study were as follows: aged 25 years or older, a matriculated student in a bachelor's or associate degree program at the university (whether full-time or part-time) and enrolled for two consecutive academic terms or more, including the current academic term. 180 participants met the study criteria, and 167 participants completed all survey items related to the research. All participants provided informed consent to participate, and the study was approved by the university's Institutional Review Board. Undergraduate students from the main campus and online programs were invited to participate.

Measures

Predictor variables included frequency of participation in vigorous physical activity (FVPA), frequency of participation in moderate-intensity physical activity (FMPA), walking days per week (WALK), and sitting time per weekday in hours per day (SIT) and the criterion variable was GPA. Demographic data included age range, academic program, and enrollment status.

Measurement / Instrumentation

Participants were asked to complete a brief survey comprising a modified version of the International Physical Activity Questionnaire Short Form (IPAQ-SF) accompanied a short battery of questions to aggregate responses related to self-reported PA behavior and grade point average (GPA) during the prior term. In contrast to the original IPAQ-SF, the reporting period was expanded from the prior seven days to an entire academic term. Prior to this study, the IPAQ-SF had been adapted to a three-month recall period to collect information on PA behavior among subjects in a cross-sectional study (Delbaere et al., 2010). Response options for PA participation and GPA were provided as ranges aimed at making the survey more user friendly, less intrusive, and reducing text-entry input errors. The surveys were administered using a secure, online survey tool (Qualtrics).

Data Analysis

Data analyses were descriptive and correlational. Frequencies and proportions were used to examine and present participant data. Relationships between each predictor variable and the criterion variable were explored using Spearman's rho. A priori power analysis was executed with G*Power (Faul et al., 2007) to determine the minimal sample size needed necessary for ascertaining statistical power. The power analysis, performed with an alpha level of 0.05, power of 0.80, and a medium effect size of 0.5 for a two-tailed test, determined that the sample size was sufficient for the study.

RESULTS

Study Participants

Of the 240 university students who accessed the survey, 180 participants met the study criteria and provided informed consent to participate. 167 participants completed all survey items related to the study, providing a 69.58% participation rate. Table 1 summarizes the study participants' characteristics.

Table 1

Respondent Cohort Demographics (n = 180)*

Characteristic	*n*	%
Age		
25–35	65	36.1
35–44	61	33.8
45–54	37	20.5
55 and older	13	7.2
College or school through which degree is being earned		
School of Aeronautics	1	0.1
College of Applied Studies and Academic Success	1	0.1
College of Arts and Sciences	15	8.3
School of Behavioral Sciences	53	29.4
School of Business	30	16.7
School of Divinity	16	8.8
School of Education	16	8.8
School of Engineering	9	5
School of Government	15	8.3
School of Health Sciences	19	10.5
School of Music	1	0.1
Enrollment status		
Full-time	123	68.3
Part-time	53	29.4

*Missing data observed. Percentages did not add up to 100%.

Relationship between Frequency of Participation in Vigorous Physical Activity (FVPA) and GPA

This study established a strong, positive relationship between both FVPA and GPA (r[167] = .869, p < 0.01) (Table 2).

Table 2

Correlation of FVPA and GPA

		FVPA	GPA
FVPA	Correlation Coefficient	1.000	.869**
	Sig. (2-tailed)		< .001
	N	167	167
GPA	Correlation Coefficient	.869**	1.000
	Sig. (2-tailed)	< .001	
	N	167	167

Note. **Correlation is significant at the 0.01 level (2-tailed).

Relationship Between Frequency of Participation in Moderate-Intensity Physical Activity (FMPA) and GPA

This study established a strong, positive relationship between both FMPA and GPA (r(167) = .909, p < 0.01) (Table 3).

Table 3

Correlation of FMPA and GPA

		FMPA	GPA
FMPA	Correlation Coefficient	1.000	.909**
	Sig. (2-tailed)		< .001
	N	167	167
GPA	Correlation Coefficient	.909**	1.000
	Sig. (2-tailed)	< .001	
	N	167	167

Note. **Correlation is significant at the 0.01 level (2-tailed).

Relationship of Walking Days Per Week (WALK) and GPA

This study established a strong, positive relationship between WALK and GPA (r(167) = .919, p < 0.01) (Table 4).

Table 4

Correlation of WALK and GPA

		WALK	GPA
WALK	Correlation Coefficient	1.000	.919**
	Sig. (2-tailed)		< .001
	N	167	167
GPA	Correlation Coefficient	.919**	1.000
	Sig. (2-tailed)	< .001	
	N	167	167

Note. **Correlation is significant at the 0.01 level (2-tailed).

Relationship of Sitting Time Per Weekday (SIT) and GPA

This study established a strong, positive relationship between SIT and GPA ($r(167) = .917$, $p < 0.01$) (Table 5).

Table 5

Correlation of SIT and GPA

		SIT	GPA
SIT	Correlation Coefficient	1.000	.917**
	Sig. (2-tailed)		< .001
	N	167	167
GPA	Correlation Coefficient	.917**	1.000
	Sig. (2-tailed)	< .001	
	N	167	167

Note. **Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

The findings of this study are consistent with prior investigations utilizing similar methodological approaches which sought to correlate PA and AP involving undergraduate students (Dzoolkarnain et al., 2021; Wehler & Stauffer, 2023; Haddad et al., 2024). Previously, a strong positive relationship ($r[357] = .636$, $p < 0.01$) was revealed among highly active undergraduate students or those engaging in "vigorous physical activity at least three days with 1500 MET min/week or seven days of walking, moderate or vigorous physical activity at a minimum of 3000 MET min/week" (p. 376); however, age was not specified in the report (Dzoolkarnain et al., 2021). Interestingly, lesser correlations were observed among minimally active, classified as those engaging in three or more days of vigorous activity in at least 20 minutes daily or five or more days of moderate physical activity, including walking or a combination of walking and moderate physical activity totaling 600 MET min/week, ($r[357] = .503$, $p < 0.01$) and inactive, classified as those who do not engage in activity sufficient enough to be considered minimally active, ($r[357] = .422$, < 0.01) undergraduate students (Dzoolkarnain et al., 2021).

Wehler and Stouffer (2023) reported strong positive relationships between FVPA and general academic skills such as working hard in class (r[791] = .840, $p < 0.05$), setting specific homework goals (r[764] = .890, $p < 0.05$), and staying organized for class (r(791) = .850, $p < 0.05$). Weak to moderately positive relationships maintaining a good study schedule (r[791] = .123, $p < 0.05$), using goal setting as a strategy for class (r[791] = .122, $p < 0.05$), setting specific homework goals (r[791] = .188, $p < 0.05$) were shared with FVPA. No significant relationships were found between PA and GPA (r[791] = .380, $p < 0.05$), however, these findings potentially point to the mediating effects of PA on executive functioning (Di Liegro et al., 2019) and the impact of regular PA on routine adherence and time management among undergraduate students (Terzi et al., 2024).

A small sample sized correlational study (n = 44) indicated an indirect effect of PA on AP through improvements in cognitive functioning, specifically rapid visual information processing which was found to share a positive relationship with GPA, though not statistically significant (Haddad et al., 2024). The investigators opined that increased PA levels were capable of tendering improvements in AP across a wider age range of undergraduate students, but the findings of the study must be accepted with caution in consideration of the small sample size. Though dissimilar from the methodological approaches of these studies, a binary logistic regression analysis comprising 244 undergraduate students demonstrated that increased PA levels were associated with higher GPA (Chung et al., 2018). Undergraduate students engaging in vigorous physical activity at least three days with 1500 MET min/week or partaking in daily activity every day and thus accumulating a minimum of 3000 MET min/week were twice as likely to have higher GPAs than those not meeting activity thresholds specified in the report.

The strong, positive relationship between WALK and GPA revealed in this study corroborates earlier reports amid undergraduate students (Mualem et al., 2018), high school students (Chiluwal et al., 2024), and school aged children, aged 14 to 19 years old (Patel et al., 2021). Ten minute increments of walking over the course of one week were found to elicit improved performance in cognitive tests among a wide spectrum of learners in elementary school, middle school, high school, and college (Mualem et al., 2018). The cohort of undergraduate students (n = 58), aged 22-27 years old, registered the closest association between walking and memory and feature detection and sequential memory tasks (r = .206, $p < 0.05$) though not statistically significant. However, their improvement in feature detection and sequential memory tasks was highest among all groups, ostensibly owing to increased serum BDNF and activin A receptor type 1C (ACVR1C), an endogenous ligand involved in brain development, which have been associated with consistent intermittent PA (La Tour et al., 2024).

