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Examining Kentucky Public Schools: Gender Differences in an Index Measure of Accountability for Academic Standards

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Kentucky public education system has made progress over the past 20 years after a number of reforms beginning in 1990. A stated goal of these reforms has been not only to improve the overall performance of students in a school, but to also ensure that no student groups be allowed to fall behind. To accomplish this, the state has adopted and implemented goals that are shared with those of the federal No Child Left Behind Act, including school accountability and a goal of proficiency for all students by the year 2014. However the most recent analysis of three statewide independent groups reported that most student groups at elementary, middle and high school level are not improving at a pace strong enough to reach the standards Kentucky aims for in the coming years.

This study investigates the effects of school characteristics on differences in female and male students' performance at different schooling levels from 2007 to 2008, controlling for the school's racial and socioeconomic composition. The data are analyzed using descriptive statistics, and fixed effects and between effects regressions. Findings suggest that, on average, female students are doing better than male students, and that some school districts exhibit large performance differences by gender for both years and in more than one school level. Although the analysis documents an achievement gap between the genders, this difference was not explained by the school characteristics evaluated with either a fixed effect or a between effect regression model. Nonetheless, the finding supports the literature that separating the effects of the school characteristics from students' social background, innate ability, and other unobservable factors is inherently difficult, as each of the influences of these factors is embedded within the school systems that are pursuing a variety of policy reforms.

INTRODUCTION

Over the past two decades, two major changes have impacted the nature of public education in the United States. First, a new emphasis has been placed on standardized monitoring of student achievement in an effort to hold schools accountable for how their students perform on various measures of grade-appropriate knowledge. A stated goal of such efforts has been not only to improve the overall performance of students in a school, but to also ensure that no student groups fall behind because of a lack of effort to help them overcome learning disparities that might have arisen because of factors such as poverty, learning disabilities, or language difficulties.

A second major change affecting public education in the U.S. is a shift in the nature of the gender disparity in educational achievement. In earlier decades, focus was on the problem of understanding why boys outperformed girls on many standard measures of educational achievement, particularly in math and science. However, the most recent report of trends in education for girls and women (NCES 2004) indicated that

- Boys are more likely than girls to be held back a year or to drop out of school;
- Girls outperformed boys on all measures of reading and writing ability in the 4^{th}, 8^{th}, and 12^{th} grades;
- Girls performed as well as boys on measures of math ability in the 4^{th}, 8^{th}, and 12^{th} grades;
- Girls were more likely to have taken geometry, algebra II, precalculus, biology, honors biology, and chemistry than boys, and nearly as likely to have taken calculus; physics being the only course more likely to have been taken by boys.

The focus of this research is to examine gender differences in the performance of male and female students in public elementary, middle, high schools and school districts on an index score developed to track school and district performance on the Kentucky accountability measure developed to meet the No Child Left Behind requirements. If gender differences are observed, two additional questions are to be evaluated. First is whether patterns of gender differences in achievement scores are common across all school levels (elementary, middle, and high school) within districts. Second is whether gender differences are associated with school level characteristics in Kentucky.

The following report sections are included in the analysis. First is a brief overview of accountability measures as they have been implemented in the Kentucky system of public schools. After that, the key literature regarding gender disparities in elementary and secondary education is discussed. The third section describes the data used in the analysis, followed by the results of the analyses designed to assess whether gender differences in accountability scores exist in Kentucky and, if so, whether they are likely to occur across all school levels within a district, and whether they are associated with school level characteristics. Based on those research findings, recommendations regarding beneficial directions for future research are offered. Finally, limitations of the research are acknowledged.

EDUCATION ACCOUNTABILITY MEASUREMENT IN KENTUCKY

The No Child Left Behind Act of 2001 (NCLB) was signed into law in January 2002. The act codified a policy view that standards, testing, and accountability were the path to improved performance (Hanushek and Raymond 2005). NCLB does not impose a national achievement standard; instead, states are required to develop their own standards to test and

assess student progress each year. The federal act, however, does require that 100 percent of students (including disadvantaged and special education students) reach the same state standards in reading and mathematics by 2014. The purpose of the target is to force states to close achievement gaps based on measured student performance if the states are to receive federal funding for their public schools.

