Building Community

Reforming Math and Science Education in Rural Schools

by Paul Boyer

A report on the National Science Foundation's Rural Systemic Initiative

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Introduction

Above the Arctic Circle, a young woman arrives for her first year of teaching at an Inupiaq village accessible only by plane. She's new to the state, new to the Native cultures of Alaska, and entirely on her own. She is the school's only teacher for ten children, ranging in age from six to seventeen. Textbooks and materials are in short supply. The children and parents are polite but reserved; she teaches how she was taught, but something seems to be missing in her relationship with the community. When the school year ends and daylight returns, she will leave. Next year, the cycle will begin again.

Three thousand miles away, another drama plays out in the wooded valleys of Appalachia. The mining and agricultural economy—always marginal in these isolated mountain regions—is eroding. In its place, a minimum wage service economy is taking over. Men and women inculcated with the values of hard work and self-sufficiency find jobs stocking shelves in megastores and cooking burgers in fast food restaurants. Proud of their heritage and attached to the land, most residents don't want to leave home. They wonder why education—especially math and science education—matters in a community where academic achievement offers few visible rewards.

The goal of America's twenty-five-year-old education reform movement is to prepare students for a more competitive, more global economy. And nothing symbolizes the need for reform more than the average schoolchild's lackluster mastery of math and science. In a technology-based economy, these are the skills needed to succeed, many assert. Yet compared to other Western

nations—including America's greatest economic competitors in Europe and Asia—students simply don't measure up[1]. Unless the nation can build proficiency, America's children will not be prepared for the future.

To close the gap, educators are focusing on the "basics"—especially the three Rs—and are working to raise standards. With encouragement from Washington, every state has developed or is developing academic benchmarks that all students must reach in core subject areas, including math and science. Testing is an integral part of the movement; increasingly, eligibility for a high school diploma requires a passing score on a "high stakes" graduation exam.

But there are vast regions of the country where schools struggle to meet these state and federal mandates. In broad tracts of rural America—from southern bayous to the arctic tundra—geographic isolation and poverty makes reform an especially difficult task. Here, schools must serve students with greater needs, yet do so with fewer resources. While metropolitan school districts spent approximately $7,000 per student in 2002, rural school districts spent just over $5,300, according to the Rural School and Community Trust. In addition, rural schools often have a harder time attracting and retaining qualified teachers and are less likely to offer a rich menu of advanced math and science courses.

But beyond a lack of money and the problem of inexperienced teachers, schools in these regions share another common trait: They serve communities disenfranchised from the rest of the nation—both economically and socially. These "pockets of poverty" remain stubbornly isolated from the benefits of a global economy, even in times of economic growth. Yet they are also home to people who continue to view their regions with pride and a strong sense of belonging. Many regions still retain their own distinctive identities. For Native Americans, there is an especially strong identity as a separate people and a desire to maintain tribes as sovereign nations.

Here, education is about more than global competition. It remains a very local enterprise that is powerfully shaped by the values and needs of residents. In this setting, the reform movement can only take root and grow when the

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1. According to the Trends in International Math and Science Survey (TIMSS), American eighth graders were outscored in a standardized test of mathematical knowledge by seventeen of the thirty-eight nations studied, including Singapore, Korea, Taiwan, and Japan. Science scores produced a similar ranking. Results of the 1999 TIMSS survey fueled the already strong standards movement, especially in math and the sciences. See National Center for Education Statistics, Institute of Education Sciences, U.S. Dept. of Education, http://nces.ed.gov/timss/

benefits of education are clear to those served. It must not only reflect national objectives, but also serve local interests. It should not simply build a more powerful nation, but also create a more empowered community. Reform cannot succeed if it arrives prepackaged from the outside. Instead, it must be led by the community—its parents, business leaders, and local educational leaders.

Education Reform and the Rural Systemic Initiative

The goal of the National Science Foundation's Rural Systemic Initiative is to promote greater math and science achievement in the most rural regions of the United States. Following the patterns of persistent rural poverty, these regions include coastal Virginia and the Carolinas, the Gulf Coast, Appalachia, the Ozark region, Alaska, rural Hawaii, much of Texas, and nearly two dozen Native American reservations across the southwest and Northern Plains. Here the performance gap is substantial and, in general, past reform efforts have had little impact. Schools in these regions typically offer fewer and less challenging math and science courses, have fewer qualified teachers, and have inadequate classroom resources. As a result, rural students—even those who successfully earn a diploma—are less prepared to enter college or the workforce than students from metropolitan schools.

But the Rural Systemic Initiative recognizes that the causes of educational inequity are complex and grounded in larger social and economic conditions within each community. A lasting solution requires more than test tubes, textbooks, or Internet access. Instead, the larger and more deeply entrenched barriers to educational excellence within highly rural communities must be addressed. In most regions, these barriers include poverty, isolation, and a lack of highly skilled jobs. There is also evidence of a mismatch between the values of parents and the values of the education system, creating an historic tension between community and school.[2]

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2. "From the perspective of community development, it is not obvious that programs promoting the outmigration of a rural community's most talented youth are desirable, especially if that community is already economically depressed," write Haller and Virkler (1993). "Rural residents might reasonably view such programs as an invitation to use their tax dollars to aid the economic development of distant (and richer) cities." See Haller, E., & Virkler, S. Another look at rural/nonrural differences in students' educational aspirations. *Journal of Research in Rural Education, 9,* 170-178. See the ERS Briefing Room on Rural Income, Poverty, and Welfare: www.ers.usda.gov/briefing/ incomepovertywelfare/

Until recently, it was assumed that the solution to rural poverty and educational inequity could be devised by outsiders and uniformly applied across schools and regions. Policy was shaped by the belief that all rural communities are fundamentally the same, that rural residents want to be more like metropolitan communities, and that rural peoples lacked the knowledge and resources to make positive change on their own. In fact, rural communities are not the same. "The diversity within high-poverty areas means that there is no single recipe for prosperity," acknowledges a Department of Agriculture report. "Strategies to improve the economic well-being of rural residents in such areas will differ based on individual and community needs." Likewise, rural communities have strengths that are not often recognized by research that focuses solely on social and economic deficits.

The Rural Systemic Initiative builds on each community's strengths and respects local leadership. The Initiative stresses development of community-wide partnerships between education, economic, and community leaders. Ultimately, the Initiative's goal is the improvement of math and science, as measured by higher scores on standardized tests, enrollment in advanced courses and college enrollment. But the route taken to achieve this goal varied from region to region and, along the way, also addressed larger issues of school governance, cultural survival, and local economic development. In this context, successful systemic reform is measured not only by academic indicators, but also through development of whole communities.

Impact of the Rural Systemic Initiative

The Rural Systemic Initiative represents a large and sustained commitment to education reform. Collectively, it reaches over 300 of the 444 counties identified by the USDA as highly rural; funding for the ten-year-old initiative exceeds $124 million. Managing an initiative of this size and scope was a significant challenge. When serving such diverse regions of the country what, in fact, did "systemic reform" mean and what constituted progress? To help answer these fundamental questions, the National Science Foundation developed six indicators of change, called Drivers, against which the work of each site was compared. Were the regions implementing a standards based curriculum? Were parents and community leaders participating in the work of reform? Ultimately: Was the performance gap shrinking?

The success of the Initiative can be measured, in part, by test scores. Data on the Initiatives' outcomes will be included throughout this report. But to fully understand the impact of the Rural Systemic Initiative, it is also important to examine how the Initiative had an impact on the regions served by, in many cases, empowering local leaders, raising expectations of parents, and fundamentally changing the culture of many of the schools served. More than anything, the Rural Systemic Initiative helped build consensus that math and science matter. "One of its greatest contributions to Indian Country is that it raised the level of discussion [about math and science education] and let local educators become part of the discussion," says Carty Monette, Project Director of the Tribal College Rural Systemic Initiative. "It brought them to the table." Building consensus and working together is at the heart of "systemic" reform.

The goal of this report is to explore the distinctive features of each project, better understand their successes and, no less important, recognize the barriers each encountered. As the search for standardization continues, the lessons learned from over twenty-five different RSI sites deserve to be shared nationwide. Their experiences have the potential to build a national educational system that can respond to the demand for excellence—but with a more nuanced understanding of rural America and its distinctive needs.

Completing a report on such an ambitious initiative was, itself, a major undertaking. "I could write a book," one project director said when asked to summarize her initiative. Indeed, every site is worthy of its own report. But with more than two dozen separate initiatives, this was not possible. Instead, the story of the Rural Systemic Initiative is told through in-depth investigations of four RSIs that reflect the strength and diversity of the whole Initiative—Appalachia, Alaska, Texas, and the Tribal Colleges. Most of these are also the oldest and most experienced initiatives; Appalachia, Alaska and the Tribal Colleges began work more than a decade ago. Extended site visits were made to these regions, where many of the innovations most associated with the rural systemic approach (such as use of "Teacher Partners" and "family math nights") were first introduced.

Other Rural Systemic Initiatives are no less successful or important and many developed innovative approaches of their own. Ozark, for example, created a model partnership with a national park, Hawaii made environmental education the focus of its work, and the Coastal RSI experimented with the development of teacher teams. The Delta RSI, meanwhile, promoted reform in

a region that, all too often, still looks and feels like the "Old South." This report also includes chapters about these RSIs, focusing on the unique contributions of each.

The different approaches to education reform described in this report highlight the guiding philosophy of the Rural Systemic Initiative: Change cannot be imposed from the outside, but must be nurtured from within. The perceived needs of American Indian students—and tribal nations—are not the same as the needs of students in a South Texas "colonia" or an Appalachian "holler." While excellence is a national goal, the path to excellence must be forged by local communities—especially in highly rural regions where the values of community, culture, and tradition are often maintained. Through the Rural Systemic Initiative, each region was allowed to find its own path to excellence.

Alaska

Hawaii


BROOKS RANGE
ALASKA RANGE
WRANGELL MOUNTAINS
ST. ELIAS MOUNTAINS
ALEUTIAN RANGE

Alaska: Nurturing Native Knowledge

It's not simply Alaska's vast size that makes the task of education reform so daunting in this state, it's also the geographic and cultural diversity. Here, where remote villages are separated by miles of roadless tundra, "rural" takes on a completely different meaning from that in the "Lower 48." Alaska has a single congressional district larger than Texas, yet the whole state contains only one major urban area—Anchorage. Even the state's capital, Juneau, qualifies as a rural community by some indicators.

More than any other state, Alaska is also shaped by its Native population. Just under one-fifth of state residents are Alaska Native, but nearly one-fourth of the student enrollment is Alaska Native. Outside of a few urban areas and coastal tourist centers, the percentage is much higher. And contrary to outsiders' stereotypes of nomadic Eskimos, they are diverse and culturally vibrant communities. The state is the traditional home of sixteen distinct indigenous cultures and languages, ranging from the Inupiaq of the northern arctic coast to the Tlingit, Tsimshian, and Haida of the southeast rainforest.

In this context, the Alaska Rural Systemic Initiative faced several challenges. First was the logistical task of bringing resources into remote schools—nearly 100 of which serve no more than a dozen students and are staffed by a single teacher. But the other and, ultimately, greater challenge was to make math and science meaningful to small, subsistence-oriented Native communities. Poverty levels are high; survival in rural communities depends on a subsistence economy and cultural values are an integral part of family life. Here, the most difficult questions facing educators are not pedagogical, but philosophical: What is the value of math and science in the Alaska Native context? For what purpose are high standards pursued?

The Alaska Rural Systemic Initiative is a success story, in part, because it provided a compelling answer to these fundamental questions. Over ten years, the project generated a wide variety of community-based programs that now spin off in many different directions. But at its heart, the effort was built around a single idea: that math and science education must reflect—and strengthen—the knowledge, values, and wisdom of traditional Alaska Native cultures. Academic excellence and cultural survival are not mutually exclusive goals, but essential partners. Building support for this idea across the state and creating a more culturally-grounded curriculum was the primary task of this unique initiative.

The Legacy of Assimilation

The Alaska Rural Systemic Initiative is part of a new approach to the education of Alaska Natives. For more than a century, even the most enlightened educators believed Native culture was backward and inferior. To "help" Alaska Natives, schools had a responsibility to inculcate the knowledge and values of Western society. Assimilation was the unapologetic purpose of schooling: "We believe in reclaiming the Native from impoverished habits and in transforming them into ambitious and self-helpful citizens," summarized one nineteenth-century commentator. Serving Natives meant destroying cultures—breaking bonds of language and tradition that had sustained people on a land they knew well.

Boarding schools were part of the strategy for assimilation of both American Indians and Alaska Natives. In the Lower 48, they came under attack in the first decades of the twentieth century for their poor facilities and often harsh treatment of Indian children. In Alaska, they remained an integral part of the territory's education system, despite growing criticism of their racist and elitist philosophy. While non-native children attended local secondary schools, Native children were sent away.

The framework of this system was maintained until 1972 when a landmark court case challenged the legality of this purposefully unequal dual system. Not until 1976 was an out-of-court settlement reached and legislative action taken that led to creation of twenty-one local school districts and construction of 126 state-supported high schools throughout Alaska's villages (elementary schools were already in place). This was a hopeful first step toward development of a more responsive education system; for the first time rural school systems

serving Native communities were put under local control, according to Alaska RSI Project Co-Director Ray Barnhardt, " . . . and concurrently, a new system of secondary education was established that students could access from their home community."

But it was not enough. While most Native children now attended schools in their own communities, little changed inside the classrooms. When Alaska's systemic reform initiative began in 1994, most rural schools still existed as islands of Western thought within seas of Native culture—continuing to teach values and employ instructional methods disconnected from the communities they purported to serve. "While there has been some limited representation of local control elements in the schools (e.g. basket making, sled building, songs, and dances), it has been at a fairly superficial level," according to Barnhardt. Mostly, they were arts-and-crafts supplements disconnected from the deeper system of cultural values that provide a sense of purpose for students and communities.

Research confirms that this approach to education is not a path to opportunity, as assimilationists assumed. Today, academic achievement of Native students consistently lags behind non-Natives and dropout rates are nearly double those of whites according to the State of Alaska. Some challenge this data, arguing that the actual dropout rate for Native students is much higher; Native educators in Fairbanks, Anchorage, and Juneau say it is closer to 60 percent in those districts. In a recent survey by the First Alaskans Institute, 19 percent of Alaska Native dropouts cited academic reasons for leaving school, but over twice as many—36 percent—cited cultural reasons. For many, school remains a disorienting institution.

Documenting Native Knowledge

Tlingit elder Marie Olson understands the barriers Native students face. Thirty years ago, while living in the Bay Area of California, she was asked to critique information about Alaska Natives taught to school children for a state textbook review committee. For the first time, she saw her home from an outsider's perspective. A few brief paragraphs described Eskimo culture, but no mention was made of the many other cultures that have long inhabited the region. Nor was any mention made of Alaska Natives as a living, contemporary people. No mention was made of the world she knew.

Olson returned home in 1972, but found that even in her own state, accurate information about Alaska Natives was missing. Reliable books were hard to find (most came from the Lower 48); fact and fiction mixed freely and much about the culture was not recorded. "Even [teachers] who wanted to acknowledge culture couldn't do it," she says. Equally alarming was the deterioration of cultural knowledge within Native communities.

Olson speaks her traditional language. She can interpret the meaning of her clan shield. On a recent autumn afternoon, she comments on the odor of cooked fish in her home; she had just finished canning twenty-two pints of salmon. But she worries that younger generations have forgotten this knowledge. It's not just the loss of history, she says. It's the loss of identity. "There aren't that many high school students who are proud of who they are," she says.

In this context, a critical task of the Alaska Rural Systemic Initiative has been to document cultural knowledge—and to show that it has value. Like Olson, Alaska RSI leaders reject the widely held view that Native knowledge is irrelevant to modern society. Instead, the traditional wisdom of Native communities represents a deep and legitimate form of scholarship that is different from, but not inferior to, Western conceptions of science. Describing the Alaska RSI in the Winter 2004 issue of *Cultural Survival Quarterly*, Alaska RSI co-principal investigators Ray Barnhardt, Angayuqaq Oscar Kawagley, and Frank Hill assert: "Though diminished and often in the background, much of the Native knowledge systems, ways of knowing, and world views remain intact and in practice, and there is a growing appreciation of the contributions that indigenous knowledge can make to our contemporary understanding in areas such as medicine, resource management, meteorology, biology, and in basic human behavior and educational practices."

Native knowledge is more than "folk wisdom" and the documentation of this knowledge requires more than knowing how Alaska Natives used plants for medicine or predicted the weather. It also requires a deeper understanding of a world view grounded in the search for coherence and underlying patterns. Native science is more than survival skills; it is grounded in a philosophy of life. According to Barnhardt, Kawagley, and Hill:

> Indigenous societies, as a matter of survival, have long sought to understand the irregularities in the world around them, recognizing that nature is underlain with many unseen patterns of order. Out

> of necessity, Alaska Native people have had to learn to decipher and adapt to the constantly changing patterns of weather and seasonal cycles. The Native elders have long been able to predict weather based upon observations of subtle signs that presage what subsequent conditions are likely to be. The wind, for example, has irregularities of constantly varying velocity, humidity, temperature, and direction due to topography and other factors. There are non-linear dimensions to clouds, irregularities of cloud formations, anomalous cloud luminosity, and different forms of precipitation at different elevations. Behind these variables, however, there are patterns, such as prevailing winds or predictable cycles of weather phenomena, that can be discerned through long observation.

To help explore and document Native approaches to science, the Alaska RSI built upon a series of colloquia on "Alaska Native Science" held in 1992 and 1993. Sponsored by the University of Alaska, the National Science Foundation, and the Alaska Federation of Natives—recipients of the subsequent RSI grant—these sessions examined the meaning of math and science in the Alaska Native world: What is Native science? How was knowledge transmitted in the past? How is it different from (and also similar to) Western science? Discussion yielded specific recommendations from sixty Alaska Native leaders and educators related to the improvement of math and science education in public schools. These recommendations provided RSI leaders with their agenda for action. The colloquia also led to development of a council of elders (of which Marie Olson is a member) to help guide the reform effort.

Cultural documentation remains an ongoing activity. Since 1994, the Alaska RSI has built a vast and growing library of Native knowledge and beliefs. "These resources include oral histories, video tapes, biographies, elder's conference reports, traditional place names and maps, language materials, curriculum resources, or any other book, tape, document, or persons that can provide insights into the traditional knowledge and skills utilized by Native people in their respective cultural regions," according to Alaska RSI reports.

Most of this material is made available, free of charge, online through the Alaska Native Knowledge Network. Resources ranging from science units to language dictionaries are contained in this vast and growing site. The listing of resources are available on the World Wide Web (http://www.ankn.uaf.edu). In

addition, a bimonthly newsletter, *Sharing Our Pathways,* has been distributed throughout the state to keep everyone up-to-date on the developments associated with the AKRSI. Together, the web site and newsletter represent significant contribution to community-based documentation of Native knowledge.

Promoting Culture Within the Standards Movement

By the mid 1990s the standards movement was taking hold across the country and Alaska, like most states, began developing its own curriculum standards meant to promote higher academic achievement within all schools. By the end of the decade, testing would also become an integral part of the effort; graduation from high school would require a passing score on a "high stakes" exam first taken in the junior year. All students—from the wealthiest urban districts to the smallest village schools—would be held accountable.

The standards movement was a potential threat to the Native educators. Some worried that Native students would be "buried" under the unstoppable force of school reform and an increasingly standardized, even nationalized, curriculum. "The state got on the standards bandwagon along with everyone else in the early 1990s," says Barnhardt. The banner was supposed to be "standards, not standardization." But "Alaska Natives had little or no involvement in the development of the state standards, so there was a lot of skepticism over what they would be used for."

But RSI leaders recognized that the standards movement also presented Alaska Natives with an opportunity. Alaska Natives represent 18 percent of the total state population and, because of high birth rates, are an even higher percentage of the school population. As a significant minority in most schools and a majority in many rural schools, it was clear that the education reform movement could not succeed in Alaska without addressing the unique needs of Native students. Natives could use their numbers to help guide the standards movement.

Showing how the state of Alaska could achieve high standards through cultural knowledge became the central task of this Rural Systemic Initiative. Building on the knowledge of elders, the Alaska RSI devised a set of culturally-based standards describing, in detail, how teachers, parents, elders, board members, and others could promote the integration of cultural knowledge in schools. For example, teachers are urged to integrate language and cultural immersion

experiences wherever possible and utilize "the study of 'place' as a basis for the comparative analysis of contemporary social, political, and economic systems." Elders are encouraged to share their knowledge with children. Board members are reminded of their responsibility to promote traditional knowledge in the governance of their institutions. Collectively, more than one hundred specific recommendations are offered (http://www.ankn.uaf.edu/standards).

