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Interstate Variation in the Mathematics Achievement of Rural and Nonrural Students

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This study challenges our monolithic view of rural education through a systematic analysis comparing rural and nonrural student achievement and schooling conditions in the nation and states participating in the 1992 and 1996 NAEP eighth grade mathematics assessments. The results show that while rural and nonrural students had comparable levels of math achievement in 1992, by 1996 rural students overall had begun to outperform their nonrural counterparts. However, the achievement gaps varied considerably from state to state, with rural students performing significantly better in some states and significantly poorer in others. The differences and gains appear to be explained by variance in a broad range of schooling factors (instructional resources, advanced course offerings, progressive instruction, professional training, safe/orderly climate, collective support). The results have important implications for comprehensive school reform efforts as we attempt to improve education for all our students, particularly those in our rural schools.

Rural student achievement provides one important barometer for monitoring national progress in public education. Rural education often has been discussed as a deficit model of instruction from which relatively low outcomes can be expected (Edington & Koehler, 1987). While this perspective has been reinforced by some local studies, it is not supported by national data (Fan & Chen, 1999; Lee & McIntire, 1999; Stern, 1994). National Assessment of Educational Progress (NAEP) assessment scores for students in "Extreme Rural" settings have risen in the last decade, and they approximate national means (NCES, 1991).[1] Since the 1980s, the achievement scores of rural students have been comparable to national averages in virtually every subject tested. More recently, rural students made further progress than their nonrural counterparts. Data from the NAEP 1996 mathematics assessment, when compared with the 1992 data, showed that the most significant improvement occurred in the rural/small town category (NCES, 1997).[2]

Despite these aggregate national trends, achievement of rural students relative to nonrural students varies significantly from state to state. Whether and how interstate variations in the achievement of rural and nonrural students are related to their different schooling conditions is an important question with implications for school reform. Little systematic information is available on the strategies that different states follow to provide financial or other types of aid to rural and urban schools and districts (Khattri, Riley, & Kane, 1997). Recent research or media reports, dealing with the effects of school location on student outcomes, tend to pay exclusive attention to the disadvantages of urban schools relative to both suburban and rural schools (see Education Week, 1998; Lippman, Burns, & McArthur, 1996).

During the past 2 decades, state legislatures have issued numerous mandates directed toward improving the quality of public education. Rural and small school districts with low fiscal capacity have often found these requirements difficult to meet (Stephens, 1988). In some cases, through extraordinary local effort, full compliance with state mandates has been met. In other cases, reform legislation has forced consolidation and reorganization of rural schools and school districts (Stern, 1994). Despite these state policy efforts, it has not been clear whether schooling conditions and student learning have improved in rural schools relative to their nonrural counterparts. The NAEP database provides an abundance of survey data which

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[1]NAEP has used a definition of rural, called extreme rural, that encompasses students in nonmetropolitan areas with a population below 10,000 and where many parents are farmers or farm workers.

[2]In past NAEP reports, a type of community variable that combined community size with a school-level socioeconomic indicator was reported. Due to the problematic nature of this variable, NAEP currently reports results by census-based description.

is relevant to the issue. However, ambiguity and the complexity of the survey data has posed a challenge to researchers trying to make clear linkages between the survey reports and assessment results.

In light of these concerns, we conducted a systematic study of NAEP 1992 and 1996 national and state eighth-grade mathematics assessment data. The study's objectives were to understand interstate variations in the academic achievement of rural and nonrural students and to identify state-level schooling factors related to their improvements and differences. Particular attention was paid to the connection between schooling conditions and student achievement. Based on our findings, we also propose state profiles of rural and nonrural education that are expected to provide insights into the problems faced by states in their rural and nonrural areas as well as the methods for addressing their unique problems.

Data and Methods

The primary data sources are the NAEP 1992 and 1996 national and state mathematics assessments, which were collected from students attending public schools in grade 8. In order to track the state-level changes in student achievement, we selected 35 states that are common to the 1992 and 1996 assessments. The 1992 and 1996 NAEP data contain information on the mathematics knowledge, skills, understanding and attitudes of a representative sample of eighth-grade students in the nation and each participating state. In addition, the data contain questionnaires completed by the students, their mathematics teachers and principals.

In this study, schools and their students are classified into rural versus nonrural categories according to their values for the "type of location" variable on which the current NAEP sampling is based: Schools in central city, urban fringe, or large town are treated as "nonrural," and schools in rural or small town as "rural." These classifications are based on geographic characteristics of the schools' locations and are determined by the Census Bureau definitions of metropolitan statistical areas (MSAs), population size, and density. Rural includes all places and areas with a population of less than 2,500. A small town is defined as places outside MSAs with a population of less than 25,000 but greater than or equal to 2,500. An advantage of the use of the Census definition of rural is that because schools are linked to places rather than only counties, it is possible to examine the distribution of rural schools across the different types of counties within which they are situated—including metropolitan areas.

