

The effect of sports activities and self-esteem on school performance: a probabilistic analysis

Abstract:

In the international literature, discussion of the impact of sports activities is mainly focused on improvements in quality of life, particularly in terms of health. However, sports can have other positive effects on individuals that may contribute to improving their academic performance. This study explores the effect of sports activities and self-esteem on the academic performance of high school students in central-southern Chile, a topic on which there is currently no evidence.

A linear cross-sectional regression and probit methods are used to determine the probability of achieving good school performance. However, because there may be selection bias, a Heckman model is estimated in two stages. Individual, academic, family and socioeconomic factors are taken into consideration. This was done with data obtained from a survey applied to 2,010 high school students.

The results provide evidence of the positive impact of sports activities and self-esteem on school performance. However, the effect on academic results increases at diminishing rates. That is, engaging in sports contributes positively (0.24 to 0.05%), but spending too much time engaging in sports negatively affects school performance (0.89 to 0.1%). While negative self-esteem influences from - 5.8% to -2.9%.

Therefore, high school students who engage in sports activities and positive self-esteem have better academic performance. Thus, given the implementation of a government policy to increase the hours of physical education, improvement in academic results could be expected.

Keywords: School performance, sports, physical activity, self-esteem, academic achievement

Introduction

Discussion of the impact of sports activities on people is broad and practicing sports is mainly associated with improvements in quality of life, especially health. In schools, the importance of physical education and extracurricular activities is sometimes overlooked in favor of more conceptual subjects that have a direct effect on university entrance exam results. This is despite the fact that the international literature indicates that physical education is important to student performance (Van der Niet et al., 2014; Grissom, 2005; Trudeau & Shepard, 1998).

In fact, there is a belief that "a sound body equals a sound mind" and that physical activity can support skills development among children (Snyder & Spreitzer, 1977). However, although parents accept that physical education and sports activities have a place in child development, they do not want sports to interfere with academic activities in the curriculum, based on the belief that such activities will lead to better academic results.

Worldwide, there is growing concern about the effects of little physical activity or participation in sports. National organizations responsible for protecting public health are alarmed by the impacts of minimal physical activity and the social consequences in terms of physical well-being (Ramirez et al., 2004). It is widely recognized that physical education, sports and other types of physical activity provide numerous benefits for young people and adults. Other studies have shown that the benefits vary widely and can affect areas such as development; physical, social, and

emotional wellbeing; and cognitive and academic achievement. Other benefits and results are classified in terms of youth child and development: physical, lifestyle, emotional, social and cognitive (Hastie, 1998; Hastie & Sharpe, 1999).

Some researchers have also suggested that physical activity, physical education and sports not only improve physical development and health but can also strengthen academic performance. This is because physical activities and sports increase the flow of blood to the brain, increasing alertness and oxytocin secretion levels and improving self-esteem (Hill, 1998; Shephard, 1997). Other authors mention that physical activity has a positive influence on concentration, memory and classroom behavior, showing a positive relationship between physical activity and intellectual performance (Trudeau & Shepard, 1998; Grissom, 2005). However, other studies have found only an insignificant association between physical activity and cognitive skills or have concluded that the relationship between physical activity and academic achievement has not been demonstrated (Rasberry et al., 2011; Thomas et al., 1994).

Additionally, psychological studies have recognized that good self-esteem as a means to achieve other important personal results. Therefore, it is considered that self-esteem and self-concept have direct and indirect effects on academic outcomes (Huang, 2011; Marsh and Martin, 2011; Lane et al, 2004.). Note that there are studies that indicate that the effect of self-esteem on school performance depends on how you measure it (Valentine et al., 2004). Therefore, it is important to consider the effect of this factor on academic performance.

Overall, considering the effects indicated in the literature, sports could also be expected to contribute to academic performance, without overlooking the fact that

academic performance is determined by diverse factors such as parental characteristics, the teacher-student relationship, the school, infrastructure, socioeconomic strata, and individual student characteristics, among others (Mizala, 1999; Toconi, 2010; Vélez, 1993). Therefore, in this research the effect that sports activities could have on school performance is studied, considering some of the traditional variables that explain academic results (grades).

Studying the effects of sports and physical education in Chile is important. In Chile, it is important to study the effects of sports and physical education, as results from the physical education component of the Education Quality Measurement System (*Sistema de Medición de la Calidad de la Educación*, known as SIMCE) have shown high levels of obesity (18%) and overweight (16%) among students. Moreover, 92% of eighth-grade students do not reach the cut-off point established for being in satisfactory physical condition, based on measurements of muscular strength, resistance, flexibility, aerobic capacity, and body mass index (BMI) among 13,585 students. This is cause for concern not only because of the high levels of obesity found on the SIMCE test, but also because of the impact that students' poor physical condition could have on other related dimensions or costs.