Critical to the success of the cultural standards has been the support they received from mainstream educators statewide who recognized that these recommendations not only validate the standards movement, but also complement state standards. While state standards identify academic benchmarks—what students need to know and be able to do at each grade level—the cultural standards address the process of learning, showing educators and community leaders how to create a better climate for learning for students. They "fill gaps in the state standards and address the 'how' as well as the 'what' of teaching," says Barnhardt.

The cultural standards have become highly visible and credible documents. They are an integral part of the state's education reform agenda and are used in many different ways. In the Juneau school district, for example, a parent handbook includes recommendations from one cultural standards publication, *Guidelines for Nurturing Culturally-Healthy Youth*. Meanwhile, Juneau School District Superintendent Peggy Cowan distributes copies of the standards to all school board candidates, most of whom are not Alaska Native and unfamiliar with the needs of the 20 percent of Juneau school students who are. With the cultural standards, she says, "we don't have to start from a blank slate." At the same time, the cultural standards are now integrated into the teacher education programs at the local University of Alaska campus, says Rhonda Hickok, program coordinator of the Building From Excellence Program within the Juneau School District. "Now you can hear faculty talking about 'culturally responsive standards,'" she says.

The cultural standards have also helped Alaska educators justify new programs; they allow grant writers to "make the case" for development or continued funding of projects ranging from cultural camps for middle school and high school students to K–5 language and culture immersion classes within a Juneau elementary school. Many of these are not funded through RSI, but they have grown and, in some cases, survived budget cuts because the cultural standards have built a base of support and provide a mandate for action.

Serving Teachers and Communities

Without question, the cultural standards are the single most visible and influential outcome of the Alaska Rural Systemic Initiative. But cultural guidelines are not enough. Even when teachers appreciate the value of culture and want to integrate cultural knowledge in their math and science classes, most lack the skills needed to do so. Most teachers in Alaska come from outside the state and know very little about Native Alaskans or their culture—even when they teach in schools dominated by Native students.

The harsh truth is that development of a culturally-grounded curriculum depends on the support and understanding of non-Native teachers. In Alaska, only 4.6 percent of the teaching corps is Native, according to Bernice Tetpon, director of the Professional Education Center at the University of Alaska Southeast. Of the 95 percent who are non-Native, most—estimates range from 80 to 90 percent—are from the Lower 48. They arrive with a sense of adventure, but little familiarity with the communities they are about to serve. Making the transition to a rural Native community is difficult and turnover is high. "Our teachers are wonderful people," says Frank Hill, who is a former superintendent of a rural school district. "But once their curiosity is satisfied, they move on. It's hard to shift from being a majority to minority."

Some teachers don't wait to find out how difficult the transition is. "There are stories of people getting off the plane, looking around, getting back on and leaving," says Hill.

This is especially true in the most isolated Native villages. The state has a responsibility to fund a local school wherever ten or more school-age children are located. This means over one hundred schools function as one-room schoolhouses—a handful of children of many different ages all taught by a single teacher. Few schools of education prepare new teachers for this kind of teaching environment. Meanwhile, state and federal guidelines for certification do not recognize that successful rural teachers are not specialists but generalists—jacks-of-all-trades—who must teach high school math, first grade English, and, in an emergency, fix the plumbing. Burnout becomes inevitable. Some rural schools have close to 100 percent teacher turnover every year, according to Hill.

To promote systemic reform, the Alaska Rural Systemic Initiative needed to build on the framework of cultural standards by providing much needed support directly to teachers and school districts. There are dozens of local initiatives,

many of which focus on providing peer support for teachers, developing culturally-appropriate curriculum materials, enriching the curriculum through summer camps and science fairs, and building stronger school-community collaboration, especially with elders.

The importance of this work is revealed through the impact of just one relatively small project. Math in Weaving is a program that shows teachers how to integrate traditional and highly complex basketmaking skills into their classes. Working with experienced weavers using traditional materials, participants learn not only the rudiments of basket making, but also gain a deeper understanding of Alaska Native culture, according to Topaz Shyrock, a middle school math teacher at Dzantiki Heeni Middle School in Juneau. A non-Native, Shyrock took the course in 2003 and says it gave her new appreciation for the depth of mathematical knowledge contained in this traditional art form.

"I was impressed with the thinking that went into those baskets. There are mathematical skills that go into putting the baskets together," she says.

Back in the classroom, Shyrock guided her students in the planning and construction of woven windsocks. Poster board and yarn replaced the more difficult to acquire cedar and spruce root, but it still provided an opportunity to discuss the Native heritage. "We talked about what the Native people of Southeast Alaska had done for thousands of years," says Shyrock. "They got to put their fingers into it at least a little bit."

What did this activity mean for the Native students in the class? "I noticed that Native students were more likely to choose the traditional designs [in the patterns they created]. Some students who have had a hard time getting into projects—Native students in particular—worked harder on this project," Shyrock says. But she stressed that the weaving project also advanced essential math skills. Her seventh graders were pushed to learn new concepts as they applied the principles of graphing, coordinate grids, and transformations. In a climate of standards and testing, there is little time for "fluff." Yet everything done in that unit helped Shyrock's students reach academic benchmarks that—lest she forget—are posted on the wall of her classroom.

These and other related programs help teachers, especially non-Native teachers, integrate cultural knowledge in the curriculum. However, to fulfill the larger vision for development of a more indigenous education system, it is also important to bring more Native teachers into the classroom, empower local school boards, and nurture respect for traditional values within Native

communities. Here the importance of a "systemic" approach is most clearly revealed. Achieving such long-term goals requires active participation of many players—school districts, the University of Alaska, and the State of Alaska. But a great deal also depends on parents and community leaders, where the value of education is first nurtured.

But the barriers are significant. According to Andy Hope, Alaska RSI Southeast Regional Coordinator, many Native families feel disenfranchised from schools. "Families have been alienated from schools for generations," he says, and pass on their feeling of distrust to their children. "You're not going to bang your head against something that isn't serving your needs." This is understandable, but it works against the long-term political, social, and economic empowerment of Natives in Alaska.

Real advancement of Native communities requires a "revolution" in Native societies, Hope believes. Alaska Natives must work together and take greater responsibility for creating the kind of schools they want. This has not yet happened, all agree. Despite the creation of local school districts nearly thirty years ago, there are only "three or four" Alaska Native school superintendents, according to Frank Hill. "We are our own worst enemies," says Hope. "We tear down people who are focusing on leadership."

In this context, the strength of the Alaska RSI is that it focuses not only on narrow issues like curriculum development, but engages Native leaders and nurtures renewed respect for cultural knowledge within whole communities. Through programs such as the Academy of Elders, which brings Alaska Native elders into schools as mentors, and cultural orientation programs for new teachers, the walls separating teachers from communities are being dismantled. For the first time, Alaska Natives are being encouraged to see themselves as the teachers. And through development of a culturally-grounded curriculum, today's students are preparing for lives of service to the nation, and their home.

Measuring the Results

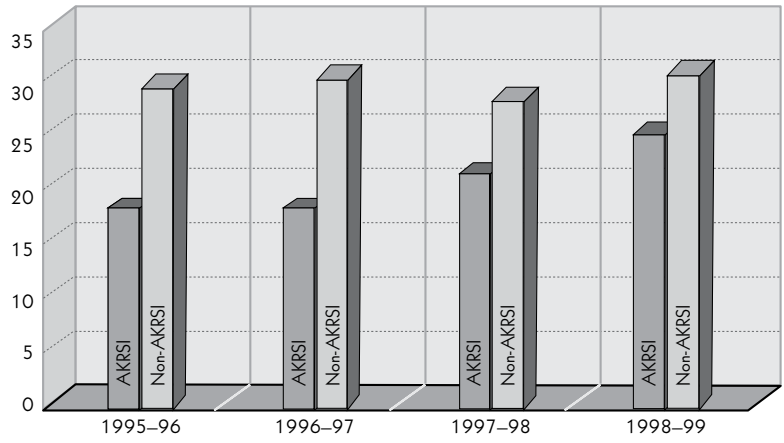
The work of the Alaska Rural Systemic Initiative is grounded in a philosophy that combines two interrelated goals: Cultural survival and higher academic achievement. The first is a long-term process that is hard to measure, but can be felt. Marie Olson, for example, sees a new generation of Tlingit children who

want to understand their clan histories, want to abide by traditional marriage taboos, and want to learn the language. There is pride—not shame—in being Native. This is a dramatic shift from even a generation ago and offers a foundation for future growth in all areas of Native society.

As part of Alaska's larger education reform agenda, however, it is also important to show measurable improvement in student academic performance; the future of the cultural standards depends on the ability to show that Native students are making gains. There is in Alaska continuing frustration over the validity of graduation examinations, created in California, that do not acknowledge the values and knowledge of Native students. Nonetheless, after ten years of work, there is clear evidence that students most affected by the work of Alaska's RSI are benefiting. In one key indicator—eighth grade math performance—the achievement gap is beginning to close. In the twenty Alaska RSI school districts (which have historically had the lowest student achievement levels in the state and nation) test scores pointed to a differential gain between RSI partner schools and non-RSI rural schools of 5.9 percentage points between 1995 and 1999 in the percentage of students who were in the top quartile on the eighth-grade standardized achievement test in mathematics. A corresponding decrease of 2.2 percentage points was documented for students in the bottom quartile for AKRSI partner schools over non-AKRSI rural schools.

The work of the Alaska RSI shows how much one grant can accomplish. It is also a reminder that educators are not all-powerful. The rhetoric of school

Eighth Grade Mathematics Performance
% Rural Students in Top Quartile on CAT-5



reform creates the impression that teachers, on their own, are responsible for the "success" or "failure" of their students. In fact, the most powerful agents of reform are contained within communities. In Alaska, where more than a century of contact with Western education has caused resentment and disorientation for Native students, the need to create bridges between two worlds is an important, but difficult task. In this context, the Alaska RSI has built a remarkably large and sturdy foundation upon which a fundamentally new vision for Native education is beginning to grow.

Bringing Culture into Classrooms

These are a few of the programs and projects sponsored by the Alaska RSI to strengthen math and science education through development of a culturally-based curriculum. Information about these and other initiatives are available through the AKRSI web site (www.ankn.uaf.edu).

Native Educator Associations: Associations of Native educators have been formed in each cultural region to provide an avenue for sustaining the initiatives that are being implemented in the schools by the AKRSI. The regional associations sponsor curriculum development work, organize Academies of Elders, and host regional and statewide conferences as vehicles for disseminating the information that is accumulated. Additional support for activities of the regional associations has been provided through the AKRSI Teacher Leadership Development Project.

Native Ways of Knowing: Each cultural region is engaged in an effort to distill core teaching/learning processes from the traditional forms of cultural transmission and to develop pedagogical practices in the schools that incorporate these processes (e.g., learning by doing/experiential learning, guided practice, detailed observation, intuitive analysis, cooperative/group learning, listening skills). The insights gained are then incorporated in the AKRSI initiatives and resources.

Academies of Elders: Native educators are convening with Native elders around a science/math theme and a deliberative process through which the elders share their traditional knowledge and the Native educators seek ways to apply that knowledge to their teaching of various components of the standards-based curriculum. The teachers then field test the

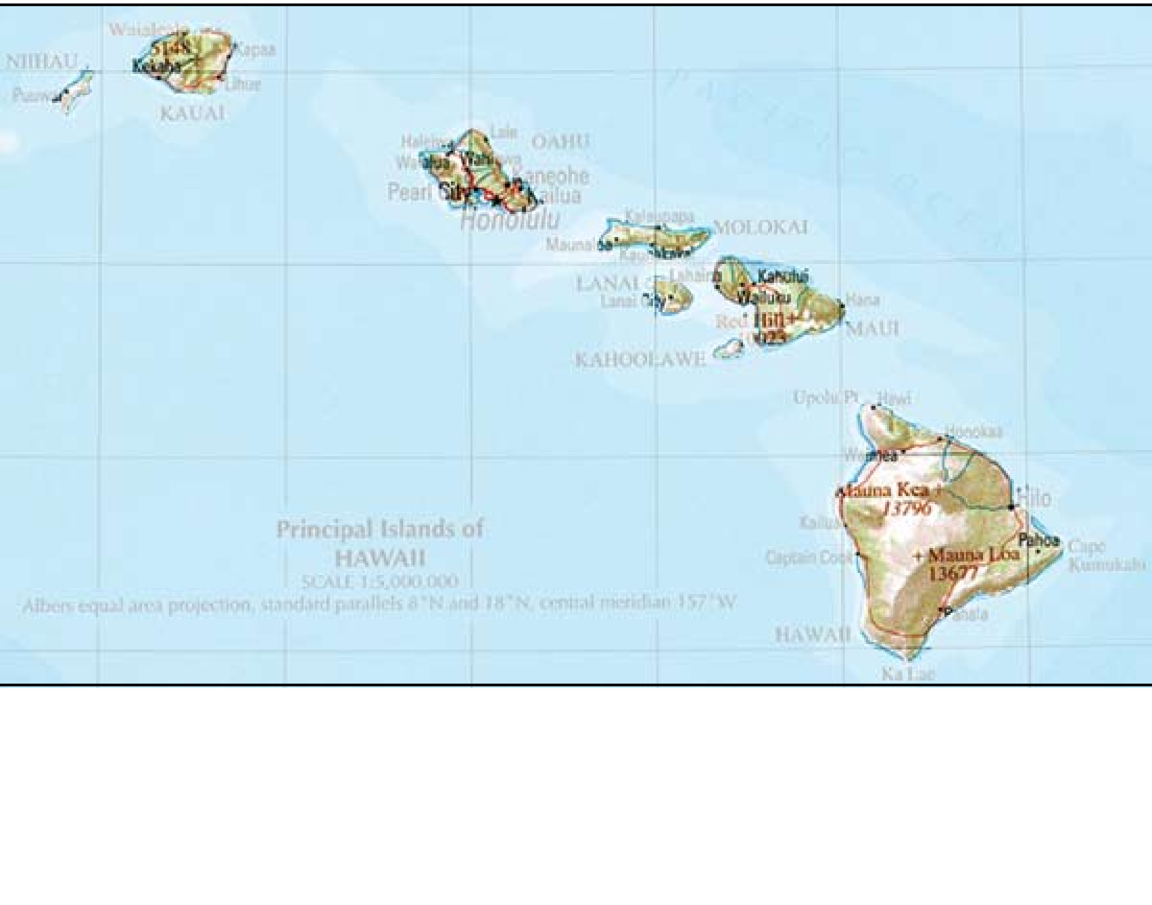
curriculum ideas they have developed, bring that experience back to the elders for verification, and then prepare a final set of curriculum units that are pulled together and shared with other educators.

Cultural Standards and Guidelines: A set of Alaska Standards for Culturally Responsive Schools have been developed for students, teachers, curriculum, schools, and communities that provide explicit guidelines for ways to integrate the local culture and environment into the formal education process so that students are able to achieve cultural well-being as a result of their schooling experience.

Village Math/Science Curriculum Applications: Several volumes of village-oriented science and math curriculum resources have been developed in collaboration with rural teachers for use in schools throughout Alaska. These resources serve as a supplement to existing curriculum materials to provide teachers with ideas on how to invigorate the teaching of basic science and math concepts using a locally identified theme (e.g., weather, food preservation, moon/tides, birch trees, berries, measuring systems).

ANSES Chapters, Camps, and Science Fairs: K–12 chapters of the Alaska Native Science and Engineering Society are being formed in rural districts serving each cultural region. These chapters are participating in ANSES science camps and are sponsoring Native science fairs in which the projects are judged for their science content by experienced science teachers and for their cultural content by Native elders. The top award recipients from the regional fairs attend the statewide ANSES Science Fair in Anchorage.

(From "Native Pathways to Education", Alaska RSI, 2004)



NIIHAU
Kekaha
Kapaa
Lihue
KAUAI
Laie
OAHU
Kaneohe
Kailua
Honolulu
Kalaupapa
MOLOKAI
LANAI
Lanai City
Lahaina
Wailuku
Hana
MAUI
KAHOOLAWE
Upolu Pt.
Hawi
Honokaa
Mauna Kea
13796
Hilo
Pahoa
Cape Kumukahi
Captain Cook
Mauna Loa
13677
HAWAII
Ka Lae
Principal Islands of
HAWAII
SCALE 1:5,000,000
Albers equal area projection, standard parallels 8°N and 18°N, central meridian 157°W

Hawaii: An Environmental Focus

On the Big Island of Hawaii, the evening silence is broken by a disturbing new sound—the croaking of frogs: Not just any frog, but an alien species known as the coqui. Originally from Puerto Rico, it is a prolific breeder, has no natural enemies, and is "really, really noisy," according to Vicki Kajioka, one of three principal investigators for this state's Rural Systemic Initiative. Dan Suthers and Violet Harada, both from the University of Hawaii at Manoa, served as co-principal investigators.

The frogs are more than a nuisance, Kajioka says. "One of the real problems for the Hawaiian Islands are the species that are brought in accidentally." In the fragile Hawaiian ecosystem, the careless introduction of a single non-native species can cause significant harm by killing or replacing indigenous animal and plant life. In the case of the coqui frog, millions of dollars are being spent on its eradication.

In science classes across the country, the lessons of environmental diversity and the importance of wise stewardship of the land are often distant and abstract concepts. But in Hawaii—specks of land in the middle of the world's largest ocean—it is impossible to forget that resources are limited and that even small changes to the environment can have serious consequences. Every new resort hotel means the loss of a habitat; the disappearance of even one species may leave a visible hole in the delicate tapestry of the island ecology. And because space is so limited, everyone must live with the repercussions of development, pollution, and the accidental arrival of a single noisome frog.

The Hawaiian Islands are beautiful; for many, they represent a vacation paradise. But Kajioka stresses that environmentally and economically it is an

increasingly unstable and dependent system. "Prior to Western contact, there was a large population being supported on the Islands," she says. They survived and developed a sophisticated culture using resources available locally. Now, however, survival for all residents depends on the timely arrival of cargo from distant ports. "Right now, most of our food comes externally," she says. The lesson of Hawaii's experience has global implications: "Once we deplete our resources, we have no more." Survival depends on learning—now—that "we need to conserve our land [and] realize that resources are limited."

In this setting, the goal of the Hawaiian RSI—known as the Hawaii Networked Learning Communities—is to nurture greater environmental awareness by giving students in rural schools the opportunity to investigate real-world environmental issues. By using the tools and skills of scientists and mathematicians to examine endangered local ecosystems, this RSI is both strengthening the curriculum and teaching something else: *Malama i ka 'Aina*—an understanding of stewardship within the cultural and environmental context of the Hawaiian Islands.

Frogs, Shrimp, and Why They Matter

Hawaii Networked Learning Communities focuses on science-based projects that take students out of the classroom, into native habitats, and doing the work of real scientists. To understand the importance of the coqui frog, for example, classes on the Big Island are using GPS equipment and GIS mapping techniques to locate and plot the frogs' quickly-expanding territory. Adaptable and prolific, Kajioka says they are now being heard even in the island's more urbanized regions. Alongside their grown-up colleagues, the students are examining their data and asking the question that matters most: "How do we control this species?"

Another group of students is examining a different, but equally worrisome problem: the disappearance of native species. Wading knee deep in an anchialine pond—a brackish freshwater ecosystem—they are looking for *opae 'ula*, a unique species of red shrimp. The ponds are threatened by development on the island, endangering this small endemic species. With nets, middle and high school students collect specimens. Back in the classroom they lean how to classify species, and discuss why some ecosystems are so degraded there are no longer any native species to classify.

On Maui, meanwhile, students at Mau Waena Intermediate School were named official caretakers of Kanaha Pond located in a nearby waterfowl sanctuary. In 2004, students developed and published a walking tour booklet for the sanctuary, including pictures of the pond, and findings from their own bird counts and water quality studies. Other teams from the school participate in habitat restoration projects, working alongside volunteers from the Native Hawaiian Plant Society to weed out invasive species.

Like all Rural Systemic Initiatives, this focus on inquiry-based instruction requires teachers to learn new skills. But for an initiative encompassing thirty-seven schools and six islands, professional development becomes a significant logistical problem. At first, training sessions for teachers were offered on Oahu. But this required some teachers from neighboring islands to leave home as early as 3 a.m. to catch the obligatory morning flight. "Now we take our training sessions on the road," says Kajioka, by offering professional development on each of the islands.

At these training sessions, the strategy is to teach inquiry-based instruction by modeling active teaching. What is the value of promoting inquiry learning by standing at a podium with a pointer? asks Kajioka. "So often when we go to workshops, it's not walking the talk," she says. In Hawaii, teachers are taught as they are asked to teach and actually do the projects they will eventually assign to students.

To provide direct support, Hawaii Networked Learning Communities supports two part-time teachers: experienced educators brought out of retirement to visit participating schools and mentor individual teachers. Technology is also being used to overcome geographic barriers. Like the Alaska RSI, the Internet helps isolated teachers stay in touch and a sophisticated virtual community is being developed. The Initiative's web site (www.hnlc.org) offers resource material, but is also a forum for educators from participating schools to pose questions, share stories, post lesson plans, and get support from part-time teachers when a site visit is not necessary.

Hawaii Networked Learning Communities is already making a measurable difference in the state's rural schools as they work to meet Annual Yearly Progress under the federal No Child Left Behind law. Kajioka says her RSI is helping promote higher expectations and academic achievement in rural high poverty schools. Through collaboration, professional development and the aggressive promotion of integrated, inquiry based math and science programs, student

interest is growing and teachers are expecting more from their students—and from themselves. While the project had only a few years to demonstrate an impact, measurable gains have been made in fifth- and tenth-grade math scores. The state does not yet have (but is developing) a standardized test for science in the fifth, seventh, and eleventh grades.

The work of this RSI has already changed the climate of teaching in dozens of schools, and development of the Internet-based Virtual Community ensures sustainability of the reform effort; the state department of education will continue to support this web site even after funding ends. But for Kajioka, there is another and equally important outcome. It is about "building awareness," she says. The future of the state's environment depends on educating children to care about the land and realize that their future is, in a very real way, tied to the health of the natural world.

"Hawaiian culture had a strong culture of conservation," she says. Native Hawaiians followed a clear and sensible set of rules that ensured the sustainability of plant and animal species and, thus, their own supply of food and raw materials. "They had enough of an understanding of the world around them to know that during the period of time when the fish are spawning, you should not catch the fish." More than ever before, it is important to teach similar lessons to the young. The land and water is not theirs to exploit, but theirs to understand and nurture.

Appalachia Coastal


OHIO
Columbus
WEST VIRGINIA
VIRGINIA
Richmond
KENTUCKY
Nashville
TENNESSEE
Memphis
Chattanooga
Charlotte
NORTH CAROLINA

Appalachia: Teachers Helping Teachers

When Kentucky released the latest data on student academic achievement in schools statewide, results were front page news and headlines were upbeat. "Most Kentucky schools improve CATS scores," reported the Lexington *Herald-Leader*, which devoted five full pages to stories and charts about the state accountability index, officially called the Commonwealth Accountability Testing System. Developed in 1999, the test measures student performance in eight disciplines, including math and science, and scores schools on a scale from 60 to 140. All schools are expected to reach scores of 100 by the year 2014.

Without question, CATS and No Child Left Behind have dramatically reshaped the education landscape of this state. One school principal featured in a *Herald-Leader* story insisted that her school's better than average performance reveals a concern for teaching, not testing. "It's not about a test score," she said. But when Morton Middle School in Lexington achieved an ahead-of-schedule score of 96.7, a giant banner was delivered to students by a masked Zorro on a horse. Only in Kentucky would this cryptic message hang in pride-of-place over a school's front door:

> Morton Middle School
> **2003/04 KCCT**
> Accountability Index **96.7**
> Novice Percent: **4.87%**
> "It's All About Kids" Climbing to Proficiency

With CATS scores, schools are compared like football teams: Who's up? Who's down? High scoring schools are congratulated and teachers practice modest replies: "We were lucky this year" or "I have really great kids." Low scoring schools are quietly critiqued. The pressure, all agree, is tremendous for superintendents, principals, and individual teachers. "All the schools are aggressively trying not to get in trouble," says Allen DeYoung, a faculty member in the College of Education at the University of Kentucky. "Backpedaling" is not acceptable, agrees one teacher.

But behind the good news story of incremental improvement and higher expectations is evidence of disparity between school systems. Most top performing schools are in wealthy and populous districts. Meanwhile, rural schools are disproportionately located at the bottom end of the scale. This is true not only in Kentucky, but across the Appalachia region where rural schools lag behind metropolitan schools—sometimes by wide margins—when measured by any state or national index of student performance.

In Kentucky and surrounding states, the need to reach higher standards is not debated among educators. The only question is how mandates will be met. Here schools work in regions of high poverty and declining enrollment. At the same time, they also work in communities with limited economies long dominated by agriculture, lumbering, and mining. While all residents express support for education, the vocabulary of "excellence" and "high standards" must share space with a traditional suspicion of outside reforms and a need to see how schooling creates opportunity for meaningful local employment.

In this setting the work of two systemic initiatives—the Appalachia RSI and Coalfield RSI—took similar paths to reform. In the "hollers" of Appalachia, teachers were the engine of systemic change. Nurturing and supporting a cadre of highly dedicated teacher leaders within schools and across districts was the key task of both reform initiatives. The result is not only measurable improvement in student achievement, but renewed hope for the future of the Appalachia region.

Higher Standards—And Jobs

Few regions are saddled with more stereotypes than Appalachia. For years it has been caricatured as the backward home of hillbillies—lawless mountain men sitting on front porches with shotguns and jugs of bootleg liquor. Like all

stereotypes there is a sliver of truth to these images: The Hatfields and McCoys are real families and the art of distilling liquor will remain as long as there are "dry" counties. But residents bristle at portrayals of mountain culture as willfully backward and ignorant. Instead, all residents insist there is a respect for education and a desire to get ahead. "A lot of kids come from families with few resources," says Jennifer Francis, a teacher from rural Powell County in east-central Kentucky. "But families are very supportive of their school."

What does make Appalachia different, all agree, is a fierce pride and loyalty to community. "It's a family pride," says Steve Henderson, Appalachian RSI Project Director. When someone says, "I'm a Spencer from Pike County," he's not talking about geography, he's describing a sense of identity, Henderson says. It's also a loyalty that transcends economics. In Appalachia, an always fragile farming and mining economy has imploded. Many mines have closed; remaining mines have replaced men with technology. One operation that employed 2,000 workers a generation ago now extracts the same amount of coal with just twenty-four employees. Picks and axes have been replaced by large machines run by workers with degrees in engineering.

Out of necessity, many Appalachian families have moved away; some former mining towns have shrunk from a population of 20,000 down to as few as 1,000. But most prefer to stay, and they want their children to stay. In this context, views toward education are complex and sometimes contradictory. "I think that most people recognize they have to get an education," says Henderson. Yet, he adds, if they get educated, they worry about finding work. Rural counties near metropolitan areas allow residents to commute, and many do. But in more isolated areas, jobs are limited to the service sector, small businesses (such as arts and crafts), and employment as prison guards or in industries that relocate to Appalachia, lured by tax breaks, cheap land, and low wages. Most of these jobs do not require a college degree.

In many rural communities, the largest employer is the local school district. Schools offer a few jobs for those who want to become teachers and administrators. But turnover within the professional ranks is low and, in the end, schools are not big enough to promise work for all who might want to pursue a professional career. In this setting, suspicion of education is understandable; high aspirations are tempered by the knowledge that those who pursue more education will probably need to leave home if they are to find satisfying work.

Looking to balance both needs—education and local employment—many

students choose paths that may appear limiting but make sense in the context of local economies and family values. For example, selecting a vocational track program in high school is a responsible choice if it leads to a stable job within commuting distance from home. Within Appalachia, being a "good student" may mean going to medical school and returning home to start a practice, *or* it may mean successfully completing high school and finding a job in a quarry or driving a truck. Both are paths to economic mobility and community service.

In Appalachia, then, education reform means providing a top notch education for all students by overcoming barriers imposed by limited funds and low expectations. High quality education is vital because, with it, students have choices. At the same time, it means recognizing and respecting the value placed on family and, more broadly, the larger and equally urgent need to build a stable economic base that can support families and provide a rationale for education.

Teachers Helping Teachers

Unlike the Alaska Rural Systemic Initiative, which works within a single state, Appalachia region initiatives work across state lines. The Appalachia RSI crosses into six states—Kentucky, West Virginia, Virginia, North Carolina, Ohio, and Tennessee. The Coalfield RSI works in Virginia and West Virginia. Coordination among these different states—each with their own educational priorities, funding structures, and political cultures—was impossible. Instead, both RSIs developed a decentralized structure that focuses most time and resources on individual school districts and teachers within those districts.

In Appalachia, the agents of change are teachers themselves. Working within their own schools and school districts, designated "Teacher Partners" carry reform into classrooms by working directly with their peers—sharing examples of best practice, introducing new curricula, and convening monthly meetings of teachers, administrators and parents. Typically, these Teacher Partners receive release time for this work. Freed from classroom responsibilities, they conduct research and mentor less experienced teachers.

Teacher Partners do not work in isolation. Each state houses a support center within a university (the University of Kentucky and Ohio University, among others) called Resource Collaboratives. As their name suggests, these centers do not control the work of Teacher Partners. Instead, they provide teachers access

to materials and opportunities for professional development. They are "on call" to serve the various needs of Teacher Partners.

Every Resource Collaborative devises its own support strategies. In the various states, the Resource Collaborative office convenes monthly meetings of Teacher Partners. In Kentucky, after nearly ten years of work, it is an experienced, confident group of educators that arrives at a Ramada Inn in Lexington for a recent fall meeting. Although organized by the Resource Collaborative, Director Kim Zeidler stresses during the lunch break that the meeting's agenda is set and controlled by the teachers. Unlike many professional development seminars—where according to one teacher, "you are taught things that you already know"—the collaborative meeting focuses on learning practical skills and solving real-world problems. For example, one teacher taught her colleagues how to use graphing calculators and develop accompanying academic units. Other sessions may discuss strategies for building support from administrators or making use of data.

"Lots of in-service is theoretical and not specific," says Jennifer Francis, a Teacher Partner serving schools in Powell County. "You spend $600 on a course and come back with nothing to show for it." Theory is not all bad, but she says "teachers are hungry for high quality instruction and materials that meet the specific needs of their classroom." State testing, she agrees, has helped focus their attention on the immediate and very practical goal of showing results. Teachers are more receptive to new ideas and strategies. To show improvement "they want new things to do," she says.

The full impact of this work is most easily seen in schools and classrooms back in the rural districts. In Kentucky, Teacher Partners convene monthly meetings with math and science teachers from across their home district. These district-wide "cadres" have, in some cases, been meeting monthly for six years. Once again, the focus is on teaching and implementing practical classroom reforms. In rural Powell County, for example, eight third-grade math and science teachers recently gathered in the community room of the county's Cooperative Extension office for a day-long session devoted to using the district's newly implemented math and science curriculum—an integrated and standards-based program called Trailblazers, partially supported by the Appalachian Mathematics and Science Partnership, another National Science Foundation project.

Led by high school math teacher and professional development coordinator

Dianne Davis and Don Ryoti, a professor from Eastern Kentucky University, teachers work through a unit on measuring the area of irregular objects, including autumn leaves. Ryoti stresses that in this new curriculum, it's not enough to merely teach the formula for finding area; that alone does not build mathematical proficiency. Students first need to visualize the concept of area. "If they just say it's 'length times width,' they might be spouting a formula and don't know what this means," cautions Ryoti. Teachers follow along and interject with suggestions from their own experience.

The cadre meeting is also an opportunity for professional development. Before the meeting Davis had asked the district's math and science teachers to complete the latest TIMSS (Trends in International Math and Science Survey). Administered to students in 38 countries, data is used to track the academic achievement of American eighth graders against their foreign counterparts. But Davis thought of a different use for the test. By administering the test to her colleagues, she was able to identify gaps in *their* mathematical knowledge. Armed with this data, she devised projects and activities to focus on weaknesses. During this session, teachers were shown how to visualize patterns of a four-dimensional object presented on a two dimensional space—a exercise taken directly from a TIMSS test question. How did she come up with this idea? From a Teacher Partner meeting, she says. That's where she first learned about TIMSS. The idea of administering the test to fellow teachers was her own innovation.

The goal of this activity was not to show teachers how to "teach to the test." It was, more broadly, a way to broaden each teacher's base of knowledge and make the best use of curriculum materials. Throughout the meeting an interdisciplinary approach was encouraged. Scattered across a table were dozens of storybooks that can be used to build math skills—from Dr. Seuss' *500 Hats of Bartholomew Cubbins* to *Caps for Sale*. "You should be able to find them in the school library," Davis says. If not? "Let me know. I'll get them for you."

All this work was completed during a single hour of just one monthly teacher meeting. Across Appalachia, dozens of similar meetings are being held, and countless innovations developed and shared. In Rockcastle County, Kentucky, Ann Booth used her year-long release time as a Teacher Partner to investigate some hunches she had about the success of students placed in remedial math courses. She carefully reviewed the records of students placed in pre-algebra during the freshman year and had her suspicions confirmed: Once locked into

this remedial track, most students would remain behind academically. Armed with data, her school eliminated pre-algebra as an option for most students and scores are starting to climb. Her research also uncovered the importance of completing geometry courses in the sophomore year; students who waited until the junior year did not have enough time to absorb the material and scored lower on standardized exams.

This work, which made such a difference for schools in her district, illustrates the power teachers have to make change—when they have time and are encouraged to become researchers, not simply implementers of policy. It is an empowering, bottom-up approach that contrasts sharply with traditional top-down mandates that, as Powell Country Superintendent Lonnie Morris observes, usually arrive on his desk without sufficient funding.

Overcoming Obstacles by Showing Results

The impact of Teacher Partners and, more broadly, the Appalachian Rural Systemic Initiative is now widely acknowledged. But RSI staff and long-time Teacher Partners remember how hard they had to work in the early years to get support from principals and superintendents. Success of the project required schools to grant release time for Teacher Partners and allow math and science teachers to attend professional development sessions during school hours—without the promise of immediate results. Few administrators relished the idea of losing a senior teacher or having to find substitute teachers. Why not just meet after school? some wondered. Resource Collaborative Director Kim Zeidler admits that she played hardball with administrators. "District superintendents call me a pit bull, and I am," she says. "I will battle the superintendent."

But support from administrators increased as the impact of the work became increasingly clear. "It takes time," says Karen Kidwell, state science consultant in Powell County. But after two or three years, there were "great leaps in test scores" within schools most committed to RSI initiatives. Within schools with the oldest and most stable cadres, "content scores are higher [than in other schools]," she says. The story of success is clear in Powell County where district-wide science scores have climbed from just under 83 points to just over 102 in five years. "After the RSI project was implemented, we were off by leaps and bounds," says Regional Teacher Partner Jennifer Francis.

In the Appalachian Rural Systemic Initiative, results can be seen across the

six-state region. Within what the Appalachian RSI calls "high implementation schools"—institutions that embrace the work of the Initiative to the fullest possible extent—there is significant improvement in test scores. The percentage of high implementation schools that meet state standards in math has grown from 33 percent to 44 percent, as of 2001. In science, the percentage of schools meeting state benchmarks climbed even more steeply—from 22 percent to 39 percent. Several Kentucky schools are showing scores higher than better financed metropolitan schools.

Focused comparisons of ARSI versus non-ARSI schools highlight the impact of this initiative. According to data compiled by the Appalachia Rural Systemic Initiative, a 2003 comparative study of two Virginia ARSI school divisions and one non-ARSI school division with very similar socioeconomic, race and ethnic situations show the following results for mathematics for all grade levels including grades three, five, and eight and Algebra I in high school:

	Wise County (ARSI)	Dickenson County (ARSI)	Non-ARSI
% Passing	76.6%	72.8%	54.9%
% Proficient	52.0%	51.0%	43.2%
% Advanced	24.5%	21.8%	11.7%

As results became clear, obstacles began to disappear. Today, many principals and superintendents are continuing to support release time, even as funding from the RSI is phased out. Taking the next step, the Lincoln County, Kentucky school board recently created seven new "Academic Performance Specialist" positions based on the teacher partner model. Teachers working at all grade levels will now continue the mentoring work pioneered by the Appalachian RSI with county funds. To sustain the work of teacher partners across the entire region Zeidler is proposing that every participating school contribute a relatively modest $3,000 to create a school-financed consortia that will allow Resource Collaborative meetings to continue.

The RSIs are promoting systemic change throughout the entire Appalachia region—even in schools not targeted for reform. Energized math and science programs inevitably draw attention from teachers in other subjects, as well as curious eyes from other schools. High scores from poor and previously low-

achieving schools cannot be ignored. In this way an initiative that began for practical and philosophical reasons as a "stealth" campaign at the local level is incrementally moving upward, drawing attention of even state departments of education. As the initiative matures, teachers involved in the project during its early years are now moving into administrative positions, carrying ideas and strategies into new schools and new school districts.

Finally, the systemic reform initiative is also changing attitudes toward rural students. One of the unfortunate barriers to equity in education is an ethic within society—and within the teaching ranks—that there are "good" students and "bad" students. This is especially true in math and science where excellence is widely believed to require some kind of innate intelligence. In tight-knit, rural communities, prejudices can be solidified against whole families; children arrive for their first day of school already marked as underachievers. One of the strengths of the RSI is that is shakes teachers and administrators out of their complacency.

Working toward excellence for all students requires new skills—and a new attitude. Not all teachers make this shift, but Wimberly Royster, principal investigator of the Appalachia RSI, estimates that "three out of four teachers want to change." Professor Alan DeYoung has studied the impact of the RSI and other National Science Foundation-funded school reform initiatives in rural schools and found they have indeed "raised the floor for all kids." Teachers are not focusing on just serving the top tier, but promoting excellence among the kids who, in the past, were simply passed over.

Challenges for the Future

Appalachia's Rural Systemic Initiatives arrived at precisely the right moment. The standards movement had begun imposing higher expectations on schools, yet funding for rural schools was lacking. "Sometimes we had to implement change before we were ready," says Frieda Mullins. In the gap between higher expectations and limited resources, the Rural Systemic Initiative provided the kind of support schools needed to show improvement.

But no single initiative can fulfill every need. Even as rural schools find ways to keep pace with state and federally imposed standards—which most educators do, in fact, endorse—they must also calibrate their work with the social and economic needs of the regions they serve. The complex environment

of Appalachian education is summarized by Frieda Mullins: "In Appalachia, parents want their children educated *and* they want them to be able to come back to Appalachia to live and to have the opportunity to sustain themselves economically, which is the real issue for us."

Some community leaders believe that educational policies focusing on standards don't do enough to create stronger, more self-sufficient communities. Raising a score from 90 to 100 is a worthy goal, but what does this achievement mean when there are no local jobs? Have the needs of Appalachia been satisfied? Not necessarily, says Marty Newell, a long-time advocate of community-based education in Appalachia. As a teenager, he helped start Appalshop, a program to teach filmmaking to Appalachian high school students. It has since grown into one of the largest arts programs in rural America. In his opinion, the rhetoric of educational excellence can work against empowered communities. "If you take a curriculum that can be used in any school in the country, you get any school in the country," he says. Standards are not incompatible with a locally-focused curriculum, but it requires an empowered corps of teachers and parents who understand the many roles a school plays.

The strength of the Rural Systemic Initiative in Appalachia is that it is locally focused and locally controlled. But educational policies—and simple economics—create barriers for educators. In Newell's view, one of the great threats to rural communities is school consolidation—closing small schools in regions with declining enrollment and busing children to distant towns. In many rural regions, "schools are the only thing that are left," he says, and when they go away residents lose more than a building—they lose a sense of identity. What's at stake is more than mere sentiment. A consistent finding in the Rural Systemic Initiative is that school has meaning only when students have opportunity and a sense of hope. The greater strength of Appalachia's RSIs is they recognize the importance of both and have done more than any other single education reform initiative to build the capacity necessary for community change.

Coalfield Rural Systemic Initiative

The Coalfield Rural Systemic Initiative involves eighteen rural school districts, several regional institutions of higher education, two state departments of education, Appalachian Educational Laboratory, and a number of other community partners in the coalfield region of southwestern Virginia and southern West Virginia. The five year project (2002–2007) works in a region with low student achievement on state and national assessments, an emerging lack of highly qualified math and science teachers, and fragmented math and science programs. A predominately white (94.5 percent) region—the largest minority populations are African American and Asian (3.8 percent and .5 percent)—the median household income is less than 60 percent of the national average.

Further, given two or more decades of declining population and the resulting loss of state and local funds, few districts have the financial resources to recruit new math and science staff to replace retiring baby boomers. Almost all district level leadership positions for these disciplines have been eliminated or made a part of a curriculum generalist position.

The Coalfield RSI is primarily about developing additional leadership capacity to improve the teaching and learning of math and science in the participating school systems. Involving local teacher leaders in high quality training enables and empowers them to build district leadership. It emphasizes a data-driven approach to improvement, providing support to district leadership, developing strong parent and community support, and partnering with local higher education institutions and other systemic reform initiatives.

The Coalfield Rural Systemic Initiative is operated by Appalachian Educational Laboratory (AEL) in Charleston, West Virginia, a nonprofit corporation that has served the education arena since 1966. AEL also operates the Region IV Comprehensive Center and the Eisenhower Regional Consortium for Mathematics and Science Education, which provides content knowledge as well as professional and technical expertise to the project. Key elements of the Coalfield RSI include:

Providing Math and Science Specialists:

Four content specialists, two in each state (one math and one science per state) work full time to provide focused assistance for improving math and science instruction in the districts served. Collaborating with teacher leaders and administrative staff in each district, specialists plan and conduct institutes and clinics designed to help teachers incorporate standards-based instruction.

Developing Teacher Leaders:

The Coalfield RSI provides limited financial support for thirty-six teacher leaders (two per district). These teacher leaders, the true agents of change in this project, reside in and are known across the region as respected, competent classroom teachers who are willing to take on leadership responsibilities. Working with the content specialists, they provide training and district assistance to support program planning and improvements. Teacher leaders model inquiry based instruction, assist in data analysis, help with school and district improvement planning, lead staff development, and encourage their students to become math and science teachers. In addition, they help to recruit new mathematic and science teachers and serve as mentors. Professional development is delivered to teacher leaders on weekends and in the summer. As of spring 2004, teacher leaders have received 120 hours of professional development.

Involving District Leaders:

Superintendents, district contacts, and school board members increased their understanding of and support for math and science instruction through training and involvement in the project. A leadership institute, provided in three retreat settings, was designed to help policy makers examine the issues that influence instruction and student performance. Participants were involved

in developing approaches to build supportive leadership strategies, district policies, community activities, and ways to best leverage RSI resources to improve instruction.

Engaging Institutions of Higher Education:

Coalfield RSI staff and faculty from eight regional colleges are working to incorporate K–12 math and science program reform into teacher preparation programs. College representatives participated in teacher leader meetings focusing on using data to enhance instruction. College liaisons have also been involved with training on the textbook adoption process that is used at the state and local levels, and identifying standards-based instructional materials.

Reform in an Era of Standards:

The Coalfield RSI began soon after the enactment of No Child Left Behind. This legislation has caused educators and the public to reexamine student performance in public schools generally, and performance in reading, math, and science specifically. Using disaggregated data to examine and address educational needs can bring to light the disparity of achievement levels among certain groups of students (e.g., low SES, African American, special education). The Coalfield RSI's focus on improving math and science performance for all students is helping education leaders address the achievement gap in the coalfield region.

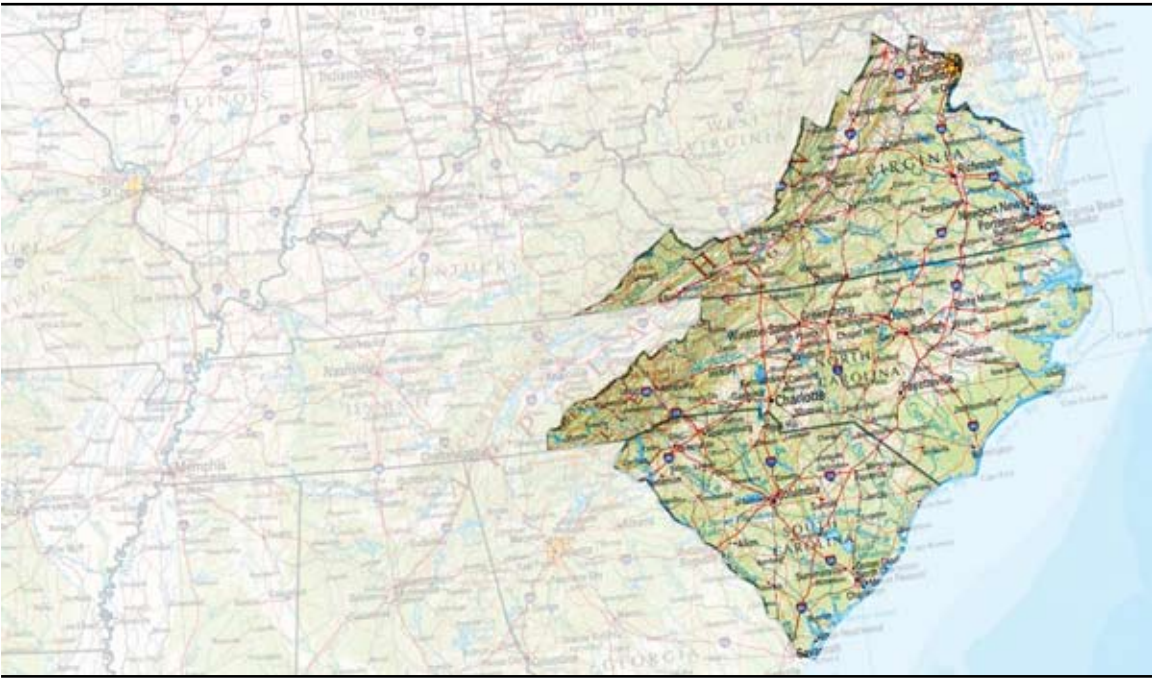
No Child Left Behind's requirement that programs be supported by scientifically based research brings a new element of importance to the routine process of adopting instruction materials, as education leaders recognize that the effectiveness of instructional programs must be documented. Both Virginia and West Virginia will select and adopt math and science instruction materials during the final years of the RSI project, providing the Coalfield RSI with an unexpected opportunity to offer guidance in understanding the adoption process. Coalfield RSI staff will also provide education leaders with the information they need to make informed selections based on the best research available.

Lessons Learned:

While the overall, measured performance of students in the Coalfield RSI districts has been low compared to national averages, they were close or, in

some instances, above state standards for acceptable performance. The need for change was not apparent, based solely on the composite data that teachers and administrators received. But the desegregation of the data required by No Child Left Behind has resulted in an overwhelming sense of disequilibrium in the education system.

This recognition of a major problem has caused teachers and administrators to be open to seeking help that addresses the underlying causes of inequity, rather than just treating the symptoms. As Dr. Michael Fullan said to a group of West Virginia educators, "Problems are our friends." The education problems of equity and quality exposed by No Child Left Behind are clearly friends to the systemic change initiatives that have been identified by this and other Rural Systemic Initiatives.—Keith Smith, Director, Coalfields Rural Systemic Initiative


Charlotte

Coastal: A Team Approach

Motorists familiar with Interstate 95 from Maine to Florida know that south of Washington, D.C. the highway passes through the southern Piedmont, a vast region of rolling hills, farmland, and pine forest. Congestion builds around Richmond and the Research Triangle of North Carolina. But for most of this route—hundreds of miles through central Virginia and the Carolinas—drivers focus on distant destinations to the north and south.

No question, the "I-95 Corridor" lacks the identity and romance of Appalachia. But rural communities located to the east of the Blue Ridge mountains and west of the Atlantic share many of the same concerns. Beyond the region's thriving urban centers, rural farming communities of the South have disproportionately higher levels of poverty, especially within the dominant African-American population. Thirty-seven school districts within the three-state Coastal Rural Systemic Initiative region report poverty rates of 35 percent or higher for families with school age children. Interstate traffic notwithstanding, the sense of isolation is palpable off exit ramps.

Here, administrators and teachers in rural schools feel pressure to meet federal and state accountability measures with limited fiscal and human resources. Most Coastal RSI school districts employ only a single curriculum supervisor and it is rare to find a curriculum supervisor or principal with a background in mathematics or science, according to Coastal RSI Principal Investigator Chuck Blanton. "The expertise on quality programs lies with the math and science faculty but the current decision-making process does not provide the opportunity for teachers' input into programmatic decisions," he says. Meanwhile, teachers have limited time to research and evaluate best

practices for quality mathematics and science programs. The result is that programmatic decisions are made by individuals with limited knowledge and understanding of quality mathematics and science programs.

Past approaches to this problem focused on increasing the knowledge base of administrators. Supervisors and administrators were targeted for professional development in state mathematics and science standards and appropriate instructional techniques. But the high turnover rate of administrators in these rural districts means the increased knowledge base is transferred elsewhere—leaving districts in a constant state of "starting over."

Administrators and teachers have become increasingly reliant on outside assistance in guiding decisions about their math and science programs. The quality of the professional development provided by state departments, higher education institutions, and independent providers is not the problem. "The problem is whether the professional development decisions made on behalf of the teachers truly meets their individual and collective needs," says Blanton.

The systemic change offered by the Coastal Rural Systemic Initiative, which serves the eastcentral portions of Virginia, North Carolina, and South Carolina, is to shift the decision-making responsibility and authority away from individuals to teams. The goal is to create an effective decision-making process that meets the specific needs of individual schools and teachers. This is the unique contribution of this successful initiative.

A Team Approach

Like the Appalachian Rural Systemic Initiative, teachers are the primary agents of change in the Coastal Rural Systemic Initiative. But as a "second generation RSI," Blanton says his site made one significant modification to the Appalachia initiative's "Teacher Partner" model. Instead of identifying two teacher leaders from each participating school to mentor peers, the Coastal RSI encouraged formation of school-wide teams that include all math and science instructors. In these schools, it is the team—not an individual teacher—that guides reform. The focus is on shared responsibility and group decision-making.

The theory is that teachers are more committed to reform when they help lead the reform effort. "The underlying reality of implementation in the classroom is that the more ownership you give teachers in the decision-making, the more

apt they are to implement it in their own classrooms," says Blanton. And in small schools "there's no reason why you can't involve all your teachers," he says. Each team is unique, but most meet once a month and decide, collectively, how to promote higher student achievement within their own school. They, not central office staff or consultants, decide "what professional development they need, what curriculum improvements they need, what instructional materials they need," says Blanton.

Teacher leadership is key, but not enough. Systemic reform doesn't happen just because decisions are made at the local level. Teachers may focus on small improvements—adding graphing calculators to the lesson plan, for example—while failing to see more fundamental gaps in their school's curriculum. To promote systemic reform, the Coastal RSI model developed a second, equally important strategy for school-based change: providing teachers with detailed and objective data about their school through annual "Program Status Reviews." These status reports, compiled by visiting teams of educators, examine twenty-six different indicators of progress, encompassing everything from the curriculum and teaching methodology to leadership and parent involvement. The yearly report includes interviews with principals as well as an annual survey of over 5,000 students. Schools can add student achievement data to the report, but the final result is more than a single number; it is a comprehensive, nuanced portrait of each school.

The Program Status Review gives each team the data it needs to identify weaknesses within a school and individual classrooms. "What [the reports] do is eliminate getting into discussions that are simply based on opinion or something read in a magazine or something a local higher education institution told you to do," says Blanton. With the annual status report, teams can make "decisions that are very much based on information and data," making the work of reform more focused and more systemic.

"At first, schools have a shopping list of things they want to do," says Blanton. "They want to get more into inquiry [based instruction]. They wanted to get into technology: 'Please help us buy these graphing calculators . . . '" But findings from the annual report often point teams in a different direction. After the first reports were completed, many teachers realized that their curriculum lacked coherence and "they had to go back to the basics," he says. "When you have teachers with twenty to twenty-five years experience who have never sat down in the summer and developed a course of study for the coming year, it

just boggles the mind." Learning to do that comes first.

The team approach works. Findings from each school's yearly review show that achievement scores are climbing, says Blanton, "and we see the gap closing," especially within schools served by the most serious and dedicated teacher teams. Within the sixty-six schools most actively involved in the Coastal RSI, Blanton says some teams meet "only as social events," while others "have taken full responsibility and authority for making decisions." Gains are directly correlated with the level of teacher leadership. "As we look up and down that scale, the differences in student achievement and, particularly, the involvement of minorities in higher level classes, is directly proportional to the intensity of those teams," he says.

As Blanton acknowledges, not every school embraced the team approach, and not every team is successful. The goal is to empower teachers and local administrators, but, at first, many educators see teams as a burden. "It was very new for them," he says. "They looked at it as an added responsibility on top of their existing teaching or administrative load." A time consuming task of the Coastal RSI staff during the first couple of years was getting teams together for meetings, usually during leave days or after school. But as teams congealed and the benefits of support became clear, attitudes began to change—and a real sense of empowerment emerged. "We have schools where teachers will never, ever allow decisions to be made without them," says Blanton. He believes that this is the single most important outcome of the Coastal RSI.

Not surprisingly, some administrators see the shift to teacher leadership as a threat. Initial support at the district level turns sour when they see what the initiative is trying to accomplish. "Administrators will sign on quickly because they see dollar signs," he says. District curriculum supervisors are especially enthusiastic because there is money for professional development. "But once they realize that what they bought into is basically sharing the responsibility and authority to make decisions with the teams, the transition can be difficult." To deal with these fears, an important part of the RSI's work is leadership training for district administrators and supervisors, showing how teacher empowerment does not eliminate the important role they play. "It doesn't have to be a competition between them and what the team wants to do." For many, "the light bulb comes on," he says. Others remain resistant.

As the Coastal Rural Systemic Initiative progresses, Blanton says the chief lesson is this: "Traditional roles are really *the* barrier in rural districts to

progress." Professional development is important, but systemic change along the I-95 corridor is also about changing traditional roles of administrators and teachers from making decisions in isolation to making decisions together. Fundamentally altering how educators think about leadership is the ambitious task of the Coastal Rural Systemic Initiative. Says Blanton: "Our strategy is aimed at creating a system that allows committed, hard working educators to be more effective and efficient in unique settings with very limited fiscal and human resources."

Texas

Delta

Ozark


TEXAS
El Paso
Houston
San Antonio
Laredo
GULF OF MEXICO

Texas: Breaking Out of Rural Isolation

Off a rutted road in a small south Texas town, almost a stone's throw from Mexico, a small Catholic church is filled nearly to capacity on a recent weekday evening. On Sunday there will be Mass, but tonight the building is occupied, not with worshipers, but with school children and their parents. Conversation is lively as adults share recipes and tell stories about an unlikely food—the spiky nopal cactus. Thorny and flat leafed, it looks forbidding in the Mexican desert where it grows wild. But scraped clean of thorns, it is a multipurpose delicacy. Tender young leaves are cooked with scrambled eggs; fleshy red fruit is collected for jelly. Grandparents recall burning thorns off cactus growing in the field so cattle could graze during times of drought.

For children of Mexican ancestry, this social event is an opportunity to learn about their heritage. But that's not all. As part of the South Texas Rural Systemic Initiative, this "Family Math and Science Night" is also showing parents that they have an important role to play in the academic success of their children. Most families gathered here live in rural colonias and speak Spanish as their first language; many have only limited education. But by the end of the evening they have learned how to reinforce lessons taught in school. Parents are reminded to include their children when they cook *nopalitos*—talking about native plants and encouraging their children to count and measure ingredients are simple ways to reinforce science and math in their daily lives. And to strengthen essential literacy skills, every family is encouraged to keep a family journal where they can record their own recipes and stories. Academic excellence becomes a family project, even at mealtimes.

Family Math and Science Nights are a success; attendance is high and participation is active. But they also illustrate the challenge of education reform in this large and highly diverse state. Within the border region, especially, there is a strong, almost religious faith in the power of education. Indeed, one local school administrator says the two most important institutions in any south Texas town are the church and the school. But it is often seen as an alien, unapproachable institution. "These parents love their kids," says JoAnn McDonald, director of the South Texas Rural Systemic Initiative. "They are very interested in having their kids succeed. But they don't always feel comfortable with schools."

The goal of the two initiatives serving this state—the Texas Rural Systemic Initiative, which targets thirty-seven counties in the north, and the South Texas Rural Systemic Initiative, which includes nineteen counties south of San Antonio, is to help schools and whole communities break out of the kind of isolation that leads to high dropout rates, low expectations, and economic disenfranchisement. "It's all one world; it's all one country," says Irma Mondragon, assistant superintendent for curriculum and instruction in the Lyford School district north of Harlingen. As a member of the community, she understands the importance of culture and the strength of language. But helping residents see that there is a world beyond their own community and the Rio Grande Valley is equally important. "Sometimes," she says, "we have to leave the Valley."

To break out of isolation, the state's interconnected initiatives focus more than most other RSIs on bringing outside resources and expertise into rural regions. In communities where math and science teachers rarely, if ever, have sustained conversations with their professional peers, the Texas RSIs have focused on building networks among teachers across the state, sponsoring professional development conferences and bringing educational specialists directly into schools and classrooms. Experts who, in the past, simply drove past rural schools on their way to urban and suburban districts are now being diverted onto the back roads of rural Texas. In the past, says Texas RSI Executive Project Director Judy Kelley, "schools looked inward to solve their problems. They didn't realize there were people outside their districts who were interested in working with them. Working with us has literally changed the vision of these districts about what they can do and who they can work with."

Cowboys, Cotton—and an Uncertain Future

Texans are prone to caricature. Ten-gallon hats and boots set the tone for a state that likes to promote its cowboy image. But a border state of this size defies simple stereotypes. Here the hats and boots are more likely to be worn by a second or third generation south Texas farm laborer than a Dallas oilman. In Washington, Congress debates immigration policy, but Texas already is—and has always been—deeply rooted in a Spanish heritage and Mexican culture. Long before it was part of the Union, Texas was Spanish territory and, later, the northern frontier of Mexico. Anglos were the newcomers; they were, and often remain, the minority. In border towns Spanish, not English, is the dominant language—not only among recent immigrants and the uneducated, but also among established professionals.

And the impact of immigration in growing. Economic disparity between the United States and Mexico and the impact of global trade is bringing more immigrants northward; within a single generation, some south Texas towns have been transformed from Anglo enclaves into almost fully Hispanic communities. Farther north, the ethnic balance shifts and in some regions there is also a strong African American presence. Reflecting this diversity, the rural population served by the Texas RSIs is more heterogeneous than most other Rural Systemic Initiatives.

Within the state's rural communities, the common denominator is poverty. All regions served by the state's Rural Systemic Initiatives are categorized as economically disadvantaged. And within these regions there is a nagging suspicion among residents that they have been left behind by an increasingly technical and global economy. Factories built along the border have moved south or overseas. Agriculture remains strong but offers few jobs. Corporate farming "is technology intensive, not labor intensive," says Kelley. Giant tractors equipped with GPS look after enormous tracts of land. As residents leave home to find work elsewhere, rural communities are left with a shrinking tax base and less state education funds.

The strength of rural Texas communities is found in a strong local pride that often centers around the school. In this state "Public School Week" is a major social event; during the first full week in March, school doors are open to the public, teachers meet with parents and families join their children for

lunch and special events. The event overlaps with the state's Independence Day, merging the two events into what Kelley calls "a huge celebration of Texas." In the fall, all eyes are on high school football teams and each school's progress is followed with a uniquely Texan passion. In this setting, rural Texans are already devoted to schools. The challenge facing every rural school is to help their students compete in an uncompromising standards-driven education system and, ultimately, technology-driven economy—with severely limited resources. Bridging the gap is the task of the Texas Rural Systemic Initiatives.

Breaking Down Walls, One Classroom at a Time

In the small town of George West, about an hour north of Corpus Christi, Dianne Jurica teaches fifth-grade science at George West Elementary. It's a small school serving grades four to six, and Jurica is the only fifth grade science teacher. Even after more than twenty years in education, she remains energetic and dedicated; her classroom is large but pleasantly overstuffed with posters, student projects and science equipment. But she often feels disconnected from colleagues—both in adjacent school buildings and in neighboring districts. Much of the time, she says, "you're in your own bubble."

It's a common complaint among rural teachers, especially the most dedicated. Most work in isolation and with access to few school resources. If they want students to use microscopes, they often have to find them or buy them with their own money. And if they attend workshops, that, too, becomes a personal expense. While the average elementary school teacher spends hundreds of dollars every year on school supplies and professional development, Jurica says she spends "thousands." Summers and weekends are devoted to preparation—never with compensation.

It is here that the gap between the rhetoric and reality of school reform is revealed: Teachers are on the front line of school reform, yet many feel they lack the resources and support needed to respond to state and national mandates. Rural teachers, most of all, feel alone in their work. In the smallest schools they even lack the ability to commiserate with peers. In this setting, the first and most important task of the Texas Rural Systemic Initiatives was to provide the kind of support rural teachers urgently need.

To bridge the gap, the Texas RSIs use a mentoring approach to classroom reform. Within each participating school at least two lead teachers, called

Teacher Partners, are paired with a "Regional Specialist," a professional educator who travels from school to school providing teachers with information on state education policy, new approaches to assessment, curriculum material—whatever the Teacher Partner needs. Most regional specialists are former teachers and bring with them not only a familiarity with state education policy and the standards movement, but also a "nuts and bolts" appreciation for the teaching profession.

"Regional Specialists provide regularly scheduled on-site support to Teacher Partners," says McDonald. "They may host reflective conferences, provide model lessons, or team teach alongside the Teacher Partner." They also help Teacher Partners identify and locate resources for teaching. In short, they are what every overworked teacher wants: an on-call mentor, messenger and errand boy who can provide the teacher with a graphing calculator and show her how to use it in the classroom.