To estimate the achievement gap between rural and nonrural students, we followed the NAEP data reporting conventions which take into account sampling weights, jackknife replicate weights and plausible values (see Allen, Jenkins, Kulick, & Zelenak, 1997). The procedure of estimation involved several steps: (a) the averages of each group's achievement scores and attached standard errors were calculated, (b) their gaps and standard errors of the gaps were computed, and (c) the statistical significance of the gaps were tested at the .05 level. In addition, effect size measures (Hedges's g) were produced to examine practical significance of the gaps.

After we obtained the state measures of rural and nonrural achievement, we examined their relationships with schooling conditions across the 35 states. To explore the state-level correlates of rural and nonrural achievement, we constructed the key schooling condition variables from the NAEP math teacher and school principal surveys that measure broad aspects of schooling. After the measures of schooling conditions were constructed, those individual measures were aggregated and analyzed at the state level for cross-state comparisons. We conducted correlation and multiple regression analyses to explain interstate variation in the achievement gap between rural and nonrural students. We also examined state-by-state changes for rural and nonrural students in their schooling conditions and outcomes from 1992 to 1996. This procedure was designed to help us more reliably identify states that succeeded in improving both rural and nonrural education simultaneously, and study them more productively.

This study has some limitations. Rural and nonrural areas in different states may have different social and cultural characteristics despite their common classifications. We recognize that the Census Bureau definitions do not take into consideration the type of employment in that area and the degree of isolation (see Khattri et al., 1997 for different definitions of "rural"). While the primary unit of analysis is state, the relationships between schooling conditions and outcomes may change at different levels of school system. Given the cross-sectional nature of the NAEP data, it is cautioned against making causal inferences from the results of our data analyses. Finally, our measures of schooling conditions are limited in that they are based on teachers' and principals' self-reports on selected-response questionnaire.

Defining and Measuring Key Schooling Conditions

Based on our literature review, we explored key schooling conditions and opportunities that affect student performance in rural and nonrural settings. Research on school size suggests that small, rural schools are in many ways more effective than large, urban schools (Howley, 1994). At the same time, research on small schools, which includes the large majority of rural schools, revealed definitive disadvantages in terms of the availability of resources and advanced courses. Given that rural schools have both advantages and disadvantages, we identified six schooling condition variables that might impact rural student achievement: instructional resources, professional training, algebra offering, progressive instruction, safe/orderly climate, and collective support. We extracted information from the NAEP survey questionnaires that were administered to eighth-grade mathematics teachers and school principals in 1992 and 1996.[3]

Instructional Resources

Rural schools typically lack the facilities, physical plants, course materials, and educational programs that typify larger, more resource-rich districts. Sparse population bases often result in geographic and cultural isolation, limited economic development, and restricted educational opportunities (McCombs & Bansberg, 1997). One item from the NAEP teacher surveys, common to the 1992 and 1996 data, was used to measure instructional resources.

Professional Training

In the context of education reform, many have expressed concern about the quality of teachers in rural schools. One index of quality is the amount of preparation. As widely believed, the Schools and Staffing Survey confirmed that rural teachers generally have less professional preparation (Stern, 1994). Part of the difference may be attributable to rural teachers' relative youth. Another contributing factor may be the limited access rural teachers in more isolated settings have to continuing education and professional development opportunities. Eleven items from the NAEP teacher surveys, common to the 1992 and 1996 data, were used to measure professional training.

Algebra Offering

A recent analysis of NAEP data revealed extremely low rates in the availability of advanced courses for 12th graders in schools located in nonmetropolitan counties compared to metropolitan counties (Greenberg, Swaim, & Teixiera, 1992). While the gap may be smaller at the middle grades level with less variability of course offerings, we note that the offering of algebra to eighth grade students for high school credit varies from school to school. One item from the NAEP school principal surveys, common to the 1992 and 1996 data, was used to measure algebra offering.

Progressive Instruction

Student-centered instructional practices with a strong emphasis on higher-order thinking skills can be considered positive signs of the implementation of many recent recommendations for the reform of teaching mathematics (National Council of Teachers of Mathematics, 1991). Rural schools enable low student-teacher ratios, individualized instruction and attention, and cooperative learning opportunities. The Schools and Staffing Survey data show that rural teachers exercise considerable control over instructional processes in their classrooms (Stern, 1994). Ten items (with four common items) from the 1992 and 1996 NAEP teacher surveys were used to measure progressive instruction.

Safe/Orderly Climate

The resource limitations rural schools often experience are somehow compensated for by the supportive ethos found in smaller communities and their generally smaller schools (Stern, 1994). According to the Schools and Staffing Survey, rural teachers were less likely than teachers in both urban and suburban schools to consider teacher absenteeism as a problem. Likewise, the survey reported that rural students experience safer learning environments and behave much more appropriately than their urban counterparts in terms of school attendance, classroom behavior, and alcohol and drug use. Seven items (with five common items) from the 1992 and 1996 NAEP school principal survey were used to measure safe/orderly climate.

Collective Support

Many researchers have found that effective schools are defined in terms of a collective identity (Lee, Bryk, & Smith, 1993; Louis & Kruse, 1995; Newmann & Wehlage, 1995). Rural schools feature close relationships and ties to the community, and strong staff commitment (DeYoung, 1987; McREL, 1990). These conditions are more likely to bring about collective support for student learning. Seven items (with four common items) from the 1992 and 1996 NAEP school principal survey were used to measure collective support.

