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Winning on the Field and Winning in the Classroom

High School Football in Rural Kentucky

Does a School's Winning Percentage in Football Affect Average ACT Scores

Jon Samokar

Capstone Project
Martin School of Public Policy and Administration
University of Kentucky
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Executive Summary

Kentucky faces many challenges in educating its children at all levels. This study focuses on elements of academic achievement of high school students. Previous studies have examined the effects of teacher training, the effects of peer influence, sorting of students and teachers across school districts, various learning interventions that have targeted specific student populations and subject areas, each in an attempt to explain or improve upon school achievement and student academic success.

Previous national studies have focused their attention on the effects of variables found within the classroom; most of these studies recognize that there are influences outside the

classroom which can affect academic achievement. My research study focuses on the effect of these outside influences. Previous research on Kentucky suggests that students attending high schools in rural areas experience different opportunities for student interaction, activities, and teacher experience compared to students in other high schools. A question for consideration then is, "can the limited educational opportunities choices found in rural schools be offset or enhanced by community engagement?"

I use a school's winning percentage in high school football as a proxy for "community specific social capital" (Fischel 2009). I incorporate the definition of community specific social capital provided by Fischel as being "one's network of friends and acquaintances,…having established a network of personal relationships…" within a community as part of the interpretation of my data. Fischel further suggests that some of the most important sources of community specific social capital would be found in the suburban and small town communities. (Fischel 2009). I test whether the winning percentage of a school's football team affects the average ACT score of the schools within rural counties. Classification of a school as rural is determined by criteria developed in the Common Core Database (CCD) from the National Center for Education Statistics. My data include the average ACT scores and the recorded participation of high school football teams of 234 high schools in Kentucky for the years 2008 – 2010. Results of the study indicate that there is a significant positive relationship that exists between a school's in participation football and the average ACT score of schools within a rural locale.

Background

Kentucky is a rural state with a population of slightly less than 4.5 million inhabitants. The population is not ethnically diverse, with about 86.1% of the population being white; the remainder of the population is 8% black, 3.2% Hispanic and 1.7% classified as other as reported by 2011 U.S. Census. The academic success of Kentucky high school students varies widely. Kentucky is a state that on one hand is fraught with areas of high poverty, high unemployment, and low academic achievement and on the other hand, areas that enjoy high wealth, prosperity and almost unfettered choices regarding access to the secondary education system. The wide and often competing interests resulting from this economic diversity make it difficult to improve academic success for all.

Parents may choose to move from district to district in search of their personal vision of the best school for their child. Students in a school can choose to associate with other students of similar academic interests, social skills levels and can benefit from peer influences found in the diversities of ethnicity and of thought found within a particular schools student population. Teachers, can opt to teach in a school of their choosing based on tenure and subject matter expertise. The element of choice provides parents and students with opportunities for which school they attend, with whom students associate and the relative quality of teachers present within the school. This element of choice can positively affect student performance and academic success.

But what occurs when classroom choices are limited by circumstance, such as when the student resides in a rural locale? There may be only one or two high schools in some rural areas,

with limited ethnic diversity, limited student peer-influence, and teacher experience, all of which can affect student academic achievement.   Families and students living in rural communities found in rural counties have fewer choices available when it comes to the educational, cultural and social institutions found in other locales. The broader question becomes then "can the winning percentage of a high school football team be used to predict the achievement level of the rural schools, as measured by average ACT scores?" While the choice of the average ACT score alone might not be the best measure of educational achievement, it does provide a nationally recognized standard of achievement and a common measure of future success across the population of high schools sampled. For purposes of this study, I estimate the effect of the winning percentage of a high school in a football program, across the four categories of locale, on a school's average ACT scores.   The presumption is that parents, if given a choice regarding selection of schools, peers for their child, comparable student ability, their place of residence, similar social values and cultural setting, would select or sort themselves in such a way to maximize the benefits received by their child. When choice and opportunity are constrained, such as in rural areas, might the opportunity to participate in activities outside the classroom offset some of the deficiencies in other factors fostering academic achievement? I will operationalize the winning percentage of high school football as a proxy for community involvement or social influence on the school's academic success as measured by the average ACT score for high schools in different locales of Kentucky.

Literature Review

The Kentucky Education Reform Act of 1990 sought to equalize funding for school districts across the state through implementation of a program called Support Educational

Excellence in Kentucky (SEEK). Support Educational Excellence in Kentucky (SEEK) utilized a per student ratio to determine guaranteed funding amounts at the individual school level (Hoyt). This was seen as a leveling of the playing field and providing relative equality for those schools that were otherwise unable to raise adequate revenue dollars within their communities to support school operations. While this remedy did provide funding to address issues like improved school facilities, teacher salaries, technology requirements and changes in school organization and curriculum, it did little to address the external influence of social or economic condition of the students outside of the school.