After years of isolation, some teachers have trouble opening their classroom door to a stranger. "At first, teachers ask, 'Who are you? Why are you spying on me?'" acknowledges Freddie Vasquez, a Regional Specialist serving ten districts around San Antonio. But soon they realize they are not being judged. "Now they say, 'Just walk in!'" The key is to build friendships and reinforce the good things teachers are doing. The same is true for administrators. Principals who wouldn't make time to meet with Regional Specialists in the early years now seek them out.

After just five years of work, the Regional Specialists have become one of the most important agents of change within rural schools—and the most appreciated among teachers. In a survey of teachers participating in the South Texas Rural Systemic Initiative, 93 percent said the mentoring by specialists was the "most beneficial" component of the project. And the cumulative impact of this mentoring approach is enormous. Statewide, there are more than one thousand Teacher Partners—every one directly supported by a Regional Specialist.

The role of the Teacher Partner is not only to get support, but to share what they learn. In the Appalachian Rural Systemic Initiative, principals and superintendents were strongly encouraged to provide release time for faculty and paid leave for their Teacher Partners. Freed from teaching, Teacher Partners had time to conduct research and develop professional development seminars for their peers. Political reality in Texas is different and RSI leaders felt they

could not ask schools to sacrifice their most experienced teachers. As a result, the sharing process is necessarily informal and opportunistic. Yet fully 98 percent of Teacher Partners report that they do share what they learn, usually by talking informally with colleagues in hallways, after school, during planning periods—whenever they have time.

A sizable minority report that they do even more. More than half of Teacher Partners surveyed report that they have led either campus-level or grade-level presentations. Nearly half have also modeled lessons for other teachers. Jurica has done all these things—not just because it is the right thing to do, she says, but because it will make her job easier in the long run. By working with other teachers, especially in the lower grades, she knows that students will arrive in her classroom better prepared.

Reaching Beyond the Classroom

Classroom support for individual teachers is a key part of the Texas RSI. But equally important is the opportunity for sustained interaction with other teachers and access to professional development seminars. The Texas RSIs organized an ambitious program of academies specifically for rural teachers and administrators that focus on what teachers consistently say they need most—practical training with the latest math and science curricula. That's what most impressed Jurica. "Exposure to hands-on activities," she said, gave her the tools and ideas that she could bring back into the classroom and share with her colleagues.

What teachers learn in today's workshops often bears little resemblance to what was taught in classrooms a generation ago. In both math and science, the focus is on what educators call "inquiry based" learning. Instead of reading about the work of scientists, for example, even grade-school children are encouraged to ask questions and conduct experiments—"learn science by doing science," is how one teacher describes the approach. For math teachers, the focus is not on memorizing equations, but on understanding underlying concepts. In the early grades, worksheets are often replaced by manipulatives—objects that can be used to visualize mathematical processes.

The idea is not to inculcate the much derided "new math" but to discover new ways to teach math so that all children will understand, not just the 10

or 20 percent who can intuitively grasp underlying concepts no matter how it is taught. Its not dumbing down, but lifting up, and this requires innovative new approaches to learning. Especially in a standards-driven climate of school reform, teachers feel obligated to expand their repertoire of skills and help those who, in the past, were written off as less capable.

In Texas, however, there is unequal access to professional development opportunities. Workshops on new content and pedagogy are plentiful; many are offered by the twenty Texas Regional Education Service Centers—quasi-government agencies that provide a range of research and consulting services to school districts statewide. But programs are usually offered in urban and suburban locations. In a state as large as Texas, rural teachers have to travel hundreds of miles to attend these sessions and stay in hotels—usually at their own expense. Some did; many didn't. McDonald heard of one teacher who worked for twenty years in a rural district before attending her first workshop.

The Rural Systemic Initiative, however, helped level the playing field by providing seminars regionally and often within rural communities. For those who need to travel, expenses are covered by RSI funds. And workshop subjects are built around the specific needs of rural teachers; their responses to RSI surveys and—especially important—student performance data determines themes for upcoming Teacher Partner Academies.

On a late autumn afternoon the focus of one workshop offered at the campus of Texas A&M University-Corpus Christi is "Rethinking Elementary Mathematics." About fifty K–5 teachers sit at tables, working through the day's exercise: Clock Arithmetic. Numbers arranged clockwise in circles from one to twelve (Mod 12) or one to five (Mod 5) produce unexpected sums—in Mod 5 one plus four equals zero. It seems strange—at first—but builds a conceptual understanding of our base ten system. Everyone in the room is sent back to the very foundations of mathematical knowledge as they add sums by circling these clocks. The activity not only offers engaging projects for children, but builds confidence among elementary school teachers, who are usually not math specialists. "If they get teachers to really understand mathematics, they are empowered to make change in the classroom," says Regional Specialist Freddie Vasquez who sits among some of his Teacher Partners and compares his answers with theirs.

Promoting Collaboration in a Climate of Fragmentation

Good teachers want to keep learning and will use their free time and own resources to grow professionally. But the powerful standards movement is encouraging all teachers to go back to the classroom; learning new skills is not only an opportunity but an obligation in a state that helped pioneer the standards movement and was one of the first to impose a "high stakes" high school graduation exam.

Few teachers are exempt from the pressure to show results. Testing begins in the third grade and different subjects are emphasized nearly every year: Reading in third, writing in fourth, science in fifth, and so on. Based largely on these scores, all schools are graded annually as Exemplary, Recognized, Academically Acceptable or—at the bottom end—Academically Unacceptable. Exemplary and Recognized schools often promote their standing with banners and signs—creating an air of competition with the state.

Most educators uniformly assert they favor higher expectations and, in general, endorse the accountability movement. "We definitely need a form of assessment," says Beatrice Martinez, a sixth grade math Teacher Partner in Lyford, who believes the state-mandated math tests are challenging, but fair. Most also believe that testing forces teachers to be more accountable for the success of their students. They are less inclined to write off students who are less academically prepared. "Without accountability, attention would not be paid to subpopulations," asserts Kelley. "No system is perfect. But [with standards] you are making an effort to help all children succeed."

That's the good news, and is a consistent theme among rural educators nationwide. But some teachers in rural Texas also believe testing becomes an unintentional barrier to the kind of reform envisioned by the Rural Systemic Initiative. Instead of promoting a more integrated curriculum and greater collaboration among teachers, the state testing system forces schools and teachers to work against each other and focus on short term goals. By testing different subjects in different years, the system encourages—almost requires—a preoccupation among teachers and administrators with the particular tests that are administered to their students and in their school.

The problem is especially acute in the many Texas districts that divide elementary education between two schools—a K–3 primary school and a

4–6 elementary school. This structure encourages the primary school to focus like a laser on what is, in essence, the high stakes third grade reading test; if children don't pass this assessment, they cannot advance into fourth grade. Not surprisingly, many primary schools devote a disproportionate amount of time and resources on this discipline. "Principals really focus on trying to get all their third graders prepared for the reading test because of the high stakes involved," says McDonald. "Sometimes this focus is at the detriment of other curricular areas that are not tested in third grade—like science." Math is also tested during the third grade, but students are not retained if they fail to meet the standard.

No question, reading matters and the early grades should be devoted to literacy, but many teachers believe relative inattention to math and science only exacerbates the pressure they feel in higher grades. Jurica often feels that she is starting from scratch when students arrive in her fifth-grade science class. Information that should be reviewed is, instead, being introduced for the first time, she says. The school year becomes a mad dash—for her and her students—to cover the vast amount of material that will be included in the fifth-grade science test.

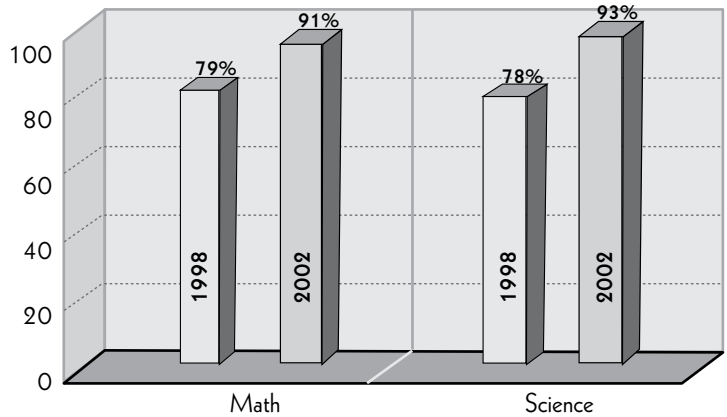
Jurica doesn't want to pit math and science against language and literacy. As an elementary school teacher, she believes in an interdisciplinary approach to teaching; in her own classroom she asks her students to read at least one science-related book a week. And she's sympathetic to the plight of her third-grade colleagues. But the larger needs of students are not served in climate of learning that sets schools and grade levels against each other. "We need a person in the district to go down to the lower grades and help them plan lessons," she says. "I wish it could be me, but I can't do that and do this."

Within the limits of her time, Jurica is trying to coordinate with K–4 teachers in her district. She has organized planning meetings with teachers from the primary and elementary school. In the past, some of her students were sent to the primary school to teach the younger children. And it's encouraging that, statewide, many Teacher Partners are, in fact, reaching out to peers at higher and lower grades. Between one quarter and one third of elementary South Texas RSI Teacher Partners have found ways to share with either middle or high school teachers, for example. But it is clear that state and federal education reform policies can work for—and against—the needs of rural teachers.

Many Definitions of Success

In a standards-driven climate, the success of the Rural Systemic Initiative is inevitably judged by its ability to raise test scores in rural schools. By this benchmark, Judy Kelly says there is "incremental progress." Although this initiative began later than many others and has had only five years to show results, both Kelly and JoAnn McDonald say scores on some math and science tests are climbing faster in schools participating in the initiative. Equally important is evidence that these schools are also increasing the number and variety of advanced math and science classes. This suggests that students are already making academic gains and raising their expectations. As the Texas RSI comes to an end, data collected from participating districts clearly illustrates that students are performing at higher levels in both math and science:

Math and Science TAAS Passing Rates, All Grades Tested



Average number of students tested per year: 31,530 in math, 4,675 in science.

Equally important, these gains are made at all grade levels tested—from elementary to high school—and within every subpopulation tracked. According to a Texas RSI report:

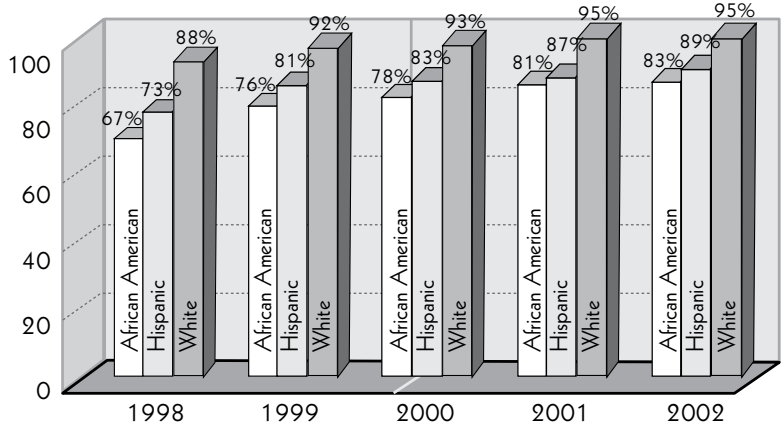
> Of the 52 districts with math TAAS results reported at every grade level tested, 50 districts increased their district passing rate from 1998 to 2002. The average district math passing rate increase was 12 percentage points. Of the 59 districts reporting eighth-grade science TAAS results, 52

districts showed increases in passing rates from 1998 to 2002. Three districts had 100 percent passing in both years. The average district science passing rate increase was 13 percentage points.

But RSI leaders know that to build a solid foundation for the academic success of all children in Texas, even more is needed. As the immigrant population grows and the dilemma of migrant education remains unresolved, "excellence" also requires early intervention and strong partnerships between schools and immigrant communities. Educators in south Texas know that before children can advance in math and science, they must be fed, healthy, secure, and hopeful. "Provide those things, then they'll listen to the other things," says Irma Mondragon.

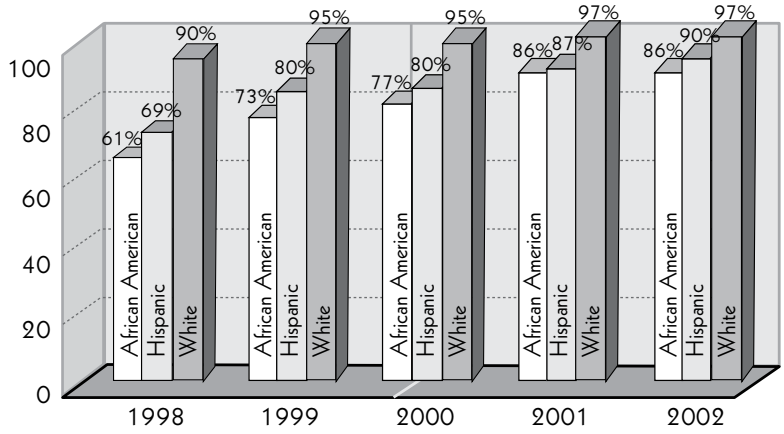
This philosophy is reflected in the work of the Lyford School District, a short drive west of the Gulf Coast. Cotton is the dominant industry—gins dominate the skyline of Sebastian and neighboring towns and the Hispanic population is large and growing. Officially, the district serves four Hispanic colonias but, in reality, "it's all colonias," says one administrator. Even Lyford, a formally Anglo town, has shifted to a dominant Hispanic population in recent decades. Here homes are well tended, but incomes are low and, out of necessity, the school fills an important social and economic role. Scattered across a sprawling school district compound as large as a small college, the Lyford school district provides

Math and Science TAAS Passing Rates, Grades 3–8 and 10



Average number of students tested per year: 2,250 African American; 15,536 Hispanic; 12,577 White

Math and Science TAAS Passing Rates, Grade 8



Average number of students tested per year: 316 African American; 2,276 Hispanic; 1,954 White

a bewildering array of programs and services that reach out to all residents.

On a typical school day, children walk between classes while, nearby, about thirty mothers are learning English as part of a federally-funded Early Start program. In an adjacent room, their young children are enrolled in a supervised daycare. The toddler room is language rich; walls are lined with books while next door babies sleep to the sound of quiet lullabies. Older children, meanwhile, benefit from an innovative dental program. A fully equipped dental clinic located in a nearby building, staffed by a full time hygienist, is linked by video to the office of a consulting dentist across the state. Without cost, and without having to leave town, students get access to health care rarely available in their own community.

Contrary to conventional wisdom that poor families don't care about education, school leaders say parents are keenly interested in the success of their children, and eagerly participate in the life of the school when they feel welcome. "You need to let them know they are important," says Superintendent Jack Damron, a lifelong resident of Lyford. While most Parent Teacher Organizations are all but ignored, meetings of Lyford's recently revived PTO attract large crowds; nearly all parents are active members. Social events supported by the school district and parents—from the annual Veteran's Day celebration to an alternative Halloween party—are major community gatherings. In these and

other ways, the school has become the hub of the community, uniting what could easily be a fragmented and disenfranchised population.

Lyford is also the administrative headquarters of the RSI's Colonias Family Program, a project within the South Texas RSI that builds a foundation of math and science knowledge among immigrants and, especially, migrant families. Using a model more commonly found among public health workers, the project supports promotoras—promoters—as liaisons who go into the colonias, work with families, help organize family math and science nights and provide transportation to school events; when the men are working late in the fields, the promotoras arrive with a van to get them to school meetings.

Although the project is small, the impact on the community—and school—is tangible; the newly revived PTO grew out of migrant family meetings and by attending math and science nights, both teachers and the superintendent have a deeper appreciation for the needs of migrant parents. "The whole philosophy of working with parents is growing," says Project Coordinator Darlene Perez, who was born into a migrant family and spent her early years in the fields before going to college.

In this way, the Lyford School District is an enthusiastic partner in the Rural Systemic Initiative, not only because it is strengthening the math and science curriculum, but also because it is helping the district reach out even farther into the community. In this school district, "success" is measured broadly. The superintendent is attentive to the testing system and test scores in most subjects are high—Jack Damron says only science remains his district's "nemesis." This is a remarkable achievement for a poor south Texas district. But these gains are built on a wide foundation of work that begins long before children enter the classroom. The line between school and home blurs and stronger communities are the result. That's what education, and the Rural Systemic Initiative, is all about.


ARKANSAS
MISSISSIPPI
LOUISIANA
OKLAHOMA
TEXAS

Delta: Leveraging Resources

Along the twisting contours of the Mississippi River as it nears the Gulf of Mexico there are communities seemingly untouched by the twenty-first—or even twentieth—centuries. "If you go and visit some of these places it would be as if you had gone back a hundred years," says Brenda Nixon, project director of the Delta Rural Systemic Initiative. When reporters go looking for regions of extreme poverty and Third World living conditions, this is where they often come.

Farming is still a way a life in the Delta region—but wealth is unequally distributed. According to one U.S. Department of Agriculture report, portions of the Delta are still "the land of large cotton, soybean, and rice farms." But over 70 percent of the residents are African-American and, within this population, "only a few [have] a stake in farming, except as hired workers." In 1990 Tunica County of Mississippi had the country's third highest poverty rate. With construction of a large casino, unemployment has declined, but the median county household income is $23,300, well below the national average for rural regions. According to the latest census, East Carroll Parish in Louisiana now holds the distinction of being the poorest area in the United States, with over 40 percent of its population living in poverty.

In these and other counties and parishes served by the Delta Rural Systemic Initiative, there are significant barriers to education reform. Educational expectations within schools and communities are low and burnout among teachers working in these high stress, low pay districts is high. When conditions deteriorate within a school or district, many educators lose hope and are only looking for a way out. "If a teacher can earn a higher salary in a neighboring

district that is better performing, they are going to leave," says Nixon. The same is often true for administrators. There are always committed educators who choose to stay, but the climate is one of instability.

In this setting, education reform is easily crushed under the weight of low teacher morale—and may even backfire. "When teachers received 120 hours or more of professional development, they became a 'Delta RSI-trained' teacher," says Nixon. However, "The training made them more qualified and they were able to get positions outside of their district." Teachers often used these credentials to move out rather than to help improve schools from within.

The central task of systemic reform in the Delta region was to create islands of hope and stability where a better climate for learning could be nurtured. "When you have high performing teachers and administrators, they must be supported or they don't stay," says Nixon. In response to these conditions, Delta RSI changed its focus from teacher professional development to leadership development and empowerment in an effort to improve conditions and retain quality teachers and administrators.

The successful approach developed by the Delta Rural Systemic Initiative was to provide support in multiple ways. Professional and leadership development was important, just as it was in most other RSI sites. But it was part of a large and diverse range of services and programs that included networking among participants, mentoring by site coordinators, summer institutes for teachers, and family math and science nights for parents. Especially important, says Nixon, was the role played by regional advisory councils. As advocates of reform within schools and across districts and communities, they played a critical role in promoting best practices and raising expectations.

Building on Each Region's Strengths

The Delta RSI worked in sixty-one school districts across three states—Louisiana, Arkansas, and Mississippi. Rather than imposing a single reform strategy across state lines, Delta RSI staff chose to build on existing reform initiatives within each state. "It's all about leveraging resources," says Nixon. In Louisiana and Arkansas, earlier funding of State Systemic Initiatives by the National Science Foundation helped these states build a foundation for reform. In Louisiana, for example, professional development programs were already in place. In Arkansas, the focus was on establishing science and math centers to

support reform across the state and increasing parental involvement through math and science nights.

When the Delta RSI was funded in 1995—five years after the State Systemic Initiatives—the existing contacts and programs were leveraged to expand the impact of the Delta RSI. "What we did was ride on their coattails—as they rode on ours—to take advantage of what they had in place, using the infrastructures already in place in those states," Nixon says.

As a result, multiple approaches to reform were taking place within the Delta region. In Louisiana, the focus on professional development produced strong partnerships among the universities across the Delta. The University of Louisiana at Monroe played an especially important role. "Senior faculty and administrators served as advisors and were integrally involved in outreach, including developing and delivering professional development to the Delta districts," according to a Delta RSI report, *Building Bridges*. The state's Board of Elementary and Secondary Education and the Board of Regents also played a key role by providing a total of $2.2 million in competitive professional development and district enhancement grants.

In Arkansas, the Delta RSI used the science and math centers to support existing professional development programs and strengthen parental involvement. Grade level modules were designed specifically for Math and Science Nights and over 800 teachers received professional development training for these events. "Often teachers would use a module in the classrooms rather than relegate it to only a few special nights," according to the Delta RSI report. For many, use of these project-based kits became their first step into standards-based teaching and learning.

In Mississippi, the challenges were different and more complex. This state did not participate in the State Systemic Initiative and the infrastructure needed to promote math/science education reform was less well developed. Here, in addition to the networking, professional development and mentoring by site coordinators, the Delta RSI made significant progress by building a cadre of teacher leaders within schools and across districts. Schools were invited to send one master teacher (called Mentor Teacher) and two less experienced, but committed "Lead Teachers" to participate in a five-day Leadership Academy. "The lead teachers typically had not received any long term professional development prior to coming to the Academy," says Nixon. This intensive summer school for teachers offered programs in math content, the use of

technology and hands-on, inquiry-based teaching techniques. Presentations from national leaders in math education were also part of the agenda.

Back in the classroom, Lead Teachers in the Mississippi Leadership Academy put into practice what they learned during their summer school programs. Follow-up surveys found that the experience changed how teachers taught their subjects. "Eighty-five percent of Lead Teachers implemented standards-based teaching and learning based on classroom observations and follow-up interviews," according to Delta RSI reports. All teachers—both mentor and lead teachers—reported that their teaching abilities had improved.

Across all three states, the Delta RSI supported a full time staff of field coordinators. Similar to the resource specialists found in Texas, field coordinators traveled to schools, worked directly with teachers, and reinforced what was modeled in professional development seminars. Nixon acknowledges that this one-on-one approach is time consuming. "It's much more efficient to have a workshop," she says. "You can have a workshop for a day and reach thirty teachers." In contrast, the work of field coordinators appears inefficient. But to build a climate for reform and to reach the neediest teachers, workshops aren't enough. In the long run, the follow-up support of field coordinators ensured successful implementation, Nixon says. Problems could be addressed and collaboration among teachers could be nurtured.

Especially important in nurturing a climate for reform, says Nixon, was the role played by regional advisory councils. represented by educators ranging from classroom teachers to superintendents and policymakers, they "were responsible for embedding the seed of reform in their districts and helping to change policies to support science, technology, and math education. These representatives proved to be very strategic in implementing reform." They participated in workshops to learn how to conduct inventories of science, technology, and math education in their districts. They also learned how to use data to support decisions, identify and support best practices, and network more effectively.

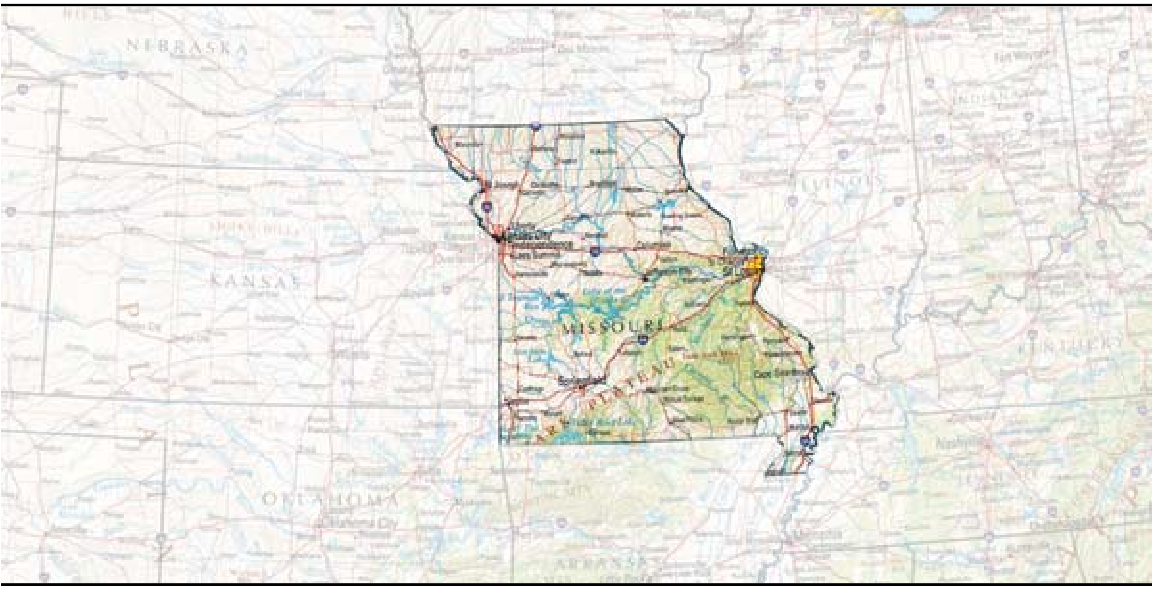
Nixon recalls the experience of one high school math teacher. Approaching burnout, he registered for a seminar providing training in a standards-based math curriculum called Core Plus. "It changed his life," Nixon says. "He no longer hated teaching. His kids were engaged and excited and so was he." This teacher then shared his experiences at an annual conference attended by regional advisory council members. Inspired by the teacher's story, some of the

members took up his cause. "They wanted to bring Core Plus into their own district," she says. With Delta RSI support, a team of teacher leaders was sent to a Core Plus institute and the program was eventually implemented district-wide. In addition, they linked the curriculum to the state standards and added a mandatory math course.

Recently, Nixon received a call from one of those regional advisory council members inviting her to visit and see the results of their work. The district's scores in math, particularly among students who had experienced the curriculum the longest, had dramatically improved. But more importantly, the district reported that understanding of important mathematical concepts was far superior than prior to the implementation of Core Plus.

Although Delta RSI ended in 2003, the impact of the initiative is still being felt. Delta RSI administrators and teachers are continuing to support STEM reform and many are now in positions of leadership. The field coordinators and a number of the most active participants are now principals or supervisors at the district and state levels. A math teacher who had participated in the Mississippi leadership program recently called Nixon to report he had received the Presidential Award in math and been appointed as a math specialist for his district. He attributed his success to the experiences he had with Delta RSI.

In these and many other ways, education improvement continues to thrive throughout the region as a direct result of Delta RSI. "Reforming education is a long, arduous process with no quick solutions," cautions Nixon, "but by creating synergistic partnerships, encouraging leadership and professional development, and providing support throughout the process the effects are long-lasting and profound."


NEBRASKA
KANSAS
MISSOURI
OKLAHOMA
Oklahoma City

Ozark:
The Community as Classroom

In the movement for education reform nationwide, it is often said that rural schools are at a disadvantage. The smallest and poorest schools, especially, cannot offer the rich menu of advanced math and science classes found at larger suburban schools. They also lack the space and equipment—such as computers and science labs—needed to teach math and science in more engaging ways. These are common complaints across rural America.

The Rural Systemic Initiative cannot, on its own, balance the scale of equity. But it is helping rural educators make the most of the resources they do have and, especially, encouraging schools to look for support beyond the classroom. By viewing the whole community as an extension of the school and the members of that community as potential teachers rural schools become, not the poorest, but among the richest in America. More than in many wealthier districts, residents of tight knit rural regions are willing to rally around "their" school and share time and expertise.

In the language of the Rural Systemic Initiative, the focus is on "building partnerships," and the ability of individual sites to promote collaboration is viewed as a significant indicator of success. Across the country, all RSI sites are reaching out to universities, businesses, local government agencies, and foundations—among others—to strengthen learning in the classroom. All are making a difference. But the full potential of school-community collaboration is revealed in rural Missouri where students in the famously isolated Ozark region are benefiting from a strong and growing partnership between the Ozark Rural Systemic Initiative and George Washington Carver National

Monument, a small national park preserving the birthplace of one of America's most celebrated scientists.

Park Rangers as Partners

When the Ozark Rural Systemic Initiative began in 2002, its first goal was to strengthen classroom teaching, says Project Director Janna Gordanier. The challenge was to introduce new ways of instruction that would help teachers—and their students—keep pace with growing academic expectations. "We were really working on teacher beliefs," she says. Convincing teachers that all children are capable of learning, even if they don't all learn the same way, is a significant challenge for teachers from the old school, but necessary in the era of standards.

In math, this means finding ways to build a conceptual understanding of numbers and how they can be manipulated, especially in the early years. The Ozark Rural Systemic Initiative encouraged schools to adopt curriculum materials that promote this use of manipulatives, such as the Everyday Math series developed by the University of Chicago, and it's a sign of success that 100 percent of the participating elementary schools are now using this standards-based material, says Gordanier.

To promote active learning in the sciences, meanwhile, the focus throughout the Rural Systemic Initiative is on doing science, especially by integrating science kits into the curriculum. In the Ozark region, schools were encouraged to purchase the acclaimed Science and Technology for Children (STC) kits developed by the National Science Resource Center at the Smithsonian Institute with funding from the National Science Foundation. Each kit focuses on a different theme—minerals, sound, and ecosystems, among others. Through simple projects and experiments, students explore key scientific concepts by, for example, building electrical circuits or analyzing the composition of soil. Each kit contains all necessary equipment and supplies.

The kits are intended for classroom use but staff from the nearby George Washington Carver National Monument also showed an interest in the standards-based STC program. The park already had visitor center exhibits and interpretive walks—similar to all national parks. But park staff, lead by Chief Ranger Lana Henry, wanted their education programs to have a larger impact in schools. "This park wanted to develop programs that enhance what

the students are actually learning in the classroom," says Superintendent Scott Bentley. "We identified the need to work with teachers and educators and find opportunities to better serve them."

When the STC kits were introduced to schools throughout the region, park staff saw a way to get involved. They purchased their own kits, completed training offered by the Ozark RSI, then found ways to link their educational materials and visitor center exhibits to the content of the STC kits. A kit devoted to soil, for example, presented an opportunity for park staff to talk about Carver's work in soil conservation and his promotion of crop rotation among poor southern farmers. A kit on botany, meanwhile, was linked to a park exhibit featuring Carver's herbarium and a related field trip experience where students collect, dissect, press and mount their own plant specimens.

National parks are, in their own way, classrooms for the nation and park rangers hope visitors will leave not only entertained but also informed about the nation's history and natural world. "All national parks have an education component," says Bentley. But the work of George Washington Carver National Monument is "fairly unique," he says. By linking their education program around the specific content of the region's schools, the park became, in a very real way, an extension of those schools. Schools are the first to benefit: Through this partnership, education reform is not the lonely task of a few under-funded rural schools, but a community-wide endeavor that involves, in this case, the talent of professional National Park Service staff.

At the same time, the needs of the park are also served. By partnering with the schools, George Washington Carver National Monument is offering a more relevant, and more sophisticated, educational program. By working with schools and using the STC kits as building blocks for their educational material "we didn't have to reinvent the wheel," says Bentley. The resulting park-based program presents scientific concepts at a higher level, he argues, and also "enhances what students are learning in the classroom." The next step, he says, is construction of a $5.2 million expansion to the visitor center. When completed, the Science Discovery Center will feature dozens of interactive exhibits centering on the content of the STC kits and linked to the life and legacy of Dr. Carver.

The collaboration doesn't end here. Grants from the National Park Foundation's "Parks as Classrooms" program have allowed schools to borrow science materials developed by the park for classroom use. Park rangers have

also been certified as trainers in the STC curriculum by the Oklahoma Science Literacy Center and are now providing professional development training for schools—thus sharing their own expertise with teachers in ways that directly strengthen the classroom experience. Park Service staff have also helped develop a character education component to the curriculum, using Carver's exemplary life as a model, that supports school literacy standards.

Equally important, Carver National Monument, supported by its affiliated nonprofit friends group, is providing space and resources for refurbishing STC kits used in schools. Everything from cotton balls to soil samples must be restocked every time a kit is used—a time consuming and costly process. Instead of hiring a company to do the work, schools are saving money by bulk purchasing supplies, using volunteers to package the kits, and storing supplies in space donated by the park. Broadening this community-wide partnership, the Ozark RSI is now looking for financial support from regional and national businesses to support the cost of restocking the kits. All this helps ensure widespread use of the curriculum materials and sustainability for the program, even after the Ozark RSI's funding ends in 2007.

Made famous as a former slave who went to college and invented more than 300 products derived from peanuts, Carver's life is celebrated at a park that preserves his childhood home amid 200 acres of woodland. But more than a shrine, park staff want to promote Carver's commitment to learning. "He was a phenomenal individual," says Bentley. He is remembered as a leading African American scientist, "but foremost he was an educator." His legacy lives on, not through historic buildings and artifacts, but through his ability to inspire a new generation of children to lives of discovery and public service. Sharing this message is the mission of both the Carver Monument and the Ozark Rural Systemic Initiative.

Tribal Colleges

New Mexico Tribal Coalition


MONTANA
NORTH DAKOTA
WYOMING
SOUTH DAKOTA
NEBRASKA

Tribal Colleges: Serving Native Nations

Indians loom large in the American imagination, but tourists are often disappointed when they pass through a modern reservation. In the Northern Plains, there is nothing especially distinctive or romantic about tribal lands. Here, tribal members dress more like cowboys than Indians and the typical home is a double-wide trailer or aging ranch house—not a tipi or other traditional shelter.

But appearances are deceiving. The veneer of housing and clothing styles masks what Turtle Mountain Community College President Carty Monette calls a twenty-first century "renaissance" of American Indian societies. For centuries, tribes were weakened almost to the point of extinction by disease, relocation, poverty, and assimilation policies that pushed tribal members off reservations and separated children from families. But for more than thirty years, Indian leaders have worked to restore what was lost and take control of their own communities. For the first time, Indians—not federal bureaucrats—are deciding how they should live and what the future should look like.

Here, tribal leaders don't talk about building communities; they talk about building nations. Federally-recognized tribes are—and always have been—sovereign nations with the right of self government. For most of American history, the ability of tribes to exercise this right was constrained by paternalistic federal policy. But since the late 1960s—following passage of the Indian Self Determination Act in 1968—tribes have worked with growing confidence and sophistication to take back their right of self governance.

The evidence of change can be found on every reservation across the Northern Plains where the Tribal College Rural Systemic Initiative is located. The antiquated image of beaded and feathered Indians contrasts with the day-to-day reality of modern reservation life: tribal councils debating economic policy; tribal foresters mapping hillsides with the aid of GPS; tribal scientists analyzing lake water for pollution; tribal police investigating a crime; tribal elders keeping ancient traditions alive; tribal doctors and nurses seeing patients in tribally-run clinics.

Yes, say tribal leaders, there is still a great deal of poverty; with unemployment rising to 50 percent or more in many reservations, tribal communities are among the poorest rural regions in the country. Alcoholism and drug abuse also exists. But this is not the whole story. The future tribal leaders are creating is more hopeful. Imagine this: Vast tracts of the rural West where all Indians are employed; where Native languages are still spoken and traditional values are respected; where the scholarship of elders—in ethnobotany, cosmology, and oral history—is kept alive for the enrichment of the nation as a whole. Here, Indians are no longer part of America's "problem;" they are a vital part of its solution. That's the kind of talk heard on reservations today.

To fulfill this vision, education has a critical role to play. The goal of self determination compels tribes to promote and—when necessary—create education systems that fulfill what any nation needs: a cadre of citizens steeped in the values of the nation and with the skills needed to run its institutions and make them stronger. For this reason, Rural Systemic Initiatives serving Native peoples are different from all others. They are not only about preparing workers for a global economy, but also—and no less urgently—about ensuring the survival and growth of tribes as distinct, self governing peoples.

"We, as a community, are only as rich, vibrant, and healthy as the poorest member of our community," says Julie Cajune, director of Indian education at the Ronan School District on the Flathead Indian Reservation of western Montana. Promoting the kind of reform that serves all members—and strengthens the nations in which they live—is the mandate of systemic reform in Indian Country.

From Assimilation to Self Determination

For over 300 years, assimilation was the goal of Indian education. In school, children were not allowed speak their own language and cultural practices

were forcibly suppressed. Meanwhile, academic expectations of educators were often minimal; most training was vocational, usually for work not available on reservations. The results were predictable: By the middle part of the twentieth century, Indians had the highest dropout rates of any ethnic group in the nation. Poverty and a culture of dependency dominated most Native communities.

Remarkably, it wasn't until the late 1960s and 1970s that a fundamentally different approach to Indian education finally took root. As part of the Johnson-era policy known as Indian self determination, tribes began to take charge of their own political and economic development. Tribal councils, established by the federal government earlier in the century but nearly powerless for most of their history, now found themselves managing multimillion dollar programs and services that, in the past, were administered by the Bureau of Indian Affairs or other federal agencies—from forestry departments and fisheries to schools and health centers. Language and culture also reemerged as a priority and, with it, a new sense of hope and pride emerged. For the first time in decades, tribes were taking control of their futures.

It was in this era that the first tribally-controlled colleges were founded. Most were two-year institutions built on the community college model and, in the early years, the curriculum was often vocational. But they represented something entirely new: They were Indian controlled institutions that respected tribal knowledge and prepared students for work available locally, often within the tribal government. The movement grew quickly. There are now over thirty colleges and universities controlled by tribes. Many now offer four-year and even graduate degrees and all but the youngest are fully accredited.

But as a system of Native higher education took root, the needs of K–12 education remained unresolved. While there are tribally-controlled elementary and secondary schools on some reservations—they are called "contract schools"—most Indian children living on reservations are enrolled in public schools. Although these schools are located within or adjacent to reservations and frequently serve a largely Indian population, tribal members often say they still feel like outsiders. At a typical reservation-based public school, the majority of teachers, administrators, and board members are non-Indian and the curriculum makes only modest attempts to integrate tribal knowledge and values. Even as tribes take responsibility for their own development, many feel public schools remain stubbornly resistant to change. "You can still walk into a school as an Indian parent and still feel that it's hostile and unfriendly," says

Julie Cajune, who is a leader in Indian education issues statewide. "You can still walk in and be reminded that you are not really a member." While graduation rates are climbing, they still lag the national average by wide margins and equity remains an elusive goal.

What's at stake, however, is not just academic success of individual students, but the future of the tribe as a whole. With each dropout, tribes lose a potential leader—someone who can help guide the nation in an increasingly technological future. In their place, tribes must rely on non- Indian expertise; the sad irony is that many tribes must hire outsiders to fill leadership positions in order to advance tribal self-government. "Every year we have a number of positions within the tribe that cannot be filled by tribal members," says Joyce Silverthorn, head of the Tribal Education Department on the Flathead Indian Reservation. "By and large the majority of these positions are science and math oriented."

Recognizing that only Indians can shape Indian policy, the National Science Foundation took a regional approach to systemic reform in Indian Country and gave each participating tribe control over its own reform effort. Under the umbrella of what was first called the High Plains Rural Systemic Initiative are seventeen individual projects, each serving a particular reservation and administered by a tribally-controlled college. One institution—Turtle Mountain College of North Dakota—also served as administrator for the entire initiative which, in time, became known as the Tribal College Rural Systemic Initiative. A separate project in the Four Corners serves tribes in the southwest.

The Legacy of Isolation and Distrust

Every Rural Systemic Initiative serving tribal communities is unique. But many of the challenges and successes of the Tribal College RSI can be told through the story of reform on the Flathead Reservation of Montana where Cajune teaches. Administered by Salish Kootenai College—one of the nation's largest tribally controlled colleges—the Salish Kootenai Rural Systemic Initiative extends over a scenic 1,250,000 acre reservation and serves seven public school districts and one tribally-controlled secondary school.

Located north of Missoula and south of Glacier Park, the reservation capitalizes on tourist traffic with small casinos and a large lakefront resort.

There are also an assortment of small tribally owned businesses, including two technology firms, SK Electronics and SK Technologies. Logging, ranching, tribal government, and the service economy provide more jobs. Aside from a few trailer parks, poverty is not immediately obvious along Route 93, the reservation's main highway; indeed, many homes and condominiums around the lake are distinctly upscale. Unlike many western reservations, it is served by well stocked supermarkets, fast food restaurants and a newly built Wal-Mart.

But the Flathead Reservation is a divided community. Like most western reservations, a large percentage of tribal land was declared "surplus" in the late nineteenth century by the federal government and opened for homesteading. Today, 45 percent of the land inside the reservation is owned by non-Indians and now remains outside tribal jurisdiction. As a result of this "checkerboarding" of land ownership among western reservations, Indians are sometimes a minority within their own nations. On the Flathead Reservation, only about half of the residents are members of the reservation's three confederated tribes and Indians are a minority within the reservation schools. Within Polson, the reservation's largest town, less than a quarter of students are tribal members. There is, however, a significant population of first and second generation tribal descendants as well as representatives from fifty-five other tribes due to the presence and programs of Salish Kootenai College.

