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Education Reform, Equal Opportunity and Educational Achievement: Do Trend Data Adequately Report Progress?[1]

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Abstract: Using Kentucky as a case study, the research described in this paper examines efforts to provide equality of educational opportunity. Standards based educational reform has produced myriad data on student achievement that are used by educators, policy analysts, legislators, and researchers to discern progress. This research makes use of multiple sources of data (CATS index, reading proficiency, math proficiency) in an attempt to more thoroughly consider progress in attempts to ameliorate gaps in student achievement that have been found to exist as related to local wealth. Findings from the study show mixed results. Although local wealth has decreased as a predictor of student achievement in reading, it is still a significant predictor of achievement in math. Gaps are closing more rapidly at the elementary school level which suggests the need to study the process of

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education at the secondary level. Lastly, student demographics, especially students qualifying for free and reduced lunch continue to be a significant predictor of student achievement. We conclude that changes to state accountability systems that move the unit of analysis from the school to the student level offer the best opportunity to utilize emerging research methodologies that will enable practitioners and analysts to better analyze educational process.
Keywords: education reform; accountability; student-level data.

Reforma Educativa, la igualdad de oportunidades y el logro educativo: Los datos de los progresos tendencia grabar correctamente?
Resumen: Usando de Kentucky como caso de estudio, la investigación descrita en este artículo examina los esfuerzos para proporcionar igualdad de oportunidad educativa. La reforma educativa basada en estándares se han producido una variedad de datos sobre el desempeño de los estudiantes que son utilizados por los educadores, analistas políticos, los legisladores y los investigadores que tratan de detectar el progreso. Esta investigación utiliza múltiples fuentes de datos (índice de CATS, el dominio de la lectura, habilidad matemática) para investigar los avances más plenamente con el fin de minimizar las brechas en logros de los estudiantes en relación a la riqueza local. Los resultados muestran resultados mixtos. A pesar de la riqueza local se ha reducido como un indicador de rendimiento de los estudiantes en lectura, sigue siendo un indicador de rendimiento en matemáticas. Las brechas se están cerrando más rápido en el nivel de la escuela primaria, lo que sugiere la necesidad de estudiar el proceso educativo en el nivel secundario. Por último, los datos demográficos de los estudiantes, especialmente a los estudiantes matriculados para el almuerzo gratis o reducido sigue siendo un indicador significativo del rendimiento estudiantil. La conclusión de que los cambios en los sistemas estatales de rendición de cuentas que se mueve la unidad de análisis del nivel de la escuela hacia el nivel del estudiante ofrece la mejor oportunidad de utilizar nuevas metodologías de investigación que permitirá a los profesionales y analistas para analizar mejor el proceso educativo.
Palabras clave: reforma educativa; la rendición de cuentas; los datos de nivel de los estudiantes.

Reforma Educacional, Oportunidades Iguais e Aproveitamento Educacional: Dados de tendência registram progresso de forma adequada?
Resumo: Usando o Kentucky como estudo de caso, a pesquisa descrita neste artigo examina os esforços para se oferecer igualdade de oportunidade educacional. Os padrões com base na reforma educacional produziram uma variedade de dados sobre o aproveitamento do aluno que são usados por educadores, analistas de políticas, legisladores e pesquisadores na tentativa de detectar progresso. Esta pesquisa faz uso de múltiplas fontes de dados (índice CATS, proficiência em leitura, proficiência em matemática) para investigar o progresso de forma mais completa a fim de minimizar as lacunas encontradas no aproveitamento do aluno em relação à riqueza local. Os resultados do estudo mostram resultados misturados. Embora a riqueza local tenha diminuído como um indicador de aproveitamento do aluno em leitura, ele ainda é um indicador de aproveitamento em matemática. As lacunas estão se fechando mais rapidamente no nível da escola elementar, o que sugere a necessidade de se estudar o processo educacional no nível secundário. Finalizando, os dados demográficos dos alunos, especialmente os alunos inscritos para almoço gratuito e reduzido continuam a ser um indicador significativo do aproveitamento do aluno. Concluímos que as mudanças para sistemas estatais de accountability que movimentam a unidade de análise do nível escolar em

direção ao nível do aluno oferece a melhor oportunidade de usar metodologias de pesquisas emergentes que irão possibilitar a profissionais e analistas analisar melhor o processo educacional.
Palavras-chave: reforma educacional; responsabilidade; dados do nível dos alunos.

Introduction

Educational reform has been ongoing in Kentucky since passage of the landmark Kentucky Education Reform Act of 1990 (KERA), making the state one of the leaders in comprehensive and systemic change in schools (Foster, 1999; Pankratz & Petrosko, 2000). KERA restructured P-12 public education through significant changes in curriculum, governance, and finance and embarked the commonwealth on a demanding pace of school accountability (Kannapel, Aagaard, Coe, & Reeves, 2000; Hunter, 1999; Legislative Research Commission, 1990). KERA was enacted in response to the landmark finance litigation, *Rose v. Council for Better Education,* in which 66 property-poor school districts and others brought suit against the Commonwealth. The class-action suit filed in 1985 asserted that the method of financing public schools was inequitable and inadequate, thus limiting learning opportunities for children living in impoverished areas. In 1989 the Kentucky Supreme Court not only supported the claims made by the Council for Better Education, but also ruled that the entire elementary and secondary school system was unconstitutional due to disparities in educational opportunity and student achievement.

What distinguished the *Rose* decision from previous school finance litigation was the focus on adequacy and the link between finance and educational outputs (Verstegen, 1998). Section 183 of the Kentucky constitution mandates that the commonwealth "provide an efficient system of common schools throughout the state". The *Rose* court defined "*efficient* as "adequate and state lawmakers and practitioners were tasked with providing "substantial uniformity, substantial equality of financial resources and substantial equal educational opportunity for all students" (*Rose v. Council for Better Education* 790 S.W.2d 186 at 9). KERA represented efforts on the part of the Kentucky legislature to address the issues of adequacy that were stipulated by the court. The policy restructured P-12 public education through significant changes in curriculum, governance, and finance. Although modifications have been made in curriculum over the past 20 years to address new learning expectations, the governance and finance systems have remained essentially untouched. KERA also launched a comprehensive system of student learning and school accountability years before it became a national priority (Kannapel, Aagaard, Coe, & Reeves, 2000; Legislative Research Commission, 1990).

Two significant events have recently taken place in Kentucky to again alter the path of education reform. First in 2006, in a second generation adequacy lawsuit, the Franklin County Circuit Court issued a summary judgment in the *Young* case (*Tyler Young, et al. v. David L. Williams et al*., Franklin Circuit Court Division II 03-CI-00055 and 03-CI-01152). The term second generation adequacy lawsuit has appeared in the literature to distinguish between adequacy claims that are being made in state courts for the first time and those that represent a second round of trial decisions in the respective states (Sturm & Simon-Kerr, 2009). In the summary judgment, the court held that Kentucky's present system of education finance was adequate. The court based its finding on two issues: first the judicial branch does not have the right to dictate the means by which schools must be funded in the commonwealth, and secondly progress in Kentucky's public schools has steadily resulted in

increased test scores. The court opined that the *Rose* court did not stipulate a timeline for improvement and that plaintiffs did not clearly link the lack of resources to measures of student achievement. Secondly, in 2009, Governor Steve Beshear signed Senate Bill 1 which suspended the Commonwealth Accountability Testing System during the 2008-2009, 2009-2010, and 2010-2011 school years and called for the establishment of a new system of testing by the 2011-2012 school year. The legislation calls for a new testing system that includes reading, language arts, math, science, and social studies. Finally, the legislation calls for the removal of the biennial CATS index and requires the establishment of a yearly accountability measure that is valid at the student level. Each of these measures were undertaken in order to strengthen and align the standards. In addition the bill was meant to streamline accountability in a way that will allow the state to track educational outcomes at a student level.

As previously noted, Kentucky has been recognized as a leader in the educational reform movement, specifically with regard to efforts to define the concept of educational adequacy. Twenty years after the *Rose* decision, it is important to carefully judge the degree to which Kentucky has fulfilled the goals outlined by the court. The court held "Each child, every child, in this Commonwealth must be provided with an equal opportunity to have an adequate education. Equality is the key word here. The children of the poor and the children of the rich, the children who live in the poor districts and the children who live in the rich districts must be given the same opportunity and access to an adequate education" (*Rose* at 74). Although, the *Tyler* judgment found that trend data indicated that there was significant progress in achievement as measured by the state assessments, a closer look at the same data paints a more complicated picture of the successes and failures in Kentucky's attempt to close achievement gaps. This study sought to answer the research question, given two decades of education reform, how successful has Kentucky been in providing an adequate education? Specifically, researchers sought to discern how well reform efforts in Kentucky have been in ameliorating differences in educational achievements that were previously found to be related to differences in local wealth. Using Kentucky as a case study this study offers insight into the effectiveness standards-based educational reform as a lever for achieving an adequate education for all students nationwide.

Standards Based Accountability and Adequacy

A hallmark of educational governance in the United States is the distribution of powers across levels and branches of government (Cohen, Moffitt & Goldin 2007). This configuration allows for local control as well as balance of power. However, it also leads to a complexity in the development and implementation of educational and social goals. Over the past half century education has been emphasized as the main lever for social policy in the United States (Hochschild & Scovronick, 2003). Generally speaking, Americans expect schools to provide children with the necessary tools to function in a democratic society and to compete and succeed in the economy. Although these charges have often been framed as the transfer of skills to individuals, for individual benefit, they are also thought to serve larger social goals such as remedying past inequalities and ensuring overall advantage in international economic competition (Ladson-Billings 2006; Spring 1996; Gordon 2000). Standards-based education reform requires both the accommodation of different student need as well as the accomplishment of performance goals in the aggregate. These overlapping and sometimes competing goals have often resulted in incoherent education

policies and disagreement over the proper distribution of resources (Hoschschild & Scovronick, 2003; Fuhrman 1993).

Social Goal of Adequacy

Adequacy lawsuits have been an attempt by plaintiffs to seek judicial remedy to the improper distribution of revenues and to realign resource use with student outcome goals. Often in adequacy cases the court is asked to rule on the progress toward the accomplishment of educational outcomes inherent in past legislation. The court must discern the meaning of short constitutional clauses that established public school systems based on the contemporary needs of the state. Decisions such as these often result in the distillation of social goals. However, as in Kentucky, the court has no power to develop policy to meet these social goals. Rather, these decisions are made by a representative legislative system and involve compromise and political maneuvering with regard to adequate funding, educational standards, and accountability.

In Kentucky, the educational reform movement over the past 20 years is the result of these political compromises that were spurred by the social desires distilled in the *Rose* case. Recognizing that education "is a principal instrument in awakening the child to cultural values, in preparing him for later professional training, and in helping him to adjust normally to his environment" (*Rose* at 190), the Kentucky Supreme Court opined "in these days, it is doubtful that any child may reasonably be expected to succeed in life if he is denied the opportunity of an education" (*Rose* at 190). The Court established the responsibility of the state to provide an efficient, adequate education to the children of the commonwealth and extended the definition of efficient to include "goals to be met by an education" (*Rose* at 193). These goals were enumerated in the trial court decision and included the following seven competencies: (i) sufficient oral and written communication skills to enable students to function in a complex and rapidly changing civilization; (ii) sufficient knowledge of economic, social, and political systems to enable the student to make informed choices; (iii) sufficient understanding of governmental processes to enable the student to understand the issues that affect his or her community, state, and nation; (iv) sufficient self-knowledge and knowledge of his or her mental and physical wellness; (v) sufficient grounding in the arts to enable each student to appreciate his or her cultural and historical heritage; (vi) sufficient training or preparation for advanced training in either academic or vocational fields so as to enable each child to choose and pursue life work intelligently; and (vii) sufficient levels of academic or vocational skills to enable public school students to compete favorably with their counterparts in surrounding states, in academics or in the job market (*Rose* at 212).

The broad reach of these competencies signaled that schools in Kentucky were meant to provide more than academic competencies but rather to develop competent citizens who were prepared to seek additional training for entry to the workforce. In order to provide students in the commonwealth with the seven competencies and to monitor progress toward achievement of this goal, Kentucky embarked on a path of standards-based education reform. These seven competencies were later adopted in lower courts in Ohio and Alabama and by the high court of Massachusetts which provides further rationale of the choice to study progress of Kentucky schools as they strive to equip students with these competencies and reach proficiency goals for all.

The Court placed the requirement to develop an adequate system, to fund an adequate system, and to monitor an adequate system solely on the state. Such a system was

defined to include content standards, resource requirements, and a means by which student performance could be measured. The content standards included the aforementioned seven competencies. The court alluded to the proper allocation of resources and measures of accountability in holding that an efficient system must "provide sufficient physical facilities, teachers, support personnel, and instructional materials to enhance the educational process" (*Rose* at 12).

Politics of Standards Based Accountability

Much like many other states in the 1990s Kentucky responded to the goals of adequacy by legislating standards-based accountability reform. Linn (2000) noted that standards-based education reform offered a challenge to the practices of education that had differentiated both content and instruction based on perceptions of student ability. The purpose of the reform was to impact instruction. Standards-based education reform requires schools and school districts to design appropriate instructional practices and strategies that meet the diverse needs of learners in myriad content areas in return for accountability as measured by student performance (Goertz, 2001; Weiss, Knapp, Hollweg & Burrill, 2001). The standards movement required more uniform content and pedagogy for all students and challenged deeply rooted beliefs about who can do intellectually demanding work (Spillane, 1999). Succinctly stated, student learning is contingent on access. Proponents of the standards movement maintained that educators must approach teaching by focusing on skill and understanding (Elmore, 2000; Fink & Thompson, 2001). As such, changes to the process of teaching include the alignment of curriculum, instruction and student assessment with content standards.

Accountability systems have historically been used by states as a way of monitoring and regulating education (Goertz, 2001). These accountability systems evolved from state defined requirements for inputs, input usage and minimum competency requirements to the standards-based movement in which states established challenging content and performance standards for all students. While most states have adopted some form of standards based accountability, a difference exists in the way the three design elements: who is held accountable?, for what are they held accountable?, and what consequences are attached to the accountability system? are addressed (Goertz, 2001). Despite design differences all systems state that "schools and school systems should be held accountable for their contribution to student learning" (Elmore & Fuhrman, 2001, p. 4).

Accountability in education requires significant changes in leadership of schools and school districts (Wong & Nicotera, 2007). The loose coupling of educational organizations allows for myriad theories of change when considering issues of educational accountability (Adams & Kirst, 1999). Accountability systems have implications for school policy and the means by which schools must organize themselves to accommodate student learning, however one chooses to measure that concept (Darling-Hammond, 1997; Spillane & Seashore Louis, 2002). The focus in school leadership has changed to include an examination of empirical evidence of best practices that support student achievement. However, the research is replete with studies examining the rift between policy and practice. Scholars have largely found that impacting change at the classroom level is elusive (Tyack & Cuban, 1995) due to the large volume of change initiatives (Hess, 1999) and the structure of educational organizations (Ogawa, Sandholtz, Martinez-Fiores & Scribner, 2003; Wong & Anagnostopoulos, 1998; Elmore, Abelmann & Furhmann, 1996). Wong and Nicotera

(2007) as well as Spillane (2006) conclude that district support is critical for the successful implementation of programs to change teacher practice and improve student learning.

Similarly, critics of standards abound. They contend that standards and state systems of accountability have created a situation wherein teachers teach to the test rather than challenge students to reach their potential. The extant literature contains a growing body of literature that offers evidence that students from underrepresented populations are taught by less qualified teachers and attend deteriorating schools that are characterized by racial and socioeconomic isolation (Author, 2007; Darling-Hammond, 1997), that testing may actually work to the disadvantage of minority groups (Berliner, 2005; Amrein & Berliner, 2002; Nichols & Berliner, 2005; Nichols, Glass & Berliner, 2006; AAUW, 1992; Haney, 1983; Oakes, 1990, 1986, 1985; Pearson & Garcia, 1994) and that the accountability systems currently in place have not effectively linked the testing system to content standards (Finn & Kanstoroom, 2001). Intergenerational poverty and the accompanying lack of social or political capital have led many to profess that the problems caused by these circumstances cannot be solved by schools alone (Berliner, 2005; Jordan & Cooper, 2003; Levin & Kelley, 1994). A growing body of literature suggests that the unwillingness of schools to change in order to achieve the goals of social justice that are part of the standards-based reform have disillusioned those populations for whom the policy was designed to help most (Fennimore, 2005; Howard, 2000). Nichols, Glass & Berliner (2006) state that although the literature base is growing with regard to the unintended consequences of high stakes testing, existing research on the relationship between high-stakes testing and its intended impact is mixed and inconclusive.

Kentucky Standards and Accountability

The standards- based accountability system that was adopted in Kentucky represented a political response to the demands of the *Rose* court. The Commonwealth Accountability Testing System (CATS) was implemented in 1999 after persistent questions about the reliability and validity of the previous system of accountability (Hunter, 1999). CATS recognized the myriad purposes of education and made use of multiple measures of student performance including the Kentucky Core Content Test (KCCT), a nationally norm-referenced test (e.g., the CTBS/5 Survey Edition), writing portfolios, and non-academic performance data (e.g., attendance, retention, and dropout rates; student transitions to next level of schooling and to adult life). The Kentucky Core Content Tests included tests in reading, writing, math, science, social studies, arts & humanities, and practical living skills. These tests are aligned with the seven competencies stipulated by the *Rose* court. Performance on each of these measures is differentially weighted to calculate a Kentucky Accountability Index for each school. Proficiency has been defined as an index score of 100. All schools are required to reach proficiency by 2014. CATS index scores are calculated yearly, although the system of sanctions and recognition operates on a biennial calendar. Concurrently with the state accountability requirements of CATS, all schools in Kentucky are required to monitor proficiency in reading and mathematics to satisfy the national accountability requirements associated with No Child Left Behind.

Theoretical Framework

According to Goertz (2006), a policy analysis may take three forms: an examination of the determinants of policy formation, an inquiry of how laws and policies are implemented, and an evaluation of policy effects. This inquiry examines the policy effects of the educational reform efforts that have occurred over the past twenty years. Equality of educational outputs was a goal of the Kentucky Education Reform Act. As such, the inquiry addressed a gap in the literature that was identified by Nichols, Glass and Berliner (2006). The intended purpose of the education reform movement was to increase opportunity for students in underrepresented populations; specifically, reformers sought to increase the achievement of students living in poverty. The adequacy provisions of the standards based accountability system in Kentucky require an equal level of educational outputs.

Alexander (2004) developed a conceptual map for understanding the definitions of adequacy. She noted that emerging research has moved away from traditional notions of equity and is now specifically identifying the relationships between resources and the different phases of the schooling process. As such, researchers are assessing both the equity of resource allocation and how that allocation is associated with differences in results. Therefore, adequacy represents a change in thinking with regard to the appropriate financing of schools and includes three components: equity in inputs, equity in process, and equity in outputs (Alexander, 2004). Thus, for a system of finance to be called adequate, it must accomplish each of the three aforementioned components.

Because Kentucky education policy requires equity in inputs and equity in outputs, the theoretical framework articulated by Alexander provided the basis for this inquiry. Researchers postulate that the variation in student outcomes given equitable revenues is the result of greater needs in schools serving primarily at-risk student populations and that school level data have applications for researchers to address questions of equity, adequacy, and efficiency (King, Sweetland, & Swanson, 2005; Baker, 2005; Goertz, 1997). Recent inquiries in to the equity of resources in Kentucky public schools have revealed tremendous progress in efforts to achieve horizontal equity (Haselton & Keedy, 2002; Picus, Odden, & Fermanich, 2001, Adams & White, 1997) although gaps are beginning to reemerge. While there is evidence that measures of horizontal equity have improved in Kentucky, there is doubt as to the adequacy of the system of finance and whether or not the current system provides sufficient resources to increase the vertical equity demands of the student population. Given the improvement in measures of horizontal equality of revenues, this inquiry seeks to discern if equity in outputs has improved in the commonwealth.

Adequate Outcomes in Kentucky: Method of Analysis

The focus on financial disparities in Kentucky obscured the larger issue of pervasive educational inadequacy (Hunter, 1999). The poor performance of the Kentucky public school system was thought to contribute to the cyclical poverty and unemployment that the state suffered in the 1980s. The *Rose* suit was brought on grounds that a lack of resources in schools resulted in a lack of opportunity to achieve for students. After two decades of education reform, opportunity to learn is still a relevant question for educators in Kentucky. This study sought to answer the research question, how well have schools overcome barriers to learning and increased equality of educational opportunity? The focus of the study was on

student achievement and included multiple measures of student achievement: CATS index, proficiency rate in reading and proficiency rate in math.

To answer the research question the study included four years of achievement data and employed multiple regression, entering blocks of data sequentially. Data included three different dependent variables: CATS Index, proficiency rate in reading, and proficiency rate in math. Three measures of student achievement were chosen in order to accommodate all measures used in state and federal accountability. Independent variables included three measures of student demographics: percent of students participating in free and reduced lunch, percent of students qualifying for special education services, and percent of students participating in programs for students with limited English proficiency. Finally, per pupil assessment was included as an independent variable to account for a measure of local wealth. An error band was calculated in order to provide a post hoc analysis. Data included the population of all schools in Kentucky from the 2004, 2005, 2006, and 2007 school years. These four years were chosen because they include the two years preceding and following the *Tyler Young* case. Also, the Kentucky Department of Education has reported that demographic data for students was unreliable prior to 2003. These four years of data included the most accurate and current data available for analysis. A multiple regression with variables entered in blocks was calculated for all schools in the aggregate and for the three levels of schooling (elementary, middle, and high school) for each of the four years included in the study. The issue of multicollinearity was addressed through an examination of tolerance and VIF calculations. Using a cutoff score of .1 for tolerance and 2.5 for VIF, multicollinearity was not found to be a problem in the model.

Sheskin (2000) states that a major goal of multiple regression is to identify a limited number of predictor variables that optimize one's ability to predict scores on the dependent variable. Through regression, the researcher is best able to make a prediction of a given phenomena (Pedhazur, 1982). This analysis includes two distinct purposes, *correlation* and *regression*, even though the terms are used interchangeably. First, regression analysis is a technique to find the relationship between one dependent variable and two or more independent variables, which is multiple correlation (Tabachnick & Fidell, 2007; Pedhazur, 1997). A second purpose is to predict future outcomes based upon analyzing an outcome measure from several independent variables. Both purposes can be utilized in interpreting the outcomes when multiple regression is used as a technique to analyze production function data (Tabachnick & Fidell, 2007; Pedhazur, 1997: Stevens, 1996).

Although schools in Kentucky have demonstrated improved performance over time, as demonstrated by trend data, current research has not considered whether or not these schools have been performing as one may predict given student demographics. The error band was chosen as a post hoc test because it may be a more appropriate measure of student achievement than trend data which fails to consider student demographics and is aggregated to the state level. Conceptually, the error band method was developed to compare student performance while taking into account student demographics. While state mandated measures of achievement requiring similar levels of performance may be effective as an outcome measure, they offer little diagnostic information on how to achieve long-term goals that are articulated in education policy (Gazzerro & Hampel, 2004). As such, one must make use of a method that will help to identify outperforming and underperforming schools. The identification of schools as outperforming or underperforming must include the use of appropriate benchmarks (schools are compared with peers of similar characteristics), an appropriate timeline (schools must demonstrate consistent performance over time), and using appropriate thresholds (performance must significantly exceed or fall below what

would be expected in that school) (Standard & Poor's, 2004). To create the error band, a standardized predicted z-score was calculated for each of the four years of study. Four calculations were made for each year: all schools, elementary schools, middle schools, and high schools. Schools were group in to four categories: schools with a standardized predicted z-score less than -2, schools with a standardized predicted z-score greater than -2 and less than 0, schools with a standardized predicted z score greater than 0 but less than 2, and schools with a standardized predicted z-score greater than 2. Researchers then examined descriptive statistics for each subgroup which included demographics, wealth and performance. Finally, the analysis included an examination of the number of outliers in each subgroup. For the purposes of this study, the residual was used to identify outperforming and underperforming schools. Schools that were identified as an outlier were performing two standard deviations above or below what would have been predicted for a school with similar characteristics. Those schools had a standardized residual score of $z \leq -2$ or a standardized residual score of $z \geq 2$. Together, the descriptive statistics as well as the performance residuals were considered to provide a more thorough picture of student performance and the success of the schools in achieving the adequacy goals set forth in KERA.

In summary, the methodology in the study involved two steps. First, a multiple regression was conducted with variables entered in blocks to discern prediction and relationship between the dependent and independent variables. Second, a post hoc analysis was performed that utilized standardized predicted z scores calculated in the multiple regression to categorize schools by predicted performance and residuals. Descriptive data were compiled for all schools in the aggregate and by school level, and grouped according to predicted z-score as part of the post hoc analysis in order to more thoroughly analyze student performance as related to local wealth and student demographics and to draw conclusions about school performance.

Results of the multiple regression analysis (with variables entered in blocks) as well as descriptive statistics are displayed in Table 1. According to these data, all measures of student achievement included in this study show an upward trend in student performance as noted by the circuit court. Student scores on the CATS index, the percentage of students testing at or above proficiency in reading, and the percentage of students testing at or above proficiency in math have increased for all schools and at all levels. The highest levels of achievement are found at the elementary school level. Elementary schools are also growing at a faster pace as measured by the CATS index and math proficiency. High schools are growing at a faster rate as measured by reading proficiency.

The linear relationship enabled researchers to examine the relationship between student achievement, local wealth, level of schooling, and measures of student demographic. Per pupil assessment was an independent variable that was included in the study as a measure of local wealth. This variable was included in the study because the *Rose* case was filed on behalf of 66 property poor school districts, and because KERA was enacted to eliminate funding and achievement disparities that were found to exist as a result of wealth. Results of the study indicate mixed results. For example, per pupil assessment was found to have a statistically significant relationship at the $p \leq .05$ level between per pupil assessment and CATS for all schools in 2004. The relationship between per pupil assessment and CATS scores was not found to be statistically significant for all schools at the $p \leq .05$ level for any other year in the study. That finding is mitigated by the fact that the relationship between local wealth and CATS scores was found to be statistically significant at the $p \leq .05$ level in high schools in 2004, 2005, and 2006. It is important to note that the amount of variance in

CATS scores that was explained by local wealth shows a downward trend in all four years of study. This suggests progress in efforts to ameliorate the relationship between local wealth and student achievement scores which was a goal of education reform in Kentucky.

Table 1
A Comprehensive Look at Student Achievement

	CATS Index					
	N	Mean	Std Dev	r^2 Per Pupil Assessment	r^2 Level	r^2 Demographics
2004 All Schools	1043	78.6	10.5	.7%*	11.9%*	29.6%*
Elementary	641	81.6	10.4	.1%		30.7%*
Middle School	192	74.4	8.9	.2%		42.3%*
High School	210	73.1	8.9	20%*		34.8%*
2005 All Schools	1098	79.2	10.4	.2%	7.7%*	29.4%*
Elementary	680	81.4	10.6	.1%		28.9%*
Middle School	198	76.6	9.0	0%		43.6%*
High School	220	74.5	8.8	10.4%*		38.6%*
2006 All Schools	1128	81.7	10.7	.2%	12.6%*	18.1%*
Elementary	705	84.7	10.6	.1%		17.6%*
Middle School	206	78.1	9.1	.1%		22%*
High School	217	75.6	8.8	7.4%*		31.5%*
2007 All Schools	1115	87.9	11.3	0%	20.8%*	27.1%*
Elementary	688	91.6	10.9	.4%		29.8%*
Middle School	208	85.7	9.6	.2%		48.0%*
High School	219	78.5	7.8	1.2%		43.0%*
	Reading Proficiency					
	N	Mean	Std Dev	r^2 Per Pupil Assessment	r^2 Level	r^2 Demographics
2004 All Schools	1043	58.9%	18.5	1.0%*	38.8%*	14.9%*
Elementary	641	66.3%	14.7	0%		27.7%*
Middle School	192	60.2%	11.8	0%		36.8%*
High School	210	35.2%	13.5	8.7%*		22.5%*
2005 All Schools	1098	60.9%	17.8	.3%	34.4%*	15.5%*
Elementary	680	67.4%	14.8	.1%		23.7%*
Middle School	198	62.5%	12.4	0%		35.3%*
High School	220	39.1%	12.8	4.5%*		25.4%*
2006 All Schools	1128	62.0%	17.0	.3%	36.9%*	10.4%*
Elementary	705	68.4%	13.5	.4%		18.4%*
Middle School	206	63.2%	12.1	.2%		21.3%*
High School	217	40.2%	12.3	5.8%*		25.3%*
2007 All Schools	1115	69.0%	11.8	0%	16.7%*	31.3%*
Elementary	688	72.4%	10.9	.5%		37.0%*
Middle School	208	66.6%	10.4	0%		49.0%*
High School	219	60.3%	10.6	1.9%*		28.5%*

Source: Kentucky Department of Education (March, 2009)

Table 1 (Continued)

	Math Proficiency					
	N	Mean	Std Dev	r^2 Per Pupil Assessment	r^2 Level	r^2 Demographics
2004 All Schools	1043	42.7%	16.9	2.8%*	10.9%*	37.4%*
Elementary	641	47.8%	16.9	.8%*		24.9%*
Middle School	192	33.7%	13.6	2.3%*		37.5%*
High School	210	35.1%	12.8	22%*		28.7%*
2005 All Schools	1098	41.0%	16.2	2.1%*	8.5%*	23.8%*
Elementary	680	44.7%	16.7	.8%*		23.3%*
Middle School	198	37.2%	13.7	.7%		41.9%*
High School	220	33.0%	12.7	17.8%*		28.9%*
2006 All Schools	1128	44.8%	16.5	2.4%*	16.1%*	18.2%*
Elementary	705	50.4%	16.2	1.1%*		18.0%*
Middle School	206	36.4%	13.2	2.4%*		24.8%*
High School	217	34.9%	12.1	16.9%*		34.6%*
2007 All Schools	1115	55.0%	16.0	1.6%*	29.6%*	21.9%*
Elementary	688	61.1%	13.8	.5%		27.4%*
Middle School	208	51.9%	12.7	1.2%		43.8%*
High School	219	38.6%	12.5	6.8%*		36.7%*

* Variance explained is significant at the $p \leq .05$ level
Source: Kentucky Department of Education (March, 2009)

An examination of the relationship between local wealth and reading proficiency shows a similar trend. A statistically significant relationship was found to exist at the $p \leq .05$ level between local wealth and reading proficiency for all schools in 2004. The relationship between local wealth and reading proficiency was not found to be statistically significant in 2005, 2006, and 2007 for all schools. However, a statistically significant relationship was found to exists at the $p \leq .05$ level between local wealth and reading proficiency for high schools for each of the four years included in the study. Again the percent of variance in reading proficiency explained by local wealth was found to decline for each of the four years included in the study which demonstrates progress toward the goal to achieve educational adequacy.

The relationship between local wealth and rates of proficiency in mathematics reveal a different pattern. A statistically significant relationship was found to exist at the $p \leq .05$ level for all schools and at all levels in 2004 and 2006. The relationship between local wealth and math proficiency rates was statistically significant at the $p \leq .05$ level for all schools, elementary schools, and high schools in 2005. Lastly, a statistically significant relationship was found to exist at the $p \leq .05$ level for all schools and high schools in 2007. Trend data reveal that the percentage of variance in math proficiency rates explained by local wealth has decreased over the course of four years.

The second independent variable entered in to the regression was school level. School level was found to be a statistically significant predictor of all measures of student

achievement for each of the four years included in the study at the $p \leq .05$ level. An interesting pattern that emerges from the data is the percent of variance explained by school level for each of the three outcome variables. The amount of variance in student achievement as measured by CATS scores and math proficiency that was explained by school level decreased from 2004 to 2005 and then nearly doubled between 2005 and 2007. Conversely, the amount of variance in student achievement as measured by reading proficiency explained by school level consistently decreased across all four years included in the study suggesting an emphasis on the acquisition of literacy skills especially at the secondary level. This finding suggests further exploration of the means by which policy is interpreted and operationalized at different schooling levels. It also suggests further inquiry in to the notion of process as articulated by Alexander (2006).

The final sets of variables entered in to the regression were measures of student demographic. The inclusion of these variables enabled researchers to draw conclusions with regard to vertical equity. Regardless of the measure chosen to examine student achievement, student demographics continue to be a statistically significant predictor of student achievement in Kentucky's schools. Trend data indicate modest decreases between 2004 and 2006 in the amount of variance explained by student demographics in the aggregate and at each level with a tremendous jump in the amount of variance explained by student demographics seen in 2007. These results seem to temper the findings of trend data that showed improvements in student achievement scores and results that indicated a decrease in the amount of variance in measures of student achievement that was explained by local wealth. While scores across the state have continued to rise, gaps in student achievement are beginning to increase. Further, these results may indicate changes in the needs of Kentucky's schools. Initially, KERA was enacted to ameliorate performance gaps in measures of student achievement that were the result of the inability of localities to raise sufficient revenues. The data reveal that local wealth has become less of a predictor of student achievement while poverty and incidence of special education are now the predominant predictors of student success.

Post hoc testing involved the creation of an error band that enabled researchers to both examine outliers and to disaggregate data based on wealth of the locality and student demographics. Descriptive statistics from the post-hoc testing appear in Tables 2 and 3 and are found in the appendix. Data in Table 2 illustrate performance in CATS, reading proficiency, and math proficiency for all schools and for each school level included in the study. The table is organized by predicted standardized z-score to illustrate how student demographics influence student achievement. According to the table, schools with a standardized predicted z-score less than -2 are among the most heavily at risk schools in the state of Kentucky. These schools, while few in number, are populated by the neediest children in the state. For example, the percent of students receiving free and reduced lunch at the elementary level ranges from 88% in 2004 to a high of 95% in 2005. In addition, the percentage of students receiving services for special education in these schools exceeds that of schools in other standardized predicted z score groups. Regardless of the measure used, CATS index, reading proficiency, and math proficiency, the performance of these schools is lower than the other schools in the state and the gaps are large. For example, middle schools in this group had an average CATS index that was nearly 15 points lower than their peers in the group with standardized predicted z-scores greater than -2 and less than 0 in 2004 and that gap grew to 20 points for the remaining three years of the study. When compared to students in the highest performing group, the gap is approximately 40 points for each year studied.

This phenomenon is equally evident when one considers reading and math proficiency. For example, the gap in reading proficiency for high school students is a modest 4 percentage points between schools in the lowest two groups. However, that gap grows to 52 points when comparing high schools in the lowest and highest standardized predicted z-score groups. Although the gap between the high schools at the extremes does begin to narrow over time, the gap increases between schools with a standardized predicted z-score of less than -2 and schools with a standardized predicted z-score greater than -2 and less than 0 and between schools with a standardized predicted z-score greater than 0 and less than 2. The schools in the bottom group show no improvement in reading proficiency until the last year of the study which illustrates the fact that schools in the greatest need are falling further behind the schools in relatively more affluent areas and those populated by students with relatively less need. This clearly is not the achievement of educational adequacy.

Math proficiency rates are perhaps the most glaring example of the failure to achieve adequacy. Recalling the results of the multiple regression, math proficiency was significantly related to local wealth in nearly all cases. Further, proficiency levels in this content area are among the lowest. For example, the average proficiency rate of middle school students in the group with a standardized predicted z-score of less than -2 was an alarming 12% in 2004 and 10% in 2005. Equally troubling is the fact that these scores are 16 points below schools with a standardized predicted z-score of greater than -2 and less than 0 in 2004 and 21 points lower than schools in the same subgroup in 2005. When compared to schools in the top two subgroups, the differences grow to 28 points and 55 points respectively in 2004 and 29 points and 50 points in 2005. No middle schools had a standardize predicted z-score in the lowest subgroup in 2006. Nonetheless, gaps exist. The difference between schools with a standardized predicted z-score of greater than -2 and less than 0 and those schools in the subgroup with the highest standardized predicted z-score is 26 points in 2006. The gap between schools at the extreme ends of the spectrum narrows in 2007, but we see a growth in the gaps in schools in the middle and at the bottom of the performance spectrum which suggests that schools that are populated with the neediest students are not gaining on their peers. Because the gap is increasing, schools are failing to achieve vertical equity. This fact is hidden by the trend scores showing progress in schools. One could draw the same conclusions from the data in Table 2 at either the elementary or high school levels.

Table 3 includes descriptive statistics and measures of local wealth. These data clearly show that a relationship does exist between local wealth and all measures of student achievement. However, data also show a change in the way that one might identify need in Kentucky's schools. Data in the table reveal that the lowest performing schools in Kentucky at the elementary and middle school levels are not in the areas with the lowest per pupil assessment. For example, the per pupil assessment in elementary schools with a standardized predicted z-score of less than -2 was $557,736 in 2004. That assessed value of property eclipses the property wealth of the other three standardized predicted z-score subgroups. A closer review of the individual cases reveals that these schools are located in large urban areas of the state where the property wealth far exceeds that or the rest of the commonwealth. These schools are also populated by the neediest children as measured by percent qualifying for both free and reduced lunch and special education services. In addition, these schools also serve large concentrations of minority populations which are not served by the majority of schools across the state.

Two trends are evident in this table. First, by removing the bottom standardized predicted z-score and the top standardized predicted z-score subgroups from the analysis, one finds the relationship between the measure of property wealth and measures of student

performance. In other words, wealthier localities are performing better on the CATS index and have higher percentages of proficiency in reading and math. Over time however, that trend begins to disappear. Gaps between the two middle groups remain stable and in some cases decrease modestly. Also, gaps in measures of local wealth also begin to decline. In some cases, relatively wealthier areas are performing at a lower rate in measures of student achievement. This is true at the elementary level when one examines CATS scores (2006 and 2007) and reading proficiency rates (2006). Property wealth is no longer a significant predictor of student achievement at the elementary school level as measured by CATS and reading proficiency 20 years after the landmark *Rose* decision. That statement cannot be made at the middle and high school levels nor can it be made after an examination of math proficiency rates. In all cases, an upward trend is noted over time in measures of student performance. Schools scoring the highest levels of achievement, however that is measured, are in the relatively wealthier districts when one examines data for schools at the middle and high school levels.

A second trend that is noted from Table 3 is the change in the relationship between local measures of wealth and student achievement at the high school level. The multiple regression revealed a decrease in the amount of variance in student achievement that was explained by local wealth. This phenomenon is clearly evident in Table 3. The average per pupil assessment in high schools with a standardized predicted z-score of less than -2 was $158.853 in 2004. That property assessment was lower than the other three standardized predicted z-score subgroups. Beginning in 2006, that phenomenon changes when one examines CATS scores and proficiency rates in math. The same change is noted in 2007 when one considers proficiency rates in reading. The change from property wealth signals a change in the means by which at risk schools are identified in Kentucky.

The *Rose* decision was filed due to disparities in measures of student achievement that were directly related to property wealth of the district. This finding suggests tremendous progress in efforts to ameliorate those differences. However, this finding is tempered by the fact that achievement gaps still exist and in many cases those gaps are growing. The high schools that are performing at the bottom of the spectrum are no longer in areas of rural poverty, but in areas of urban poverty which suggests the need to reexamine the policy goals of education reform in Kentucky. It is fair to say that adequacy has improved with regard to property wealth, but not based on family wealth. As noted in the literature review, the equity of the finance distribution system (SEEK) has shown improvement over time. The improved equity of the finance system has resulted in upward trends in student achievement and an elimination of property wealth as a significant predictor of student achievement. Both of these results were intended outcomes of the policies put in place in 1990. However, these policies placed accountability at the school level. Results from this study suggest that equality of educational opportunity, or adequacy, has not improved at the student level. This indicates a need for changes to both the policy and the process by which children are educated so that all may be given the resources and skills necessary to attain proficiency.

The last set of data from the post hoc test is found in Table 4, and is included in the appendix. These data illustrate the number of outliers found in the predictive model. The examination of outliers was made because it compares like schools on a similar measure, and because it enables the researcher to discern outperforming and underperforming schools. In order to see improvement in efforts to achieve adequacy, one would hope to see a greater number of outperformers at the lower end of the standardized predicted z score spectrum. The data reveal that the number of underperforming schools is double that of the number of outperforming schools in the subgroup with a standardized predicted z score of less than -2

in both CATS and reading proficiency. There are almost no outliers in the bottom subgroup in measures of math proficiency. When coupled with the descriptive statistics detailing lower levels of student performance on measures of student achievement in the schools with negative standardized predicted z-scores, this represents definitive evidence that trend data do not accurately reflect progress in efforts to close achievement gaps or to provide educational adequacy.

Table 4 also illustrates that fact that the majority of schools that were classified as outliers were at the elementary school level. Data in the table reveal that there are more outperforming schools serving children with relatively more needs although the number of outperforming schools begins to decline in 2006. These data highlight the fact student achievement is predicted by student demographic as evidenced that there are indeed few outliers in the model. An adequate system would be one in which student achievement was not predicated by local wealth or student demographics. Progress toward that goal would be demonstrated by the existence of more outperformers in schools with a negative standardized predicted z-score.

Discussion and Implications

In finding the system of public education in Kentucky to be unconstitutional in 1989, the state Supreme Court recognized the necessity of an adequate system of education to enable all children and youth to reach their potential as citizens in a global society and as competitors in a global economy. By placing the responsibility for creating a system of public education on the policymakers and citizens of the Commonwealth, the high court thrust Kentucky to the forefront of national debate on educational reform (Hunter, 1999). Kentucky education policy requires equality in the provision of education and equality in measures of educational achievement. Equality is the key to the decision. This finding permeates educational policy and practice in the commonwealth. In 2006, the Franklin County Circuit Court found that Kentucky's schools were adequate citing upward progress in measures of student achievement since the enactment of KERA. The court noted that plaintiffs failed to link the finance system to measures of student achievement.

The problem with the court's finding is that a simple examination of trend data does nothing to address what the trends mean. Trend data does not address prediction; it does not consider outperforming or underperforming schools. The use of a multiple regression and ad hoc testing in the form of an error band provided a more accurate assessment of the current state of educational adequacy in Kentucky.

Results from this study suggest five major findings. First, the amount of variance in student achievement as measured by CATS and reading proficiency that was previously explained by local property wealth has decreased in public schools in Kentucky. Wealth is still a significant predictor of math proficiency across the commonwealth although that relationship is declining over time. High school achievement is most influenced by property wealth, but the significance of wealth as a predictor of student achievement at the high school level is declining as well. Second, student achievement is significantly predicted by the level of schooling with the highest measures of student achievement occurring at the elementary school level. This suggests the need for further study in the area of educational process. It would appear that there are successful practices occurring at the elementary school level that have not been implemented at the middle and high school levels.

Third, while the significance of property wealth as a predictor of student achievement has decreased, student demographics continue to be a significant predictor of student achievement in Kentucky's schools. This is particularly true for students who qualify for free and reduced lunch, and to a lesser degree for students who are enrolled in special education. Most recently, scores from the 2007 school year reveal a large increase in the amount of variance in student achievement explained by student demographics. This finding indicates a need to reconsider the unit of analysis in the accountability system. The finding is substantiated by the lack of outliers in the predicted model. Since the predicted model was constructed by the use of independent variables that included local wealth and student demographic, the finding is contrary to the circuit court ruling that the school system was adequate.

Fourth, a change in the way that schools are classified as at risk may be required. When the *Rose* case was adjudicated at risk schools were classified as those in property poor areas. Today, at risk schools in Kentucky appear to be in areas of tremendous property wealth. These schools are populated by extremely large percentages of students who qualify for free and reduced lunch services, by a large percentage of students who receive special education services, and by an increasingly diverse population of students.

Finally, progress was not uniform when considering multiple outcome measures. Succinctly stated, the CATS index may actually distort the progress taking place in schools. Our analysis included three outcome measures of schooling. According to the results from this study, math performance in Kentucky's schools lag far behind student performance as measured by CATS and reading proficiency. The *Rose* court went to great lengths to enumerate the seven competencies with which all students were to be equipped. Perhaps the focus on an index score has taken efforts away from measurement toward progress in the seven separate competencies.

Have the public schools in Kentucky been successful in achieving the outcome goals articulated in *Rose* and KERA? Results from this study suggest mixed results. This study confirmed the upward trends cited by the *Young* court. All schools, at each level, regardless of wealth, and student demographic are indeed making progress toward proficiency goals. However, large gaps remain in Kentucky's schools based on student demographic. According to the court's definition of equality of educational opportunity, this result is neither equitable nor adequate. The inquiry revealed a relative lack of progress in the area of math which suggests a failure to equip all students with the seven competencies. Lastly, the study highlights the difficulty associated with the political creation of a system of educational accountability. In Kentucky, the decision was made to aggregate results at the school level and to hold schools accountable. This is an interesting choice considering the fact that equality of educational opportunity is probably best measured at the student level. We view calls for change to the accountability system that are now the law in Kentucky as part of the natural evolution of policy. The new requirements for accountability and student scores that are reliable at the student level will enable schools to make use of new technologies that allow for interpretation of student performance and assist schools to better use those data to plan for more individualized instruction.