Data from the Coleman Report suggested that student achievement is affected in part by variables not directly related to the classroom experience (Coleman 1966). Hanushek further developed findings from these preliminary data and subsequent research through his estimation of educational production functions (Hanushek 1998). The most common production functions serve to measure various inputs relative to various student, peer and school characteristics. The Coleman Report and subsequent studies suggested that student achievement can be affected by peer influences, although peer influence in the report was measured on race rather than ability. Subsequent research suggests that peers play a larger role in the achievement levels of low-ability students than they do in higher-ability student achievement and raising the average peer level increases individual student achievement levels in schools across countries (Zimmer and Toma 2000). Their study included family and socioeconomic characteristics as inputs to peer effects. Data from a study of New York State teachers examining the sorting of teachers within schools and across school districts have indicated that low-income and lesser-ability students often have lesser-qualified teachers in the classroom, thus affecting student achievement . (Lankford, Loeb, and Wyckoff 2006). Hanusek also examined of how effectively local school

officials have utilized funding in order to make the best use of school resources. Finding from this study included, that there is no strong or consistent relationship between school resources and student achievement. (Hanushek 1997)

Are students attending rural schools less well-off academically as a result of attending a rural school? In other words, do characteristics of rural schools such as limited access to social, cultural or family/parental, and other community specific support; contribute to a lower level of academic achievement? Some households make residential choices (where to live) among the local school districts and these Tiebout choices influence the quality and expenditures on local school and community resources.

But what happens to children living in areas without a choice among schools? By circumstance of geographic location, students who reside in a rural locale have on average less choice when it comes to which schools they attend, with less social and cultural opportunities, yet are held to the same measure of achievement in the form of the ACT test. I hypothesize that community involvement with a school in activities outside the classroom can serve as a substitute for the other beneficial influences that are missing in a rural setting. If this is correct, community involvement will be positively associated with a school's academic achievement. I propose that using the winning percentage of a high school's football team can serve as a proxy for this community involvement. Now I describe how I empirically assess whether it is associated with the average ACT score.

Research Design

Data

Data for this study is gathered from multiple public sources including Common Core Database (CCD) from the National Center for Education Statistics database, from National Science Foundation grant DUE- 0830716 research conducted by Eugenia Toma PhD, the Kentucky Department of Education, Institute for Educational Sciences (IES), US Census, and the Kentucky High School Athletic Association (KSHAA).

I classified the locales of schools as city, suburban, town, or rural based on definitions and criteria provided by the National Center for Educational Statistics, Common Core Database. It is important to note that the Locale codes used for classification of the school's is based on the physical address of that school. (see appendix 2a & 2b). The data for the Kentucky average ACT scores for the schools stem from a database previously generated from National Science Foundation grant DUE- 0830716 conducted by Eugenia Toma PhD. I calculated the winning percentages of Kentucky high school football teams from public records provided by the Kentucky High School Athletic Association.

Some data was not reported by the schools for the average 11th and 12th grade ACT score results for the 2008 to 2010 school years. Not all schools that reported ACT scores played football during the time period of the research and not all schools that played football during the time period of the study were required to report ACT scores. A description of the variables used is provided in Table 1.

Table 1

Description of Variables	
School Measures	
Variable	**Description**
locale_cat_CCD	Location code, either City, Suburban, Town or Rural
Spending in $K dollars per student	Spending per student
average daily attendance	Percentage average daily attendance. This is for the previous school year
act_11_grade	Average ACT score for 11th grade
act_12_grade	Average ACT score for 12th grade
Student Measures	
ethb_ccd	Percentage of black students identified in the school from CCD data
etha_ccd	Percentage of Asian students identified in the school from CCD data
ethh_ccd	Percentage of Hispanic students identified in the school from CCD data
Free and reduced lunch program	Average number of students in school on free and reduced lunch
dropout	Percentage of high school students who drop out. This is for the previous year
Teacher Measures	
Average years' experience	Average years of experience of teachers in a school
Football Measures	
Variable	**Description**
Winning percentage	Winning percentage of a school's football program
nonfootball	School did not have a football program