Although Indians and non-Indians are neighbors, there is a deeply entrenched climate of distrust between both. "There is a hundred years of hurt," acknowledges Steve York, non-Indian principal of a Polson elementary school and lifelong resident of the reservation. On the Fathead Reservation, anger is still expressed over a proposal by a former Polson mayor to secede from the reservation. In recent decades, conflict between Indians and non-Indians often focuses on the control of natural resources—such as water, timber, and fish—and touchy legal issues over, for example, the right of tribal police to arrest nonmembers. Asserting political authority is part of each tribe's maturation as self governing nations, says Germaine White from the tribe's Natural Resources Department. "But now we're called uppity Indians. It's just like the Jim Crow South." Although each Tribal College Rural Systemic Initiative site is small—most serve dozens, not thousands, of teachers—the challenge of reform in these settings is as great as, and possibly greater than, initiatives in Appalachia, Texas, or any of the other major regions served. Here, tribal colleges must break a deeply entrenched culture of silence and, in some cases, build rapport with

communities that have, in the past, expressed strong resistance to the tribe's vision for culturally-based education and greater political empowerment.

Building Bridges and Focusing on Culture

This climate of suspicion is a significant—perhaps the most significant—barrier to reform within many of the tribal college RSI sites. While other Rural Systemic Initiatives were quickly embraced by schools and teachers ready for change, tribal initiatives began in a climate of distrust and bad feelings, according to Roger McClure, director of K–12 programs for the Salish Kootenai RSI. "Despite the fact there was a defensive posture with the tribes and the non-Indian population, which included the school districts, we were able to bridge this gap by going directly to the school boards, administrators and teachers in all our reservation K–12 school districts," he says. The first job was to build relationships, according to Joyce Silverthorne, "We are trying to work with teachers, gently but persuasively. It's a courtship." Here, progress must be measured incrementally and even small inroads are significant.

At Salish Kootenai, outreach began with development of a steering committee of approximately three dozen teachers and tribal educators. Much like the Teacher Partner meetings in Appalachia, these gathering were an opportunity for networking among teachers and a chance to discuss the academic needs of Indian students. The focus was on peer support: Teachers often took responsibility for leading discussions and introducing resources—from web sites, CD-ROMs, and packaged curricula. Regularly published newsletters kept teachers up-to-date on future meetings and professional development opportunities statewide. A well-stocked resource library, which now overflows into a spare bathroom, gave teachers access to everything from FOSS Kits—an integrated science curriculum used throughout the Rural Systemic Initiative—to the highly popular StarLab portable planetarium.

Through these monthly gatherings attitudes did begin to change—and more quickly than many thought possible. Regina Sievert, a former teacher at the Two Eagle River Tribal school who now directs the related NSF-funded Leadership Development for Master Teachers Project at the college, saw firsthand how early resistance turned to strong support. The first response from many teachers was, "'I cannot do this,'" she says. Few believed they could serve the needs of Indian students without angering the dominant non-Indian

population. The teachers complained: "'I'd have parents calling me. I'd have my superintendent and my principal breathing down my neck.'" Now, she says, many of these same teachers "are leaders in the RSI Steering Committee. They're the ones going out and developing new courses—not just new aspects to their courses—but entirely new courses, with [the needs and interests of] Indian students in mind."

At Polson High School, for example, science teacher Dan O'Brien was funded by the RSI to attend a week-long forensic science program at the University of St. Louis. He came home and created what may be the first high school level forensic science course in Montana. Why forensic science? Because it's real science and high school kids—including the Indian students—think it's cool. "We were high on the wave of CSI shows," says O'Brien. Using the semester-long forensics class as a "lure," O'Brien paired it with zoology in the fall. "We never said [the students] had to take the fall course to be in spring forensics. But they inevitably did." The result is record Indian enrollment in two advanced science classes. "We've had two packed classes every year and we've had very high representation of Native kids in there, which was our goal."

In this and other classes, the goal was not only to make math and science interesting, but to also make it more culturally relevant. In the era of self determination, the goal of education is to graduate students who are proud of who they are, can keep traditions alive, and feel responsible for the future of their nations. Higher academic achievement (as measured by retention and test scores) is important, but not the only goal. Academic excellence through culture is the real objective.

To some, a culturally-based curriculum implies a preoccupation with the past—sitting around a camp fire, tanning hides, and telling stories. Traditional skills and stories do have value, but this simplistic portrayal misses the real purpose of culture in any society. It is not sentimental or stagnant, but a necessary foundation for the future. "Tribes are charged with the stewardship of a land base," says Cajune. "With technology today, tribes are utilizing twenty-first century technology to inform and assist that stewardship. But there are bodies of [traditional] knowledge and ways of knowing that are also now considered valid and important." Blending both in the curriculum is the modern definition of cultural sensitivity.

Examples of this culturally-based approach to education are found throughout the reservation's schools. At Polson's Linderman Elementary School, teacher

Mary Larson turned her unit on the life cycle into a study of the reservation's ecology. Setting aside textbooks, her third graders conducted fieldwork at a tribal research station on Flathead Lake. Bugs were collected in the riverbed, then all were invited into the scientists' lab. "We looked under microscopes, we drew pictures, and learned about may flies, catalpa flies," says Larson. "The kids loved it." Abstract concepts came to life and children focused on the ecology of their own community. No less important was the opportunity to see where and how scientists work. For a tribe that must manage a diverse ecosystem, the need for scientific expertise will only grow. Future leaders may come from this class.

In a related project, the Rural Systemic Initiative, in collaboration with the tribe's natural resources department, funded development of a reservation-wide curriculum in river ecology. Students first engaged in a detailed study of a nearby stream—cataloging the various plants and animals that live in the water. Then, with aquariums from the RSI and fish supplied by the tribe, they reproduced this environment in classroom aquariums. Keeping the system healthy was the next challenge. By testing and recording how the aquarium deteriorated and how it could be restored to health the students learned about the dynamic life of even the smallest mountain stream. "Interestingly, many of the students felt compelled to go back and clean up the creek," says Germaine White, who helped coordinate the project.

Back at Polson High, Dan O'Brien developed his own unit showing just how harmful careless human intervention can be on the reservation's ecology. Twenty five years ago, O'Brien recalls counting 650 bald eagles in nearby Glacier Park on a single fall day. The eagles were thriving because their food supply—principally Kikoanee Salmon—was also robust. "Back then the fishing limit was fifty salmon a day," he says. "The joke was you could cross the spawning streams on their backs, they were so thick. They talked about opening up a cannery on the reservation." But then, "it all collapsed." Between 1985 and 1988—three short years—the number of salmon went from a record high to zero. Not a single Kikoanee Salmon remained in the Flathead Lake ecosystem. Why? "Somebody got a little greedy, didn't do their science, and wanted to get even more salmon," he says. And, with their demise, the number of bald eagles also shrank. On a recent fall day he returned to Glacier and saw one eagle.

Learning this lesson—documented with charts and graphs—is a vivid illustration of an interdependent ecosystem. For students, the assignment is to

analyze the data and "write a detailed, step-by-step, cause-and-effect description of exactly why this food chain became unstable and finally collapsed." But O'Brien stresses that it is also cultural. "What we have here is a very culturally relevant situation. It's their home and their industry collapsed. They have a vested interest in seeing that the animals and plants remain the way they want them to."

To support and encourage this work, the Salish Kootenai initiative—like many other Tribal College RSI sites—provided tangible support through annual mini-grants to teachers. Funds supported the purchase of supplies needed to develop new classes and projects. A minigrant award to O'Brien, for example, paid for the purchase of human blood samples for the forensics "crime lab." Equally important were RSI-sponsored professional development workshops—on the Flathead Reservation they are called Pupil Instruction Related (PIR) days—and funding for teachers to attend workshops statewide and nationwide. With this kind of support, teachers break out of the isolation and climate of low expectations that is such an impediment to reform in rural schools.

Changing the System

By making classes more dynamic and culturally relevant, more Native students are enrolling in advanced level math and science classes and are performing at a higher level. "That's my gut feeling," says O'Brien. This is good news but, ultimately, it's not enough. Tribal educators say the dilemma of high dropout rates and low academic achievement cannot be solved through curricular reforms alone. "There are things you can do with an integrated curriculum, but don't expect that to solve all the other issues because it's way more complicated than that," says Cajune.

To promote academic achievement for Indian students, educators also need to focus on barriers that are embedded in school policies. Despite his good work, for example, O'Brien believes one of the most serious stumbling blocks for his Indian students is absenteeism. Students who leave school to attend cultural events, such as the annual "jump dance," or a relative's funeral easily fall behind academically and may simply not return. Other students slip between the cracks when they change schools; one girl relocated seven times during the 2004 school year as she moved around the reservation from one family member to another.

Addressing this kind of problem requires a district-wide response—but coordination is difficult to achieve. Many reservation RSI leaders, including those on Flathead Reservation, note that each school district follows its own calendar. With leadership from the Salish Kootenai College RSI, however, key policy changes have been made. For example, all of the reservation's K–12 schools now have a cultural leave policy that allows students to attend traditional tribal ceremonies without penalty. The schools also adjusted their school calendars at Christmas vacation to allow time for traditional jump dances that are held the first week of January.

In this setting, the tribal college RSIs are stepping forward and providing leadership in the development of coordinated, reservation-wide educational policy. On other reservations, breakthroughs occur when the tribal college acts as matchmaker; on the Turtle Mountain reservation, for example, Turtle Mountain College President Carty Monette started hosting a monthly breakfast with superintendents of the small reservation's public, private, and parochial schools. Remarkably, it was the first time they had met together for business. Monette and his RSI program continued to work with their K–12 schools and they have now adopted a common school calendar, something the Salish Kootenai College RSI site is striving to achieve.

Accepting this kind of involvement—and even leadership—from a tribal college is new, and is itself evidence of success. Superintendents who would not return phone calls from tribal educators when the RSIs began now know that partnerships with the tribe are beneficial and necessary. At Linderman Elementary School, for example, Principal Steve York speaks with gratitude about the influence of the tribe's college. "Salish Kootenai College is providing an important service," he says. "They are respected for that. They should have a leadership role on the reservation and they are stepping up to the plate."

With growing confidence, tribal leaders are becoming advocates for Indian students—both inside and beyond the classroom. Many tribal college RSIs helped establish local chapters of the American Indian Science and Engineering Society (AISES), and encouraged student participation in Native science fairs. On the Flathead Reservation, teachers active in the RSI Steering Committee also take responsibility for organizing a reservation-wide math and science Olympiad. Native students from elementary to high school gather each year for a day of exhibitions and competitions—building spaghetti bridges, competing in egg drops, and constructing their own robots, among dozens of

other challenges. All this creates time and space for Indian students to develop interest in math and science disciplines.

But this is only the first step. Empowered by these successes, RSI leaders look forward to exerting even more influence in school systems. Many tribal leaders believe more can be done to "Indianize" schools—not just for Indians, but for all students through appropriate inclusion of Indian units in all curricular disciplines. They look forward to a day when Native knowledge in such fields as botany, astronomy, and history will not be dismissed as "folklore," but will, instead, will be part of society's larger body of knowledge. "People with different ways of knowing have huge contributions to make," says Cajune. There is no reason, for example, why the study of medicinal plants cannot be a unit in the science curriculum. Assuming that the knowledge of a tribal elder is not real scholarship impoverishes the nation. By infusing this knowledge and these perspectives in the education system, all students—Native and non-Native—are enriched.

To help build appreciation for this approach to Native scholarship, the Salish Kootenai RSI has sponsored cultural programs and summer camps for teachers, providing a brief but intensive immersion experience in the traditional values and skills of the tribe. Tipping their hat to the Alaska RSI, which pioneered the development of cultural camps for educators, RSI leaders in the Lower 48 say the camps they sponsored have accomplished nothing less than a change of heart among some teachers. "Now I understand," said one teacher after spending a week in the wilderness with tribal elders. The benefit is not only for Indian children, but all students.

Measuring Success

At the conclusion of the RSI, the centuries-old achievement gap remains. On all reservations, dropout rates are higher than the national average, often by wide margins. On the Flathead Reservation, tribal education leaders say the non-completion rate may exceed 50 percent. That's what Department of Education Director Joyce Silverthorne found by carefully tracking a cohort of students from first grade to high school; of eighty-eight tribal members who entered school as first graders, she says, only thirty-three left with a diploma. A few may be on "the five-year plan" and graduate within a year or two—but the majority are lost in the pipeline.

Data only tells part of the story. Even students who do persist may leave with limited academic expectations and low self-esteem. Steve York, the Polson elementary school principal, sees firsthand what is well documented in the research literature: that Indian children arrive at school in first grade just as eager and just as capable as any child. But something happens between fifth and seventh grade, he says; grades slip, indifference grows, expectations decline. Putting all the blame on schools is misplaced; in some cases, they are an island of support and stability for children. Teacher Mary Larson describes the emotional weight some of her students must bear—alcoholic parents, broken homes, jailed fathers. On her own, Larson started a support group for a group of girls from her school, but cries describing the struggles some must overcome. Intellectually, she knows she can't change the lives of every girl, but mourns every time a girl threatens to give up.

No single initiative can overcome all these barriers. But across the RSI sites, there is a strong belief that the initiative accomplished a great deal. It succeeded, they say, because, it helped eliminate the deeper—and truly systemic—barriers to needed reforms. In a climate of distrust, the tribal colleges nurtured communication between tribes and schools and helped establish the right of tribes to participate in the debate over school reform. "One of its greatest contributions to Indian Country is that it raised the level of discussion [about math and science education] and let local educators become part of the discussion," says Carty Monette, principle investigator of the entire Tribal College RSI. "It brought them to the table."

Roger McClure makes a similar point:

> Once we had all the reservation education stockholders at the table, differences began to dissipate and true partnerships were developed. These partnerships remain and we hope to secure funding to continue our work with them. Reservation educators, both tribal and non-tribal, have come to realize we can accomplish more by working together to effect systemic school reform. The schools also have become and remain grateful for all the professional development and resources that RSI, through the auspices of NSF, has been able to provide to them over the years. What they have learned to appreciate is that a rising tide lifts all ships and that the students in their

> care are better off today because of the contributions of the Rural Systemic Initiative. We at SKC and the Tribes are better off today because they have given us the opportunity to bridge the gap.

No less important, the Tribal College RSI helped raise academic expectations within tribes. One of the greatest barriers to reform is not weak school systems, but a defeatist attitude among tribal members who acquiesce in mediocrity. At the start of the initiative, says Monette, "we found out that a lot of schools didn't have any science majors or math majors teaching science or math . . .We found that some high schools and middle schools didn't even teach algebra." One survey of teachers working in schools targeted for systemic reform found that only three were even aware that national science and math standards had been developed. Yet there was a debilitating conviction within many reservations that nothing would change.

On some reservations, this sense of powerlessness was a serious barrier. At Fort Berthold College in North Dakota, Fort Berthold RSI Program Director Jill Gillette attended community meetings and talked with leaders who agreed with her that "the schools have to change." But she was challenged as well: "This change has to be change that is 'really done,'" they told her. It's not enough to hold meetings, complete surveys, and write reports that end up "shelved in the funding agency and the school." The first response within the tribe was, "we'll believe it when we see it."

But when tribes ask for more, they start to get more. By helping teachers create new courses, encouraging schools to add advanced classes, and introducing curricula that is cutting edge, not second rate, expectations began to grow within schools and communities. More must be done, but the floor has been raised higher. This is the kind of solid, incremental progress that is driving the whole self determination movement forward.

Most importantly, the Tribal College Rural Systemic Initiative helped advance a larger movement for the development of tribes as self governing nations. As a first step, the many curricular reforms that were implemented—literally hundreds of new units and courses across the seventeen sites—helped bridge the centuries-old gap between schools and the communities they served. For the first time, many students were shown that education is compatible with Indian culture, and essential for the development of tribal nations. The

value of the Tribal College RSI is not only that it helped tribes reach a goal. Instead, it also helped them define their goal. What does Indian leadership in education look like? What is a culturally-relevant curriculum? Through this initiative tribes were given an opportunity to move beyond rhetoric and take control of education reform so that—year-by-year and student-by-student—they will move closer to the day when tribal nations are the kind of economic and culturally-vibrant communities that all members hope they will be.

Innovation Across Indian Country: Projects from Other Tribal College Rural Systemic Initiatives*

Minigrants

Minigrants are used at many Tribal College RSIs to encourage the development of projects and courses within reservation schools:

- The Fort Peck RSI awarded a minigrant for an innovative middle school hydroponics project. Students and parents designed and built a garden of native plants and grew tomatoes raised from seeds stored in various locations—including the International Space Station. Tomato plants were later dissected and examined under microscopes.

Cultural Integration

All tribal college sites stressed the integration of culture within the curriculum of reservation schools. By sponsoring culture camps, developing culturally-based units and courses, and hosting community forums, every tribal college successfully promoted their tribe's culture and language. For example:

- Dull Knife College worked extensively during the 2002–2003 year with the Chief Dull Knife Cultural Curriculum Committee to address integration of culture in local schools. The committee consisted of college

* Based on summary papers prepared by Tribal College RSI sites

staff, K–12 teachers and administrative staff, students, community elders, and community members. As a result of the collaboration, regional schools offered courses, delivered by college staff and qualified professionals, for teachers in Native American Studies during the school year. Training in Cheyenne history, culture, and language was provided.

Science Fairs, Camps and Parent Days

Most Tribal College RSI sites supported or sponsored science fairs and parent nights to encourage more Native participation in inquiry-based science projects and build support for math and science within the home and community:

- Little Big Horn RSI on the Crow Reservation sponsored four Summer Science Camps for grades K–5. Each focused on a different theme: Taking Care of Mother Earth; Pollywog Pond; Bugs, Beetles, and Butterflies; and Animals and their Young. Meanwhile, a Cyber Rez Camp focused on developing computer skills for older children and a Youth Camp stressed respect for culture and language. Nearly 100 children participated in the two-week camps.
- Candeska Cikana RSI hosted weekend enrichment programs for students. Saturday academies focused on physics and robotics. Sunday academies engaged students with projects using math, chemistry and biology. The focus of both was on cooperative learning and problem solving. This RSI also sponsored an after school tutoring program in math and science.
- Fort Belknap College sponsored Family Math Nights, attended by approximately 20 percent of the elementary school students and their parents. Projects from the Dodson Family Math program were used to strengthen basic math concepts. In addition, the college sponsored parent forums to discuss Indian education and state education policy.

Policy Change

At the policy level, the Tribal College RSI helped create more trusting and productive relationships between tribes and regional school systems. In many cases, the tribal college helped overcome decades of silence and distrust that weaken relationships between school administrators and tribal members. For example:

- Turtle Mountain RSI played a leadership role in developing a common calendar for schools serving the Turtle Mountain Reservation.
- Wind River negotiated a common calendar among schools for RSI training.
- Little Big Horn RSI sponsored a "Crow Education Summit" to discuss the impact of No Child Left Behind. Participants included both tribal and state education leaders.

Data Gathering

Across Indian Country, there is surprisingly little data on the academic achievement of Indian children. Developing an accurate picture of education within a reservation is difficult when resources for data collection are limited and children often attend a variety of different schools—including public, tribal, and parochial.

- Responding to this gap, the Turtle Mountain Rural Systemic Initiative created the Turtle Mountain Center for Education Statistics. Through a collaborative effort with the OIEP and Turtle Mountain area schools, a comprehensive system of aligning the Bureau of Indian Affairs-funded schools in North Dakota was established. For the first time, a single center is collecting, analyzing, and retrieving data about all Indian children from this small, but diverse, reservation. Now tribal educators can identify with accuracy where reforms are needed and also build support for systemic reform within the community.

Standards-Based Math and Science Curricula

Every tribal college RSI site supported adoption of standards-based curricula within their region's schools. Most offered:

- Free access to books, curricula, and science kits through an RSI resource center. Most stocked sample FOSS kits, the StarLab portable planetarium, and math curricula (such as Trailblazers or Everyday Math). Many also provided books and culturally-based material for teachers and participating schools.
- Professional development training in use of FOSS kits and other curricula.


ARIZONA
NEW MEXICO
TEXAS

New Mexico Tribal Coalition: A Place for Pueblo Values

Native American communities in rural New Mexico were also served by the Rural Systemic Initiative. Here, the New Mexico Tribal Coalition, managed by the Santa Fe Indian School, worked with twelve Bureau of Indian Affairs-funded schools serving Indian children from each of the state's nineteen Pueblos. To strengthen math and science instruction for the 2,500 students enrolled in these schools, this RSI promoted the adoption of community-based education, with Pueblo values placed at the heart of the curriculum. This approach to reform, called Circles of Wisdom, reflects the simple but still revolutionary idea that Pueblo communities know best what their children need to learn.

"Community-based education starts with a sense of respect for our community," says Santa Fe Indian School Superintendent Joseph Abeyta. "We listen to community members with the understanding that they are the experts in educating Pueblo youngsters." This new curriculum must also be aligned with New Mexico state standards. However, state mandates are only the starting point; RSI leaders say their expectations for Pueblo students are higher and encompass more than academics. "The New Mexico state standards—those should not be the ceiling for us," according to New Mexico Tribal Coalition Co-principal Investigator Louise Naranjo; "they should be the ground level."

