Academic Performance of Texas Public Schools and Its Relationship with Students’ Physical Fitness and Socioeconomic Status

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ABSTRACT
This study investigated the relationship between public schools’ academic performance in Texas and their students’ physical fitness and socioeconomic status (SES) at school-district level. Spearman rank correlations showed that the correlation between body mass index fitness (BMI HFZ) and academic performance was stronger than cardiovascular fitness (CV HFZ). SES was strongly associated with academic performance. Three-way ANOVA analyses revealed significant main effects of gender, SES, and BMI HFZ on Reading tests passing rate while only SES was significant for Math tests passing rate. Higher BMI fitness was associated with higher level of academic performance for school girls than boys except for those in low SES level. Geographically Weighted Regression (GWR) analyses identified important and spatially varied relationships between physical fitness variables, SES, and academic performance across Texas, suggesting the need for regional and locally-targeted policies to address place-specific critical factors for improving schools’ academic performance.

KEYWORDS
Academic Performance, BMI, Cardiovascular Fitness, GWR, SES, Three-Way ANOVA

INTRODUCTION
According to U.S. Department of Health and Human Services, approximately half of youths who are aged 12-21, are physically inactive in daily life (US Department of Health and Human Services, 2009). The prevalence of physical inactivity and sedentary habit among youth may result in bad consequences for children’s health (Castelli, Hillman, Buck, & Erwin, 2007; Strong et al., 2005). For example, physical inactivity may lead to low level of physical fitness, which may contribute to an elevated risk for health issues, including obesity, cardiovascular diseases, and type 2 diabetes (Minck, Ruiter, Van Mechelen, Kemper, & Twisk, 2000; Ondrak, McMurray, Bangdiwala, & Harrell, 2007; Warburton, Nicol, & Bredin, 2006). In addition, being physically inactive has adverse effect on mental health, such as depression, anxiety, stress, and self-esteem (Centers for Disease Control, 2008; P. A. Liao, Chang, Wang, & Wu, 2013). Therefore, it is important to advocate physical activities in adolescence, aiming at improving physical fitness and reducing the risks of chronic diseases in

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adulthood (Eveland-Sayers, Farley, Fuller, Morgan, & Caputo, 2009; P. A. Liao et al., 2013; Must, Jacques, Dallal, Bajema, & Dietz, 1992). Physical fitness, usually positively correlate with physical activity (Strong et al., 2005), is defined as a set of attributes that people achieved when they have the ability to perform physical activity (Caspersen, Powell, & Christensen, 1985); it is the health outcome of physical activity. Physical fitness has five components: body composition, cardiovascular fitness, muscular strength, muscular endurance, and flexibility (Coe, Peterson, Blair, Schutten, & Peddie, 2013; Svin, 2003).

Higher levels of physical fitness are often associated with better academic achievement (Bass, Brown, Laurson, & Coleman, 2013; Castelli et al., 2007; Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001; Janak et al., 2014; London & Castrechini, 2011; Stevens, To, Stevenson, & Lochbaum, 2008; Tremblay, Inman, & Willms, 2000; Van Dusen, Kelder, Kohl, Ranjit, & Perry, 2011). In other words, physical fitness is commonly found to be positively associated with academic performance and students who are physically fit tend to have better academic performance. For example, an assessment by Eveland-Sayers et al. (2009) on 3rd-, 4th-, and 5th-graders found a positive association between muscular fitness and Math scores. Fox, Barr-Anderson, Neumark-Sztainer, and Wall (2010) extended the study to middle and high schools, and found a positive relationship between physical activity and academic achievement. These findings are important in practice since they suggest that the efforts to promote physical fitness in schools may help improve learning outcomes.

However, few studies have examined the relationship between students’ physical fitness and their academic performance at a school-district scale. In addition, despite that socioeconomic status (SES) has been found to be associated with both academic performance and physical fitness (Freitas et al., 2007; Kim et al., 2003; Sirin, 2005), the existing findings did not consider the effect of SES on the relationship between physical fitness and academic performance. Furthermore, the existing studies assumed that the association between physical fitness and academic performance are consistent across the study area, neglecting spatial non-stationarity of the association. Exploration of the spatial variation of the relationship between physical fitness and academic performance is missing in literature.

The purposes of this research were two-fold. First, we investigated the relationship between physical fitness, SES, and academic performance at school-district level in the state of Texas. We hypothesized that there is a positive relationship between school children’s physical fitness and their academic performance, and that there is an interaction effect between physical fitness and SES on academic performance across genders and education stages. Second, we applied Geographically Weighted Regression (GWR) to explore the spatial variation in the relationships between academic performance, SES, and physical fitness for school children in Texas. Understanding the spatial variation of the relationship is critical for developing appropriate area-specific policies to improve students’ academic achievement in target areas.

DATA AND METHOD

Data Source

This study used Texas Physical Fitness Assessment Initiative (PFAI) program data (Texas Education Agency, 2014a) and the State of Texas Assessments of Academic Readiness (STAAR) tests data (Texas Education Agency, 2014b). In 2007, Texas Education Agency (TEA) implemented a health assessment program called PFAI to improve the awareness of physical fitness in schools. This program requires that all public schools in Texas perform an annual physical fitness evaluation of their students in grade 3-12 (Texas Education Agency, 2014a). PFAI consists of different categories of tests and is considered a comprehensive physical fitness evaluation. TEA collects approximately 2 million school children’s fitness data annually. This dataset provides a valuable resource for researchers and policy makers to understand school children’s health and physical fitness status.
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