In the last several years, Kentucky has adopted and implemented goals that are mirror those of NCLB, including:

- uniform expectations for all students;
- assessments tied to core content test results measuring what students know and can produce in reading and mathematics as well as in other subject content areas;
- school accountability;
- proficiency for all groups by the year 2014.

As part of the Commonwealth Accountability Testing System (CATS), the state set scores for indicating student work as novice, apprentice, proficient, or distinguished for various subjects. The Kentucky Department of Education (KDE) has released subject-area scores showing the average performance level for every defined student group for each school in Kentucky. Currently, the state is moving from the Commonwealth Accountability Testing System to a system based on new state higher and more demanding academic standards. The new system was mandated in the state legislation (Senate Bill 1) which was enacted by 2009 General Assembly. Under Senate Bill 1, Kentucky has committed to meeting standards that are higher and better aligned with "college-readiness" expectations.

TRANSITION INDEX SCORE

The "transition index" scores were created by the Prichard Committee for Academic Excellence, the Kentucky Association of School Councils, and the Council for Better Education to inform the public about how well individual Kentucky schools and districts are performing and to support future decisions about how to improve student achievement during the Senate Bill 1 transition. Basically, it is a single number that sums up students' progress on all subjects being tested in the state Core Content Tests. The Department of Education reports the percent of students at each performance level on tests of reading, mathematics, science, social studies, and on-demand writing for each year. It also released subject-area scores showing the percent of students achieving the levels of novice, apprentice, proficient, and distinguished. These results were used by the three statewide groups to calculate a transition index which closely resembles the academic data published by the state in past years. The formula for calculating a transition index is as follows.

First, the percent of students at each performance level is taken to calculate an index for each subject using a formula the state Department used in past years. Next, each percent is multiplied by weights for each performance level shown below and summed to get a number that ranges from 0-140.

Novice Nonperformance	0.00
Medium Novice	0.13
High Novice	0.26
Low Apprentice	0.40
Medium Apprentice	0.60
High Apprentice	0.80
Proficient	1.00
Distinguished	1.40

Source: Kentucky Association of School Councils

Then, the index results for each subject are multiplied by the weighted average as shown. Again, these weights for each subject test at each schooling level are similar to the formula KDE used officially in past years.

	Elementary	Middle	High
Reading	0.266	0.253	0.222
Mathematics	0.266	0.253	0.222
Science	0.186	0.196	0.222
Social Studies	0.186	0.196	0.222
Writing On-Demand	0.096	0.102	0.111

Source: Kentucky Association of School Councils

Finally, the resulting numbers are summed to get an index for the whole school on the 0 to 140 scale. An index score of 100 is equivalent to a school-wide average of each category of students scoring at the proficient level in all subjects, and an index score of 140 indicates that, on average, students are performing at the distinguished level in all subjects. As such, the transition index provides an additional tool for measuring how schools compare on the current tests since all Kentucky students take the same test. The results are calculated for all schools, all districts, and for the whole state. In addition, a projection is made of what the school's index score would be in 2014 if it continues improving at the same rate for five more years.

GENDER DIFFERENCES IN EDUCATION

Historically, males were perceived as performing better than females in school; however, over the last several decades the gap between male and female academic attainment and achievement has, in many instances, closed and in some cases reversed (NCES 2004). National Center for Education Statistics (NCES) reports that, nationwide in 2003, females out-performed males on reading and writing tests in the 4th, 8th, and 12th grades. Additionally, they performed as well as males on measures of math ability in 4th and 8th grade, and there was little difference

in the 12th grade scores. There are also differences in high school completion rates between males and females. Males of all races are less likely to graduate from high school than females of the same race. However, NCES reported that the average score of males was higher than that of females on all Advanced Placement (AP) exam subjects.

