1-2008

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Research Brief

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The Gaston Institute's *Research Briefs* report on ongoing research in areas of the Institute's interest. We thank Russ Lopez, Richard Campbell and James Jennings for submitting this case study for publication as part of this series.

January 2008

Abstract

Boston MA's schoolyards had seriously deteriorated since the middle of the 20^{th} century resulting in dangerous and unusable outdoor spaces. Beginning in the mid 1990s, a program to renovate these schoolyards has resulted in approximately half of the schools now having outdoor recreational, learning and garden spaces. This study compared the 4^{th} grade test score results in renovated vs. unrenovated schools. Controlling for school demographics, schools that had a renovated schoolyard had more of their students passed the state mandated math test (1.06, 95% confidence interval = .00012, .12). Effects on the state mandated English language arts test were not as great. While this is an ecologic analysis and there may be other factors that influenced the better performance on the math test, this study suggests that improvements to the physical environment of schools and/ or better access to physical activity may result in better school performance.

Introduction

The concept of "active living" is attracting much attention in contemporary public health and urban planning literature. Active living refers to the integration of physical activity into everyday life and is aimed at promoting the health, well-being, and functional capacity of individuals and communities.(Sallis et al., 2006) In the United States, the interest in active living has been sparked, in large measure, by rising obesity rates, with particular concern focused upon a child obesity epidemic that has seen the percentage of obese 2- to 19-year olds increase from 5 percent in 1971-74 to 17.1% percent in 2003-2004.(CDC, 2001; Ogden et al., 2006) Logically, successful promotion of active living requires the development of policies and programs that meet the needs of different populations.(Blair & Nichaman, 2002; Flynn et al., 2006; Nestle & Jacobson, 2000)

We have examined the Boston Schoolyard Initiative (BSI) as an innovative policy which revitalizes degraded schoolyard plays areas through a multi-stakeholder process involving public and private resources. In that case study, we proposed that the experiences of the BSI offered instructive lessons for active living strategies and programs because its multi-stakeholder approach maximizes potential school and community impacts. While conducting that case study - sponsored by the Robert Wood Johnson Foundation's Active Living Program- researchers were asked by the BSI staff to examine the association between schoolyard projects and school achievement. We present the results of the analysis of the association between renovated schoolyards and test scores here. Since this paper is exploratory, the findings reported here are not definitive, but they do suggest that the redevelopment of degraded play spaces can positively impact the school achievement of children. Using an ecologic study methodology, we compare the performance of fourth grade students on the Massachusetts Comprehensive Assessment System (MCAS), a series of standardized tests taken by nearly all public school students, in schools which participated in the Boston Schoolyard Initiative and schools which did not. An ecologic study is one that uses groups rather than individuals as its level of analysis.(Morgenstern, 1998) We did not directly measure or use any information on any individual student. Instead, we compared data gathered from entire schools. The results indicate an association between the presence of a schoolyard project and the school's performance on 4^{th} grade MCAS math scores after controlling for the racial/ethnic composition of a school and the percent of students receiving reduced or free lunches.

Background

In the early 1990s many Boston schoolyards were in disrepair and oftentimes the scene of gang or drug activity, marking them as community sore spots rather than reflecting safe recreational or learning environments. Some schoolyards were only used as parking lots, and most lacked trees, recreation equipment or soft areas for play. Covered with broken glass or worse, they were unusable by children and served as a dreary reminder of the city's constrained fiscal resources and inattention to the needs of low-income children and the places in which they played.

The problem of distressed schoolyards was hardly unusual at a time when maintaining even essential services posed a challenge to many cash-strapped municipalities. However, it may have been particularly acute in Boston, where social unrest over school busing in the 1970s was still a vivid memory.(Lukas, 1986) Boston schoolyards were a visible symbol of substandard service, particularly in comparison with communities outside the city. Finding a way to address

Boston's schoolyard inequities and shortcomings represented an important policy priority for Mayor Thomas Menino, who first became mayor in 1993 and whose administration touted neighborhoods and community development as priorities for the city.