For instructional resources and algebra offering variables, we used one item and computed percentage estimates for selected response categories. The percentage of students whose math teachers report they "get all or most resources" was calculated to estimate adequacy of instructional resources. The percentage of students whose school principals report they offer eighth graders algebra for high school credit was calculated to estimate advanced course offering. For all of the remaining schooling condition variables which involved multiple items, we chose to use the Rasch measurement method (see Wright & Masters, 1982). While the 1996 NAEP teacher and school survey questionnaires

[3]According to the NAEP sampling design, teachers were selected if they taught student eighth grade mathematics. In this study, teachers' measures were matched to their students.

Table 1
Percentages and NAEP Mathematics Scores: Rural and Nonrural Students (Eighth Grade)

	Rural		Nonrural	
Year	Percentage of all students	Mean Score	Percentage of all students	Mean Score
1992	28.06 (3.13)	265.54 (1.36)	71.94 (3.13)	267.18 (1.26)
1996	33.09 (3.14)	276.06 (1.92)	66.91 (3.14)	267.58 (1.80)

Note. The NAEP mathematics scale ranges from 0 to 500. The standard errors of the statistics appear in parentheses. It can be said with about 95% confidence that, for each population of interest, the value for the entire population is within ± 2 standard errors of the estimate for the sample. In comparing two estimates, one must consider the standard error of the difference.

update portions of the 1992 version, the two surveys maintain common sets of items. The items common to both 1992 and 1996 survey forms were used to equate the scale constructed from the 1992 data with the measures reported for 1996. These variables were scaled by setting the mean of the item scale at 50 and the scale value of 1 logit at 10 (See Appendix for description of the measures.).[4]

Interstate Variation in Rural Achievement Gap

In 1992 NAEP math, eighth grade students in the nation's public schools scored 271 on the 0-500 NAEP scale. Among those students, rural students' average math scale score was 266, whereas nonrural students' average score was 267 (see Table 1). The gap between the two groups of students is both statistically and practically insignificant (.05 in effect size). However, the pattern changed in 1996. In the nation, rural students' average math scale score was 276, whereas nonrural students' average score was 268. While the percentage of rural students didn't change significantly from 1992 to 1996 in the nation, rural students made a significant gain (about 11 points) from 1992 to 1996 while nonrural students remained about the same (see Table 1). Consequently, rural students' average mathematics score turned out to be 8 points higher than their nonrural counterparts in 1996, which was statistically significant and practically meaningful (.23 in effect size).

Despite these national aggregate patterns, the results vary substantially from state to state. First, some of the rural states performed at the top (e.g., Iowa and Maine), while others performed below the national average (e.g., Arkansas and Mississippi). Secondly, while 14 states, among the 35 states that were common to 1992 and 1996 assessments, had statistically significant achievement gaps between rural and nonrural students, the direction of gap was not consistent across the states (see Figure 1). Rural students performed better than nonrural students in seven states (Connecticut, Indiana, Massachusetts, Michigan, Nebraska, New York, and Rhode Island). At the same time, rural students performed worse than nonrural students in the other seven states (Georgia, Kentucky, Maryland, North Carolina, South Carolina, Virginia, and West Virginia).

These interstate variations raise a question as to the extent to which those patterns are related to differences in schooling conditions. Table 2 shows the correlations between average math achievement and schooling condition measures by location across the 35 states. Multiple regression analysis shows that all these six factors together explain about 84% of the total variation in rural achievement. It turns out that instructional resources, safe/orderly climate and collective support are significant predictors, while professional training, algebra offering and progressive instruction are not. In other words, rural students in states where they have access to instructional resources, safe/orderly climate and collective support tend to perform better than their counterparts in states where they don't. The low correlations for algebra offering may be due to the likelihood that the quality of algebra course offered is not strictly comparable among different states. Table 2 shows quite similar patterns of relationships for nonrural students except an idiosyncratic pattern in professional training. Mul-

[4]The logit is a "log odds" unit. Both person measure and item difficulty are measured on the same logit scale. The difference between a person measure and item difficulty is equal to the log of the person's probability of answering 'yes' to the item. This idea can be extended to any item with ordered response alternatives. For instance, items selected for progressive instruction in this study involve four response categories asking teachers about the frequency of certain instructional activities (1 = never, 2 = monthly, 3 = weekly, 4 = daily). A teacher who chooses the third category can be considered to have chosen "monthly" over "never" (first step taken) and also "weekly" over "monthly" (second step taken), but to have failed to choose "daily" over "weekly" (third step not taken). BIGSTEPS, the Rasch measurement program, was used to construct objective measures from the responses of teachers and school principals over the 2-, 3- or 4-point scale items.