Research consistently finds generally similar performance of girls and boys in mathematics and reading in the early grades and a growing male advantage in math scores and growing female advantage in reading scores as they move through school (Maccoby and Jacklin 1974; Willingham and Cole 1997). One explanation of this might be the cognitive differences due to biological differences. Girls tend to excel on tests of verbal fluency, arithmetic calculation, and memory for the spatial locations of objects while boys tend to excel on tests of verbal analogies, mathematical word problems, and memory for the geometric configuration of an environment (Spelke 2005). Nevertheless, it is difficult to separate intrinsic capacities and social factors that produce them. Research that focuses exclusively on social and environmental factors will provide an incomplete picture of the complex nature of gender differences.

The way in which school systems allocate boys and girls to different academic locations and expectations also appears to matter in the search for explanations of gender inequalities. Boys and girls can be placed in different tracks in terms of course-taking patterns in school. Hallinan and Sorensen (1987) noted that girls were less likely to be allocated to high ability groups in school than boys. Moreover, after controlling for the overall educational level of the parents, daughters do relatively better in households with a better-educated mother than in households with a better-educated father, and sons do otherwise (Buchmann, DiPrete and McDaniel 2008). As such, educational aspirations and performance are highly correlated (Teachman and Paasch 1998). The way families valued girls' educational careers or the way in

which school systems operate contributed to gender inequalities in educational outcomes (Marks 2007).

Aside from the potential expectation of families and educationally relevant resources, some studies find differences in parental involvement depending on the gender of the child. On the one hand, Stevenson and Baker (1987) found that parents are more involved in school activities with sons and more involved in home activities with daughters; their involvement with boys declines as children grow older, but the involvement with girls remains constant. On the other hand, Muller (1998) found that parental involvement in children's schooling is not gender specific and it may serve to counteract gender stereotypes.

There is also an ongoing debate regarding whether teachers systematically favor one gender over the other. Research based in the early 1990s concluded that teachers called on and praised boys more often than girls (Sadker 1994); however, there are more recent arguments that schools favor girls and contribute to a "war against boys" (Sommers 2000). Additionally, the empirical evidence of whether and how teachers' gender plays a role in students' gender differences in educational outcomes is inconclusive (Buchmann, DiPrete and McDaniel 2008). It is unclear whether the effectiveness of instruction can vary because students might learn more, on average, from teachers of the same gender or whether there might be a bias in the ways boys and girls are taught.

Whether or not boys and girls should be taught in sex-specific classes is becoming one of the most complex questions facing education. Some have concluded that girls are more likely to excel in math and science if they are taught among their own sex because students grow in confidence when surrounded by their own gender, and teachers can adapt lessons to suit intrinsic characteristics (Sax 2005; Despontin 2006). A major study done by Professor Alan Smithers,

concluded that there is no evidence that children achieve more at single-sex schools. Despite there being no overriding advantages for single-sex schools on educational grounds, there appears to be no disadvantage either, he asserted. The report also concluded that gender has very little impact on how well a school performs. Instead, it was other factors, rather than single-sex status, which appeared to account for the results, such as social background and ability (Smithers 2006). Another report on differences between the genders concluded the same thing - that there is more overlap between boys and girls than differences, according to Usha Goswami, a neuroscientist and professor of education at the University of Cambridge. Two boys could be as different from each other as they were from girls, Professor Goswami said.

RESEARCH QUESTIONS

Under Senate Bill 1, Kentucky has committed to meeting higher standards that are better aligned with college-readiness expectations. As measured by the Commonwealth Accountability Testing System (CATS) as a score of 100, all schools have made some progress toward the goal, most schools have made adequate progress to reach 100 by 2014, and a few schools have already reached the goal.[1] According to the Prichard Committee for Academic Excellence, the Kentucky Association of School Councils, and the Council for Better Education, however, the status of student groups based on family income, disability, gender, ethnic background, and program participation are not improving at a rate sufficient to reach proficiency by 2014, and major achievement gaps continue to weaken statewide performance. Therefore, as a contribution to identifying policy options for improving the educational performance of a student group, the purpose of this study is to examine the effects of school characteristics on gender differences in

[1] Kentucky Board of Education, Strategic Plan Progress Report 2005

the performance of male and female students in public elementary, middle, and high schools, net of schools' racial and socioeconomic contributions. The research questions that the study sought to answer were:

- Do some schools exhibit large differences in academic achievement between female and male student groups?
- Do the performance differences exhibited by some schools occur at all levels within the same school districts?
- Are there characteristics of schools significantly associated with gender differences?