In 1996 a mayoral task force introduced a public-private partnership, known as the Boston Schoolyard Initiative, in order to plan and develop renovations to rebuild Boston's schoolyards. Since its founding, the BSI has been effective in bringing a variety of stakeholders into the program to offer a wide range of support. Each schoolyard project reflects participation by both students and neighborhood children (only 50% of children at a given school come from the surrounding community – the rest are bused in). A funders' collaborative assists schoolyard groups in securing financial support for their schoolyard projects, while educational partners assist in the design of learning environments. The network of stakeholders includes business partners, community organizers, higher educations institutions, cultural organizations, teachers, parents' groups, and students.(Easley, Evans, & Healtherly, 2005)

To be eligible for participation, schools must first compete for a planning grant as a sign of its commitment to the program. The grant supports a year-long pre-design program which allows the local planning participants, with the assistance of a part-time community organizer, to become a working body and to create a vision for the schoolyard. Schools develop partnership relations in the community during this process, and students share ideas for the schoolyard space. Ideas generated in this phase are then presented to a landscape architecture team, which helps turn the broad ideas into a workable design that fits budget limits of approximately $250,000 (including both private and public funding). Actual physical improvement projects are managed by the city. The period from conception to final project can take up to five years, The major reason for this extensive development timing is that many different parties have to be brought together to discuss schooling and civic issues for the first time.

Methods

The Massachusetts Comprehensive Assessment System (MCAS) was used as an indicator of academic achievement because results were readily available and allowed comparisons between schools. Introduced in response to state legislation in 1993, MCAS is a statewide series of tests given to almost all public school students and represents the Massachusetts version of the national testing requirements of the No Child Left Behind law. Tests are administered in the spring of each year. Fourth graders take two tests, English Language Arts and Mathematics. Four possible grades are reported: Warning/Failing, Needs Improvement, Proficient and Advanced. While the high school level tests are required for graduation, the 4th grade tests are not required for advancement to the next grade. We only used the 4th grade tests for two reasons. First, there are only thirteen high schools in the Boston Public School System, not a large enough sample size to give an analysis the statistical power to reveal differences between renovated and non-renovated schoolyards; combining high school scores with elementary school scores was rejected because the two types of schools and their tests, are too different to merge. Second, the fourth grade scores are the group that the BPS reports on their web site, making them most accessible for download.

All Boston Public Schools that had published fourth grade test scores were included in the study. Schools that have received BSI projects were identified by BSI staff. School test scores (percent scoring Proficient or Advanced on Math and English Language Arts) and demographic data were downloaded from the Boston Public Schools website.(BPS, 2005) Schools reporting 0% of students passing either Math or English Language Arts were excluded from the analysis.

Summary statistics were calculated along with correlational statistics. Student's T-Test was performed on the unadjusted test score results and demographic variables to determine if there were differences between the renovated and non-renovated schools. Math and English Language Arts results were analyzed separately. The percent scoring either Proficient or Advanced (representing passing) were the dependent variables and the percent free lunch, percent Black, percent Hispanic, and percent Asian were the independent variables. We selected these demographic variables because of longstanding differences in performance on standardized tests between varying ethnic groups. In general, lower income and Black and Hispanic students tend to score lower on standardized tests. (Hoerandner & Lemke, 2006; Orlich & Gifford, 2006; Roscigno & Ainsworth-Darnell, 1999) Eligibility for free lunches was used as a proxy for income. We created a dummy variable to represent the presence of a renovated schoolyard, coded as 1 if the school had a renovated schoolyard, 0 if it had not. The other variables were treated as continuous variables varying from 0 to 1, corresponding to the percent of that variable at a given school. The sample was weighted using the total number of students in each school. Stata was used for the statistical analysis.(Stata, 2005)

Results

Seventy-two (72) Boston public schools out of a total of 82 reported 4th grade MCAS English Language Arts of Math test scores in 2003. Approximately two thirds of these schools have hosted BSI projects. In general, schools that have received projects are demographically similar to non-BSI schools with similar percentages of Blacks, Hispanics, Asians and Whites. There were differences between renovated and non-renovated schools. A higher percentage of students in the renovated schools were receiving free lunches ($p = .04$), the renovated schools were larger ($p = .0565$) and a larger percentage of students at the renovated schools passed the Math test ($p = .0567$).(See Table 1)

Math and Language scores were highly correlated with each other (.79), as was the percentage of Hispanic and Black students (.67). There were more modest correlations between free lunch and language scores (-.28), Asians and the number of total students (.27), Hispanics and free lunchs (.36), Blacks and Asians (-.29) and Hispanics and Asians (-.24). No other correlations were statistically significant or were greater than .2.