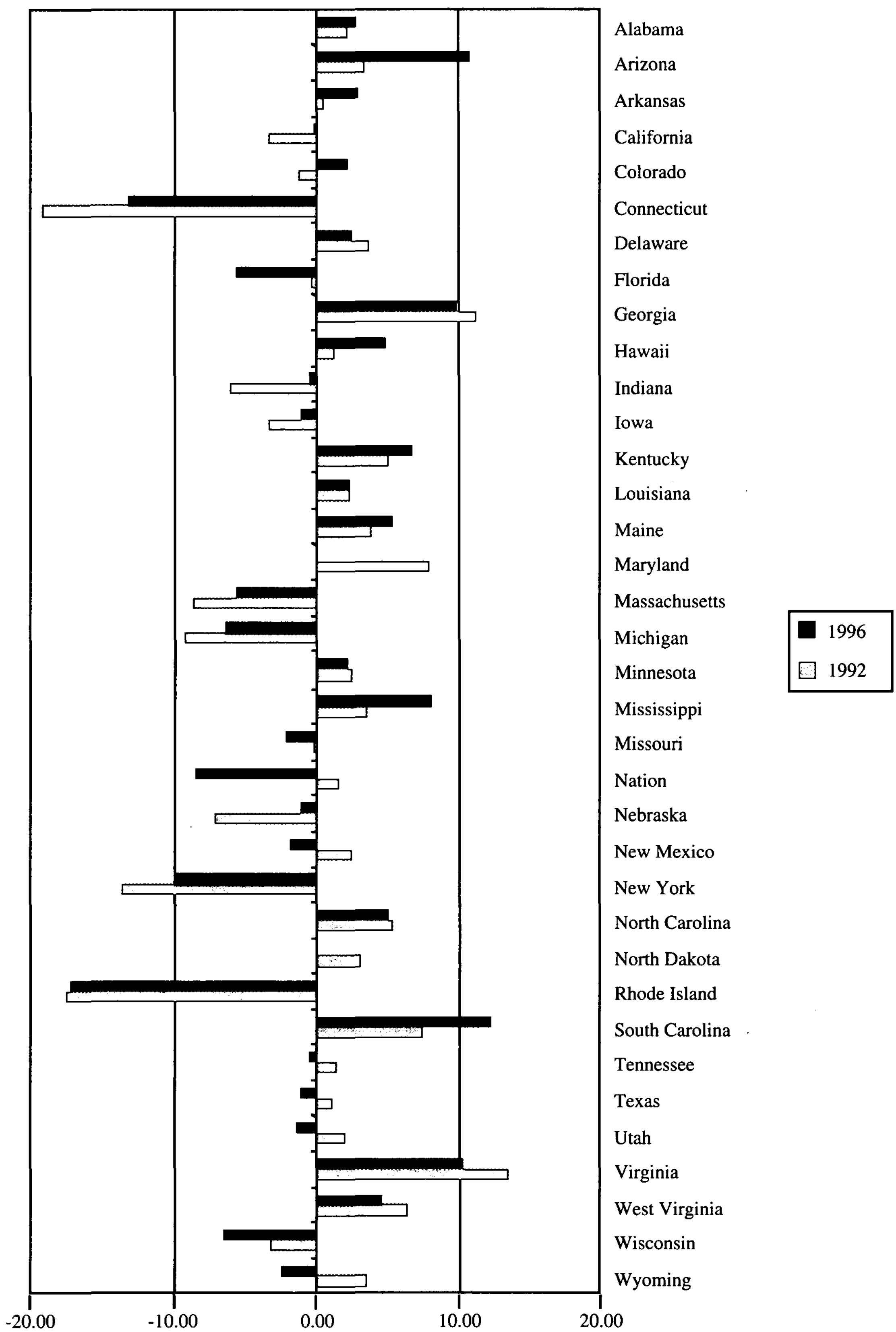

Figure 1. 1992 and 1996 NAEP eighth grade mathematics achievement gaps between nonrural and rural students in 35 states: Gap = nonrural minus rural average score.

Table 2
Correlations of Math Achievement with Schooling Conditions by Location in 1992 and 1996 (n = 35 States)

	Instructional Resources	Professional Training	Algebra Offering	Progressive Instruction	Safe/Orderly Climate	Collective Support
Rural						
1992	.70	.35	.07	.36	.86	.67
1996	.50	.32	.15	.21	.73	.49
Nonrural						
1992	.47	.55	.06	.52	.68	.67
1996	.12	-.23	.15	.26	.52	.45

Note. Zero-order correlations are calculated separately for each location and year.

Table 3
Correlations of Rural-Nonrural Math Achievement Gap with Schooling Condition Gaps (n = 35 States)

	Instructional Resources	Professional Training	Algebra Offering	Progressive Instruction	Safe/Orderly Climate	Collective Support
1992	.53	.03	.20	.54	.51	.46
1996	.34	.15	.21	.26	.33	.47

Note. Zero-order correlations are calculated separately for each year.

tiple regression analysis shows that all these six factors together explain about 69% of the total variation in nonrural achievement.