DATA

The Department of Education reports data on the percent of students at each performance level on tests of reading, mathematics, science, social studies, and on-demand writing as well as subject area scores showing percent novice, apprentice, proficient, and distinguished. The data in this study include the transition index scores defined previously for each school and each school district in Kentucky, along with various characteristics of the individual schools, all for the school years 2007 and 2008. With this data, I am able to examine whether the characteristics of the schools have an effect on average female and male students' achievement, after controlling for the racial and socioeconomic composition of the school. Controlling for these factors is important because analyses conducted without controls may overestimate or underestimate the effects of school characteristics on student outcomes. For this study, the dependent variable was the difference in transition index scores between female and male students in each school in 2007 and 2008. I excluded schools which did not have data at any points in the study. It is

assumed that any schools which were dropped from the analysis due to insufficient data were randomly distributed among schools.

There were 1,898 Kentucky schools in 176 school districts included in the analysis. Of these, 1101 were elementary schools, 411 were middle schools, and 386 were high schools. The same schools were used in all the analyses conducted, although the number of schools differs for each regression analyses due to missing data. One possible explanation for this is that the Department of Education has thresholds for group size and does not report data where the number is below the threshold in order to protect student privacy. The explanatory variables included in the analysis were school characteristics regarding the distribution of student and teacher characteristics as described later.

GENDER DIFFERENCES IN ACCOUNTABILITY SCORES

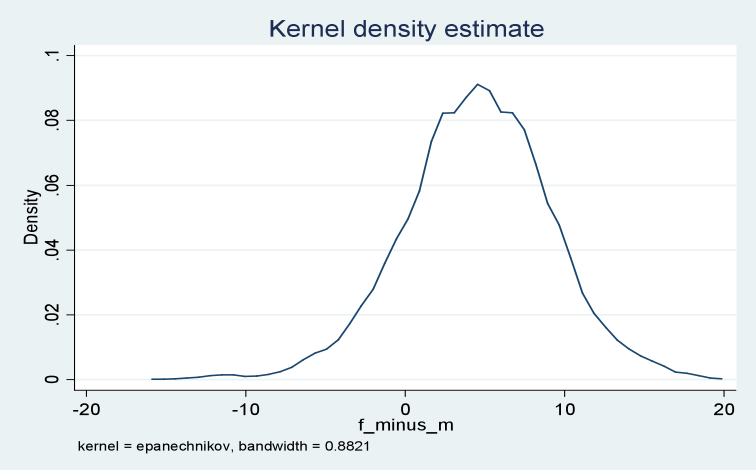
Before moving to the multivariate analysis, some descriptive statistics for the study sample are shown in the summary statistics table and a Kernel Density Estimation graph. Table 1 and Figure 1 show that the distribution of differences between the genders in school transition index scores is approximately normal with a mean of about 4.5 and a standard deviation of about 4.6. The approximate normality of these measures implies that females score better on average, but with variation throughout Kentucky. The variance of about 20.9 among the schools also describes how widely the differences vary among schools. There are schools with differences from +19 to -15 when the school's index score for males is subtracted from the index score for females, indicating a large positive or negative differences, but schools with differences that large are unusual. However, this variation provides an opportunity to explore what school

characteristics and other factors might influence the size and direction of school gender differences.

Table 1: Summary Statistics of Differences in the Transition Index Scores by Gender for Kentucky Public Schools Female Scores minus Male Scores

Percentiles	Differences	Smallest
1%	-7	-15
5%	-3	-13
10%	-1	-12
25%	2	-12
50%	5	**Largest**
75%	8	17
90%	10	18
95%	12	19
99%	15	19
No. of Observations	1898	
Mean	4.52131	
Largest Std.Dev.	4.57059	
Variance	20.89034	

Figure 1: Kernel Density Estimation of Differences in the Transition Index Scores by Gender for Kentucky Public Schools Female Scores minus Male Scores



PATTERN OF GENDER DIFFERENCES ACROSS DISTRICT LEVELS

For this portion of the research the unit of analysis is the school district rather than the individual school. An indicator of the relative size of the difference between a district's average score for females and males was developed. The values of the indicator of gender difference were defined as follows:

- **Indicator of gender difference = 1** if the district's average female transition index score minus the district's average male transition index score is greater than 5.
    - This means that the female advantage in scores is relatively large.
- **Indicator of gender difference = 0** if the district's average female scores minus average male scores is greater than or equal to zero and less than 5.
    - This means that females still have an advantage in scores, but the difference from males is relatively small.
- **Indicator of gender difference = -1** if the district's average female score minus the average male score is less than zero.
    - This means that on average, male students have higher scores than their cohort female students.

The indicator of gender difference was calculated for each district for 2007 and 2008 and summed for the two years. Two questions were examined.

1. Is the indicator of a large gender difference stable from one year to the next?
    1.1. **If the indicator sum across both years = 2**, then a large female advantage persists across both years.

1.2. **If the indicator sum across both years = -2**, then a male advantage persists across both years.

1.3. **If the indicator sum across both years is between -2 and 2**, then a gender difference was not said to persist.

2. Are there school districts where a gender difference persisted across both years in more than one school level within the district?

Table 2 indicates that there were 49 school districts in Kentucky that exhibited relatively large differences of female over male average transition index scores for both years in more than one level within the same district. Six of the districts (Butler, Knott, Lee, Owen, Pike, and Taylor) exhibited relatively large female advantages over both years in all school levels – elementary, middle, and high school.

Table 2: Female Advantage in Transition Index Scores for 2007 and 2008 at District Levels

Elementary School Districts	Middle School Districts	High School Districts
	Adair	Adair
	Anderson	Anderson
Bardstown Ind	Bardstown Ind	
	Bell	Bell
	Boyd	Boyd
Breathitt	Breathitt	
Butler ***	Butler ***	Butler ***
Carter	Carter	
Casey		Casey
	Clark	Clark
Dawson Springs Ind	Dawson Springs Ind	
Dayton Ind	Dayton Ind	
	Elliott	Elliott
Estill	Estill	
	Fort Thomas Ind	Fort Thomas Ind
Franklin	Franklin	
Fulton	Fulton	
	Gallatin	Gallatin
	Garrard	Garrard
Greenup	Greenup	
	Henry	Henry
	Hopkins	Hopkins
	Jackson	Jackson
Knott ***	Knott ***	Knott ***
Lee ***	Lee ***	Lee ***
	Lewis	Lewis
	Lincoln	Lincoln
	Livingston	Livingston
	Magoffin	Magoffin
	Marion	Marion
	Mason	Mason
	Menifee	Menifee
Metcalfe	Metcalfe	
	Monroe	Monroe
	Morgan	Morgan
	Nelson	Nelson
	Oldham	Oldham
Owen ***	Owen ***	Owen ***
Paris Ind	Paris Ind	
Pike ***	Pike ***	Pike ***
	Powell	Powell
Russell	Russell	
	Scott	Scott
Taylor ***	Taylor ***	Taylor ***
Todd	Todd	
Trimble	Trimble	
	Union	Union
Walton-Verona Ind	Walton-Verona Ind	
	Woodford	Woodford

Note: Six school districts with three asterisks indicate persistent gender differences exhibited into all levels of schooling.

As shown in Table 3, while there were thirteen districts where average scores for males were higher than average scores for females in both years, Williamsburg Independent was the only district where two levels, elementary and high school, exhibited that type of difference, and no district exhibited that pattern for both years across all three school levels.

Table 3: Male Advantage in Transition Index Scores for 2007 and 2008 at District Levels

Elementary School Districts	Middle School Districts	High School Districts
Crittenden	Corbin Ind	Berea Ind
Danville Ind	Hancock	Eminence Ind
Middlesboro Ind	Mayfield Ind	Fairview Ind
Paducah Ind	Mercer	Newport Ind
Williamsburg Ind *		Williamsburg Ind *

Note: Asterisk represents that, except for other districts, Williamsburg Ind exhibits persistent higher male scores in elementary and high school districts.

GENDER DIFFERENCES AND SCHOOL LEVEL CHARACTERISTICS

For this portion of the research, the unit of analysis is the individual school. A multiple regression model of 1,898 observations was employed. The model includes the school identifier, school year, school type (elementary, middle, or high school), student-teacher ratio, total enrollment, percent of students identified as Asian, Black, Hispanic, White, and Other Ethnicity, percent of students receiving reduced price or free lunch, percent of teachers with masters' degree, and average years of teachers experience as explanatory variables. The difference in transition index score of female and male students is the dependent variable. The data for school type was analyzed with binary variables where each school is assigned a 1 if at that level; and 0 otherwise. The value-added achievement model estimates how much of the gain in transition index score is due to the characteristics of the school, controlling for the school's racial and

socioeconomic composition. The null hypothesis is that the school characteristics have no effect on achievement gain between female and male student groups. The alternative hypothesis is that there is some effect.

$$Y_{ij} = B0 + B1x + B2z + \varepsilon_{ij}$$

In the model indicated above, Y_{ij} is the difference in female and male student scores for school i at each school year j; x is a vector of school characteristics; z is school racial and socioeconomic composition, however, they are auxiliary to this study; and ε is the disturbance term. If, net of all other factors including school racial and socioeconomic composition, there is a decrease in achievement gap between female and male student groups associated with school characteristics, then a policy promoting adoption of such characteristics might make gender performance more similar.

As shown in Table 4, 5, and 6, the percentage of the variance explained by school district fixed effects in each model for elementary, middle, and high school were 60% to 82%. That is the percentage of the variance not accounted for by explanatory variables, but fixed within districts. The results of fixed effect regressions for all school levels such as elementary, middle, and high schools demonstrate that variations in the explanatory variables did not have a statistically significant relationship with the difference in transition index scores of female and male students. Also, the results of the between effects regression model illustrated in the Table 7, 8, and 9 support this analysis as well. As a result, this study finds **no** evidence that school characteristics such as school type, student-teacher ratio, total enrollment, percent of students identified by ethnicity, percent of students receiving reduced price or free lunch, percent of teachers with masters' degree, or average years of teachers experience are associated in a

significant way with differences in index scores by gender. Therefore, the alternative hypothesis, which predicted that the school characteristics have effect on achievement differences between female and male student groups, was not supported. The fixed effects models estimate the effects of changes in school characteristics, and there is no apparent effect. Between effects models estimate the effects of average levels of school characteristics, and there is no apparent effect either.

Table 4: Fixed Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at Elementary School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	86.810	216.163	0.40
Percent of Teachers with Masters' Degree	0.022	0.035	0.63
Total Enrollment	0.006	0.009	0.62
Average Years of Experience	0.015	0.136	0.11
Student Teacher Ratio	-0.079	0.198	-0.40
Year 2008	-0.276	0.280	-0.99
Free Lunch	0.004	0.030	0.13
Percent of Black Students	-0.880	2.203	-0.40
Percent of Hispanic Students	-0.779	2.279	-0.34
Percent of Asian Students	-1.127	2.230	-0.51
Percent of Other Ethnicity	-0.883	2.011	-0.44
Percent of White Students	-0.862	2.172	-0.40
Number of Observations	1101		
Corr (fixed effects, explanatory)	-0.25		
Model F Test: F (11, 568)	0.43		
Model P Value	0.94		
Percentage of Variance in Fixed Effects	0.6		

Table 5: Fixed Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at Middle School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	-782.771	916.951	-0.85
Percent of Teachers with Masters' Degree	-0.077	0.048	-1.59
Total Enrollment	-0.001	0.008	-0.24
Average Years of Experience	-0.063	0.150	-0.42
Student Teacher Ratio	0.004	0.142	0.03
Year 2008	-0.649	0.286	-2.26
Free Lunch	-0.011	0.024	-0.46
Percent of Black Students	8.066	9.277	0.87
Percent of Hispanic Students	8.734	9.276	0.94
Percent of Asian Students	7.542	9.096	0.83
Percent of Other Ethnicity	8.059	9.181	0.88
Percent of White Students	7.953	9.184	0.87
Number of Observations	411		
Corr (fixed effects, explanatory)	-0.75		
Model F Test: F (11, 206)	22360.52		
Model P Value	< 0.001		
Percentage of Variance in Fixed Effects	0.82		