In Chile, there is little evidence concerning how sports and self-esteem affect school performance. Therefore, the objective of this study is to analyze the impact of sports activities and self-esteem on the academic performance of high school students. The school performance variable considered is grades. It is a dichotomous variable if the grade is excellent-good or average-poor, which has been widely used in the literature as a proxy variable (Toconi, 2010). Following the literature, the study includes

variables associated with the student, family, and school that contribute to determining academic performance (Mizala, 1999; Toconi, 2010; Vélez, 1993; Treviño, 2003). A self-esteem indicator is constructed based on a series of questions taken from the Rosenberg scale. The data used are from a survey applied in 2010 to high school students in central-southern Chile.

Material and methods

To determine the effect of sports activities and self-esteem on school performance, linear regression models of the probability of achieving "good" academic results were estimated. In addition, Heckman's estimation model in two stages was used, Heckman (1979), including assessments of self-perception, school attendance, bad habits, a proxy for physical skills, and socio-demographic variables. This was done with data obtained from a survey applied to 2,010 high school students attending 13 schools (public, private subsidized and fully private) in central-southern Chile in November 2012. The descriptive statistics of the survey are presented in Table 1.

The survey sought to capture information about the school, family, and student. Specifically, the students were asked about whether they liked sports, their self-esteem and their performance. The Rosenberg scale, which is the most widely used in the literature, was used to measure self-esteem (Rosenberg, 1989). The score was based on responses related to the level of agreement of how valuable, important, and useful the students considered themselves, as well as the level of agreement about their own qualities, skills, pride, attitude, satisfaction, and respect. In terms of performance, two variables were considered: the student's grade point average and the dummy variable of perception of academic performance (1: good and 0: poor).

With the dependent variable of the grade point average, we proceeded to estimate simple linear regression models through ordinary least squares, considering as explanatory variables those associated with the school (type), family (educational level, parents' years of schooling and employment, type of dwelling, number of household members, whether the parents and siblings engage in sports, etc.), and the student (age, gender, time spent studying and playing sports, types of sports, satisfaction with the educational establishment, self-perception, and self-esteem, among others).

Because of a potential selection bias in the sample, we chose to carry out the estimation using the Heckman method in two stages. The model's specification consists of two equations: the equation we are trying to estimate (academic performance) and a selection equation (auxiliary regression) that corresponds to a discrete selection (probit) model that measures the probability of being in the sample. It should be noted that the auxiliary regression has in common continuous variables that are determinants of academic performance, in order to prevent identification problems.

Specifically, in the first stage the auxiliary regression is estimated using maximum plausibility to obtain the probability that a student engages in sports or not. What is important is that we estimate the inverse of the Mills ratio, which represents the probability of being in the sample over the probability of not being in it, thus:

$$\hat{\lambda}_i = \lambda(z_i' \hat{\gamma}) = \frac{\varphi(z_i' \hat{\gamma})}{1 - \varphi(z_i' \hat{\gamma})}$$

In the second stage, ordinary least squares is used to estimate a model in which grades are the dependent variable and among its regressors is the inverse Mills ratio, that is, the equation of interest. This model is represented as follows:

$$y_{1i} = x_i' \beta + \sigma_{12} \hat{\lambda}_i + v_i$$

It should be noted that a selection bias test is carried out, the null hypothesis of which is that the Mills ratio is not significant; that is, there is no bias. If the null is rejected, this would imply that the classical OLS estimation is more appropriate.

In addition, a probit model was used to determine the probability that a student's academic performance is good. To do this, the aforementioned regressor variables in the simple linear regression model were included and academic performance was established as the dependent variable. The value of this variable was one if the student had a grade point average equal to or higher than 5.5, and zero if the student's grade point average was below this threshold. This value was defined to match the Chilean Ministry of Education's value for identifying a grade as "good."

Results and discussion

The literature recognizes a series of benefits derived from sports activities (Trudeau & Shepard, 2008; Hastie and Sharpe, 1999; Bailey et al., 2009, Evenson et al., 2009). For example, sports have been shown to improve self-esteem, health, socialization, concentration, grades, and the ability to make friends. Therefore, in this study those aspects were considered. In terms of empirical evidence, the interviewees were asked about their perception of these aspects. The data indicate that high school students believe that sports improve or aid health (80.2%), self-esteem (63.7%) and socializing (52.1%) (Table 2). However, for the students it is not so clear that sports help improve grades and concentration, as only 22.5 and 21.9% of the students, respectively, agree strongly that playing sports benefits those aspects.

It was found that on average the students have good self-esteem, with an average sample value on the Rosenberg scale of 26.8 points, which falls within the interval of normal self-esteem (20-33 points). The aspects most highly valued by the high school students are feeling that "I am capable of doing things as well as others" and that "I am a valuable person, at least in comparison to others" (Table 3).

In addition, the simple linear regression model indicates that engaging in sports activities apart from physical education at school positively influences grades in high school (0.4%), but at a diminishing rate (-0.9%). That is, spending time playing sports improves academic performance, but as the hours spent on sports increase, the increase in benefits in terms of grades decreases. This is because the estimated parameter associated with the variable had a positive sign, but its square has a negative sign.

The results above are validated in the simple linear regression, in the two-stage Mincer estimated model, and in the probit model for obtaining good academic performance. Nevertheless, as shown in Table 4, the selection bias test indicates that there is no bias in the estimation. Therefore, the appropriate model for assessing the influence of sports on grades is the ordinary least squares estimation (1), and the appropriate model for assessing the probability of achieving good academic performance is the probit model (3).

The models results indicates that engaging in sports activities apart from physical education at school positively influences grades in high school (0.5%), but at a diminishing rate (-1%).

Also, the variables associated with whether the student's mother or sibling play sports also have a positive influence, but the assessment of sports skills has a negative influence. In other words, the stronger the student's belief that he or she is good at sports, the lower their grades. This could be explained by the fact that if a student considers herself to be good at physical activities but not academic ones, she may dedicate more time to sports and reduce hours spent studying. In other words, she may spend more time on the activity for which she believes she has better skills.

Other important determinants that have a positive influence on academic performance as measured with grades are age, attending a subsidized private school, having positive self-esteem, number of cars in the household (income proxy) and hours spent studying (Table 4). Meanwhile, grades are negatively affected by low self-esteem, poor class attendance, and drug use. The influence of negative self-esteem on school performance is also verified with an impact of -5.8%.

Thus, physical education, promotion of school sports and self-esteem are not only important from a health perspective, but also because of their influence on academic performance. This is the basis of the importance of schools considering this aspect not merely as an activity aimed at improving student health but also as a determining factor of student academic and personal development. Therefore, sports should be encouraged both inside and outside educational establishments. Schools should also promote self-esteem, not only for its intrinsic value in terms of emotional health but also because of its importance in explaining the academic performance of high school students.

In addition, considering the results of this study, the increase in the number of hours of physical education (from three to four hours per week) implemented by the Ministry of Education in 2013 will have indirect effects on academic performance, although the aim of the policy change was to improve the health of the country's students. Also, because it is only a one-hour increase, it is likely to generate only positive effects, since dedicating many hours to sports can also have a negative influence on performance (given the negative sign of the parameter associated with the squared sports variable).

Although the findings provide evidence of the statistical significance of sports as a determinant of grades, the results should be approached with caution. This is because the impact is small and the predictive capacity of the models is relatively low, which may be due to the omission of important variables such as household income. That variable could not be directly considered because the survey was applied to children and youth, who are generally unaware of their household income. Therefore, the number of cars in the household and the type of dwelling (owned or rented) were used as a proxy for income, but while the first datum is significant, the second one is not.

Conclusions

The main descriptive findings provide evidence that students recognize that playing sports, self-esteem and engaging in physical activity generate benefits related to health and socialization. According to the estimations, the variables related to bad habits (drug use), low self-esteem, and class absences negatively influence school performance. Meanwhile, age, attending a subsidized private school, having positive self-esteem, number of cars in the household, and number of hours spent studying have a positive influence.

What is most important, given the objective of this study, is that the estimations indicate a positive relationship between academic performance, self-esteem and sports activities. However, while spending time engaging in sports improves academic performance, as the hours spent on sports increase, the increase in benefits in terms of grades diminishes. With that, it may be expected that the national policy to increase physical education hours in schools will lead to an improvement in academic results in high school.

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Tables

Table 1 - Descriptive Statistic

Variable	Obs.		Mean	Std. Dev.	Min.	Max.
Age	2010	16.67	1.06	14	21	2010
Gender	2010	0.45	0.50	0	1	2010
Type of school ^a	2010	1.79	0.67	1	3	2010
Siblings	2010	1.94	1.29	0	6	2010
Cars	2010	1.09	1.05	0	5	2010
Lives with parents	2009	1.50	0.85	1	5	2009
Height	2010	166.67	8.92	118	193	2010
Weight	2010	63.23	11.42	35	125	2010
Likes sports	2010	1.48	0.59	0	2	2010
Hrs. of sports/week	2010	8.83	8.82	0	70	2010
Father attended university	2005	0.30	0.46	0	1	2005
Mother attended university	2004	0.27	0.44	0	1	2004
Father has postgraduate degree	1998	0.09	0.28	0	1	1998
Mother has postgraduate degree	2001	0.09	0.28	0	1	2001
Mother works	2001	0.64	0.48	0	1	2001
Father works	2002	0.92	0.27	0	1	2002
Father plays sports	2002	0.32	0.47	0	1	2002
Mother plays sports	2007	0.21	0.41	0	1	2007
Overweight	2006	0.24	0.43	0	1	2006
School infrastructure ^a	2010	2.45	0.74	1	3	2010
Sports infrastructure ^a	2010	2.21	0.77	1	3	2010
Would change school ^a	2010	2.00	0.79	1	3	2010
Smokes (# of cigarettes)	2010	1.30	4.06	0	50	2010
Drinks (# of days)	2010	0.71	1.00	0	7	2010
Drugs	2010	0.28	0.62	0	3	2010
Absences	2008	6.82	8.26	0	69	2008
Grade average	2010	5.65	0.60	0	7	2010
Self-esteem ^b	2044	26.77	3.06	10	40	2044
Type of teacher ^a	2010	2.78	0.51	1	3	2010