Model

This is an exploratory study where I examine the data to determine whether the relationship between participation in high school football and academic success varies by locale. A regression analysis was conducted on data gathered for each individual schools average ACT test for 12th grade students during the study period from 2008 to 2010. This regression included 689 observations, (observation = 1 school during 1 school year) from 230 schools for the three year period. The study regression will use robust standard errors to correct for heteroskedasticity. The model used for the study is described by the following:

$$Y_{act} = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta n X n + e$$

The dependent variable Y, for my analysis is the average ACT for 12th grade high school students at each school. I will estimate the regression on data on several subsamples of the data using the classification. This will allow me to examine whether the above explanatory variables show different relationships with the average ACT score depending on the school's locale. The following explanatory variables, $X_1 - X_n$ are included in the regression: *School Measures* - Student to teacher ratio, average daily attendance, dropout rate, spending per student (in dollars), and student to computer ratio, average ACT scores for 11th and by year and locale, *Teacher Measures* - Average Teacher Experience (years), *Student Measures* - Percentage of students receiving Free & Reduced Lunch, percentages of Asian, Black and Hispanic students in the school population, and *Football Measures* – the Winning percentage of a school's football team and a dummy variable that equals 1 if a school does not have a football program and 0 if it does.

Results

Table 2 - Results for All Locales												
Robust	**Rural**			**Town**			**Suburban**			**City**		
Average 12th grade ACT Score	**Coef.**		**Std. Err.**	**Coef.**	**Std. Err.**		**Coef.**	**Std. Err.**		**Coef.**	**Std. Err.**	
Average 11th grade ACT score	0.449	***	0.073	0.427	***	0.106	0.536	***	0.110	0.499	***	0.109
Average daily attendance	-0.027	***	0.008	0.058		0.082	0.077		0.128	0.097		0.059
Drop out rate	0.016	***	0.005	0.071		0.090	-0.086		0.094	0.044		0.080
Average year's experience Teachers	0.058	*	0.034	0.133	**	0.063	0.029		0.052	-0.004		0.076
Spending per student in $K	-0.192	***	0.042	-0.156	**	0.063	0.017		0.126	-0.045		0.073
Student to teacher ratio	-0.089	***	0.027	-0.137	***	0.040	-0.092	***	0.032	-0.156	***	0.032
Student to Computer ratio	0.139	**	0.051	-0.045		0.081	0.064		0.051	0.042		0.071
Percentage free and reduce lunch	-0.028	***	0.006	-0.033	**	0.013	-0.043	***	0.015	-0.070	***	0.017
Percentage Asian students	0.310	*	0.177	0.303		0.185	0.139		0.146	0.105		0.066
Percentage Black students	0.013		0.016	-0.008		0.011	0.001		0.013	-0.003		0.007
Percentage Hispanic students	0.003		0.083	-0.030		0.040	-0.038		0.076	-0.001		0.036
Winning percentage	0.769	***	0.283	0.284		0.365	-0.065		0.469	0.352		0.393
nonfootball	0.152		0.225	-0.089		0.475	-0.547		0.530	0.007		0.362
_cons	16.068		1.597	9.541		7.810	5.172		11.507	7.193		5.348
Significance level: * p<0.10; ** p<0.05; *** p<0.01												

Next I want to consider the results across locales based on the findings presented in Table 2. A positive relationship was found to exist between the winning percentage of a high school's football team and a school's average ACT score. For my purposes the primary variables of interest are participated school's winning percentage in football and the schools locale.

The winning percentage of a school's football team is represented in the data as an integer that would fall between the values of 0 and 1. The interpretation of which represents a situation where a team could either have lost all of its games (0) or won all of their games (1). More precisely, a school's winning football percentage is associated with the coefficient of (0.77) multiplied by the winning percentage (.60), thus resulting in an increase in the school's overall average ACT score by (0.462) points, all other variables held constant. This is a small but substantively important finding, as any incremental increase or decrease to the ACT score enhances or decrease students' life chances.

Limitations of the data

There are several limitations for these data which are obvious and worthy of mention, first there is a selection bias in the form of gender in that participation as a player in high school football is limited almost entirely to male students, however the research is not based on and individual students participation but on the school having a football program. Secondly there was no individual student observations information gathered for this research and it was limited school level data only. Third the average ACT scores were not lagged from year to year and did not follow the individual students from the 11th to 12th to measure any change in performance.

Fourth, not all schools that reported ACT data participated in football program and not all schools that participated in football programs were required to report ACT scores.

Some loss of data was experienced from schools from not reporting in all categories. Football in Kentucky is a male dominated sport and results of this study are not generalizable to other high school sports, nor generalizable outside of Kentucky. The average ACT scores were not lagged from year to year and did not measure changes in ACT scores from 11th to 12th grade. Data for the study collected at the school level only and does not include student level observations.