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Appendix

Table 2

Post Hoc Testing Descriptive Statistics

CATS Index																
	$z \leq -2$				$z > -2$ & $z < 0$				$z > 0$ & $z < 2$				$z \geq 2$			
	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP
2004	61	74	15	1.1	74	59	14	1.1	83	44	13	.8	97	11	10	1.2
Ele	66	88	21	2.6	78	71	16	1.5	86	42	13	.8	97	10	10	1.1
Mid	66	80	16	2.3	70	62	14	1.0	78	38	11	.7	97	4	9	.3
High	58	75	18	.0	68	54	12	.4	77	27	10	.7	100	5	5	.0
2005	61	79	23	2.8	75	63	21	1.9	83	43	22	1.3	94	4	25	1.1
Ele	65	95	29	6.1	78	73	29	2.4	85	43	24	1.5	92	2	27	.6
Mid	53	83	31	4.8	73	62	19	1.6	80	40	14	.8	91	5	13	.8
High	63	80	24	.7	70	57	16	1.0	79	29	11	.8	88	5	7	.4
2006	69	74	22	2.6	77	66	24	2.5	86	59	29	2.4	94	21	23	4.4
Ele	69	97	32	3.2	82	81	32	3.6	88	56	32	2.3	94	20	24	4.5
Mid	58	95	35	8.1	76	72	24	2.2	80	46	21	2.1	97	3	14	1.6
High	72	79	27	.4	71	57	17	1.0	79	31	12	1.2	96	7	9	.4
2007	69	71	24	2.6	82	60	22	2.0	93	49	28	1.4	107	11	21	2.0
Ele	76	81	28	11.3	88	72	33	2.1	95	45	29	1.4	106	9	21	1.5
Mid	62	82	29	7.7	82	63	21	1.3	89	40	17	.9	98	7	16	.8
High	63	66	42	4.0	75	59	16	1.0	82	34	12	.6	95	4	11	.3
Reading Proficiency																
	$z \leq -2$				$z > -2$ & $z < 0$				$z > 0$ & $z < 2$				$z \geq 2$			
	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP
2004	28	68	14	.9	49	51	13	1.3	68	50	14	.8	85	2	8	.7
Ele	50	88	19	6.8	61	71	16	1.2	72	41	13	.8	86	9	9	.6
Mid	36	78	17	2.9	55	62	15	.7	64	39	11	.9	85	4	9	.3
High	25	74	18	.0	29	53	12	.3	40	27	8	.8	77	5	5	.0
2005	30	71	20	1.8	51	55	18	1.9	69	51	23	1.4	79	1	25	.4
Ele	42	94	29	6.5	63	73	28	2.4	72	42	24	1.5	79	2	27	.0
Mid	38	84	27	5.3	59	62	19	1.4	66	40	14	.9	80	5	13	.7
High	24	78	25	.5	33	57	16	.9	44	30	11	.9	67	2	7	.2
2006	32	71	20	1.4	52	57	20	2.4	70	64	30	2.6	85	2	14	7
Ele	49	95	28	6.4	65	80	31	3.5	72	56	30	2.2	82	20	24	4.0
Mid	36	95	35	8.1	60	72	25	2.5	66	45	20	1.7	86	3	14	1.6
High	32	74	30	2.0	35	56	16	1.0	44	31	12	1.2	74	7	9	.4
2007	61	74	34	3.9	63	61	23	2.0	75	47	28	1.3	88	11	22	2.0
Ele	55	91	27	12.5	69	72	33	2.1	77	45	29	1.3	87	9	21	1.5
Mid	41	84	28	8.6	63	64	21	1.3	70	40	17	.9	84	7	15	.6
High	42	66	42	4.0	56	59	16	1.0	66	34	12	.6	84	4	11	.4

Source: Kentucky Department of Education (March, 2009)

Table 2 (continued)

	Math Proficiency															
	z≤-2				z>-2 & z<0				z>0 & z<2				z≥2			
	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP	Mean	SES	SpEd	LEP
2004	21	71	14	.6	35	59	14	1.1	50	43	13	.9	72	11	10	1.1
Ele	26	92	20	.8	41	72	16	1.5	53	41	13	.9	76	8	9	1.3
Mid	12	81	17	1.6	27	62	14	.8	39	38	11	.9	67	6	10	.8
High	18	77	19	0.0	29	54	12	.3	41	26	10	.8	76	10	3	.0
2005	18	78	21	2.0	35	63	22	1.6	48	44	22	1.7	62	4	24	1.2
Ele	18	99	43	0.0	39	74	28	2.2	50	41	24	1.9	60	2	28	1.0
Mid	10	83	31	4.8	31	62	19	1.2	43	40	14	1.2	60	6	11	.9
High	17	75	24	0.0	26	58	16	.9	39	29	12	.9	56	12	9	.9
2006	24	73	19	.5	37	65	24	1.9	51	59	23	3.0	72	19	22	5.9
Ele	-	-	-	-	45	81	32	2.4	55	54	29	3.4	71	18	22	6.5
Mid	-	-	-	-	32	72	24	2.4	40	45	22	2.0	61	10	17	2.8
High	21	79	26	0.0	27	56	17	.8	41	32	12	1.4	61	8	9	.6
2007	27	72	20	1.5	47	59	22	1.9	63	49	29	1.6	81	9	21	2.5
Ele	39	94	31	4.4	56	73	33	2.5	66	44	29	1.6	81	10	22	2.3
Mid	26	84	28	8.6	47	64	21	1.3	57	39	17	.9	73	7	15	.6
High	29	80	22	.2	33	58	17	.9	43	33	12	.8	71	4	11	.8

Source: Kentucky Department of Education (March, 2009)

Table 3

Post Hoc Testing – Performance and Local Wealth

	CATS Index											
	z≤-2			z>-2 & z<0			z>0 & z<2			z≥2		
	N	CATS	PPA	N	CATS	PPA	N	CATS	PPA	N	CATS	PPA
2004 (N=1043)	28	61	$326,429	496	74	$319,012	497	83	$348,321	22	97	$465,317
Elem (N=641)	22	66	$557,736	283	78	$316,730	327	86	$352,764	9	97	$393,264
Middle (N=192)	5	56	$505,569	81	71	$303,940	104	78	$360,118	2	97	$438,845
High (N=210)	4	58	$158,853	93	68	$238,956	111	77	$366,544	2	100	$456,845
2005 (N=1098)	18	61	$385,518	565	75	$337,404	472	83	$361,419	43	94	$370.243
Elem (N=680)	12	65	$615,561	336	7751	$335,936	299	85	$364,575	33	92	$336,672
Middle (N=198)	4	53	$591,193	93	73	$338,321	93	80	$369,710	8	91	$420,542
High (N=220)	5	63	$287,255	99	69/55	$276,355	115	79	$372,314	1	88	$515.764
2006 (N=1128)	26	69	$358,428	549	77	$376,296	515	86	$359.579	38	94	$481,046
Elem (N=705)	7	69	$631,556	353	82	$380,015	317	88	$356,631	28	85	$375,396
Middle (N=206)	3	58	$496,494	105	76	$370,546	94	80	$393,863	4	97	$537,231
High (N=217)	6	72	$281,192	97	71	$290,546	110	79	$393,282	4	96	$503,517
2007 (N=1115)	34	69	$438,825	505	82	$399,121	556	93	$387,529	20	107	$523,704
Elem (N=688)	28	76	$671.561	296	88	$383,109	350	95	$290,279	14	106	$509,155
Middle (N=208)	7	62	$675,662	89	82	$381,322	107	89	$415,987	5	98	$480,030
High (N=219)	5	63	$557,557	94	75	$320,984	116	82	$396,270	4	95	$495,160

Source: Kentucky Department of Education (March, 2009)

Table 3 (continued)

	Reading Proficiency											
	$z \leq -2$			$z > -2$ & $z < 0$			$z > 0$ & $z < 2$			$z \geq 2$		
	N	Read	PPA	N	Read	PPA	N	Read	PPA	N	Read	PPA
2004 (N=1043)	35	28	$244,365	435	49	$342,615	570	68	$336,623	3	85	$419,235
Elem (N=641)	22	50	$568,496	285	61	$311,970	326	72	$356,269	8	86	$404,499
Middle (N=192)	4	36	$575,212	78	55	$305.610	108	64	$356,027	2	85	$438,845
High (N=210)	5	25	$196,625	91	29	$243,110	112	40	$361,058	2	77	$456,848
2005 (N=1098)	35	30	$312,202	451	51	$354,912	595	69	$348,812	17	79	$326,318
Elem (N=680)	11	42	$617,776	338	63	$336,061	298	72	$365,386	33	79	$336,673
Middle (N=198)	6	38	$545,407	92	59	$327,261	91	66	$376,553	9	80	$436,586
High (N=220)	7	24	$322,254	92	33	$275,925	119	44	$367,073	2	67	$402,356
2006 (N=1128)	32	33	$327,116	427	52	$381,383	664	70	$366,006	5	85	$604,390
Elem (N=705)	11	49	$656,018	347	65	$382,183	321	72	$352,814	26	82	$444,913
Middle (N=206)	3	36	$496,494	108	60	$366,188	91	66	$399,804	4	86	$537,231
High (N=217)	8	32	$327,323	96	35	$285,148	109	44	$395,771	4	74	$503,517
2007 (N=1115)	32	51	$440,111	523	63	$393,824	537	75	$390,791	23	88	$543,844
Elem (N=688)	30	55	$659,648	292	69	$380,645	351	77	$391,050	15	87	$515,562
Middle (N=208)	6	41	$678,274	89	63	$370,600	107	70	$423,800	6	84	$528,305
High (N=219)	5	42	$557,557	97	56	$319,665	112	64	$397,074	5	84	$528,127