^aIn the variables with a scale from 1 to 3, 1 is “poor,” 2 is “average,” and 3 is “good,” except drugs, where the choices for frequency of consumption are: 1: “never”; 2: “sometimes”; and 3: “regularly.”

^bThis was measured using the Rosenberg scale of 10 to 40 points; self-esteem is considered normal if it is between 20 and 33 points.

Table 2 - Perception of the impacts of sports (percentages^a)

		Strongly disagree	Disagree	Agree	Strongly agree	Total
Sports helps:	Health	3.3	0.8	15.8	80.2	100
	Self-esteem	3.8	5.6	26.9	63.7	100
	Socializing	3.7	11.1	33.1	52.1	100
	Making friends	7.9	18.6	35.0	38.5	100
	Grades	9.0	31.8	36.7	22.5	100
	Concentration	8.8	34.6	34.7	21.9	100

^aPercentage of frequency of responses for a sample of 2,010 students.

Table 3 - Self-esteem

	Average^a	Deviation
I feel that I am a valuable person, at least in comparison to others.	3.20	0.72
I feel that I have a number of good qualities.	3.19	0.66
I definitely tend to believe that I am a failure.	1.93	0.86
I am capable of doing things as well as other people.	3.28	0.74
I feel that I don't have much to be proud of.	2.11	0.96
I have a positive attitude about myself.	3.13	0.76
Considering everything, I am satisfied with myself.	3.01	0.80
I would like to have more respect for myself.	2.66	0.93
I sometimes feel useful.	2.25	0.93
Sometimes I feel like I am good for nothing.	2.01	0.91
Average scale^b	26.77	

^a Sample of 2,010 students, self-qualification from 1 to 4 (1: "Strongly disagree"; 2: "Disagree"; 3: "Agree"; 4: "Strongly agree"). ^b The Rosenberg scale ranges from 10 to 40 points; self-esteem is considered normal if it is between 20 and 33 points.

Table 4 - Estimations of school performance: OLS, OLS-Heckman and probit

Variables ^a	(1)	(2)	(3)
	OLS Grade	Heckman Grade	Probit Performance
Age	0.0227+ (0.0125)	0.0138 (0.0153)	0.0297 (0.0285)
Type of school: subsidized private	0.173*** (0.0283)	0.166*** (0.0347)	0.339*** (0.0620)
Self-esteem_negative	-0.0322*** (0.00495)	-0.0292*** (0.00603)	-0.0578*** (0.0114)
Self-esteem_positive	0.0278** (0.00864)	0.0210+ (0.0111)	0.0406* (0.0192)
Change	-0.0647*** (0.0163)	-0.0610** (0.0197)	-0.139*** (0.0373)
Sports	0.00428* (0.00183)	0.00504* (0.00202)	0.002498* (0.00596)
Sports ²	-0.00891*** (0.00228)	-0.00999*** (0.00255)	
Self-perception of sports skills	-0.0426*** (0.0125)	-0.0677* (0.0280)	
Absences	-0.00648*** (0.00160)	-0.00625** (0.00200)	-0.0159*** (0.00363)
Hours of studying	0.00269** (0.000903)	0.00271* (0.00110)	
Cars	0.0416** (0.0129)	0.0319* (0.0155)	
Height/weight	0.0959** (0.0335)	0.132** (0.0423)	0.179* (0.0764)
Mother_playssports	0.0708* (0.0317)	0.0896* (0.0382)	0.167* (0.0735)
Sibling_playssports	0.0658* (0.0321)	0.0388 (0.0377)	
Father_playssports			0.0220 (0.0603)
Drugs	-0.0428* (0.0213)	-0.0287 (0.0260)	-0.0707 (0.0482)
Sports_concentration	0.0313* (0.0144)	0.0496** (0.0183)	0.0396 (0.0329)
Constant	4.850*** (0.298)	4.988*** (0.387)	-0.461 (0.659)
Mills_lambda		-0.0429 (0.100)	
N	2001	1989	2003
R-sq	0.121	0.267	0.258

^a Standard errors in parentheses + p < .10; * p < .05; ** p < .01; *** p < .001.