Conclusions

This exploratory study set out to answer the two questions as part of an exploratory study; 1) does a relationship exists between a schools participation in a high school football program and the schools average ACT score for that school, and 2) if there is a relationship that does exist, is that relationship affected by a schools locale.

The answer to the first question is that as a result of this exploratory research, a significant and positive relationship was established between average ACT scores and a high school winning percentage in football teams when considering the state level data. The second question was answered affirmatively in that this relationship is affected by locale, with the rural locales experiencing a significant and positive improvement in average ACT scores when there high school had a winning percentage when compared to the other locales.

As part of an exploratory study these results considered the possibility that winning percentage of a school's football team could act as proxy for community specific social capital, attempting to measure the effects of social, cultural or peer influences have an influence on

classroom performance, this does not however imply a causal relationship. Explanatory variables not measured by this study, such as an effective school administration, good coaching, an abundance of student athletes, other school programs, other social and community based activities could also provide explanation for ACT scores..

Recommendations

- Expand existing research to a more in depth study which incorporates student level observations and tracks student academic performance from school to school and comparing a student's 11th grade performance to their performance as a 12th grade student

- Utilize this research model to study effects of girl's high school sports to see if there is a similar relationship to ACT scores.

- Consider expanded study using student level observations in order to enhance ability to track changes in academic achievement

- Identify highest performing rural schools and conduct study to identify additional community specific social capital variables in order to leverage successes

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Appendices

Appendix 1
School Identifiers and Characteristics

(From the School Level Data for Public School Districts in Kentucky 1998 – 2011)		
Variable	**Description**	**Years included in study**
oaacode	6 – digit school identifier	2008 - 2010
sch_name	School name	2008 - 2010
dist_name	District name	2008 - 2010
dist_no	3 – digit district number; first three digits of ooacode	2008 - 2010
sch_year	4 – digit year; last year of school year	2008 - 2010
sch_type	3 = High School, grades 9,10,11,12	2008 - 2010
locale_cat_CCD	Old location code	2008 - 2010
ulocale_CCD	New location code	2008 - 2010
local_cat_CCD	Derived location code from old and new codes	2008 - 2010
Loc_cat_median_CCD	Average location code for all years	2008 - 2010
spending	Spending per student	2008 missing
ada	Percentage average daily attendance. This is for the previous school year	2005 - 2011

Student Characteristics

(From the School Level Data for Public School Districts in Kentucky 1998 – 2011)		
Variable	**Description**	**Years included in study**
ethb_CCD	Percentage of students identified as black in the school from CCD	2005 - 2010
etha_CCD	Percentage of students identified as Asian in the school from CCD	2005 - 2010
ethh_CCD	Percentage of students identified as Hispanic in the school from CCD	2005 - 2010
fr_per	Percentage of students in school on free and reduced lunch	2005 - 2011
dropout	Percentage of high school students who drop out. This is for the previous year	2001 - 2007

Teacher Characteristics

(From the School Level Data for Public School Districts in Kentucky 1998 – 2011)		
Variable	**Description**	**Years included in study**
avg_years_exp	Average years of experience	2005 - 2008

Index Scores

(From the School Level Data fo Public School Districts in Kentucky 1998 – 2011)		
Variable	**Description**	**Years included in study**
act_c_x	ACT score composite	2005 - 2011

Appendix 2a
Local Codes
(Information Taken from the NCES CCD website)

Corresponding Categories	Metro-centric	Urban-centric
City	1, 2	11, 12, 13
Suburb	3, 4	21, 22, 23
Town	5, 6	31, 32, 33
Rural	7, 8	41, 42, 43

Appendix 2b
Definitions for Locale Codes
(Information Taken from the NCES CCD website)

New Urban-Centric Locale Codes

11 - City, Large:
Territory inside an urbanized area and inside a principal city with population of 250,000 or more.

12 - City, Midsize:
Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.

13 - City, Small:
Territory inside an urbanized area and inside a principal city with population less than 100,000.

21 - Suburb, Large:
Territory outside a principal city and inside an urbanized area with population of 250,000 or more.

22 - Suburb, Midsize:
Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.

23 - Suburb, Small:
Territory outside a principal city and inside an urbanized area with population less than 100,000.

31 - Town, Fringe:
Territory inside an urban cluster that is less than or equal to 10 miles from an urbanized area.

32 - Town, Distant:
Territory inside an urban cluster that is more than 10 miles and less than or equal to 35 miles from an urbanized area.

33 - Town, Remote:
Territory inside an urban cluster that is more than 35 miles from an urbanized area.

41 - Rural, Fringe:
Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.

42 - Rural, Distant:
Census-defined rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.

43 - Rural, Remote:
Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster.