

Journal of Rural Social Sciences

Volume 21
Issue 2 *Volume 21, Issue 2*

Article 4

12-31-2006

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Recommended Citation

Smith, D.. 2006. "Appalachian and Rural Student Performance Differences on Kentucky's Educational Assessment: Eighth Grade Results." *Journal of Rural Social Sciences*, 21(2): Article 4. Available At: <https://egrove.olemiss.edu/jrss/vol21/iss2/4>

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**APPALACHIAN AND RURAL STUDENT PERFORMANCE
DIFFERENCES ON KENTUCKY'S EDUCATIONAL ASSESSMENT:
8TH GRADE RESULTS**

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ABSTRACT

For assessment and accountability, the Kentucky Department of Education (KDE) developed the Kentucky Instructional Results Information System (KIRIS). Because the KIRIS assessment relied on student performance and was "high stakes" for schools, the fairness of the assessment was important. This paper examined whether 8th grade students living in Appalachia and/or in primarily rural school districts perform differently on the assessment than their peers. The four years of data (1993-1996) for this study came from KIRIS Cycle 2 data. The dependent variable was a composite score of student performance on constructed-response reading, mathematics, science, and social studies tests. The study found very small but significant performance differences existed based on Appalachian residence and rural-urban mix of school district over this KIRIS Accountability Cycle. Several suggestions for further decomposing the patterns of difference found in this study are made.

For assessment and accountability in achieving Kentucky's education reform goals, the Kentucky Department of Education (KDE) developed the Kentucky Instructional Results Information System (KIRIS). KDE used the data gathered through KIRIS to hold schools accountable (Insko 1996). Because state law mandated that the assessment and accountability system be primarily performance-based, KIRIS consisted of a variety of performance measures, including constructed-response questions in reading, math, science, social studies, practical living, and the arts. In addition, KIRIS used on-demand writing prompts and portfolios in writing and mathematics.

From the passage of the Kentucky Education Reform Act (KERA) until the end of 1996, student performance at Grades 4, 8, and 11 was collected, assessed and reported each year.¹ Every two years, the KIRIS assessment results were used to

¹Originally, only three grades were tested for the purposes of accountability: 4, 8, and 12. With the 1996-97 assessment, the number of grades tested expanded to five (4, 5, 7, 8, and 11) to shorten the length of the assessment for students at the lower grades. Moreover, KIRIS itself was reformed and replaced with the Commonwealth Accountability Testing System (CATS) after the 1997-98 school year. To keep the analysis from becoming too complex, only Cycle 2 data is included in the analysis.

determine which schools were deemed successful and unsuccessful. These efforts heightened public attention to educational quality while focusing schools on student achievement. The use of student achievement tests to make inferences about school performance made KIRIS a “high-stakes” accountability system for schools (Kentucky Department of Education 1997a). Successful schools accrued financial rewards while unsuccessful schools received additional state assistance.

Because the KIRIS assessment relied on student performance and was “high stakes” for schools, the fairness of the educational system and the assessment was important. Each year the KIRIS assessment was reviewed extensively for possible bias, and items judged by the Bias Review Committee to disadvantage student subgroups were either dropped from the test or modified (Kentucky Department of Education 1997a). Still, quantitatively examining the results of the assessment across student groups for performance differences remained an important check for possible bias. Initial quantitative studies of KIRIS results found small academic performance differences by gender and race among Kentucky students (Smith, Neff, and Nemes 1999). This research examines whether students living in Appalachia and/or in primarily rural school districts also perform differently on the KIRIS assessment than their peers in other parts of the state.

Appalachian Residence

The Appalachian mountain region was the first American frontier of the British colonies (Dunaway 1996). Once European colonizers nullified Native American claims to Appalachia and appropriated their lands, homesteaders settled this mountain chain (Dunaway 1996; Salstrom 1994). During the period that followed, these English, German, and Scots-Irish farmers and their descendants developed a yeomanly barter-and-borrow agriculture, which met their subsistence needs and left them with some surplus to sell in Eastern markets (Harrison and Klotter 1997; Salatino 1995; Salstrom 1994).

By the 1850s, however, the social forces of natural population increase, inheritance rights, and immigration as well as declines in agricultural prices, and adverse federal monetary policies began to undermine barter-and-borrow agriculture (Salstrom 1994; Turner 1983; Wolfe 1995). At this time, the Appalachian region came increasingly under the influence of mining companies, logging companies and railroads (Drake 2001; Salatino 1995). Many mountaineers became wage laborers employed in lumbering and mining to supplement their dwindling agricultural enterprises (Dunaway 1996; Salstrom 1994). Others

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migrated out of Appalachia seeking jobs in other regions (Eller 1982; Schwarzweller, Brown, and Mangalam 1971).

The transition to timbering and mining gave birth to the class system in Appalachia. At the top of the Appalachian class structure were the mine and timber owners, operators, and superintendents who formed the core of the upper classes in the region. Most of these individuals were not native mountaineers (Eller 1982). Most held college degrees and were tied by marriage to elites in the North. Over time much of the wealth, power and political control of the region became concentrated into the hands of successful members of these upper classes (Dunaway 1996).

Just below the northern elite were the middle classes composed mainly of the remnants of high cultured Appalachian elite. This group, consisting of a small fraction of Appalachian households, had been among the wealthiest landowners, slaveholders, merchants, and industrialists in the precapitalist system (Dunaway 1996). Their progeny also attended college and married elite from outside the region; however, their ties tended to link them to other Southern families (Dunaway 1996). Thus, the outcome of the civil war had hampered their class status. Those individuals that returned to this region after college often worked as lawyers, doctors, merchants, or middle level technicians and managers (Eller 1982). These college and family ties of the upper and middle classes meant that these individuals were also firmly rooted in the capitalist system.

Below the elites lay the mass of mountaineer society. Under barter-and-borrow relations, there had been few banks to make loans, little available money with which to make transactions, and few labor-saving farm implements to be found in the region (Salstrom 1994). People had traded their labor with the expectation that those they helped would return the favor later. Such a system ensured a modicum of equality among community members. However, as mountaineers began working in timbering and mining, they subordinated themselves to the coal company and became scrip dependent. The increasing dependence on scrip and decreasing reliance on agriculture ensured that most of these mountaineers became members of the region's lower classes reflecting their lack of valued skills, wealth, and/or land (Drake 2001; Dunaway 1996; Eller 1982; Salstrom 1994).

The class structure that capitalism developed was soon replicated within local institutions, including school systems. Two school systems evolved in many Appalachian counties: a consolidated county school district enrolling mountaineer students from the backwoods areas, and a small independent school district enrolling students from the towns. The independent districts historically served the

children of coal company officials and local business owners and were better supported and staffed than the county school districts, especially since the coal companies often taxed their workers to support these schools (DeYoung 1983; Eller 1982; Salatino 1995; Shackelford and Weinberg 1977; Smith and DeYoung 1992).

Given their history, it is no wonder that Kentucky's Appalachian consolidated county and independent school districts would show performance differences. In fact, over a half century later differences were still to be found. DeYoung (1983) observed sizable differences between Appalachian independent districts and Appalachian county districts on student achievement test scores. Moreover, he established that Appalachian independent districts were not only superior to Appalachian county school districts but also to non-Appalachian county school districts. DeYoung (1983) suggested these differences may be related to differences in the economic bases of the Appalachian communities with independent schools, although other indicators of quality of life among Appalachian counties may also play a part (Duncan and Tickamyer 1982).

Of course, DeYoung's study of Appalachian educational performance was published two years before the Council for Better Education, a nonprofit organization consisting of rural school districts, boards of education, and public school children (many of them Appalachian), sued Kentucky's State Legislature for failure to provide an efficient school funding system as required by the state constitution (Collins 1995). The Kentucky's education reform and its KIRIS assessment system was the outcome of this suit (Insko 1996). It is unclear whether Appalachian performance differences remain under the education reform.

Rurality

Defining rural has always been a complex issue (Kannapel and DeYoung 1999). Scholars have identified at least three meanings of rural status: a spatial meaning (few people distributed within a large space), an economic meaning (areas in which farming and other types of resource extraction activities form the basis of social organization), and a cultural meaning (people in places with traditional norms and conservative values) (Willits and Bealer 1967; Willits, Bealer, and Crider 1982). While these definitions have been historically linked, their overlap has declined (Wilkinson 1991). As these meanings have diverged, it has become increasingly more difficult to capture rurality (i.e., "ruralness") as a characteristic that can be studied.

Sociologists and educators have traditionally hypothesized that rural residents are educationally disadvantaged (Kannapel and DeYoung 1999). They have done

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so for many reasons. From a spatial standpoint, the low population density of rural areas upset the normal ratio of strong and weak personal ties among individuals and thus inhibited community interaction and adversely affected education (Granovetter 1973; Wilkinson 1991). In addition, low population densities meant rural schools were small, local, community schools. Advocates of centralization, consolidation, bureaucratization and professionalization have often labeled such schools wasteful, understaffed, and inferior (Kannapel and DeYoung 1999).

From an economic standpoint, the boom-bust cycles inherent to the extractive economies common in rural areas led to periods of depression that not only affected the quality of individuals' lives but also the local tax base, which had traditionally been the main support for school districts and their schools (Duncan and Tickamyer 1982). Lastly, from a cultural standpoint, rural researchers have noted that the traditional cultures of rural areas have often been at odds with education and education reform (Brim 1923; Bushnell 1999; Carney 1912; Drake 2001).²

Early examinations of educational quality have suggested an adverse effect of rurality on education (Brim 1923; Carney 1912; Stern 1994). More recent comparisons have found that rural students now perform as well as their peers (Stern 1994; Fan and Chen 1999).³ While many school and district comparisons have been made based upon rurality as a concept, few published empirical reports examined school or district achievement by rurality. Numbers reported by Peevley and Ray (2001) showed slight differences between Tennessee school districts on K-5 reading achievement by level of school district rurality. These findings showed that the least rural districts in Tennessee are slightly better than the most rural districts; however, the substantive and statistical significance of these results remain unknown.⁴ Moreover, Smith et al. (1999) found that performance differences by

²Citizens in many rural communities continue to worry about the migration of the best and brightest rural youth out of countryside although research has shown that this trend has slowed since the 1980s (Cronmartie 2000; Nord and Cronmartie 2000; Schachter, Jensen, and Cornwell 1998).

³While these rural-urban comparisons are rarely questioned, critics point out that many of these comparisons, as well as many educational reforms, have resulted from the desire to remake the rural school system to have them resemble the systems that served urban, middle-class America (DeYoung and Boyd 1986). That rural-urban differences might be a function of the questions asked has seldom been discussed.

⁴Table 3 of Peevley and Ray (2001) present numbers of school districts by achievement level and rurality level. They use these numbers to argue that the most rural districts performed less well on most measures of the Tennessee Accountability Index (TAI). However, the percentages in their

gender and ethnicity increased as the grade level increased, making it possible that performance differences by Appalachian residence and rural-urban mix will be larger at later grade levels.

The purpose of this paper is to explore student performance differences on the KIRIS assessment by Appalachian and rural-urban status. The previous research suggests several hypotheses:

1. Appalachian students as a subgroup will perform poorer on KIRIS assessment measures than will non-Appalachian students.
2. Students in predominantly rural school districts will perform poorer on KIRIS assessment measures than will students from predominantly urban school districts.
3. Appalachian students in predominantly urban school districts (i.e., independent city school districts) will perform better on KIRIS assessment measures than will all other combinations of Appalachian residence and rural mix.

Methodology

Data

The data for this study came from KIRIS assessment data maintained by the Kentucky Department of Education. Each year, according to legislative mandate, every eighth grade student in Kentucky was tested for assessment and accountability purposes. The data analyzed here come from the 2nd KIRIS accountability cycle, covering the four academic years 1992-93 to 1995-96. At the end of each KIRIS assessment cycle, the assessment system was slightly changed to take care of any methodological or political issues that had arisen during the cycle. Changes occurring at the end of Cycle 2 made composite comparisons with later accountability cycles more complicated. For simplicity only Cycle 2 data were examined in this study.

table are table percentages instead of column percentages. To compare the three groups, column percentages are necessary. Recomputation of the table using the numbers finds stronger indications of percentage differences, which may be considered substantively significant if the TAI measures the entire population of Tennessee school children. If the TAI measures only a sample then inferential statistics are necessary to determine significance. Calculation of a chi-square test on this table finds a chi-square value of 8.52 which is not statistically significant. This finding would mean that the rurality and school district achievement in K-5 reading are not statistically associated.

Variables

Dependent Variable: The KIRIS Constructed Response Index. The dependent variable in this study was the constructed response index—a composite score of individual student performance on the KIRIS constructed-response reading, mathematics, science, and social studies tests.⁵ Using a graded-response IRT model (Samejima 1969; Kentucky Department of Education 1997a), the patterns of student scores on the constructed-response questions were converted to a single continuous measure of student performance for each content area (called theta). Applying cut-points developed by standard setting committees in 1992 and verified by a KIRIS standards validation study in 1995 (Kentucky Department of Education 1995), the students' theta score for each content area (i.e., reading, mathematics, science, and social studies) was converted into one of four categories: novice, apprentice, proficient, and distinguished (Kentucky Department of Education 1995; Kentucky Department of Education 1997a). Each of these categories was then assigned a numerical weight of 0, 40, 100, and 140 respectively. These content area scores could then be averaged over a school or a district and used as a summary measure of student performance in each content area. In addition, because each of these four components contributed equally to the state's accountability metric, the constructed response index could be calculated by averaging the test indices.

Independent Variables: Appalachian Residence and Rural-Urban Mix. Geographically, Appalachia refers to the mountainous region in the eastern United States running from New York to Alabama (Eller 1997). These mountains separate the Atlantic Coastal Plain from the Interior; however, people have often disagreed about what areas should be included as Appalachian (Drake 2001). The most often used definition, advanced by the Appalachian Regional Commission (ARC), includes a geographic area that stretches through 13 states from New York to Mississippi (Appalachian Regional Commission 1997). In this study, Appalachian status was operationalized using the current Appalachian Regional Commission boundary, whereby, 49 of Kentucky's 120 counties are classified as Appalachian. Table 1 shows the distribution of Appalachian and non-Appalachian students over the KIRIS Cycle 2. As can be seen from the table, Appalachian students comprised approximately one-third of Kentucky's total student population during this four-year period.

⁵These four content areas are the core of the KIRIS accountability system, each area constituting 14% of the KIRIS Accountability Index (Kentucky Department of Education 1997a; Kentucky Department of Education 1997b).

SOUTHERN RURAL SOCIOLOGY

TABLE 1. DISTRIBUTION OF 8TH GRADE STUDENTS BY APPALACHIAN STATUS, 1992-93 TO 1995-96.

APPALACHIAN STATUS	ACADEMIC YEAR			
	1992-93	1993-94	1994-95	1995-96
	31563	33622	33058	33726
NON-APPALACHIAN.	(66.8%)	(67.2%)	(67.4%)	(67.9%)
	15671	16417	15961	15928
APPALACHIAN.	(33.2%)	(32.8%)	(32.6%)	(32.1%)
	47234	50039	49019	49654
TOTAL.	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Ruralness was defined in this study using the number of rural and urban student each in school district as found in the School District Data Book (1994). The inclusion of this data allowed for the creation of a continuous variable describing the proportion of rural students in each school district in 1990. A strength of this measure is that the use of proportions moves sociological and educational research away from a dichotomous definition of rurality and allows for the possibility of differences in student interaction based on their ruralness or urbanness. The use of this proportion was viewed as particularly desirable since previous social science research has shown that the size of minority groups within the population affects interaction patterns between members of the majority and minority (Brown and Bigler 2002; Kanter 1977; Simon, Aufderheide, and Kampmeier 2004).

For ease in tabular display, this study collapsed the proportion of rural students into three categories: rural, urban, and mixed. A rural school district was categorized as one having 85 percent or more of its student body residing in rural locations.⁶ Conversely, an urban school district was defined as one having 15 percent or less of its student body coming from rural areas. Mixed school districts, serving both rural and urban students, were defined as having a population more than 15 percent and less than 85 percent rural. Using these definitions, approximately 47 percent of the 176 school districts in the Commonwealth were rural, 28 percent were mixed, and 25 percent were urban.

⁶Scheffe's post-hoc comparisons only test for significance differences among levels of the main effects. Thus, significant differences among the unadjusted means of the interaction term are not shown or discussed. Adjusted means do have adjusted post-hoc Scheffe's tests for the interaction term and are discussed.

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Table 2 shows the distribution of students within school districts classified rural, mixed, and urban over KIRIS Cycle 2. As can be seen from this table, rural and mixed districts have nearly the same percentages of students (around 35

TABLE 2. DISTRIBUTION OF 8TH GRADE STUDENTS BY RURAL-URBAN MIX OF SCHOOL, 1992-93 TO 1995-96.

RURAL-URBAN CATEGORY	ACADEMIC YEAR			
	1992-93	1993-94	1994-95	1995-96
	17098	18124	17642	17543
RURAL.	(36.2%)	(36.2%)	(36.0%)	(35.3%)
	16270	17317	17068	17359
MIXED.	(34.5%)	(34.6%)	(34.8%)	(35.0%)
	13866	14598	14309	14752
URBAN.	(29.4%)	(29.2%)	(29.2%)	(29.7%)
	47234	50039	49019	49654
TOTAL.	(100.1%)	(100.0%)	(100.0%)	(100.0%)

percent in any given year). Students attending urban districts make up slightly less than a 30 percent of Kentucky's eighth grade population. While one might assume that all of the school districts within the Appalachian region would have been concomitantly classified as rural, this was not so. Within the Appalachian region, 18 percent of the school districts were classified as urban; 26 percent were mixed and 55 percent were rural. All urban districts in the Appalachian region were independent school districts, while the county school districts were either rural or mixed. Outside Appalachia, 28 percent of the school districts were urban; only three of these urban districts were county districts--Jefferson (which contains the city of

TABLE 3. DISTRIBUTION OF 8TH GRADE STUDENTS BY GENDER, 1992-93 TO 1995-96

GENDER	ACADEMIC YEAR			
	1992-93	1993-94	1994-95	1995-96
	23982	25598	25139	25403
MALE.	(50.8%)	(51.2%)	(51.3%)	(51.2%)
	23252	24441	23880	24251
FEMALE.	(49.2%)	(48.8%)	(48.7%)	(48.8%)
	47234	50039	49019	49654
TOTAL.	(100.0%)	(100.0%)	(100.0%)	(100.0%)

Louisville), Fayette (which contains the city of Lexington), and Kenton (which is part of the Cincinnati metropolitan area). The rest of the urban districts were independents.

Control Variables. Previous research found significant performance differences on the Constructed Response Index by gender and ethnicity in 8th Grade (Smith et al. 1999). While sex is operationalized as a dichotomous variable (male, female), ethnicity consists of five categories—white, black, Hispanic, Asian, and other. Table 3 shows the distribution of students by gender over KIRIS Cycle 2. There are more males than females in Kentucky’s eighth grade over this four-year period. Table 4 presents the distribution of students by ethnicity. Kentucky 8th grade students are overwhelmingly white. Around 9 percent of the students are black, while Hispanics, Asians and Other ethnicities together account for approximately 1.5 percent of Kentucky’s 8th grade students.

TABLE 4. DISTRIBUTION OF 8TH GRADE STUDENTS BY ETHNICITY, 1992-93 TO 1995-96.

ETHNICITY	ACADEMIC YEAR			
	1992-93	1993-94	1994-95	1995-96
	42107	44863	43858	44211
WHITE.....	(89.2%)	(89.7%)	(89.5%)	(89.0%)
	4549	4390	4284	4559
BLACK.....	(9.6%)	(8.8%)	(8.7%)	(9.2%)
	228	185	233	224
HISPANIC. ...	(0.5%)	(0.4%)	(0.5%)	(0.5%)
	153	223	216	205
ASIAN.....	(0.3%)	(0.5%)	(0.4%)	(0.4%)
	197	378	428	455
OTHER.....	(0.4%)	(0.8%)	(0.9%)	(0.9%)
	47234	50039	49019	49654
TOTAL.....	(100.0%)	(100.2%)	(100.0%)	(100.0%)

Results

To test the hypotheses, a 2 x 3 analyses of covariance (ANCOVA) was conducted on KIRIS composite index for each year using The SAS System for Windows, Version 8. Appalachian location and rural-urban mix were independent variables. The covariates were sex and ethnicity. Table 5 presents a summary of the ANCOVA results for each year. Controlling for sex and ethnicity, the KIRIS composite index varied significantly by rural and Appalachian residence. In addition, a significant interaction between Appalachian and rural-urban mix was

TABLE 5. ANCOVA SUMMARY TABLE

YEAR	SOURCE	SS	df	MS	F	p	η^2
1992-93	APPALACHIAN.....	98311.25	1	98311.25	171.45	<.0001	.003
	RURAL-URBAN MIX.....	90187.27	2	45093.63	78.64	<.0001	.003
	SEX.....	504537.97	1	504537.97	879.88	<.0001	.017
	ETHNICITY.....	909707.01	4	227426.75	396.62	<.0001	.032
	APPALACHIAN*RURAL URBAN MIX..	85918.80	2	42959.40	74.92	<.0001	.003
	ERROR.....	27078541.98		573.42			
	TOTAL.....	28853005.67					
1993-94	APPALACHIAN.....	49056.31	1	49056.31	77.09	<.0001	.001
	RURAL-URBAN MIX.....	106259.80	2	53129.90	83.49	<.0001	.003
	SEX.....	437485.64	1	537485.64	844.61	<.0001	.016
	ETHNICITY.....	1049697.73	4	262424.43	412.38	<.0001	.031
	APPALACHIAN*RURAL-URBAN MIX. .	94610.24	2	47305.12	74.34	<.0001	.003
	ERROR.....	31836432.47		636.37			
	TOTAL.....	33697477.89					
1994-95	APPALACHIA.....	34037.47	1	34037.47	52.85	<.0001	.001
	URBAN.....	119139.59	2	59569.80	92.49	<.0001	.004
	SEX.....	439749.96	1	439749.96	682.76	<.0001	.013
	ETHNICITY.....	1184799.59	4	269199.90	459.89	<.0001	.035
	APPALACHIAN* RURAL-URBAN MIX.	57876.35	2	28938.18	44.93	<.0001	.002
	ERROR.....	31557610.21		644.07			
	TOTAL.....	33453384.99					
1995-96	APPALACHIAN.....	16067.77	1	16067.77	29.00	<.0001	.001
	URBAN.....	29567.05	2	14783.53	26.68	<.0001	.001
	SEX.....	337538.69	1	337538.69	609.12	<.0001	.012
	ETHNICITY.....	1177210.02	4	294302.50	531.10	<.0001	.040
	APPALACHIAN*RURAL-URBAN MIX. .	31615.57	2	15807.78	28.53	<.0001	.001
	ERROR.....	27509239.25		554.14			
	TOTAL.....	29173567.82					

found in the ANCOVA models for the last three years of KIRIS Cycle 2. While the independent variables were significantly related to dependent variable in every year, the η^2 statistics are extremely small, suggesting that these independent variables and covariates explain little of the variation in the KIRIS Constructed Response index.