Table 6: Fixed Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at High School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	-1263.278	941.313	-1.34
Percent of Teachers with Masters' Degree	-0.039	0.080	-0.48
Total Enrollment	0.003	0.008	0.35
Average Years of Experience	-0.169	0.334	-0.50
Student Teacher Ratio	-0.277	0.312	-0.88
Year 2008	0.413	0.661	0.62
Free Lunch	0.088	0.081	1.08
Percent of Black Students	12.715	9.335	1.36
Percent of Hispanic Students	13.024	9.695	1.34
Percent of Asian Students	13.265	9.816	1.35
Percent of Other Ethnicity	14.005	9.510	1.47
Percent of White Students	12.680	9.415	1.35
Number of Observations	386		
Corr (fixed effects, explanatory)	-0.71		
Model F Test: F (11, 192)	1.83		
Model P Value	0.05		
Percentage of Variance in Fixed Effects	0.7		

Table 7: Between Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at Elementary School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	-313.293	1874.275	-0.17
Percent of Teachers with Masters' Degree	-0.014	0.023	-0.65
Total Enrollment	0.000	0.001	0.38
Average Years of Experience	-0.032	0.087	-0.38
Student Teacher Ratio	-0.147	0.096	-1.53
Year 2008	-2.834	1.391	-2.04**
Free Lunch	0.008	0.011	0.73
Percent of Black Students	3.253	18.742	0.17
Percent of Hispanic Students	3.161	18.745	0.17
Percent of Asian Students	3.252	18.738	0.17
Percent of Other Ethnicity	2.969	18.747	0.16
Percent of White Students	3.222	18.742	0.17
Number of Observations	1101		
Sd (between effects, explanatory)	4.139		
Model F Test: F (11, 557)	2.18		
Model P Value	0.01		

***P < 0.01, **P < 0.05, *P < 0.1, two-tailed

*** Indicates significant at the 0.01 level; ** at the 0.05 level; and * at the 0.1 level

Table 8: Between Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at Middle School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	-738.96	6340.116	-0.12
Percent of Teachers with Masters' Degree	0.005	0.031	0.17
Total Enrollment	0.000	0.001	-0.22
Average Years of Experience	-0.25	0.119	-2.11
Student Teacher Ratio	-0.164	0.108	-1.51
Year 2008	-8.423	3.75	-2.25**
Free Lunch	-0.012	0.017	-0.69
Percent of Black Students	7.514	63.399	0.12
Percent of Hispanic Students	7.598	63.415	0.12
Percent of Asian Students	7.364	63.379	0.12
Percent of Other Ethnicity	7.382	63.388	0.12
Percent of White Students	7.560	63.397	0.12
Number of Observations	411		
Sd (between effects, explanatory)	3.181		
Model F Test: F (11, 195)	2.33		
Model P Value	0.01		

***P < 0.01, **P < 0.05, *P < 0.1, two-tailed

*** Indicates significant at the 0.01 level; ** at the 0.05 level; and * at the 0.1 level

Table 9: Between Effects Regression Model for Predicting the Effects of School Characteristics on Gender Difference in Index Scores at High School Level

Explanatory Variables	Coef.	S.E.	t Value
Constant	-940.106	1981.056	-0.47
Percent of Teachers with Masters' Degree	0.077	0.043	1.82
Total Enrollment	7.69e	0.000	0.01
Average Years of Experience	-0.122	0.156	-0.78
Student Teacher Ratio	0.043	0.150	0.29
Year 2008	(omitted)		
Free Lunch	0.057	0.020	2.82*
Percent of Black Students	9.261	19.807	0.47
Percent of Hispanic Students	9.554	19.841	0.48
Percent of Asian Students	9.144	19.807	0.46
Percent of Other Ethnicity	9.310	19.814	0.47
Percent of White Students	9.370	19.810	0.47
Number of Observations	386		
Sd (between effects, explanatory)	3.427		
Model F Test: F (10, 182)	4.29		
Model P Value	< 0.001		

