In Theory…

Longitudinal Analysis of the Impact of Students' Participation In Athletics on Academic and Affective Outcomes

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Abstract

This study examines the association between participation in school-sponsored athletics activities during middle and high school years and students' outcomes in academic and affective domains, using the National Educational Longitudinal Study of 1988 (NELS:88). A multilevel growth model over three bi-annual collection time periods was used to determine whether athletics had a positive effect on cognitive (mathematics and reading achievements) and affective (locus of control and self-concept) components of student development. The results indicated students who regularly participated in athletics during all three time periods exhibited a statistically significantly higher growth rate on math achievement, though the effect size was small, than those who did not participate at all. However, for reading and two affective domain variables, locus of control and self-concept, no evidence of positive effects of athletics was found. What we consistently saw was students who participated in sports had higher initial status for all cognitive and affective domain dependent variables, and this pattern occurred almost exactly in the order of the frequency of sports participation (i.e. 3-times > 2-times > 1-time > no participation). Further, this order persisted across all high school years. Implications of the findings, limitations, and future directions of the study are discussed.

Keywords: Multilevel growth model, Athletics, Academic achievement, Social cognitive theory, Self-efficacy in sports

Introduction

A current trend in public schools in the United States is to trim budgets of extracurricular activities to increase the financial support for academics. Administrators are cutting back on the budgets for athletic competitions or removing athletics from their districts all together. This nationwide trend is generally supported, as seen in the following statement made by Gary Sanford, a retired American high school teacher living in Poland, in 2012: "…because you could never definitively determine if school budgets truly allowed for fiscally-sound sports programs without taxing academics through all the administrative hoodwinking, extracurricular sports programs should not be in public schools period…." (Sanford, 2012, para. 2). A focus on academics is a fight we can all support, as only seven percent of eighth-grade students reached the "advanced level" in eighth-grade math achievement according to 2011 Trends in International Mathematics and Science Study data (Rich, 2012).

For decades, the common argument that athletic opportunities keep students in school has been presented by supporters of athletics, but there may be more than truancy support that should be considered. The National Federation of State High

School Associations' mission statement says they provide "leadership for the administration of education-based interscholastic activities, which support academic achievement and good citizenship….and…believe...participation in education-based activity programs promotes student academic achievement, enriches each student's educational experience, and develops good citizenship and healthy lifestyles" (2011).

In the most recent National Collegiate Athletic Association (NCAA) Graduation-Success Rate Report, published in 2012, student-athletes had a 65% college graduation rate, as opposed to the Federal Graduation Rate of 63% (NCAA, 2013). The data support the traditional argument of proponents for athletics. However, there appear to be more benefits than just academic success. According to Daniel Gould, a professor of Applied Sports Psychology at Michigan State University, there are:

> Not only are school sports justified on educational grounds, but researchers have shown that participation in them and other extracurricular activities have positive effects on adolescents. For example, a multiyear study conducted in Michigan has shown that children who participate in sport have increased educational aspirations, closer ties to school and increased occupational aspirations in youth. It has been demonstrated, then, that school sports participation has a number of desirable benefits. (Gould, 2010, para. 2)

Other scholars also stated this, supporting a multitude of advantages, as in the following: athletics participation provides a broad range of attributes that allow students to not only succeed in the classroom but also that will continue to benefit them in their adult lives. Affective traits such as rigor, teamwork, problem solving, self-esteem, and self-efficacy are also improved by participation in athletics (Treasure, Monson, & Lox, 1996).

While athletics are not the only departments that face budget cuts, it is one with the largest impact on student life, both academically and affectively (Edmonds, 1981). Students without an outlet in athletics are at greater risk of dropping out, being disruptive, and failing to strive for post-high school educational opportunities (McMillan & Reed, 2010). One of the greatest benefits gained from participation in athletics is the building of self-concept and an understanding of locus of control, two important components that attribute to high self-efficacy (Bong & Skaalvik, 2003).

Self-efficacy is defined as the strength of one's belief in one's own ability to complete tasks and reach goals. It plays an important role in academic achievement, athletic competition, and everyday life. Building higher self-efficacy can be difficult. Building a history of success, listening to encouragement and setting reasonable goals are some of the ways to build self-efficacy (Bandura, 1997).

Being faced with a dilemma of the decision between putting more resources into academics by sacrificing those used for athletics, evaluating gains and losses coming out of the decision, even though the knowledge may not alter the decision, is useful because we will be aware of the possible consequences that we face in the near future. Therefore, the purposes of the present study are threefold to determine:

1. Does athletic participation positively influence the academic achievement

scores, such as mathematics and reading, of students over time?
2. What is the impact of athletics on internal locus of control?
3. How does participation in athletics impact a student's self-concept over time?

The next section will contain a more detailed explanation of the concepts and variables used in this article.

Literature Review

Self-Efficacy, Self-Concept, and Locus of Control

In 1977, Bandura argued that people are in charge of their own development of their abilities that allow them to set goals and to develop a strong locus of control. Locus of control refers to how much one believes he or she can control events that affect him or her. One's locus can either be conceptualized as either internal, where he or she can control his or her life, or external, where his or her environment or fate controls the decisions he or she makes (Rotter, 1966).

Bandura also stated people who have strong beliefs in themselves, and who view themselves highly, in other words have a high self-concept, will be more likely to accomplish a goal, since they are more likely to apply what they know and use other means at their disposal to do so. Within the construct of Bandura's Social Cognitive Theory, self-efficacy will drive how people decide what they are going to do and how they will do it, more than likely using skills they feel are the strongest they possess. As a consequence, self-efficacy beliefs exercise a powerful influence on the level of accomplishment individuals ultimately realize.

How much self-efficacy people have determines how hard they will work and how much attention they will place on a given task or activity (Schunk, Hanson, & Cox, 1987). When someone has higher self-efficacy, he or she is more apt to be more persistent, give more effort, and not let obstacles stop him or her from completing his or her goals. In addition to these factors, high self-efficacy provides the ability to overcome stressful situations and lower anxiety as student-athletes attempt to complete a task (Pajares & Miller, 1994).

According to Feltz (1988), self-efficacy "can be considered a situationally specific self-confidence" (p. 423). Athletes are conditioned to perform at a high level of competition, both against their opponents and within themselves. This "competitive edge" allows athletes to maintain high levels of self-efficacy while subduing "cognitive and somatic anxiety" (Feltz & Lirgg, 2001, p. 350).

Pajares (1996) indicated higher levels of perceived self-efficacy have been associated with greater choice, persistence, and with more effective strategy use. We hypothesize, then, that athletics could provide an opportunity to increase self-efficacy, which can be seen as transferable to and built upon in the classroom. Athletics could provide an intense magnitude of benefits that would otherwise be lost unless a student participates and persists through multiple years of participation.

In a 1976 article published in the Review of Educational Research, Shavelson, Hubner, and Stanton tried to define the construct of self-concept. They stated:

> In very broad terms, self-concept is a person's perception of himself. . . . We do not claim an entity within a person called "self-concept." Rather, we claim that the construct is potentially important and useful in explaining and predicting how one

> acts. One's perceptions of himself are thought to influence the ways in which he acts, and his acts in turn influence the ways in which he perceives himself. . . .Seven features can be identified as critical to the construct definition. Self-concept may be described as: organized, multifaceted, hierarchical, stable, developmental, evaluative, and differentiable. (Shavelson et al, 1976, p. 411)

Athletics support the development of internal locus of control through the mentorship found in the coach-athlete relationship (Fredrick, 2000). Building an internal locus of control leads to a tremendous amount of affective abilities that carry over to both the classroom and beyond into adulthood (Danish, Petitpas, & Hale, 1993). Taking responsibility for one's actions, not letting opinions of others influence a student's thought pattern, and having the tendency to work hard to achieve goals are just some of the benefits that can be gained through a high level of internal locus of control (Broh, 2002).

Self-efficacy, self-concept, and locus of control are all related in the context of self-learning. The major difference between the three is self-efficacy has a "relatively short history" (Bong & Skaalvik, 2003). Self-efficacy also does not concern itself with individual skills and abilities but rather with how much one believes he or she can do them (Bandura, 1986). When applied to an academic setting, it becomes "more difficult to identify the critical distinction" between self-concept and self-efficacy (Bong & Skaalvik, 2003, p. 7). The assessment of student self-concept as opposed to self-efficacy often differs in the administration of the instrument. Often beyond a Likert-scaled assessment of self-concept and scenario based assessments of self-efficacy, we assert there is no difference in the constructs when it pertains to academia (Pajares, Miller, & Johnson, 1999).

Athletics and Academics

According to the Social Cognitive Theory (SCT), students can learn through a variety of techniques but cannot demonstrate what they have learned until a motivator tells them to do so (Bandura, 1977; 1986). SCT emphasizes social influence and the internal and external effects on individuals. SCT considers social environmental factors, as well as past experiences and how they relate to future actions and expectations and shape how a person will react to similar situations are key factors in the theory. Self-regulation, a goal in SCT, drives individuals to achieve goal-directed behavior, such as making ethical decisions and ensuring they have academic success through goal setting, which is a key component of athletics (Cox, 2007).

Bandura found, through a series of case studies, that modeling is the key to acquiring proper etiquette and behaviors. Students learn in the classroom through the modeling of the instructor, which may be the same way an athlete learns the mechanics of a technique through the modeling of a coach. The value for students to recognize the modeling in both settings can only strengthen the overall benefits found in SCT.

In athletics, the motivator can be external or internal depending on the skill mastery of the athlete and the purpose of what is being learned. An athlete is taught a sport-specific skill through step-by-step demonstration by his or her coach. The skill is then replicated, with either verbal feedback or further demonstration, often called "fine tuning" (Cox, 2007, p. 278) or what we have coined and referred to as "adaptive skill refinement" due to the following reasons.

The athlete adapts a unique style to the skill being demonstrated based on his or her physical and cognitive abilities striving to reach the "mastery" level of said skill. This adaptive skill refinement allows the athlete to master an abundance of skills, no matter his or her sport, rather quickly, as he or she does not have to be "textbook" as long as he or she understands the basic premise of the skill. Adaptive skill refinement does not only apply to athletics, but to academics as well. Athletes learn through demonstration, modeling, and practice, which are also seen in the classroom often called knowledge, understanding, and application in Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). The similarities between academic preparation and athletic competition and preparation, as mentioned before, are staggering. Through modeling, goal setting, and understanding, student-athletes have the opportunity to benefit more than their sedentary peers.

It must be noted that the parallels between basic, innate processes an athlete learns on a daily basis and the academic learning processes that educators strive to have students obtain are not limited to these three. We believe that the only difference between the entire hierarchy in Bloom's Taxonomy and the process of coaching and participating in athletics is the language used.

The processes of setting goals, regulating oneself, and self-efficacy are all keys to applying the SCT if a change in behavior is the desired effect (Schunk, 1990). Setting athletic goals is a practice and process that allows the athlete to change behaviors and outcomes through practice and applied in competition (Locke & Latham, 1990). In sports psychology, three variances of goals, i.e. outcomes, performance, and process goals, are prominent, each serving a unique purpose that culminates in the overall drive for success.

Outcome goals, such as winning a game or placing first in a competition, are overarching goals that are a means to an end. In education, an outcome goal might be graduating from high school or passing a state-mandated test. Performance goals are individual goals of the athlete/student that can be compared to other individuals performing the same task or competing in the same sport. Hitting 20 homeruns during a baseball season would be an example of a performance goal, with scoring in the 90th percentile on a standardized test being its academic counterpart.

The most finite of goals in athletics are process goals. Process goals are usually related to motor skills in athletics such as keeping one's eye on a pitch in softball or keeping one's head off the mat in wrestling. These process goals are the most important goals an athlete can set, because they set the foundation for incremental success that is built upon, leading to improved performance and athletic outcomes (Cox, 2007). Process goals in academics, one would assume, would be set by the instructor. As authorities on the subject matter, they structure the flow and goals of the course so students are given tidbits of information and are then given time to process said information, apply it, and build upon each lecture and activity until a working knowledge of the material is obtained.

Thus, the literature seems to suggest there are quite a lot of similarities between academic and athletic domains.

The values and "life skills" learned through athletic competition can only enhance what is being taught in the classroom through the overlapping and overload of the underlying goals of athletics and academics, which are to enhance the overall life of a student, whether in the cognitive or affective domain.

Methods

The data analyzed in this study are derived from the National Educational Longitudinal Study of 1988 (NELS:88), sponsored by the National Center for Educational Statistics (NCES). The data used in this study come from the three bi-annual collections by the NCES in 1988, 1990, and 1992, when the subjects were eighth, tenth, and twelfth grade students. respectively, attending either middle school or high school. The data contained surveys collected from students, parents, teachers, and school administrators, as well as student test scores for each given year. An oversampling of Hispanic and Asian/Pacific Islanders was performed to ensure a large enough sample size for those subgroups so that the results have acceptable precision (NCES, 1990).

Sampling consisted of two stages, the first being a stratified sample of 1,655 public and private schools from a pool of over 40,000 that contained 8th grade students. Of the 1,655 selected, 1,057 schools participated in the NELS:88. The second stage was a random selection of on average 26 students per school. The total sample in the base year was 24,599 student surveys completed and 23,701 student academic test scores compiled. The parents of these students were asked to complete surveys as well, gathering data about highest level of education, employment status, student activities, and tendencies outside the classroom for various uses throughout the study. Each school administrator was also asked to complete a questionnaire, which led to the compilation of 1,035 surveys.

Study Sample

There were three criteria for selecting the sample for this study. First, since we used the first three waves of data (8th, 10th, and 12th grade student information), we selected students who had valid (i.e. positive) longitudinal sampling weights. Sampling weights, also referred to as the expansion weights, were calculated to "compensate for unequal probabilities of selection into the base year" (NCES, 1990, p. 25) and were provided by NCES.

Second, students needed to have a sports participation record for each wave. When a student did not respond, we coded it as "not participated." Further information on coding of sports participation is provided in the next section, "Independent Variable of Interest."

Third, students needed to have provided information of their gender, race/ethnicity, and socioeconomic status (SES). These criteria reduced the sample size to N = 16,232. The sample was approximately 49.3% male (N = 8009) and 50.7% female (N = 8223) in gender, and in race/ethnicity, there were 68.2% White, non-Hispanic (N = 11,075), 9.9% Black, non-Hispanic (N = 1,600), 12.2% Hispanic (N = 1,987), 5.9% Asian/Pacific Islander (N = 965), and 3.7% from other racial or ethnic category (N = 605).

Note the relative or normalized weights were computed by the expansion weights divided by their average to reflect the actual sample size and were then applied to all the analyses in the present study, including descriptive and multilevel analyses.

Measures

Using the National Education Longitudinal Study (NELS) from 1988 through 1992, variables were selected in order to examine our three research questions. In terms of the roles each variable played in our research questions, we classified them into key independent variable of interest, dependent variables, and covariates for statistical control.

Key independent variable of interest

The key independent variable of interest in the present study was the number of times a student participated in sports activities during middle and high school years (*NSPP*). This variable was the sum of three dummy variables of sports participation at each time point (*dSPBY*, *dSPF1*, and *dSPF2*). The sports participation dummy variable at each time point was created by first dummy coding all activities within the NELS:88 data that corresponded with athletics including both team and individual sports, cheerleading, and intramural athletics at each time point and taking on value one (1) if the student participated in at least one activity and zero (0) if not. Note that missing information was treated as zero (0) (not participated). (See Appendix A for details)

The NSPP variable was treated as a categorical variable in this study because of its potential non-linear association with the dependent variables. Therefore, three dummy variables were created by making zero (0) times participation as the reference category. The composition of each category was as follows: Three (3) Times (*D_SP3TIM*, *n* = 4744, 29.2%), Two (2) Times (*D_SP2TIM*, *n* = 3783, 23.2%), One (1) Time (*D_SP1TIM*, *n* = 4488, 27.6%), and Zero (0) Times (*n* = 3217, 19.8%).

Dependent variables

In this study, we chose two academic achievement variables (i.e., mathematics and reading) from the academic domain and two psychological variables (i.e., locus of control and self-concept) from the affective domain of human functioning, since we hypothesized that both of the domains can be improved by participating in sports, as suggested by the literature. Then, for the academic achievement variables, the IRT theta scores provided by the NELS data file were used as students' test scores. The IRT theta scores were used because they could represent the students' actual growth/change in their proficiency level of the subject over time, since the scores were vertically equated.

For the psychological variables in the affective domains, such as locus of control and self-concept, the NELS data file provided the norm-referenced scale scores normed at each wave. That is, after the composite scores for each variable were computed at each wave, they were standardized so that there was a mean of zero (0) and standard deviation of one (1). As such, these variables' values cannot represent the actual change/growth, but they can represent the change in the relative standings of each student compared to the peers in the same grade.

The locus of control variable was a composite of six items from a student questionnaire with the available responses being "True" and "False." The questions focused on both internal and external locus of control with questions such as "every time I get ahead something stops me" and "I don't have enough control over my life." (See Appendix B for complete list)

Self-concept was also represented as a composite, defined by seven true or false questions, including "I feel good about myself" and "At times I think I am no good at all." (See Appendix C for complete list)

Covariates

Students' background information such as race/ethnicity, gender, and socioeconomic status (SES) was used as the control variables, because these are well-known characteristics that have strong associations with academic achievement, and we anticipated they were also associated with affective domains, such as locus of control and self-concept. Further, since it was anticipated these background variables could influence the sports participation status, we decided to use these as covariates to statistically control these effects.

As for race/ethnicity, since there were five categories in the original race/ethnicity variable, we created a set of four dummy variables representing "Black," "Asian," "Hispanic," and "Other" category by *dBlack*, *dAsian, dHisp*, and *dOther*, which made "White" the reference category. Similarly for gender, a dummy variable *dFemale* representing the "Female" category was created, which made "Male" the reference category. As for SES, we used the base year (i.e. 8^{th} grade) SES, which was a standardized composite score created by family income, parents' education, and parents' occupational status (M=-.043, SD=.80).

By including these covariates in the analysis, we were able to estimate the impacts of sports participation on the dependent variables as more realistic estimates.

Results

Descriptive Statistics

Table 1 represents the number of available cases (*N*), sample means (*M*), standard deviation (*SD*), minimum (*Min.*), and maximum (*Max.*) of math achievement, reading achievement, locus of control, and self-concept at three measurement occasions (8^{th}, 10^{th}, and 12^{th} grades), respectively. The descriptive statistics are presented separately by four groups, which represent the subgroups classified by the number of times of sports participation during middle and high school years.

From Table 1, it can be seen that mean Math IRT Theta scores are higher when sports participation occurs more often. Though all four groups show increasing trends, when sports participation occurred in all three waves, the mean is the highest, ranging from (48.50 to 57.85), whereas those who never participated in sports ranged from (42.63 to 51.20). The rank order is always "3 times participation" being the group with the highest mean, "2 times" second, "1 time" third, and "0 participation" the group with the lowest mean at each time point. Examining the mean Reading IRT Theta scores in Table 1, we see the same pattern as in Math scores; that is, the more times a student participates in sports, the higher his or her achievement would be. Participating in sports in all three time periods leads to reading scores from (48.76) in the first wave to (55.01) in the third as opposed to (44.85 and 51.60) for those who did not participate at any time.

As for the affective domain variables, such as locus of control and self-concept, they also favor sports participation. For example, while the mean of locus of control for not participating in athletics was (-.12, -.08, -.05), respectively, we see that those that were involved at each time point had positive means (.17, .15, .16). In the self-concept variable, much larger differences between group 1 (3-times participated) and group 4 (0-times participated) was observed. That is, when students did not engage in sports at all (group 4), the means were consistently low (-.15, -.14, -.12), but among those who reported participating in all three waves (group 1), they were consistently high (.16, .14, .13).

In Table 2, correlation coefficients among dependent, independent, and control variables are provided. As for four dependent variables (math, reading, locus of control, and self-concept) and the key independent variable (sports participation), the variable represented in the table indicates those variables within each wave (e.g., Math 8th, Math 10th, and Math 12th), so that we can see the nature of associations more precisely in each time point. From Table 2, it can be observed that academic achievement variables are much more highly positively associated with each other (.666-.921) than the affective domain variables (.102-.576), which may indicate the cognitive attributes are more stable over time than the affective attributes. The signs of sports participation with the dependent variables are all positive and statistically significant at any wave, though the sizes are relatively small at about the .1 through .2 level. The negative signs of correlation coefficients seen in Black and Hispanic students with academic achievement variables indicate they are behind compared to White, non-Hispanic reference group students of same grade.

Multi-level modeling

We fitted a multilevel model for growth to the data in three steps in gradually increasing orders of complexity. That is, first, unconditional linear growth model (referred to as "Model A"), in which only level-1 (L-1) predictor is the time variable, "Time" which was coded as "Time" = (0, 2, 4) to represent a passing of time in years for each measurement occasion, 8th, 10th and 12th grade, respectively. Thus, Model A can be written as follows:

L1: $Y_{ti} = \pi_{00} + \pi_{10} + \pi_{10} Time_{ti} + \varepsilon_{ti}, \varepsilon_{ti} \sim N\ (0, \sigma_{\varepsilon}^2)$

L2: $$\pi_{0i} = \beta_{00} + u_{0j},\quad \pi_{1i} = \beta_{10} + u_{1j},\quad \begin{pmatrix} u_{0j} \\ u_{1j} \end{pmatrix} \overset{i.i.d.}{\sim} N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_0^2 & \sigma_{01} \\ \sigma_{01} & \sigma_1^2 \end{pmatrix}\right]$$

where Y_{ti} represents the value of *Y* for student *i* at time *t* and the notation *i.i.d.* attached to both L-1 and L-2 random errors (i.e. ε_{ti} for L-1, $(u_{oi}, u_{1i})^T$ for L-2, respectively) indicates that those errors are assumed to be independent and identically distributed. Because of the coding scheme of *Time*, β_{00} represents the overall mean initial status of the dependent variable *Y* at 8th grade and β_{10} represents the average annual growth (i.e., change) rate.