The first hypothesis was that Appalachian students as a subgroup would perform poorer on KIRIS assessment measures than would non-Appalachian students. The unadjusted and adjusted means for Appalachian and non-Appalachian subgroup performance, presented in the top panel of Table 6, revealed that the first hypothesis is supported by the data. Appalachian students performed slightly, but significantly ($p < .05$), poorer on the KIRIS Constructed Response Index than their non-Appalachian contemporaries in every year examined.

The second hypothesis was that students in predominantly rural school districts will perform poorer on KIRIS assessment measures than students from predominantly urban school districts. The second panel of Table 6 presented unadjusted and adjusted subgroup means on the KIRIS constructed-response index by rural-urban school district mix. This hypothesis was also supported by the data. Students in predominantly rural school districts scored, on average, significantly below ($p < .05$) their counterparts in urban and mixed school districts in all four years examined.

The last hypothesis examined was that Appalachian students in predominantly urban school districts (i.e., independent city school districts) would perform better than all other subgroups examined. Looking at the unadjusted means for these subgroups in the last panel of Table 6, one might believe this hypothesis was supported by the data. Appalachian students in predominantly urban school districts, on average, outperformed their contemporaries in three out of the four years examined (the only exception being the 1992-93 school year). However, once the group means were adjusted to control for the confounding effects of gender and ethnicity, the superiority of the Appalachian urban school district students receded. The adjusted group means did not support the third hypothesis that Appalachian students in urban districts outperformed their counterparts. However, Appalachian students in urban districts did compare well to the other groups, especially students in non-Appalachian urban and mixed districts. Over the four years studied, Appalachian urban district student means were significantly different from students in other Appalachian districts, however, the differences from non-Appalachian student means eroded over the course of the cycle. By the end of the cycle, there were no differences between Appalachian urban students and non-Appalachian

TABLE 6. ADJUSTED AND UNADJUSTED GROUP MEANS FOR THE CONSTRUCTED RESPONSE INDEX

		1992-93		1993-94		1994-95		1995-96	
		UNADJUSTED	ADJUSTED	UNADJUSTED	ADJUSTED	UNADJUSTED	ADJUSTED	UNADJUSTED	ADJUSTED
		M	M	M	M	M	M	M	M
APPALACHIAN		27.10	26.60	33.43	34.60	38.59	37.50	36.01	34.95
NON-APPALACHIAN		32.00 ^a	30.59 ^a	36.76 ^a	37.31 ^a	41.66 ^a	39.79 ^a	37.14 ^a	36.53 ^a
RURAL		28.55	26.42	34.85	34.39	38.97	36.00	36.55	34.43
MIXED		30.67 ^b	27.98 ^b	35.76 ^b	34.25	42.49 ^b	38.92 ^b	38.11 ^b	35.78 ^b
URBAN		32.25 ^b	31.37 ^b	36.56 ^b	39.23 ^b	40.57 ^b	41.01 ^b	35.48 ^b	37.01 ^b
APPALACHIAN	URBAN	32.99	30.21	41.49	40.36	45.11	41.78	40.01	37.71
APPALACHIAN	MIXED	29.31	27.27 ^c	33.72	32.63 ^c	41.15	37.64 ^c	37.17	34.81 ^c
	RURAL	25.63	22.31 ^c	32.27	30.82 ^c	36.89	33.07 ^c	35.09	32.34 ^c
NON-	URBAN	32.17	32.53 ^c	36.00	38.10	40.06	40.24	35.01	36.31
APPALACHIAN	MIXED	31.06	28.69	36.33	35.87 ^c	42.85	40.20	38.35	36.75
	RURAL	33.52	30.54	39.03	37.97 ^c	42.36	38.93 ^c	38.90	36.52

student scores. What is consistent in these data was that Appalachian students in predominantly rural school districts consistently have the lowest performance of any group in the analysis. Thus the forces that tend to separate Appalachian students from other students continue to be present.

Discussion

This study has explored the data for potential performance differences by Appalachian residence and rural mix of school, while taking race and gender into account. During the examination, very small but significant student performance differences exist based on Appalachian residence and rural-urban mix of school district over this KIRIS Accountability Cycle. When examined separately, non-Appalachian and urban school districts' students appear to have the highest performance in the state at the eighth grade level over KIRIS Cycle 2. However, when the interaction of Appalachian residence and rural-urban mix are examined, Appalachian urban school district students performed just as well as other urban school district students in the rest of the state. On average, Appalachian rural school district students have the lowest performance of any group and this plays a major role in aggregative differences. These results have important implications for future research.

The finding of relatively small but statistically meaningful and empirically consistent performance differences at the eighth grade level does not necessarily mean that the study of subgroup performance differences should be abandoned. As previously noted, analyses of KIRIS data at grades 4, 8, and 11 found performance differences on the KIRIS assessment by race and gender increased as grade level increased (Smith et al. 1999). Thus, it is possible that performance differences by Appalachian residence and rural-urban mix are larger at later grade levels. More research will need to be done to test that hypotheses.

The current results demonstrate that some residual effects of Appalachia's historic two-tier education system remain. Although the Kentucky Education Reform Act has improved funding equity by lessening the differences in per pupil spending between school districts within the state, the performance gap between the historically well financed independent districts and the county districts has declined by only a small amount. How this historical difference continues to manifest itself is unknown. Further quantitative and qualitative comparative and historical research is needed to understand how these differences between county and independent districts persist and how Appalachian rural county district student performance can be specifically targeted for improvement.

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Even though there are small but consistent and statistically significant performance differences in the KIRIS assessments between students in Appalachian rural districts and Appalachian urban districts, this does not necessarily imply that the KIRIS assessment or the accountability system is biased. It does, however, mean that this simple examination is not sufficient to discount the possibility of question bias. In the future it is hoped that Differential Item Function (DIF) analyses will be performed and published to more clearly discount the possibility that some portion of this performance gap depends on the artifacts of assessment.

Beside item bias, there are additional alternate explanations for such performance differences. One frequently advanced hypothesis suggests that Appalachian rural performance lags behind other groups' performance as a function of socioeconomic status differences. Because Appalachia has long history of disadvantage within the nation, the effect of their community's economic status (e.g., the percentage of households in poverty) becomes confounded with the effects of the Appalachian status and/or the urban-rural mix of the school. It is hoped that future research on rural and Appalachian students, schools and/or school districts will include income measures that will allow these issues to be explicated further. Economic status must be addressed better in future research.

Lastly, as discussed much earlier in the paper, researchers need to consider carefully which definition of rurality or urbanity will work best for their area given the geography, history, and social structure. One weakness of the current operationalization of rurality as rural-urban mix may be the validity of the school district as a unit of analysis; however, in Kentucky, school districts, like counties, tend to be small. There are 176 school districts within the 120 counties that comprise Kentucky. The overwhelming majority (84%) of these school districts are structured to have several elementary schools feeding into a consolidated school building (either a consolidated middle school or a consolidated high school). Thus, in most school districts all rural and urban students are interacting in a single consolidated school building for somewhere between three and seven years of their education. Therefore, the use of school districts as the unit of analysis accurately describes the interactional mix of many schools in this state, at least at the secondary school level. Future research should examine the use of differing definitions of rural-urban mix by grade level and structure of school.

Another weakness of rural-urban mix is that the information used to calculate the measure is collected by the decennial census. This long interval makes the accuracy of the rural-urban mix variable questionable in areas of rapid population growth and change. In the future, research on rural schools may wish to consider

multiple rural indicators such as economic dependency codes (which would highlight regions with high levels of resource extraction activities) and accessibility indicators (which would provide an indication of the geographic and cultural isolation of a school or school district) to triangulate on rural areas. Consequently, the clear patterns of small but consistent differences in performance is undoubtedly resultant from a mix of environment and schooling-related factors.

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