A strong, positive relationship was established between PA, including walking, and AP among a large sample (n = 1870) of high school students (r = .650, $p < 0.01$) (Tarigan et al., 2022) and walking, in conjunction with other physical activities, among school aged children was reported to have a strong, positive relationship with AP (Patel et al., 2021). The findings of this study are of particular interest since PA participation decreased during the first two years of college (Han et al., 2008; Kwan et al., 2012) which overlapped with the 17 to 19 year old age segment included in the sample.

Moreover, this study established a strong, positive relationship between SIT and GPA (r[167] = .917, $p < 0.01$) which has also been observed in prior reports involving similar methodological approaches among student populations (Sharma et al., 2017), including undergraduates (Felez-Norbrega et al., 2017). Spearman's rho analyses also uncovered strong relationships between sedentary time and responses associated with stress, anxiety, and depression on the Depression Anxiety Stress Scale (DASS) and biomarkers of acute neurophysiological stress,

including NADPH oxidase 2 (NOX2), a precursor of reactive oxygen species (ROS), that has been demonstrated to instigate oxidative stress, during the proctoring of examinations (Nocella et al., 2024). Physically active undergraduate students were found to have lower DASS scores; however, registered higher NOX2 levels suggestive of heightened ß-adrenergic activity correspondent with vigorous PA (Vitiello et al., 2011). However, protracted periods of sitting and sedentary behavior may be required to prepare for examinations or complete assignments and projects as substantial daily sedentary time has been reported among undergraduate (Lee & Kim, 2018; Moulin et al., 2021), graduate (Howard et al., 2019), and medical and professional (Janampa-Apaza et al., 2021) students. Despite showing a strong, positive relationship between SIT and GPA, sufficient PA is required to derive a plethora of health improving benefits and enhanced neurocognitive functioning as noted in the literature.

Fifty-two percent (n = 55) of study respondents reporting sitting more than five hours per day during the prior term, a threshold that has been previously reported as increasing risk of developing cardiovascular and pulmonary disease risk (Poses-Ferrer et al., 2021); however, health risks associated with protracted periods of sedentarism can be offset by regular or intermittent PA performed throughout the day (Park et al., 2020). The extended sitting time of study respondents can potentially be linked to suboptimal physical and/or social environments, a lack of sufficient social support, wavering support from household and family members, employers, the institution, neighborhood and related community contexts and social networks. However, respondents reporting greater sitting time may also possess substantial self-efficacy, heightened outcome expectations, and marked determinism as evidenced among graduate and professional students who are less likely to be active than their undergraduate counterparts (Jett et al., 2024). It is possible that respondents reporting greater sitting time may in fact have sufficient social support and supportive physical and social environments, but PA during the prior term was not prioritized due to a confluence of scholastic and occupational demands often faced by NTAS.

Though undergraduate enrollment of NTAS continues to rise, this group faces a significant attrition risk. Early reports have indicated that NTAS are more than twice as likely than TAS (38% > 16%) to dropout during their first year (National Center for Education Statistics [NCES], 1996). The first year of college is typically entails the greatest likelihood of attrition among both NTAS and TAS and is largely fomented by poor academic performance and a host of socioeconomic and socioecological elements (Chen et al., 2019). Since NTAS represents a large enrollment share at a multitude of institutional types, ostensibly helping buoy tuition-dependent institutions with NTAS enrollment reported at 1,123,306 students at private nonprofit and for-profit institutions during Fall 2024 (NSCRC, 2025), it is imperative that the entire higher education sector explore and critically analyze the motivations associated with enrollment and threats to attrition. Discernment of higher education institutions amid the current tide of legislative uncertainties and consequent economic impacts is essential not just to their bottom line, but their longevity and institutional legacy. The timeless edict of meeting "students where they are" is no more resonant than it is now. If institutions wish to capitalize on the cresting wave of NTAS enrollment, they must act now to assess and accommodate current and prospective students to achieve outcomes that are mutually beneficial to the student and the institution. Recognizing the attrition risks accompanying NTAS and the strong relationship of PA and AP demonstrated in this study and how AP influences student success, specifically graduation and employment opportunities, institutions should strongly consider engaging in research revolving around the role of PA modulating dropout risk.