Source: Kentucky Department of Education (March, 2009)

Table 3 (continued)

	Math Proficiency											
	$z \leq -2$			$z > -2$ & $z < 0$			$z > 0$ & $z < 2$			$z \geq 2$		
	N	Math	PPA	N	Math	PPA	N	Math	PPA	N	Math	PPA
2004 (N=1043)	28	21	$226,603	517	35	$313,911	473	50	$357,990	25	72	$510,275
Elem (N=641)	11	26	$547,306	301	41	$307,393	315	53	$366,378	14	76	$488,779
Middle (N=192)	4	12	$485,659	87	27	$296,389	98	39	$369,396	3	67	$512,538
High (N=210)	3	18	$165,282	93	29	$231,679	113	41	$370,276	1	76	$575,212
2005 (N=1098)	25	18	$307,592	568	35	$323,559	460	48	$379,195	45	62	$404,032
Elem (N=680)	2	18	$402,497	364	39	$321,147	275	50	$391,409	39	60	$385,629
Middle (N=198)	4	10	$591,193	95	31	$329,607	92	43	$379,365	7	60	$429,442
High (N=220)	3	17	$176,201	100	26	$256,607	113	39	$384,788	4	56	$614,222
2006 (N=1128)	25	24	$263,018	524	37	$356,985	548	51	$380,964	31	72	$547,255
Elem (N=705)	0	-	-	387	45	$344,013	290	55	$399,487	28	71	$559,654
Middle (N=206)	0	-	-	115	32	$358,655	84	40	$408,952	7	61	$567,373
High (N=217)	5	31	$212,530	99	27	$279,909	108	41	$404,472	5	61	$537,730
2007 (N=1115)	35	27	$358,158	497	47	$387,554	563	63	$401,091	20	81	$572,614
Elem (N=688)	8	39	$687,415	341	56	$368,257	317	66	$418,221	22	81	$558,131
Middle (N=208)	6	26	$678,274	92	47	$355,118	104	57	$439,113	6	73	$528,305
High (N=219)	4	29	$323,811	101	32	$319,437	109	43	$410,177	5	71	$528,127

Source: Kentucky Department of Education (March, 2009)

Table 4
Post Hoc Testing Outliers

	CATS Index											
		$z \leq -2$			$z > -2$ & $z < 0$			$z > 0$ & $z < 2$			$z \geq 2$	
	N	Out-perform	Under-perform	N	Out-perform	Under - perform	N	Out-perform	Under-perform	N	Out-perform	Under-perform
2004 (N=1043)	1	1	0	27	22	5	29	19	10	1	1	0
Elem (N=641)	1	1	0	22	15	7	13	9	4	0	0	0
Middle (N=192)	0	0	0	3	3	0	5	3	2	0	0	0
High (N=210)	0	0	0	4	4	0	3	2	1	0	1	0
2005 (N=1098)	1	0	1	29	21	8	21	10	11	7	1	6
Elem (N=680)	0	0	0	21	12	9	9	5	4	5	0	5
Middle (N=198)	0	0	0	4	4	0	5	4	1	2	0	2
High (N=220)	0	0	0	1	1	0	8	5	3	0	0	0
2006 (N=1128)	2	1	1	26	25	11	28	21	7	3	0	3
Elem (N=705)	1	0	1	24	17	7	12	7	5	2	0	2
Middle (N=206)	2	0	2	5	5	0	3	2	1	1	1	0
High (N=217)	0	0	0	3	1	2	2	2	0	1	1	0
2007 (N=1115)	1	1	0	27	17	10	25	14	11	0	0	0
Elem (N=688)	2	0	2	23	13	10	7	3	4	0	0	0
Middle (N=208)	0	0	0	2	2	0	6	3	3	0	0	0
High (N=219)	1	0	1	3	3	0	5	3	2	0	0	0

Source: Kentucky Department of Education (March, 2009)

Table 4 (continued)

	Reading Proficiency											
	$z \leq -2$			$z > -2$ & $z < 0$			$z > 0$ & $z < 2$			$z \geq 2$		
	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform
2004 (N=1043)	0	0	0	20	17	3	19	7	12	0	0	0
Elem (N=641)	1	1	0	14	9	5	8	4	4	0	0	0
Middle (N=192)	0	0	0	6	4	2	3	2	1	0	0	0
High (N=210)	0	0	0	3	3	0	5	4	1	2	2	0
2005 (N=1098)	0	0	0	23	15	8	32	13	19	0	0	0
Elem (N=680)	2	0	2	21	12	9	7	2	5	3	0	3
Middle (N=198)	0	0	0	3	3	0	3	0	3	1	0	1
High (N=220)	0	0	0	2	1	1	9	7	2	0	0	0
2006 (N=1128)	0	0	0	21	14	7	25	12	13	0	0	0
Elem (N=705)	1	0	1	17	11	6	9	2	7	1	0	1
Middle (N=206)	2	0	2	5	4	1	0	0	0	0	0	0
High (N=217)	1	1	0	3	2	1	4	4	0	2	2	0
2007 (N=1115)	2	1	1	29	15	14	21	14	7	0	0	0
Elem (N=688)	3	0	3	21	14	7	9	4	5	0	0	0
Middle (N=208)	0	0	0	4	2	2	3	2	1	0	0	0
High (N=219)	1	0	1	4	2	2	4	4	0	1	1	0

Source: Kentucky Department of Education (March, 2009)

Table 4 (continued)

	Math Proficiency											
		$z \leq -2$			$z > -2$ & $z < 0$			$z > 0$ & $z < 2$			$z \geq 2$	
	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform	N	Out-Perform	Under-Perform
2004 (N=1043)	0	0	0	18	15	3	27	18	9	0	0	0
Elem (N=641)	0	0	0	14	12	2	15	8	7	0	0	0
Middle (N=192)	0	0	0	5	5	0	5	4	1	0	0	0
High (N=210)	0	0	0	4	3	1	3	2	1	1	1	0
2005 (N=1098)	0	0	0	22	19	3	20	12	8	8	2	6
Elem (N=680)	0	0	0	18	14	4	1	0	1	7	2	5
Middle (N=198)	0	0	0	3	3	0	3	1	2	1	0	1
High (N=220)	0	0	0	3	3	0	7	5	2	1	1	0
2006 (N=1128)	1	1	0	25	20	5	31	20	11	1	0	1
Elem (N=705)	0	0	0	23	15	8	9	6	3	0	0	0
Middle (N=206)	0	0	0	4	4	0	3	1	2	1	1	0
High (N=217)	2	2	0	0	0	0	4	4	0	2	2	0
2007 (N=1115)	0	0	0	25	20	5	24	17	7	0	0	0
Elem (N=688)	0	0	0	26	21	5	8	6	2	0	0	0
Middle (N=208)	0	0	0	2	1	1	2	1	1	1	1	0
High (N=219)	0	0	0	2	1	1	4	3	1	1	1	0

Source: Kentucky Department of Education (March, 2009)

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