***P < 0.01, **P < 0.05, *P < 0.1, two-tailed

*** Indicates significant at the 0.01 level; ** at the 0.05 level; and * at the 0.1 level

DISCUSSION

In the last several years, Kentucky has adopted and implemented goals that are intended to be better aligned with college-readiness expectations for all students, including using multiple assessments tied to the core content and measuring what students know and can do. There is increased emphasis on school accountability by providing information on student performance to parents and information on school performance to the public and policy makers. There is also a goal that all student groups will score at the proficient level by the year 2014.

This study represents an initial effort to identify options for improving the educational performance of particular groups – female and male students. This research investigated patterns of gender differences in achievement scores among public schools in Kentucky. It was found that female students generally perform better than male students, but that the variation between

schools on this difference is large. Also, it was determined that 28 percent of Kentucky school districts exhibited a large female advantage in scores in both 2007 and 2008 in at least two school levels within the district. This is in contrast with only 3 percent of Kentucky school districts that exhibited male scores higher than female scores in both years, and only one school district exhibited that difference for both years in two school levels.

Finally, gender differences in Kentucky on an index score developed to meet the No Child Left Behind accountability requirements were **not** found to be explained by the school characteristics of school type, student-teacher ratio, percent of students by ethnicity, percent of students eligible for reduced price or free lunch, percent of teachers with masters' degree, or average years of teachers experience.

These findings confirm that Kentucky is in line with prior studies where researchers have documented that gender differences in education have changed in recent decades. The historical gap between male and female academic attainment and achievement has closed, and in many public schools across the country and in Kentucky, has reversed -- with females generally outperforming males on school accountability measures. It is possible that school and classroom efforts to provide equal opportunities for both school-aged boys and girls have improved, but are not having an equal effect for the genders. While the research literature does not support the efficacy of sex-specific education programs for addressing the current gender difference in performance, further research on this topic should seek to obtain and evaluate data to learn what individual, family, school, and cultural factors might explain gender differences in education outcomes, so that such persistent differences can be reduced by helping boys catch up to girls rather than redirecting resources in a manner that causes girls' performance to decline.

LIMITATIONS

This study is limited by not having sufficient data on more school characteristics as well as the transition index scores of the female and male students to conduct a more complete analysis. It is possible that the evidence provided by the analysis could be subject to selection bias and problems with external validity. First of all, schools dropped out of the analysis might not be actually "random" and they might be the ones that could provide interesting results. Second, the underlying data for calculating the transition index came from the state Department of Education which has thresholds for group size and does not report data where the number is below that level. Therefore, district results are more complete than the school results because larger groups are more likely to get reported. Finally, this analysis was conducted on school-level aggregated data and not on individual student data. As such, readers should be cautious in any generalizations to individuals. Rather, all the findings in this analysis may be generalized only for traditional public schools in Kentucky.

CONCLUSION

The empirical results suggest that, on average, female students score higher on the standardized tests given in Kentucky schools than male students, while the difference is approximately normally distributed. This research examined whether school characteristics can explain levels or changes in these gender differences. The results indicate that much of the variation between school districts in gender differences is fixed within districts (i.e. fixed effects) and not explainable by changes in school characteristics. These fixed levels are explainable, on average, by ethnicity, and sometimes by other factors. The results also indicate the school characteristics analyzed are not contributors to the differences in academic performance between

the genders. The lack of evidence that these gender differences change with measurable school characteristics makes policy changes difficult to suggest.

Further research may reveal policy options for decreasing the achievement gap among student groups. Although this study indicates the fact that schools matter, from the observation that schools in Butler, Knott, Lee, Owen, Pike and Taylor school districts in Kentucky have female students who exhibited relatively large differences in performance compared to their male counterparts at all schooling levels for both 2007 and 2008, the other research in this study could not explain why. Nonetheless, the finding supports the literature that separating the effects of the school characteristics from other factors is inherently difficult, in large part because measurement errors for school and other factors (social background and innate ability) are likely correlated with each other.

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