Bi-variate analysis (regressions using single independent variables) found no association between having a schoolyard project and either test score results, and the percentage of variation explained by BSI projects was very small. The free lunch, Asian, and Black percentages in each school was associated with test outcomes, the Hispanic percentage was not. (See Table 2)

In the full model using multiple independent variables, schools that had a BSI project had six percentage points more students passing the Math MCAS than those without projects. This represents an approximately 25% greater percentage of students passing the Math MCAS. All the other variables were negatively associated with Math MCAS performance, though only the Black percentage was statistically significant at the .05 level. The presence of a schoolyard project had no discernable effect on English Language Arts MCAS scores. (See Table 3)

Discussion

This study found an association between the presence of a schoolyard project and the school's performance on 4th grade MCAS math scores after controlling for the racial/ethnic composition of a school and the percent of students receiving reduced or free lunches. There are other variables that ideally might be included in this type of analysis, such as the percent male/female, percent of students in special education, year schoolyard project was completed and the dollar amount of each schoolyard project. It would also be important to know and quantify how each project is being used and the degree to which the renovated space has been incorporated into the school's learning environment. These kinds of variables should be investigated further based on the current study.

The results reported here, therefore, should be reviewed with caution. This is an ecologic study, the data was limited to publicly available information and students were not directly tested nor were statistics gathered on any individual. There is no evidence that students who passed the Math MCAS have used the schoolyard projects or that these projects contributed to the school's performance. Individual level characteristics, including schoolyard use, time at the school and physical activity levels have not been assessed or used in this analysis. The BSI staff has indicated that they try to target the most distressed schools for improvements, and the renovated schools had more students receiving free lunches than the non -renovated schools, but successful schoolyard projects depended on extensive involvement and cooperation of principals, teachers, other school staff, parents, students and neighbors. Based on this preliminary study, we propose that it is precisely this kind of civic involvement and capacity to work together that may positively influence student achievement in the form of standardized test scores.

The results of our study suggest that schoolyard projects are associated positively with aggregate school achievement. . There are several ways that improved schoolyards could possibly help to raise test scores. We put forward several possible pathways here, but their soundness and importance are not known.

The improved schoolyards could lead to more physical activity before, during and after school and this physical activity could make students more willing and able to learn. The effect of the activity could be to calm students and make them more ready to learn or the physical activity could make students healthier, which might result in better learning abilities. But a recent study found no association between academic achievement (grades) and physical education among a randomized sample of sixth graders.(Coe, Pivarnik, Womack, Reeves, & Malina, 2006) Perhaps the students in the Boston Public Schools are at greater risk for poor academic performance, making them more likely to respond to the positive effects of physical activity, or the pathways between renovated schoolyards and increased academic performance lie elsewhere.

Improved schoolyards could result in educational improvements through active learning and teacher initiated projects. These pedagogical innovations could be important in improving standardized test scores. Improved schoolyards have been shown to be associated with innovative teaching practices in other contexts.(Brink & Yost, 2004; Dyment, 2005)

Improved schoolyards could result in better teacher and staff morale or better student morale, also potentially affecting performance. The psychological effects of an environment changing from a degraded/abandoned landscape to these state of the art play spaces could be a motivating factor for both teachers and students, particularly since the prerenovation landscapes were so degraded they may have had an outsized effect on would be users.(Kozol, 1991) The self-esteem and sense of hope of children could have been degraded by the stigma attached to going to unrenovated schools.(Kotlowitz, 1991; Wiltfang & Scarbecz, 1990).

Perhaps the community based participatory process the BSI used to renovate the schools resulted in the increased capacity of schools to meet their educational challenges, an effect hypothesized in the community development literature. (Chavis & Watersman, 1990; Rich, Giles, & Stern, 2001) The improvement may have come from the way community organizing can boosted social capital and the general networks of trust and cooperation that were created and enhanced. (Gital & Vital, 1998) In particular, parental involvement, part of the school organizing effort, can contribute to improved schools. (Lopez, 2003).

Improvements could have attracted other resources, thereby improving the ability of the schools to teach their students. These coalitions between schools and the surrounding neighborhoods and institutions could have led to lasting partnerships, eventually resulting in increased resources for learning. Schools with improved schoolyards could now be attracting the best teachers and principals, also eventually assisting students to learn. In the context of Boston's limited school choice options, these physically and civically improved schools could also serve to attract students from families with a tradition of academic achievement and aspiration.

Again, our inability to locate or develop additional potentially explanatory variables including proxies for schoolyard use, parental involvement, school based social capital, and other factors for inclusion in this analysis are a limitation of this study. But our findings should provide cautious optimism for those working to improve schools.

The results of this analysis suggest that renewed attention to school play spaces and in-school physical activity is warranted. As schools feel pressure to comply with national and state testing requirements, recess time and active physical activity opportunities have declined. A focus on redeveloping dilapidated schoolyards and more opportunities for physical activity may have the potential to improve learning as well as address the growing problem of childhood obesity. While the ecologic nature of this study might limits its application, the study suggests that the physical environment in schools should be a concern to all who seek understanding about the factors that support and increase student achievement.

Our findings underscore the importance of the current interest in active living research and design efforts and broaden their relevance to healthy development and school performance. To date, there has been comparatively little attention to the potential for active living initiatives to enhance emotional and cognitive development of young people. This research suggests that active living initiatives may play a role not only in promoting physical health, but also cognitive and mental health development. Such broader impact is of particular importance in children because their early experiences may have lasting influence upon adult health and development.

Acknowledgements

The authors would like to thank the staff of the Boston Schoolyard Initiative for their contributions to this research. We are also grateful for the participation of individuals both inside and outside the Boston Public Schools who gave their time to be interviewed. Funding for this case study was provided by the Active Living Research program of The Robert Wood Johnson Foundation

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Table 1. Descriptive Statistics

	BSI Project Schools N = 47				Non-BSI Project Schools N = 25			
	Mean	**Standard Deviation**	**Minimum**	**Maximum**	**Mean**	**Standard Deviation**	**Minimum**	**Maximum**
Total Students	388.38	202.03	113	907	314.92	141.61	148	704
Percent Passing Language MCAS	34%	0.18	7%	72%	35%	0.17	11%	79%
Percent Passing Math	25%	0.15	3%	62%	22%	0.17	2%	62%
Percent Receiving Free Lunches	73%	0.05	33%	88%	68%	0.14	35%	89%
Percent Asian	7%	0.12	0%	73%	7%	0.10	0%	40%
Percent Black	46%	0.25	4%	89%	47%	0.26	4%	90%
Percent Hispanic	34%	0.22	5%	89%	28%	0.19	3%	76%

Table 2. Bivariate Regression

4th Grade English Language Arts

Variable	**Coefficient (95% Confidence Limit)**	**R2**
BSI Project	-.0047 (-.096, .087)	0.0002
Free Lunch	-.70 (-1.01, -.38)**	0.19
Asian	.27 (.01, .53)**	0.05
Black	-.24 (-.38, -.09)**	0.12
Hispanic	-.054 (-.27, .16)	0.01

4th Grade Math2

Variable	**Coefficient (95% Confidence Limit)**	**R2**
BSI Project	.043 (-.04, .13)	0.02
Free Lunch	-.52 (-.83, -.22)**	0.13
Asian	.36 (.11, .61)**	0.11
Black	-.25 (-.38, -.11)**	0.15
Hispanic	-.027 (-.23, 18)	0.002

Multiple Regression Using Ordinary Least Squares
* Significant at the .05 level ** Signficant at the .01 level

Table 3. Mulitivariate Regression

4th Grade English Language Arts

Variable	Coefficient (95% Confidence Limit)
BSI Project	.02 (-.047, .089)
Free Lunch	-.32 (-.79, .14)
Asian	-.25 (-.73, .23)
Black	-.52 (-.92, -.13)**
Hispanic	-.42 (-.92, .082)

4th Grade Math2

Variable	Coefficient (95% Confidence Limit)
BSI Project	.06 (.00012, .12)*
Free Lunch	-.24 (-.64, .15)
Asian	-.06 (-.48, .36)
Black	-.44 (-.77, -.10)*
Hispanic	-.31 (-.72, .10)

Multiple Regression Using Ordinary Least Squares
* Significant at the .05 level ** Signficant at the .01 level