Second, the conditional growth model with key independent variables, which was referred to as Model B, was fitted. The key independent variable in this study is the number of sports participation time points in middle and high school years (*NSPP*), which takes the value of either 0, 1, 2, or 3. As mentioned before, this variable can be considered as a quantitative variable in general, but in this study, we treated it as a categorical variable, anticipating that there could be non-linear effects. Therefore, a set of three dummy variables (*D_SP1TIM, D_SP2TIM, D_SP3TIM*) that represents one-time sports participation, two-times participation, and three-times participation, respectively were included as the level-2 predictors. Note that this choice of dummy variables made "no participation" the reference group. Thus, the following model was fitted as Model B:

L1: $Y_{ti} = \pi_{00} + \pi_{10} + \pi_{10} Time_{ti} + \varepsilon_{ti},$

L2: $\pi_{0i} = \beta_{00} + \beta_{07} D\_SP3TIM_i + \beta_{08} D\_SP2TIM_i + \beta_{09} D\_SP1TIM_i + u_{0i}$
$\pi_{1i} = \beta_{10} + \beta_{17} D\_SP3TIM_i + \beta_{18} D\_SP2TIM_i + \beta_{19} D\_SP1TIM_i + u_{1i},$

Table 1. ***Descriptive Statistics of Math, Reading, Locus of Control, and Self-Concept Scores over 3 Occasions by 4 Sports Participation Patterns***

	Math			Reading			Locus of Control			Self-Concept		
Number of times participated in sports	8th grade	10th grade	12th grade	8th grade	10th grade	12th grade	8th grade	10th grade	12th grade	8th grade	10th grade	12th grade
3 times (*N*)	(4,611)	(4,667)	(4,170)	(4,608)	(4,665)	(4,165)	(4736)	(4691)	(4620)	(4736)	(4694)	(4622)
M	48.50	54.20	57.85	48.76	52.66	55.01	.17	.15	.16	.16	.14	.13
SD	8.44	9.21	9.90	8.39	9.93	10.55	.56	.59	.62	.61	.65	.68
Min.	25.29	26.50	27.42	24.14	23.27	25.46	-2.45	-2.66	-2.65	-2.91	-2.54	-3.06
Max.	67.23	72.90	80.67	63.49	71.86	77.55	1.28	1.43	1.43	1.23	1.34	1.24
2 times (*N*)	(3,648)	(3,626)	(2,877)	(3,649)	(3,631)	(2,873)	(3758)	(3648)	(3317)	(3760)	(3652)	(3321)
M	46.15	51.44	54.93	47.04	50.67	53.47	.07	.06	.07	.05	.03	.02
SD	8.68	9.81	10.31	8.68	10.25	10.67	.59	.63	.64	.63	.66	.69
Min.	24.36	24.87	28.34	23.96	23.10	24.06	-2.51	-2.66	-3.02	-2.91	-2.95	-3.68
Max.	67.23	72.90	80.67	63.49	71.86	77.55	1.35	1.46	1.43	1.25	1.35	1.23
1 time (*N*)	(4,335)	(4,086)	(3,202)	(4,332)	(4,098)	(3,208)	(4459)	(4159)	(3963)	(4462)	(4154)	(3968)
M	43.75	48.73	52.35	45.47	48.83	51.82	-.04	-.05	-.02	-.03	-.07	-.05
SD	8.41	9.74	10.20	8.50	10.14	10.80	.62	.64	.65	.65	.69	.71
Min.	23.34	26.33	25.84	24.17	22.27	23.75	-2.77	-2.79	-2.74	-2.73	-3.58	-3.68
Max.	67.23	72.90	80.67	63.49	71.86	78.51	1.45	1.46	1.43	1.23	1.35	1.24
0 time (*N*)	(3,068)	(2,886)	(2,292)	(3,075)	(2,901)	(2,300)	(3178)	(2912)	(2850)	(3179)	(2915)	(2852)
M	42.63	47.83	51.20	44.85	48.59	51.61	-.12	-.08	-.05	-.15	-.14	-.11
SD	8.50	9.92	10.32	8.73	10.51	10.88	.63	.63	.65	.67	.70	.71
Min.	23.98	25.51	28.98	23.43	22.61	24.35	-2.51	-2.66	-2.65	-2.91	-2.95	-3.69
Max.	67.23	72.90	80.67	63.49	71.86	77.55	1.52	1.53	1.38	1.23	1.35	1.24
Overall (*N*)	(15,662)	(15,265)	(12,541)	(15,664)	(15,295)	(12,546)	(16131)	(15400)	(14750)	(16137)	(15415)	(14763)
M	45.49	50.88	54.56	46.68	50.39	53.22	.03	.03	.05	.02	.00	.01
SD	8.80	9.96	10.48	8.69	10.31	10.80	.61	.63	.65	.65	.68	.70
Min.	23.34	24.87	25.84	23.43	22.27	23.75	-2.77	-2.79	-3.02	-2.91	-3.58	-3.69
Max.	67.23	72.90	80.67	63.49	71.86	78.51	1.52	1.53	1.43	1.25	1.35	1.24

Table 2. ***Correlation Matrix among Dependent, Independent, and Control Variables***

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1. Math 8th	1																				
2. Math 10th	.883**	1																			
3. Math 12th	.843**	.921**	1																		
4. Reading 8th	.713**	.696**	.667**	1																	
5. Reading 10th	.696**	.757**	.724**	.801**	1																
6. Reading 12th	.666**	.716**	.742**	.745**	.814**	1															
7. Locus 8th	.295**	.298**	.303**	.308**	.305**	.299**	1														
8. Locus 10th	.238**	.271**	.269**	.246**	.284**	.270**	.427**	1													
9. Locus 12th	.246**	.260**	.278**	.252**	.270**	.292**	.373**	.467**	1												
10. Self-Concept 8th	.150**	.155**	.171**	.137**	.140**	.130**	.533**	.327**	.271**	1											
11. Self-Concept 10th	.132**	.153**	.160**	.122**	.147**	.131**	.318**	.574**	.353**	.484**	1										
12. Self-Concept 12th	.126**	.136**	.155**	.102**	.120**	.128**	.264**	.362**	.576**	.388**	.535**	1									
13. Sports Participation 8th	.158**	.150**	.147**	.115**	.104**	.096**	.131**	.089**	.082**	.121**	.081**	.081**	1								
14. Sports Participation 10th	.209**	.201**	.203**	.142**	.125**	.111**	.132**	.124**	.107**	.123**	.131**	.100**	.296**	1							
15. Sports Participation 12th	.212**	.214**	.214**	.137**	.128**	.087**	.140**	.131**	.108**	.141**	.138**	.121**	.265**	.504**	1						
16. Black	-.219**	-.215**	-.218**	-.178**	-.173**	-.187**	.052**	-.020*	-.055**	.081**	.100**	.082**	-.039**	-.044**	-.024**	1					
17. Hispanic	-.187**	-.182**	-.167**	-.169**	-.159**	-.142**	-.088**	-.038**	-.035**	-.028**	-.009	-.003	-.079**	-.077**	-.073**	-.124**	1				
18. Asian/PI	.122**	.128**	.132**	.046**	.059**	.069**	-.023**	-.008	-.014	-.001	-.006	-.018*	.033**	.018	.009	.083**	-.094	1			
19. Other	-.086**	-.085**	-.077**	-.077**	-.077**	-.061**	-.029**	-.015	-.016	-.025**	.011	-.021*	-.009	-.016*	-.022**	-.065**	-.073**	-.049**	1		
20. Female	-.026**	-.031**	-.059**	.096**	.081**	.099**	-.023**	.018*	.058**	-.179**	-.141**	-.121**	-.074**	-.087**	-.144**	.011	.005	-.004	-.008	1	
21. SES	.488**	.492**	.502**	.443**	.445**	.434**	.222**	.177**	.183**	.116**	.089**	.909**	.189**	.245**	.234**	-.175**	-.259**	.076**	-.063**	-.026	1

p < .05* p< .01**, N= 16,232

where β_{00} now represents the average 8th grade initial status of *Y* (dependent variable) for the non-sports participation group and β_{07}, β_{08}, and β_{09} represent the expected difference in initial status for "3-times sport participation," "2-times sports participation," and "1-time sports participation" groups compared to the reference "no participation" group, respectively. Similarly, β_{10} represents the average annual rate of change for the "no-participation" group, and β_{17}, β_{18}, and β_{19} are the expected difference in the rate of change for "3-times sport participation," "2-times sports participation," and "1-time sports participation" groups compared to the reference "no participation" group. Though omitted in the above equations, the same distributional assumptions as Model A were made for the L-1 and L-2 random error terms. Observe, however, that the L-2 variances and covariance (σ_0^2, σ_1^2 , and σ_{01}) are now residual variances and covariance after accounting for the three sports participation dummy variables, which are different from the ones in Model A.

Finally, at the third step, we included demographic background variables such as gender (*dFemale*), race/ethnicity (*dBlack*, *dHisp*, *dAsian*, and *dOther*) and SES (*BYSES*) in the level-2 model for control purposes. Note that the continuous variable SES was grand mean centered and the dummy variables of gender and race/ethnicity were all uncentered. The final model, which adds the above covariates on top of Model B, is referred to as Model C.

The key hypotheses tested to answer the research questions 1-3 stated in the previous sections are: H_o: $\beta_{17} = 0$ vs H_a: $\beta_{17} \neq 0$, H_o: $\beta_{18} = 0$ vs H_a: $\beta_{18} \neq 0$, and H_o: $\beta_{19} = 0$ vs H_a: $\beta_{19} \neq 0$. In other words, these hypotheses test whether any of the rate of change for the sports participated groups was different (we expected "higher") than that for the "non-participated" group after controlling for demographic background covariates. This test can be conducted by a t-test, and it was conducted for each dependent variable, i.e. math, reading, locus of control, and self-concept. The results of Models A, B, and C for each dependent variable are presented in Table 3 - Table 6 and the model-based trajectories for each sports participation group based on the results of Model C are depicted in Fig. 1 - Fig. 4.

Mathematics Achievement (See Table 3 and Figure 1)

Analyzing the data via a multilevel growth model (MLM) allowed us to observe the change of dependent variables of interest in terms of status along with the rate of change, while we controlled for race, gender, and SES. By controlling for these demographic variables, we find that "3-times participated" is a .201 (p<.001) higher rate of change compared to the reference, showing that Math achievement scores not only increased but also increased at a faster rate for students who participated more in athletics than those who did not.

For other sports participation groups, there were no significant differences in slopes compared to the reference group, which had the significant positive slope of 2.097 (p<.001). Note the "3-times participation" group and the "2-times participation" group had a higher initial status (3.21 (p<.001) and 1.578 (p<.001), respectively). This means that even though sports participation groups had initial advantages, the "3-times participation" group increased math achievement scores at a significantly higher rate than the rate for the "non-participation" group.

Race was also found to have an effect both on the initial status and the rate of change. As for the initial status, while Asian had significantly higher initial status (1.608, p<.001) compared to the reference group, other groups had significantly lower initial math scores in the following descending order: Hispanic (-2.636, p<.001), Other (-3.245, p<.001), and Black (-4.907, p<.001). With respect to the rate of growth, Asian again had a significantly higher growth rate (.335, p<.001) compared to White, but other groups did not have statistically significant difference from the slope for White.

Table 3. Results of Multilevel Model Taxonomy for Math Achievement

Model Description			**Model A** Unconditional Linear Growth Model	**Model B** Conditional Growth Model with Key Independent Variables	**Model C** Final Model (Model B and Covariates)
Fixed Effects		Parameter			
Initial Status, π_{0i}	*Intercept*	β_{00}	44.716***	42.404***	44.498***
	BYSES	β_{01}			3.851***
	DBLACK	β_{02}			-4.907***
	DHISP	β_{03}			-2.636***
	DASIAN	β_{04}			1.608***
	DOTHER	β_{05}			-3.245***
	DFEMALE	β_{06}			.436*
	D_SP3TIM	β_{07}		5.549***	3.21***
	D_SP2TIM	β_{08}		3.081***	1.579***
	D_SP1TIM	β_{09}		.696*	.1859
Rate of Change, π_{1i}	*Intercept*	β_{10}	2.069***	1.910***	2.097***
	BYSES	β_{11}			.328***
	DBLACK	β_{12}			-.072
	DHISP	β_{13}			.093
	DASIAN	β_{14}			.335***
	DOTHER	β_{15}			-.121
	DFEMALE	β_{16}			-.156***
	D_SP3TIM	β_{17}		.400***	.201***
	D_SP2TIM	β_{18}		.214***	.077
	D_SP1TIM	β_{19}		.007	-.041
Variance Components		Parameter			
Level 1	Within-person	σ_ε^2	8.109***	8.115***	8.153***
Level 2	Initial status	σ_0^2	67.708***	62.957***	48.290***
	Rate of change	σ_1^2	1.028***	.997***	.912***
Pseudo R^2					
		R_ε^2		.000	-.005
		R_0^2		.075	.287
		R_1^2		.030	.113

~p <.10; * p<.05; **p<.01; *** p<.0

Socio-economic status had positive association with both initial status (3.851, p<.001) and growth rate (.328, p<.001), as did gender, which showed a higher initial status for females (.436, p<.05) but a lower growth rate (-.156, p<.001) than for males.

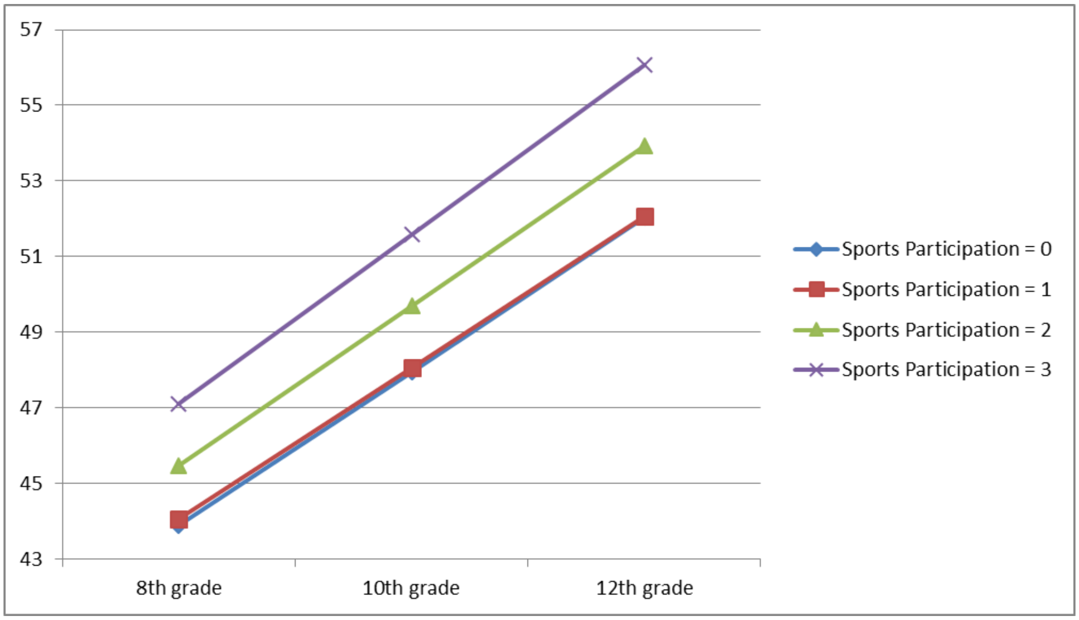

Figure 1. Math Achievement Model-Based Trajectories by # of Sports Participation

Reading Achievement (See Table 4 and Figure 2)

The multilevel model analysis for reading achievement did not lead to a significant difference in slopes compared to the reference group, which had a significant positive slope of 1.490 (p<.001). This may be interesting in that the results indicated the differential effects of sports participation on distinct subjects. Note that the "3-times participation" group did have a statistically significant higher initial status .445 (p<.001) compared to the reference "zero participation" group, but other groups did not.

Race was again found to have an effect on both the initial status and the rate of change. Asian (.395, p<.001) showed a significantly higher growth rate when compared to White, while Black (-.279, p<.01) showed a significantly lower growth rate compared to the reference White group. When compared to the reference White group, all groups had lower initial reading status in the following descending order: Asian (-.807, p<.05), Other (-2.085, p<.001), Hispanic (-2.424, p<.001), and Black (-3.931, p<.001), which indicated White had the highest initial reading scores on average.

Both socioeconomic status (3.933, p<.001) and female (2.085, p<.001) exhibited statistically significant positive coefficients on the initial statuses, showing females and students with higher SES scores would begin with academic advantages in reading. The growth rates were also significant as shown by SES (.257, p<.001) and gender (*dFemale*) slopes on the rate of change (.111, p<.05), establishing that females with higher SES started at a higher initial status, and they also make a progress at a higher rate in reading achievement.

Table 4. Results of Multilevel Model Taxonomy for Reading Achievement

Model Description			**Model A** Unconditional Linear Growth Model	**Model B** Conditional Growth Model with Key Independent Variables	**Model C** Final Model (Model B and Covariates)
Fixed Effects		Parameter			
Initial Status, π_{0i}	*Intercept*	β_{00}	46.059***	44.651***	45.724***
	BYSES	β_{01}			3.933***
	DBLACK	β_{02}			-3.931***
	DHISP	β_{03}			-2.424***
	DASIAN	β_{04}			-.807*
	DOTHER	β_{05}			-2.085***
	DFEMALE	β_{06}			2.085***
	D_SP3TIM	β_{07}		3.583***	.445***
	D_SP2TIM	β_{08}		1.768***	1.57
	D_SP1TIM	β_{09}		.319***	-.147
Rate of Change, π_{1i}	*Intercept*	β_{10}	1.442***	1.454***	1.490***
	BYSES	β_{11}			.257***
	DBLACK	β_{12}			-.279**
	DHISP	β_{13}			.062
	DASIAN	β_{14}			.395***
	DOTHER	β_{15}			-.117
	DFEMALE	β_{16}			.111*
	D_SP3TIM	β_{17}		.019	.-.099
	D_SP2TIM	β_{18}		.022	-.056
	D_SP1TIM	β_{19}		-.077	-.098
Variance Components		Parameter			
Level 1	Within-person	σ_ε^2	17.975***	17.963***	17.993***
Level 2	Initial status	σ_0^2	61.167***	59.169***	44.919***
	Rate of change	σ_1^2	.970***	.991***	.903***
Pseudo R^2					
		R_ε^2		.001	-.001
		R_0^2		.033	.266
		R_1^2		-.022	.069

~p <.10; * p<.05; **p<.01; *** p<.001

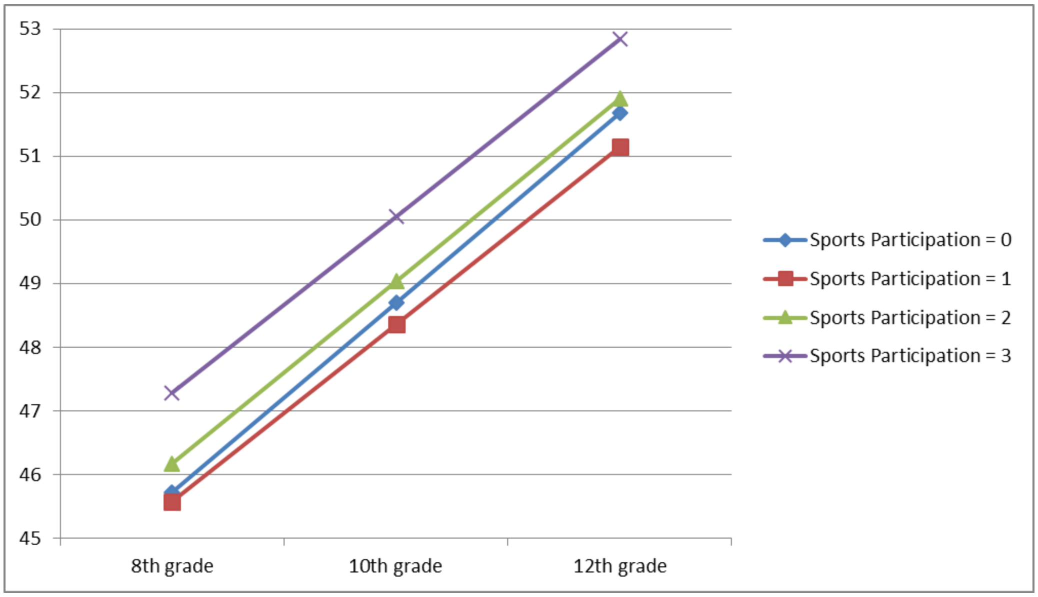

Figure 2. Reading Achievement Model-Based Trajectories by # of Sports Participation

Locus of Control (See Table 5 and Figure 3)

Multilevel modeling analysis led to significantly higher initial statuses for “3-times participation” (.216, p<.001) and “2-times participation” (.149, p<.001), but no significant differences in growth rate were observed in the students’ locus of control. Looking at covariates, we find that the growth rate for Hispanic (.028, p<.001), Other (.032, p<.01), and female (.033, p<.001) are statistically significantly higher than the reference group, White. On the other hand, initial statuses for these minority racial/ethnic groups were significantly lower than White in the following descending order: Hispanic (-.07, p<.001), Black (-.062, p<.05), Asian (-.086, p<.01), and Other (-.116, p<.001).

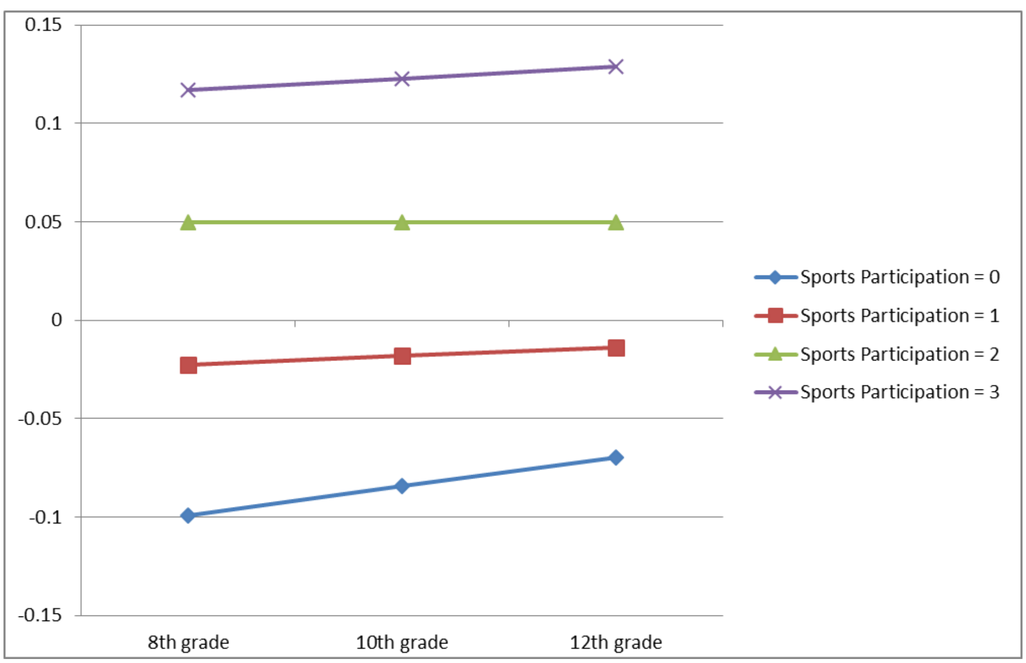

Figure 3. Locus of Control Model-Based Trajectories by # of Sports Participation

Table 5. Results of Multilevel Model Taxonomy for Locus of Control

Model Description			**Model A** Unconditional Linear Growth Model	**Model B** Conditional Growth Model with Key Independent Variables	**Model C** Final Model (Model B and Covariates)
Fixed Effects		Parameter			
Initial Status, π_{0i}	*Intercept*	β_{00}	.006	-.142***	-.072***
	BYSES	β_{01}			.123***
	DBLACK	β_{02}			-.062*
	DHISP	β_{03}			-0.07***
	DASIAN	β_{04}			-.086**
	DOTHER	β_{05}			-.116***
	DFEMALE	β_{06}			-.005
	D_SP3TIM	β_{07}		.290***	.216***
	D_SP2TIM	β_{08}		.199***	.149***
	D_SP1TIM	β_{09}		.096***	.07
Rate of Change, π_{1i}	*Intercept*	β_{10}	.003	.012*	-.015*
	BYSES	β_{11}			-.001
	DBLACK	β_{12}			.008
	DHISP	β_{13}			.028***
	DASIAN	β_{14}			.005
	DOTHER	β_{15}			.032**
	DFEMALE	β_{16}			.033***
	D_SP3TIM	β_{17}		-.014*	-.004
	D_SP2TIM	β_{18}		-.013~	-.007
	D_SP1TIM	β_{19}		-.007	-.005
Variance Components		Parameter			
Level 1	Within-person	σ_ε^2	.215***	.215***	.215***
Level 2	Initial status	σ_0^2	.171***	.159***	.148***
	Rate of change	σ_1^2	.005***	.005***	.004***
Pseudo R^2					
		R_ε^2		.000	.000
		R_0^2		.070	.135
		R_1^2		.000	.200

~p <.10; * p<.05; **p<.01; *** p<.001

Self-Concept (See Table 6 and Figure 4)

The results of the multilevel modeling analysis for self-concept showed sports participation did not affect the growth rate in students, which was the same result as the locus of control variable. However, the initial statuses of “3-times participation” (.233, p<.001) and “2-times participation” (.145, p<.001) were statistically significantly higher than that of the reference “zero participation” group. We also found Black (.242, p<.001), and female (-.197, p<.001) had significantly higher initial statuses than the reference White and male groups, respectively. Also, socioeconomic status (SES) had a positive statistically significant coefficient (.75, p<.001), which indicated the higher the SES, the higher the self-concept in the initial status. Finally, we also found that growth rate was statistically significantly higher for females compared to males (.018, p<.001).

Table 6. Results of Multilevel Model Taxonomy for Self-Concept

Model Description			**Model A** Unconditional Linear Growth Model	**Model B** Conditional Growth Model with Key Independent Variables	**Model C** Final Model (Model B and Covariates)
Fixed Effects		Parameter			
Initial Status, π_{0i}	*Intercept*	β_{00}	.008	-.157***	-.050**
	BYSES	β_{01}			0.75***
	DBLACK	β_{02}			.242***
	DHISP	β_{03}			.017
	DASIAN	β_{04}			.009
	DOTHER	β_{05}			-.040
	DFEMALE	β_{06}			-.197***
	D_SP3TIM	β_{07}		.300***	.233***
	D_SP2TIM	β_{08}		.196***	.145***
	D_SP1TIM	β_{09}		.144***	.121
Rate of Change, π_{1i}	*Intercept*	β_{10}	-.001	.009~	-.005
	BYSES	β_{11}			-.002
	DBLACK	β_{12}			.002
	DHISP	β_{13}			.018*
	DASIAN	β_{14}			-.012
	DOTHER	β_{15}			-.121
	DFEMALE	β_{16}			.018***
	D_SP3TIM	β_{17}		-.014**	-.008
	D_SP2TIM	β_{18}		-.014~	-.010
	D_SP1TIM	β_{19}		-.011	-.010
Variance Components		Parameter			
Level 1	Within-person	σ_ε^2	.207***	.207***	.207***
Level 2	Initial status	σ_0^2	.221***	.210***	.192***
	Rate of change	σ_1^2	.009***	.009***	.009***
Pseudo R^2					
		R_ε^2		.000	.000
		R_0^2		.050	.131
		R_1^2		.000	.000

~p <.10; * p<.05; **p<.01; *** p<.001

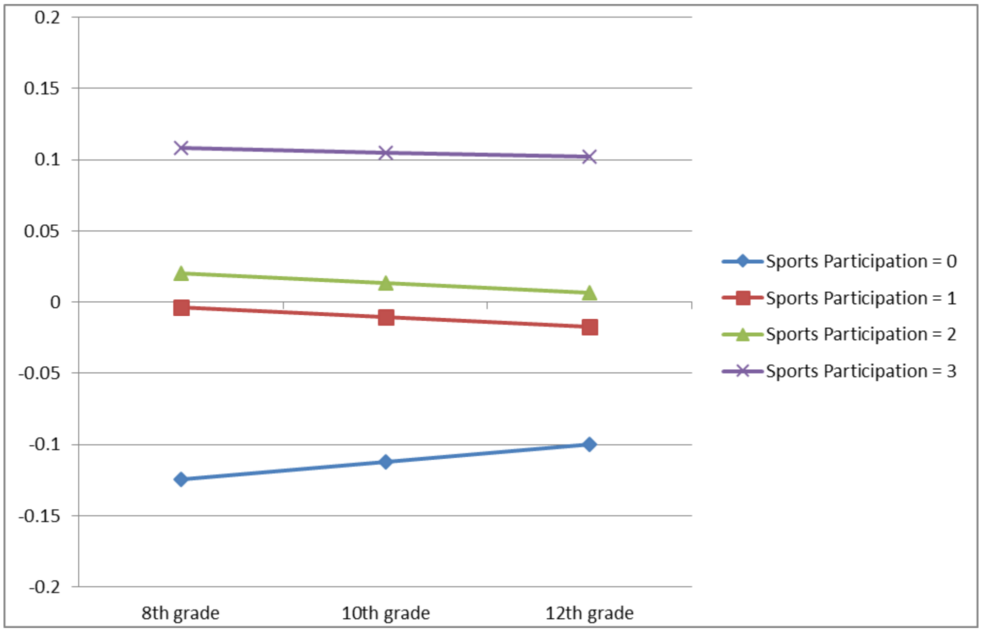

Figure 4. Self-Concept Model-Based Trajectories by # of Sports Participation

Discussion, Limitations, & Future Directions

When looking at sports participation across time, we see students who continue to have participated had a statistically significantly higher increase in math achievement than those who did not. This is particularly true for students who participated in sports for all middle and high school years. Also, in general, there was a tendency that the longer students participate in athletics, the larger the academic gain, although the gains were not statistically significant. In contrast, this statistically significant positive effect was not seen in reading or in the affective domain variables such as locus of control and self-concept. As mentioned, it is interesting to see there could be differential effects of sports participation on different academic subjects. As for the affective domain dependent variables, it was surprising to see there were no positive effects of sports participation on the development of affective domains such as locus of control and self-concept. This finding was surprising because there are theoretical reasons to believe that participating in sports activities increases the affective domain competency such as the locus of control and self-concept (Treasure, Monson, & Lox, 1996; Edmonds, 1981).

When we make a closer examination of the statistically significant positive effect of sports participation on math achievement, the practical significance of this effect seems to be minimal, considering that the estimated effect was .201, and the approximate pooled standard deviation (SD) of math achievement was about 9.72, which can be obtained as a weighted average of three SDs at each wave, as shown in Table 1. This value indicates if two students with similar backgrounds (e.g., gender, race, and SES) started 8^{th} grade with the same level of math achievement, one participated in athletics for all years up to 12^{th} grade and another did not participate in sports at all, the expected average gain of full sports participation is .804 in four years (.201 x 4) on average, which is less than one-tenth of the pooled standard deviation. This is a rather small effect size according to the Cohen's rule of thumb. Thus, as the conclusion for the posited research questions in this study, we conclude there was not enough evidence to support the notion that participating in sports during middle to high school years increases academic achievements and positive effects on students themselves. Though we found a small gain in mathematics achievement, it is probably not a substantively important effect.

Though it was not the main objective of this paper, an interesting pattern came out as the byproduct of our analyses. That is, students who participated in sports had higher initial status (measured at 8th grade) for all cognitive and affective domain dependent variables, and this happened almost exactly in the order of the frequency of sports participation (i.e., 3-times > 2-times > 1-time > no participation), except for the 1-time participation group in reading achievement compared to the no participation group, and this pattern persisted across all high school years (see Table 1). This association between continued participation and higher initial status may be reflective of the level of engagement in school activities. If this is the case, one possible explanation we can make for the results of the initial status differences is students who were more actively engaged in school activities, including athletics, may have possessed a personality trait that leads to the success of the student. That is, whether it is to be classified as motivation, perseverance, or persistence, students who engaged in school activities for longer durations may have had an inherent trait that was partly quantified through the creation of the sports participation variables. This conjecture is just one of many alternate explanations on the initial status differences by the frequency of sports participation; however, these traits were neither measured directly nor indirectly in the NELS:88 study, which was a limitation of the present study. As for expanding the interpretation of the sports participation as an indicator of broader concept of the level of students' engagement on school-sponsored activities, if we wanted to examine the independent effects of participating sports activities, we could have included and controlled for other extracurricular activities (e.g., academic clubs, band, chorus) to see if it was truly athletics or extracurricular activities as a whole that led to the results. Such information could be useful, since it helps us understand the nature of the impact different types of extracurricular activities may have on students' cognitive and affective outcomes.

Another limitation of this study was the missing data on sports participation variables. In order to keep the sample size as large as possible, we assigned the students to the non-participant categories if they did not respond to any of the sports participation items (see Appendix A) at each wave. Though this judgment may be justified and the missing proportion is relatively small (about 6 -8 % missing), it may have slightly skewed the results.

Third, the reason we did not see any differences on the affective domain variables may have been that it was too early to observe the effects of sports participation on those psychological variables. The effects may appear in their later lives, such as becoming more successful in their jobs and becoming better citizens, where increased locus of control and self-concept are the driving forces of the successes.

Finally, readers are warned to exercise caution when interpreting the results, especially the ones for the model that predicted the initial status at 8th grade. In this study, students' frequency of participating in sports activities in middle and high school years was used for predicting the differences in the initial status. Some readers may have recognized that interpreting this part of the results as causal inference does not make sense since, strictly speaking, the frequency of sports participation variables include the entire duration of the studied years. Clearly, we cannot state the participation in sports in high school caused the increase in the initial status. One possibility, which may or may not be viable, of interpreting this variable as a predictor of initial status is that it represents the students' average tendency of frequency of participating in sports in high school years that come later. This could also be interpreted as a proxy of the students' general disposition of persistence or perseverance. If either one of these is a viable interpretation, then the way the sports participation variables were used in the model may be justified. However, this may be quite a stretch of the interpretation. For this reason, the interpretation of this part of the results should be considered carefully. There was a significant amount of variability in the dependent variable that already existed at the initial 8th grade measurement occasion, and some portion of the variability could be explained if we look at the fact retrospectively. If we really want to understand what caused the initial difference, we need information on variables such as persistence, perseverance, and motivation mentioned above that were measured at 8th grade or before, in addition to the background factors such as SES, gender, and race/ethnicity variables for which we already controlled.

Though there are several limitations, the present study sheds light on the nature of the short-term impacts of sports participation on students' cognitive and affective development, which were evaluated within the time frame of middle and high school years.

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Appendix A: Items Used for Constructing Sports Participation Dummy Variables (*dSPBY*, *dSPF1*, *dSPF2*) at Each Time Point

dSPBY	*dSPF1*	*dSPF2*
BYS82B: Varsity Team Sports	*F1S41AB*: Basketball	*F2S30AA*: Varsity Team Sport
BYS82C: Intramural Sports	*F1S41AC*: Football	*F2S30AB*: Individual Sport
BYS82D: Cheerleading	*F1S41AA*: Baseball/Softball	*F2S30AC*: Cheerleading
BYS83F: Non-School Sport	*F1S41AD*: Soccer	*F2S30BJ*: Intramural Team
	F1S41AE: Swim Team	*F2S30BK*: Intramural Individual
	F1S41AF: Other Team	
	F1S41AG: Individual Sport	
	F1S41AH: Cheerleading	
	F1S41AI: Drill Team	

Note. BY, F1, and F2 as the prefix for each variable indicate that it is measured as Base Year (BY), First Follow-up (F1), and Second Follow-up (F2), respectively, and each item variable name appearing in the table is the variable name appearing in the original NELS:88 data file.

Appendix B: Locus of Control (*BYLOCUS2*, *F1LOCUS2*, *F2LOCUS2*) Composite Items

8th Grade Locus of Control, (*BYLOCUS2*, 6 items)	10th Grade Locus of Control, (*F1LOCUS2*, 6 items)	12th Grade Locus of Control, (*F2LOCUS2*, 6 items)
BYS44B: I don't have enough control over the direction my life is taking.	*F1S62B*: I don't have enough control over the direction my life is taking.	*F2S66B*: I don't have enough control over the direction my life is taking.
BYS44C: In my life, good luck is more important than hard work for success.	*F1S62C*: In my life, good luck is more important than hard work for success.	*F2S66C*: In my life, good luck is more important than hard work for success.
BYS44F: Every time I try to get ahead, something or somebody stops me.	*F1S62F*: Every time I try to get ahead, something or somebody stops me.	*F2S66F*: Every time I try to get ahead, something or somebody stops me.
BYS44G: My plans hardly ever work out, so planning only makes me unhappy.	*F1S62G*: My plans hardly ever work out, so planning only makes me unhappy.	*F2S66G*: My plans hardly ever work out, so planning only makes me unhappy.
BYS44K: When I make plans, I am almost certain I can make them work.	*F1S62K*: When I make plans, I am almost certain I can make them work.	*F2S66K*: When I make plans, I am almost certain I can make them work.
BYS44M: Chance and luck are very important for what happens in my life.	*F1S62M*: Chance and luck are very important for what happens in my life.	*F2S66M*: Chance and luck are very important for what happens in my life.

Note. BY, F1, and F2 as the prefix for each variable indicate that it is measured as Base Year (BY), First Follow-up (F1), and Second Follow-up (F2), respectively, and each item variable name appearing in the table is the variable name appearing in the original NELS:88 data file.

Appendix C: Self-Concept (*BYCNCPT2*, *F1CNCPT2*, *F2CNCPT2*) Composite Items

8th Grade Self-Concept, (*BYCNCPT2*, 7 items)	10th Grade Self-Concept, (*F1CNCPT2*, 6 items)	12th Grade Self-Concept, (*F2CNCPT2*, 6 items)
BYS44A: I feel good about myself.	*F1S62D*: I feel I am a person of worth, the equal of other people.	*F2S66D*: I feel I am a person of worth, the equal of other people.
BYS44D: I feel I am a person of worth, the equal of other People.	*F1S62E*: I am able to do things as well as most other people.	*F2S66E*: I am able to do things as well as most other people.
BYS44E: I am able to do things as well as most other people.	*F1S62H*: On the whole, I am satisfied with myself.	*F2S66H*: On the whole, I am satisfied with myself.
BYS44H: On the whole, I am satisfied with myself.	*F1S62I*: I feel useless at times.	*F2S66I*: I feel useless at times.
BYS44I: I certainly feel useless at times.	*F1S62J*: At times, I think I am no good at all.	*F2S66J*: At times I think I am no good at all.
BYS44J: At times I think I am no good at all.	*F1S62L*: I feel I do not have much to be proud of.	*F2S66L*: I feel I do not have much to be proud of.
BYS44L: I feel I do not have much to be proud of.		

Note. BY, F1, and F2 as the prefix for each variable indicate that it is measured as Base Year (BY), First Follow-up (F1), and Second Follow-up (F2), respectively, and each item variable name appearing in the table is the variable name appearing in the original NELS:88 data file.