While somewhat rudimentary, the results of the study demonstrate a strong relationship between PA and AP among an underserved and understudied, but considerably sized enrollment demographic within higher education. The results are also in alignment with a bevy of correlational studies with PA and AP as variables focusing on TAS (Trott et al., 2024; Shantakumar et al., 2022; Osipov et al., 2021; Keating et al., 2013). To date, there has been a paucity of literature associating PA and AP among NTAS, not counting overlapping of younger NTAS included in study cohorts as observed in a meta-analysis by Trott and colleagues (2024). It is the hope of the researcher that this study bellwethers a spate of correlational research among NTAS which help formulate evidence-based practices to sustain NTAS thus contributing to greater academic success and improved student outcomes.

Limitations

Despite offering several heuristic contributions to education and physical activity research, the study was characterized by some notable shortcomings. Foremost, a smaller sample size, comprising just 167 subjects, limits generalizability of findings, statistical power and consequently imprecise estimates of population parameters, in spite of the sample size exceeding the minimum threshold established by G*Power analysis with an alpha level of 0.05, a power of 0.80, and a medium effect size of 0.5. Sampling was impacted by institutional recruitment constraints as academic departments within the university and their corresponding schools and colleges no longer facilitate participant recruitment efforts on behalf of undergraduate, graduate, and doctoral students.

Additionally, time associated with recruitment was limited due to logistics associated with the academic calendar and attendant term. Also, greater recruitment of subjects was stymied by participation being limited to qualified undergraduate students at one institution. In subsequent studies, it would behoove researchers to include two or more institutions within a correlational design to enable greater recruitment and the execution of a comparative analysis.

Also, the study was contingent upon self-reporting of both predictor and criterion variables which could potentially endanger accuracy and validity of measures. Concerningly, self-reported surveys are susceptible to be impacted by biases which largely stem from respondents desiring to provide the most socially acceptable response (Brenner & DeLamater, 2016). Overreporting of physical activity participation is quite prevalent in scientific research (Brenner & DeLamater, 2013) and has previously impacted the original IPAQ instrument (Auweele & Rzewnicki, 2003) of the shortened and modified version featured in the current study. Also, respondents, especially ones who may not have an athletic background or engage in regular PA may not be able to delineate between vigorously intense physical activity and moderately intense physical activity. Notably, the construct of the IPAQ permits a lot of leeway among differing PA intensities and walking which may obfuscate respondents and lead to incomplete or erroneous responses.

Furthermore, eligibility criteria related to study participation were not fully accounted for. Inclusion criteria for the study were as follows: aged 25 years or older, a matriculated student in a bachelor's or associate degree program at this specific university, whether full-time or part-time, and enrolled for two consecutive academic terms or more, including the current academic term; however, it did not differentiate between the first or second, or subsequent, undergraduate degree being earned. Some NTAS may be earning a second undergraduate degree. For example, a respondent may be enrolled as a student in the accelerated Bachelor of Science in Nursing (BSN) program at the institution which requires completion of a bachelor's degree prior to admission. In this hypothetical scenario, said

respondent who is enrolled in the accelerated BSN program would warrant a separate NTAS classification than an NTAS who is a first-time undergraduate student or an NTAS undergraduate student who is working towards their first degree.

Lastly, though computationally similar to Pearson's product moment correlation coefficient, Spearman's rho does not furnish descriptive statistics, such as mean, measures of center, variability, and standard deviation since it can only account for ordinal, or ranked, data. Collecting raw data instead of ordinal data would have permitted the execution of a t-test or ANOVA to compare the means of two or multiple groups, respectively. Though data collection was eased to encourage respondent completion and optimize survey experience by eliminating the need for respondents to enter raw numbers associated with their GPA and PA behavior which could contribute to errors, it severely limited the ability to collect more meaningful data that likely would have burnished this investigation and strengthened the foundation for subsequent inquiries. Collection of raw data would have enabled the implementation of a cluster analysis which would have revealed groupings within the data set and visually represented distributions.

CONCLUSIONS

This study has addressed a gap in the research concerning the association of PA and AP of NTAS by reviewing existing literature and performing data analysis affirming a strong relationship between PA and AP. The findings and implications associated with this study bear great significance to subsequent research and eventual practice which is especially critical amid an evolving landscape of legislative changes and economic uncertainties facing the higher education sector. Higher education institutions are primed to capitalize on the increasing demand for academic programs among non-traditional students, including NTAS. Tactful deployment and curation of recruitment and retention measures involving this demographic might mean the difference between flourishing and floundering for institutions in an ambivalent climate. Therefore, it is essential that institutions embrace and refine to their liking any findings that have practical application, such as availing opportunities related to physical activity to non-traditional students.

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