Why do some states have higher rural student performance relative to nonrural students while others have reverse the pattern? Interstate variations in rural-nonrural achievement gaps were only slightly related to variation among the states in their geographic composition: the correlations between state rural achievement gaps and percent rural students were .21 for 1992 data and .29 for 1996 data. Correlations between rural gaps in schooling conditions and math achievement at the state level are shown in Table 3. It shows that the achievement gap is related to schooling condition gaps to varying degrees: moderate correlations with instructional resources, progressive instruction, safe/orderly climate, and collective support; but weak correlations with algebra offering, and professional training. Multiple regression analysis shows that all six factors together explain about 45% of the total variation. This implies that states which equalize schooling conditions across type of location, addressing school input, process and context variables together, would have relatively small achievement gap between rural and nonrural students.

To explore the relationship between gaps in math achievement and schooling conditions further, we selected two states, Connecticut and Virginia. While both of these states had smaller proportion of rural students (37% in Connecticut and 28% in Virginia), they showed opposite patterns of rural-nonrural achievement gaps. In Connecticut, rural students performed significantly better than their nonrural counterparts in 1992 (19 points in NAEP scale score and .54 in effect size). In Virginia, nonrural students performed significantly better than their rural counterparts in 1992 (14 points in NAEP scale score and .39 in effect size). Similar patterns recurred in both states in 1996. The reasons for their contrasting patterns of rural-nonrural math achievement are evident when we consider their schooling conditions in rural vs. nonrural settings (see Table 4). In Connecticut, rural students had significantly better learning conditions in terms of instructional resources, professional training, and safe/orderly climate (statistically insignificant differences in algebra offering and progressive instruction). In contrast, rural students in Virginia had significantly worse learning conditions in terms of instructional resources, professional training, progressive instruc-

Table 4
Rural-Nonrural Education Gaps in Connecticut and Virginia

		Connecticut			Virginia		
		Nonrural (63%)	Rural (37%)	Gap	Nonrural (72%)	Rural (28%)	Gap
Math Achievement	1992	267.69	286.77	-19.08*	271.29	257.78	13.51*
	1996	274.77	287.89	-13.11*	272.63	262.26	10.37*
Instructional Resources	1992	65.41	80.32	-14.91*	68.89	61.31	7.58
	1996	66.52	77.95	-11.43	78.02	55.09	22.93*
Professional Training	1992	75.90	77.60	-1.70	75.44	75.19	0.26
	1996	74.35	79.66	-5.31*	76.56	70.33	6.23*
Algebra Offering	1992	91.27	90.35	0.92	98.64	100.00	-1.36
	1996	97.09	96.56	0.53	100.00	100.00	0.00
Progressive Instruction	1992	54.03	57.52	-3.49	54.30	51.56	2.74*
	1996	61.46	64.20	-2.74	59.30	53.62	5.68*
Safe/Orderly Climate	1992	77.07	85.30	-8.23	71.30	66.79	4.52
	1996	70.26	81.62	-11.36*	72.49	73.62	-1.13
Collective Support	1992	97.94	94.29	3.64	98.67	85.88	12.79*
	1996	90.56	98.53	-7.97	104.49	95.57	8.92

Note. "Gap" is nonrural minus rural values: Negative gap values indicate that rural values are higher than their nonrural counterparts.
*$p < .05$.

tion, and collective support (statistically insignificant differences in algebra offering and safe/orderly climate).

Interstate Variation in Rural Achievement Gain

At the national level, there was uneven academic progress in math achievement from 1992 to 1996 by type of community. For grade 8, students from rural/small towns made an average 10-point gain, whereas students from central cities made a 2-point gain and students from urban fringe/large towns made no gain. Although less dramatic than at the eighth grade, fourth graders showed similar patterns: a 5-point gain for rural, a 3-point gain for urban fringe/large town, and a 2-point gain for central city students. While rural students made most progress at the national level, there is also substantial interstate variation in the extent of rural students' academic improvement.

We examined state-by-state math achievement gains over the 1992-1996 period for eighth grade rural students. While both nonrural and rural students made significant progress in four states (i.e., Texas, North Carolina, Michigan, and Kentucky), only nonrural students made significant progress in nine states, and only rural students made significant progress in eight states. We classified states into two groups depending on whether their rural students' math achievement significantly improved from 1992 to 1996 (12 states which made significant progress vs. 23 states which didn't) and compared those two groups in their progress toward better schooling conditions during the same period. Figure 3 shows the distributions of those two groups of states across seven variables using their standardized gain scores. When we compared the states where their rural students have made significant academic progress ("Yes" group) with those where their rural students didn't ("No" group), the former group tends to have made more positive gains than the latter in most schooling conditions: in algebra offering, collective support, instructional resources and safe/orderly climate but not in professional training and progressive instruction. We also did the same type of classification for nonrural students (13 states which made significant progress vs. 22 states which didn't) and made comparison between the two groups. Figure 4 shows that

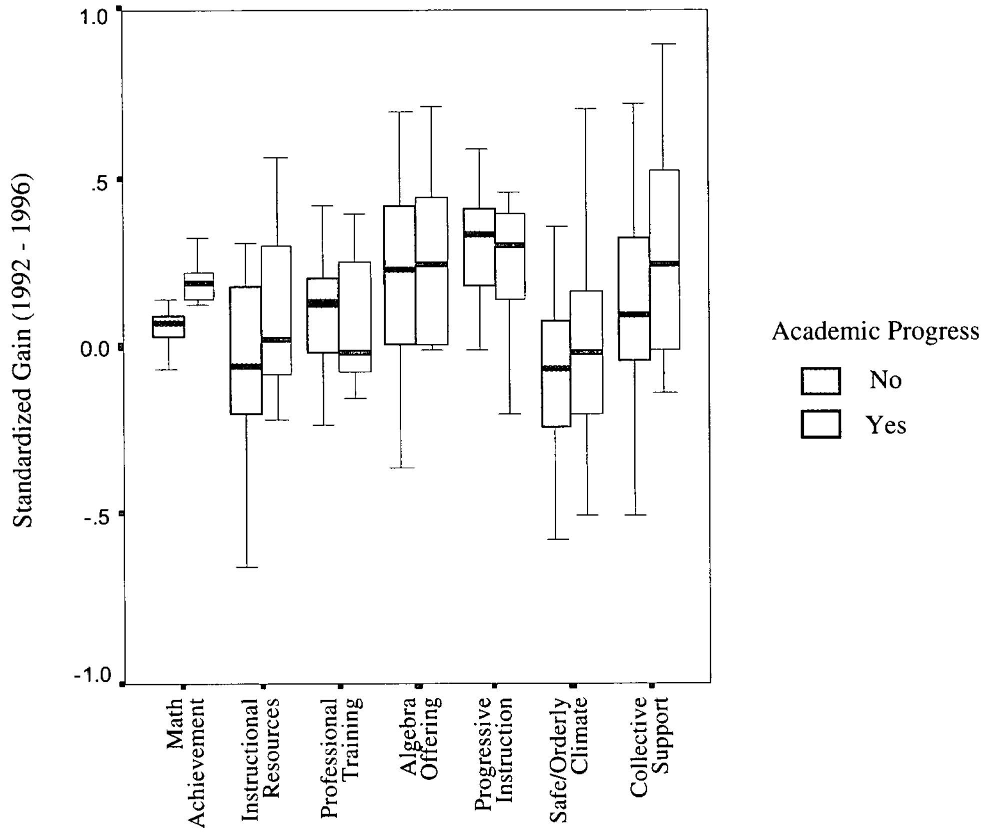

Figure 2. 1992-1996 gains in rural schooling conditions and outcomes: Profiles of states making significant academic progress (Yes) vs. states that did not (No).

the "Yes" group was better off than the "No" group in all schooling conditions. These results indicate that both rural and nonrural students' academic progress are related to improvements in a broad range of schooling conditions at the state level.

Further, we looked at two states, North Carolina and Texas, where both rural and nonrural students made significant improvements in their math achievement over the 1992-1996 period. Those two states were also found to have relatively equal distributions of achievement between rural and nonrural students. Table 5 shows in what areas of schooling the states made progress at the same time. For instructional resources, nonrural students made significant gain in both states while their rural counterparts didn't. In contrast, for algebra offering, rural students had substantial progress in both states to approximate their nonrural counterparts. This may indicate differentiated policy strategies for the improvement of rural and nonrural education in both states. At the same time, rural students in the two states made progress in different areas: ones in North Carolina gained more progressive instruction, while ones in Texas gained more collective support.

State Profiles of Rural and Nonrural Education

Building on our findings, we suggest a potentially meaningful and informative approach to interpreting and reporting state-level NAEP results on student achievement by type of location. We bring in the measures of key schooling conditions, as constructed through the Rasch model-based equating of the 1992 and 1996 teacher and school survey data. This allows us to make criterion-referenced interpretations of those schooling condition measures and examine their progress toward certain goals (see the threshold values in Appendix). We break down the average measures of student achievement and its correlates by location and year. As we display both gaps and gains in all six schooling variables and math achievement together, we can see more of the whole picture.

As an example, Table 6 shows the profiles of rural and nonrural education (grade 8) in Maine. The percentage of rural students in the 1996 sample was 77. While nonrural students scored higher than rural students in both 1992 and 1996, the gaps were not statistically significant. In terms of schooling conditions, nonrural students scored higher in

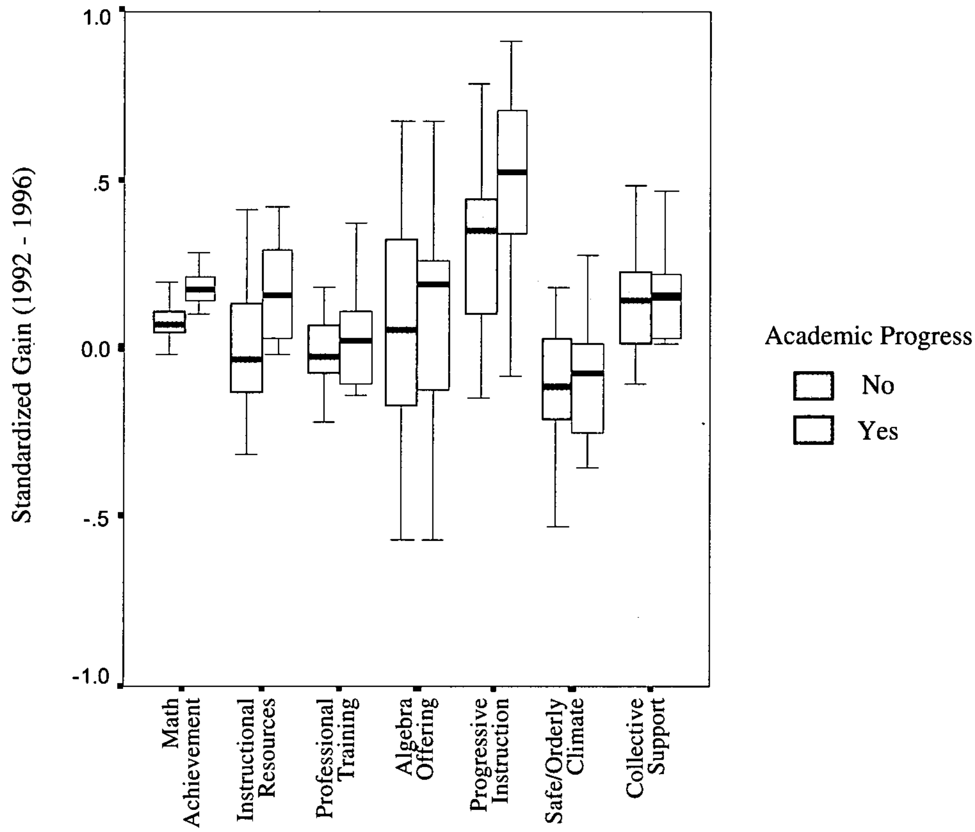

Figure 3. 1992-1996 gains in nonrural schooling conditions and outcomes: Profiles of states making significant academic progress (Yes) vs. states that did not (No).

progressive instruction, while rural students scored higher in safe/orderly climate. These mixed conditions may balance out their effects on academic achievement. Rural students made a significant gain from 1992 to 1996, while nonrural students didn't. While rural students also made significant progress in progressive instruction, nonrural students regressed in instructional resources and safe/orderly climate.

In addition to the above rural-nonrural comparisons, it is necessary to know where rural and nonrural education stand by themselves and to assess their needs for improvement. Instructional resources and algebra offering variables are the most straightforward since their measures were in percentage units. For example, if there is an agreement that at least 90% of students should have adequate resources and have access to an algebra course, then it becomes obvious that both rural and nonrural students in the state were below the goals in the 1990s. For math achievement, there exist NAEP math achievement levels set by the National Assessment Governing Board: for example, 299 is the cut score for Grade 8 Proficient (see Reese, Miller, Mazzeo & Dossey, 1997). Likewise, we can set desired levels of professional training, progressive instruction, safe/orderly climate and collective support (see Appendix). For instance, if we set adequate level of safe/orderly climate at 68 (the highest threshold value where students are likely to attend schools with no or little problems in all concerned aspects), then we can find that both rural and nonrural students in Maine generally meet the standards.

Discussion

We used the most recent NAEP math assessment data to determine whether location (rural vs. nonrural) matters in student achievement. Our study found that students in the nation's rural schools show highly comparable levels of achievement relative to their nonrural counterparts in 1992 NAEP eighth grade math. In fact, rural students started to outperform nonrural students in 1996 NAEP eighth grade math as a result of the two groups' uneven academic progress from 1992 to 1996. However, it remains to be seen whether there are time-bound circumstances that account for the rural gains during this 4-year period and whether

Table 5
Rural-Nonrural Education Gains in North Carolina and Texas

		North Carolina		Texas	
		Nonrural (55%)	Rural (45%)	Nonrural (81%)	Rural (19%)
Math Achievement	1992	260.78	255.43	264.83	263.65
	1996	270.07	265.09	269.99	271.07
	Gain	9.29*	9.66*	5.17*	7.42*
Instructional Resources	1992	51.74	56.84	67.37	84.91
	1996	69.72	59.70	79.82	76.41
	Gain	17.99*	2.85	12.45*	-8.50
Professional Training	1992	71.25	70.63	73.20	69.59
	1996	75.76	75.07	75.16	75.37
	Gain	4.50	4.45	1.96	5.79
Algebra Offering	1992	97.41	78.85	91.05	56.84
	1996	95.22	92.00	94.58	87.38
	Gain	-2.19	13.15	3.53	30.55*
Progressive Instruction	1992	53.94	52.43	58.59	57.14
	1996	61.12	61.46	57.65	54.83
	Gain	7.18*	9.03*	-0.94	-2.31
Safe/Orderly Climate	1992	65.96	69.29	64.52	73.81
	1996	64.48	65.09	63.55	77.41
	Gain	-1.48	-4.20	-0.97	3.60
Collective Support	1992	80.87	80.00	85.32	76.98
	1996	85.52	76.87	88.83	92.41
	Gain	4.65	-3.13	3.51	15.43*

Note. "Gain" is 1996 minus 1992 values.
*$p < .05$.

rural students' academic growth will continue to outpace their nonrural counterparts.

Our study reveals substantial variations among states in rural student achievement and schooling conditions. Interstate variations in rural students' math achievement are closely related to interstate variations in their key schooling conditions. These schooling conditions as the correlates of student achievement turn out to include not only traditional school inputs (instructional resources, well-trained teachers and course offerings) but also schooling practices and context (progressive instruction, safe/orderly climate and collective support). We also found that the academic improvement of rural and nonrural students over the 1992-1996 period varies from state to state. It turns out that the achievement gains for both rural and nonrural students were related to their improvements in schooling conditions at the state level.

The perennial challenge faced by rural schools to provide cost-effective, quality schooling increases as standards and expectations are raised for all students, and requires systemic, value-added reform strategies. Any state policy agenda for improving the outcomes of rural education should assess their diverse local needs in a broad range of schooling conditions and consider comprehensive school reform strategies that address those needs together. While the list of variables considered in this study is never exhaustive, the state education profiles introduced herein illustrate how we can combine and report information from school survey and student assessment data. This kind of report should help state educational policymakers be more

Table 6
Rural-Nonrural Education Gaps and Gains in Maine

		Nonrual (23%)	Rural (77%)	Gap
Math Achievement	1992	281.63	277.84	3.79
	1996	288.17	282.86	5.31
	Gain	6.54	5.02*	1.52
Instructional Resources	1992	72.00	71.80	0.20
	1996	47.14	71.18	-24.04*
	Gain	-24.86*	-0.62	-24.24*
Professional Training	1992	72.65	71.97	0.68
	1996	68.53	70.56	-2.03
	Gain	-4.12	-1.41	-2.71
Algebra Offering	1992	82.48	72.96	9.52
	1996	84.70	81.95	2.75
	Gain	2.21	8.99	-6.77
Progressive Instruction	1992	62.10	58.15	3.94*
	1996	62.20	61.71	0.49
	Gain	0.10	3.56*	-3.45
Safe/Orderly Climate	1992	81.91	77.33	4.58
	1996	69.14	76.70	-7.56*
	Gain	-12.77*	-0.63	-12.14*
Collective Support	1992	92.29	86.84	5.45
	1996	82.65	84.82	-2.17
	Gain	-9.63	-2.01	-7.62

Note. "Gap" is nonrural minus rural values. "Gain" is 1996 minus 1992 values.
$*p < .05$.

aware of the gap between rural and nonrural education and make informed policy decisions to narrow the gap.

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Appendix
Description of Schooling Condition Variables

Instructional Resources

One item from the NAEP teacher survey, common to the 1992 and 1996 data, was used: How well does your school provide resources? The percentage of students in a state whose math teachers report "get all" or "get most" for this question was estimated to measure instructional resources.

Professional Training

Eleven items from the 1992 and 1996 NAEP teacher survey were used to "measure" professional training. Applying the Rasch model to measure professional training produced item calibration reliability of 1 and person measurement reliability of .68. The following selected scale scores indicate threshold points, at or above which teachers took one or more college courses in the math content areas or had training in the math pedagogy areas.

17	had training in problem-solving
26	had training in use of manipulatives
35	had training in use of calculators and estimation
44	had training in math thinking
58	took 1 or more college courses in algebra
61	took 1 or more college courses in probability/statistics, calculus and geometry
71	took 1 or more college courses in number systems/numeration
78	took 1 or more college courses in measurement

Algebra Offering

One item from the NAEP school principal survey, common to the 1992 and 1996 data, was used: does school offer eighth graders algebra for high school credit? The percentage of students in a state whose schools report "yes" for this question was estimated to measure algebra course offering.

Progressive Instruction

Ten items from the 1992 and 1996 NAEP teacher survey were used to "measure" progressive instruction. Applying the Rasch model to measure progressive instruction produced item calibration reliability of 1 and person measurement reliability of .71. The following selected scale scores indicate threshold points, at or above which teachers address the content areas and have their students engage in the activities regularly in their math classrooms.

37	address reasoning for unique problems
41	address communicating math ideas
46	have students discuss math with others students
50	have students work real-life math problems and use a calculator
55	have students do math in small groups and solve problems with other students
85	have students write reports/do projects

Safe/Orderly Climate

Seven items from the 1992 and 1996 NAEP school principal survey were used to "measure" safe/orderly climate. Applying the Rasch model to measure safe/orderly climate produced item calibration reliability of .99 and person measurement reliability of .79. The following selected scale scores indicate threshold points, at or above which schools have no or little problems in terms of safety or orderliness.

35	racial/cultural conflicts and gang activities
39	teacher absenteeism
56	physical conflicts
58	student tardiness and absenteeism
68	student misbehavior

Collective Support

Seven items from the 1992 and 1996 NAEP school principal survey were used to "measure" collective support. Applying the Rasch model to measure collective support produced item calibration reliability of .98 and person measurement reliability of .75. The following selected scale scores indicate threshold points, at or above which schools have positive relations among the members and positive attitudes to and support for academics.

35	teachers' relations with administration
38	teacher attitudes to academics
43	relations between teachers and students
52	teacher morale
57	parent support for academics
60	regard for school property
65	student attitudes to academics