The focus of the New Mexico Tribal Coalition is to increase content knowledge and encourage inquiry-based approaches to teaching through professional development. Teacher surveys, with self-reported data, demonstrate that teachers lack the confidence to teach much of the math and science content

required by the state. By building a stronger foundation of knowledge in math and science, teachers have the confidence to experiment, raise expectations—and draw on the strength of Pueblo culture.

To promote classroom reform, the focus is on mutual support between schools. The principals of the New Mexico Tribal Coalition schools are all members of the Coalition of Educators of Native American Children (CENAC). Monthly meetings are held, with sites rotating among participating schools. Reflecting Pueblo values, decisions are made by consensus and leadership is shared. Working collectively, CENAC has successfully leveraged funds through grants to serve the needs of Pueblo children and promote initiative-wide reforms.

Evidence of Change

The impact of the coalition is seen, first, in new approaches to assessment. Teachers moved from thinking of assessment as one big comprehensive test to creating and using multiple forms of assessment. It became not an examination, but "a collection of student knowledge." Teacher researchers also began including parents in assessment feedback. They eventually decided it was important to include students in the reflection of their own learning and began using assessment to increase reflection and learning. This is the foundation of inquiry-based learning and addresses some community-based education goals.

New approaches to the teaching of math and science were also devised. Each school developed its own approach to curricular reform, but partnerships between schools strengthened the work of each institution. One example of this collaboration was the MathLand study group, which paired two CENAC schools with a non-CENAC school. Teachers from Navajo Elementary, a public school in Albuquerque successfully using the MathLand program, mentored two Pueblo schools struggling with its implementation. The study group, which met six Saturdays in 2004, discussed samples of student work, assessment and teacher strategies, and identified useful resources. The public school modeled lessons and all teachers brainstormed solutions to obstacles.

In addition, the New Mexico Tribal Coalition sponsored annual science fairs among participating schools. Preparing for the exhibition encouraged teachers to include more project-based teaching strategies, while the judging form reinforced the goals and objectives of science standards. The emphasis on

Native science projects and presentation of a Native Scientist award means that culturally based education was encouraged—and rewarded. Many science fair winners went on to participate and place in state and national science fairs.

A focus on cultural knowledge was also stressed in other ways. Through a course called Native Applied Brain for Science, teachers were shown how Native science abounds in all Pueblo communities and is a natural process for learning. Mimicking traditional approaches to learning through storytelling and demonstration, the course paired a cultural/community expert with a Western scientist for learning activities, such as pottery making, hide tanning, architecture, and agriculture.

Teacher reflections revealed increased attention to the development of critical thinking skills and greater use of experimentation and the scientific method. Other teachers reported that the culturally-based activities provided deeper appreciation of the spiritual aspects of education and allowed teachers to incorporate Native language in lessons. Interestingly, the experience also made teachers want to learn more about Western science. Collectively, teachers are beginning to see the connections between Native ways of knowing and Western thought and gaining a new perspective of teaching science by using community knowledge.

Lessons Learned

Ideas and Inspiration for Communities, Teachers, Administrators, and School Boards

Lessons Learned: Ideas and Inspiration for Communities, Teachers, Administrators, and School Boards

What can all rural schools learn from the work of the Rural Systemic Initiative? This final section focuses on projects almost any rural school can implement, often at little expense.

On their own, these activities are not enough to overcome the achievement gap. Even the well-funded Rural Systemic Initiative struggled to overcome long-standing barriers to reform in rural education. Equity will not be possible as long as rural schools are inequitably funded. Turnover rates in highly rural schools will remain high as long as salaries remain disproportionately low. Schools serving persistently poor rural regions will always be treated as second class institutions when excellence is defined narrowly with a one-size-fits-all orientation. Individually, teachers and school leaders can do little on their own to overcome these hurdles, at least over the short term.

But it is also true that teachers and administrators, more than legislators, shape the climate within individual schools. On their own, they cannot change the structure of American education, but good schools and engaged students still exist even in unlikely places precisely because teachers, administrators, and staff have learned how to create havens of hope and excitement. The following strategies, gleaned from successful RSI sites, are meant to offer inspiration for practicing educators and may be a starting point for truly systemic reform within school districts, across states, and—possibly—within the nation.

The focus is on classroom-based activities and tightly focused school or district-wide initiatives. But reform requires more than projects. It is, more deeply, built on a philosophy of education that respects the integrity of rural communities. The following ideas are part of a larger effort to define rural education not by its weaknesses, but by its strengths. Guided by this new perspective, the ideas offered here are only a first step.

Strategy One: Develop Teacher Leadership

As a group, teachers are altruistic and most enter their profession eager to make the world a better place. But once inside the classroom, many discover how little authority they really have. In American public schools, teachers are rarely considered innovators or leaders. New teachers quickly learn that their job is to implement policies shaped by others, especially in the growing climate of standards-based education. "It's not up to you what to teach every day," summarized one New York teacher in a recent *New York Times* story. Too often, the result is dissatisfaction and burnout. The most idealistic teachers are, not surprisingly, among the first to leave.

Feelings of powerlessness are not new. More than twenty years ago, the Carnegie Foundation for the Advancement of Teaching, in its influential report on the American high school, described a climate of professional isolation and apathy that many teachers still recognize nearly a quarter century later. "The combination of the self-contained classroom and a heavy schedule gives teachers few opportunities to share common problems or sustain an intellectual life," it found. One teacher, when asked with whom he discussed his professional concerns, responded, "My wife." The report concluded:

> We cannot expect teachers to exhibit a high degree of professional competence when they are accorded such a low degree of professional treatment in their workaday world. Nor can we expect to attract the best and brightest into teaching when they have had twelve years of opportunity to observe firsthand the daily frustrations and petty humiliations that many teachers must endure.

Subsequent reports and "blue ribbon commissions" offered strategies for improving the status and authority of teachers in America. Some progress has

been made; salaries are higher in most states and more planning periods are scheduled during the school day. But the status of teachers remains low and classroom autonomy may even be eroding in the twenty-first century. What inhibits the kind of deeper reform advocated by the Carnegie Foundation and many other education leaders? Why are teachers still at the bottom of the pecking order?

"What I learned is how really powerful the design of a system is," says Sue McCormick, superintendent of schools in Polson, Montana, which serves part of the rural Flathead Indian Reservation and participated in the Salish Kootenai College RSI. Public school systems, like health care and political systems, resist change, especially at the grassroots level, she says. School reforms that stress teacher empowerment so often fail, she believes, because public education is not structured to support what she calls "collegial research"—planning and collaboration among teachers. Educators may talk about the value of "bottom-up" reform—but that's not how school systems are structured. Instead, she says, the system is built on a nineteenth century factory model that purposely disempowers teachers. Teachers are isolated from other teachers; each orbits in his or her own classroom. "I know we've made some progress trying to change," says McCormick, "but it's a very strong system."

This top down approach doesn't fit the needs of the twenty-first century. If schools are to truly meet the needs of every student, then teachers must be more, not less, empowered. They must not simply implement curricular reforms, they must also become reformers. They must be encouraged to conduct research, innovate, and experiment every day of the school year. And they must be given the training and skills needed to play a more empowered role in school reform.

But what can teachers and administrators do—now—to promote reform even within the current system? Is it possible to empower teachers and achieve bottom-up reform without tearing down the existing walls of American public education? Finding ways to support innovation within classrooms and individual schools was a key goal of the Rural Systemic Initiative. There is no one right way of accomplishing this goal of teacher empowerment. However, Rural Systemic Initiative sites emphasized three key strategies:

1. ***Identify and nurture a core group of master teachers willing to lead local school reform.***

In most schools, there are teachers who are recognized and respected for their experience and expertise. If leaders are not present, the process of reform begins by nurturing a cadre of leaders. "If a campus does not have clear leaders in mathematics or science [areas targeted for reform in the Rural Systemic Initiative], they will have to invest time and money in developing a willing teacher's knowledge and skills," says JoAnn McDonald, director of the South Texas Rural Systemic Initiative.

This was the challenge facing leaders in the Delta Rural Systemic Initiative where low salaries and extremely difficult working conditions created a climate of low expectations and instability among the teacher corps. Teacher leadership was not emerging simply because demoralized faculty were only looking for a way out. Ironically, RSI training was, at first, viewed by these teachers not as a way to strengthen schools, but as an opportunity to find better work elsewhere. With RSI training, teachers could more easily find a job in a higher performing district. Delta RSI leaders realized that their initiative could, inadvertently, contribute to the climate of instability.

To address this dilemma, Delta RSI leaders chose to work first with a small corps of experienced teachers—those with established leadership skills and a commitment to their school. While it is tempting to focus professional development on struggling teachers, Delta RSI leaders realized they must first create islands of hope and stability by focusing on teachers with an established commitment to working in difficult schools. The first step was to develop a Leadership Academy for master teachers and less experienced but committed "lead teachers" from each school.

In the end, the goal was not simply to train more confident instructors, but to build a core of teacher leaders able to mentor peers. Identifying and working with teachers committed to taking responsibility for innovation and reform within a school was the starting point of the Delta RSI.

2. ***Provide teachers with the time and resources needed to collaborate.***

Encouraging teachers to innovate has little meaning when they are expected to lead reform during their limited free time. Some teachers will give up lunch hours, evenings, and weekends for a worthy cause, at least for a while. But any reform that requires indefinite uncompensated personal sacrifice is not going to succeed.

"The most important thing is. . . to make sure that the lead teachers have time to work with other classroom teachers," says McDonald. But she acknowledges that school leaders are reluctant to reduce teaching loads. Few RSI sites were able to negotiate significant release time for teachers. Small schools, especially, can't afford to lose a single teacher—especially when it might be the school's most senior math or science instructor. Only in Appalachia, where RSI funds were used to reimburse schools, were a significant number of lead teachers granted part or full time leave to work as mentors.

However, McDonald proposes that on-site staff development and other team-led initiatives are still possible even without additional funding and outside consultants through a model of staff development like Lesson Study where teachers work together to plan and implement high quality research lessons as an integral part of the school day (see the following Web sites for more information on Lesson Study: http://www.tc.edu/lessonstudy/ and http://www.schoolrenewal.org/strategies/strategies.html). "Another thing that lead or master teachers would do is to observe other teachers and allow other teachers to observe them teaching," says McDonald. Of course, there would be opportunities to sit and discuss what they learned. "Lead teachers could conduct demonstration lessons where they model the use of materials, technology, or promising strategies." Ultimately, the goal is to integrate this relationship into the regular school day.

3. ***Finally, teacher leaders should define clear and measurable goals.***

If teacher teams are not guided by a clear vision, reforms have a tendency to be piecemeal, focusing on small gaps in the curriculum, for example, or a sudden but short-lived enthusiasm for an idea promoted in an educational journal. Instead, reform requires a long term plan and the ability to measure change over time. The first task of the teacher team should be to study current conditions of the school and the needs of students. "The team can use student performance data and other related data to analyze their current science or math program," says McDonald, to "identify weaknesses and to align curriculum with state and national standards."

This was the approach taken by the Coastal RSI where the focus was on empowering teacher teams. There, the first step was to gather a wide range of data about the school—ranging from test scores to parent surveys.

Armed with a comprehensive portrait of their school, teachers then had the information they needed to identify gaps and focus on truly systemic reforms. Director Chuck Blanton emphasizes that without this critical step, many teacher teams would solve small problems (provide training in graphing calculators, for example), while completely overlooking fundamental failures (low achievement among minority students, for example) or yawning gaps in the curriculum (no advanced math courses).

School reform rhetoric always stresses this need for "research-based reform." But the advantage of the Coastal RSI approach is that it offers a richer, more nuanced portrait of each school. Success or failure is measured by more than performance on standardized tests. Schools can incorporate a wide range of data, including affective outcomes, such as a school's relationship with the community and its role in strengthening the local economy. It also puts schools in charge of reform, instead of endlessly worrying about conforming to external mandates. Taking control of reform means taking control of data.

Strategy Two: Promote Community Engagement

Educators often lament the lack of support from parents and community leaders, especially in regions where there is a perceived climate of low academic expectations. In this setting an "us" versus "them" climate emerges; schools are viewed by educators as islands of learning in a hostile sea of disinterest and apathy. In a standards-based climate, teachers feel that the burden of higher expectations rests entirely on their shoulders. They begin to believe they are working against—not with—the community they serve.

In this climate, school reform will languish. Short term academic gains may be achieved by certain narrow measurements (a math or reading test, for example), especially in the earliest grades. But lasting systemic change rarely takes place. The lesson of past reform efforts is decisive on this point: Few schools can permanently maintain academic goals that are not embraced by the community as a whole.

School reform rhetoric often stresses the importance of parent and community partnerships. Too often this leads to narrow, one-way relationships. Parents are considered partners only if they do what schools tell them to do (come to parent meetings, help their children with homework, etc.). The community

is supportive only when it provides resources to the schools. This work has value. But real partnerships require deeper and sustained collaboration between educators, parents, and community leaders. School leaders must not assume their job is to gain acquiescence from parents and civic leaders for their reform agenda. Rather, they must be willing to listen and respond to what serves the larger needs of the community.

In some communities, this may lead to significant changes within schools. Schools may find it necessary to change what they teach and how they teach. They may add services and programs that appear to take time away from academic work and test preparation. None of this is easily accomplished. Often, the pressure to achieve immediate gains on standardized tests makes the necessarily long-term process of community involvement seem cumbersome and unrewarding. Why spend time and resources on activities that are not "measurable," and will not yield gains on this year's math test? But the long term impact is significant. Only by cultivating this climate of support with the larger community will schools be able to achieve gains that are lasting and build an education system that strengthens the communities they serve.

Most Rural Systemic Initiative sites recognize the importance of building partnerships with communities. In south Texas, RSI leaders worked with local schools to engage parents who are, in many cases, recent arrivals from Mexico and have limited English skills. These parents have enormous faith in the power of education, but are also hesitant to reach out to schools and teachers. Once encouraged to take part in the work of the school, relationships blossomed. In Alaska, meanwhile, the challenge was greater. Here schools have to break through the barrier of distrust and apathy dividing Alaska Natives from the public school system. The goal was to bring Native leaders into the process of systemic reform and encourage schools to incorporate the traditional knowledge and values that still live within Native villages.

Collectively, the lesson of these and other RSI sites is that schools can promote academic success by transforming their relationships with their communities. The success of their efforts suggest a three-part strategy for greater community engagement:

1. ***Seek out disenfranchised constituents and bring them into the process of local school reform.***

   This was the guiding principle of the Alaska RSI—and the key to its

success, argues Ray Barnhardt, one of the project's principle investigators. For the first time, Alaska Natives were involved in shaping their own reform agenda and finding ways to integrate Native knowledge into the curriculum. Much more needs to be done, but after just a decade of work, a new attitude toward education is beginning to emerge within Native communities. Elders are finding that their knowledge is respected by the young and that their ideas are welcomed by new teachers. Community leaders are taking more responsibility for supporting schools and encouraging their children to value education. State education leaders see Native leaders as allies, not enemies of reform.

What made all this happen? The RSI-sponsored publication, *Alaska Standards for Culturally Responsive Schools*, was widely distributed and well received. But no less important, stresses Barnhardt, was Native leadership in this and other projects. "The process of producing [the guidelines] had as much impact on the education here as anything else," he says. For the first time, Native knowledge was honored and Native leaders were given responsibility for shaping education policy goals. For the first time, public education is becoming (at least on the margins) a seamless part of community life, not an alien institution.

Consultation with the community cannot be a half hearted political process. The Alaska RSI succeeded because its leaders genuinely believe that schools are enriched when Native knowledge is incorporated into the curriculum, when teachers learn from elders, and when traditional values are expressed in school. The involvement of the community and the integration of traditional knowledge is not a "concession" to the community, but an opportunity the schools should eagerly embrace.

To succeed, community engagement also requires patience. Barnhardt is reluctant to offer a specific strategy for bringing community leaders into the process of school reform. The Alaska RSI is "a model, not a template," he says. Each community must create its own set of initiatives and goals. But the work of Alaska RSI staff shows that educators must be willing to listen, not dismiss complaints, and avoid jumping to quick-fix solutions. I repeatedly attended Alaska RSI-sponsored forums where elders were encouraged to speak. In most cases, there was no formal agenda and most ended without a clear solution, yet—over time—these gatherings helped nurture a climate of trust and understanding that led to clearly focused

and well-received projects. By its example, this is the lesson from Alaska: Encourage community members to talk about what they know, develop educational activities that incorporate local knowledge, and never see the conversation as finished.

2. ***Support families, not just students***

It is widely understood that parent involvement is important. "Reams of research and anecdotal evidence show that the most effective school districts have a strong partnership among the schools, the community, and the home," write Hobart Harmon and Ben Dickens in a 2004 issue of the *American School Board Journal*. No Child Left Behind even requires states and school districts to develop strategies for increased parent involvement.

Unfortunately, rural schools too often push parents out of the way as they rush to meet academic benchmarks. Parent involvement is treated as a time consuming distraction from the more urgent task of academic work. "Classrooms in too many rural schools no longer have time to accommodate the visits by 4-H leaders or other community-oriented groups that once had ready access to the school," write Harmon and Dickens. Parents begin to believe that academic achievement is a teacher's responsibility, "an internal problem of the school," not a shared responsibility.

But several RSI sites believed the foundation of academic achievement could not be built without greater parent involvement. In South Texas, for example, the work of the Colonias Family Project was an integral part of the larger school reform effort. Administrators and RSI staff based in the Lyford School District north of Harlingen linked the high level of community support and high test scores to RSI-funded outreach programs, such as Family Math Nights. On their own, these events help reinforce academic content taught in the classroom. But it is clear that another and possibly greater benefit emerges when parents start interacting with teachers and other parents. The revitalized Lyford PTO, for example, was a direct outcome of migrant parent meetings. As collaboration grows, a sense of common purpose emerges. Teachers know that parents understand and support their work.

All educators express support for parent involvement and most schools have mechanisms for parent involvement—PTOs and parent-teacher

conferences, at a minimum. What Lyford school district and the South Texas RSI offer is a different, richer definition of parent involvement. It recognizes that, in the end, parents are the most important teachers in the lives of their children. Schools happily take credit for the achievement of their students, but the real work of excellence is accomplished at home, and starts long before the first day of school. In Texas—and elsewhere—an exemplary school cannot exist without exemplary families and it serves the interest of educators to build support and confidence among these vital parent partners.

Fortunately, there are many initiatives around the country supporting greater parent involvement. The lesson of the RSI is that it must be more than a perfunctory effort. It is more than newsletters, homework helper Web sites, and occasional pep talks. Instead, it should bring parents into schools and take teachers into communities—not once or twice, but repeatedly. In Lyford and other schools, this is accomplished, in part, by offering a wide range of educational services specifically for parents and the larger community. In these schools, parents can always be found on school grounds—participating in Early Start programs, checking out books in a school library that serves the whole community, volunteering in their child's classroom—among many other strategies. Here, the key question is not, "How can parents help us educate our students?" but: "How can we help parents educate their children?" Finding answers to this question is the first step toward a new relationship.

Building stronger and more complex relationships with parents and communities also provides a strong argument against rural school consolidation. The continuing trend toward consolidation reflects budget concerns, but is more easily accomplished when schools are viewed as nothing more than facilities for the organized instruction of children. This task can be accomplished in any location and the only acknowledged drawback of consolidation is a longer bus ride. But when a school is more deeply rooted in the lives of families—when it is a resource for the whole community—it is less easily uprooted. Opponents of school consolidation often assert that schools provide small rural communities with a sense of identity. Through parent partnerships, they can do even more to develop a sense of cohesion and common purpose in rural America.

3. ***Seek partnerships outside the school that strengthen opportunities for learning.***

Beyond field trips and career day interactions, schools benefit by the active involvement of civic organizations, businesses, and other community resources in the academic work of schools. Building a role for the community within the curriculum allows poor and under-resourced schools to accomplish more with less. The boundary between school and community begins to blur as the whole community becomes a classroom.

Educators and policymakers operate as if schools, alone, are the only educational institutions in the country. But a wide range of organizations also have an educational mission. In most regions there are a wealth of institutions—parks, museums, civic groups, and even businesses—that serve children and communities. Usually, each pursues its work in isolation. The state park hires its own rangers and runs its own educational programs; the local 4-H has its own clubs and meetings; the local orchard sponsors its own harvest festival. Individually, each provides a service to the community. But several RSI sites found that communities can do more to strengthen schools when the expertise of each is shared and linked to the task of education reform.

This is the key lesson of the Ozark Rural Systemic Initiative, where RSI staff built a strong and continuing relationship with George Washington Carver National Monument. By linking the educational activities of this small national park to the science curriculum in the region's schools, students were, in effect, provided with a satellite campus and a cadre of experienced and enthusiastic park ranger/teachers. For small, cash strapped schools, this kind of collaboration is invaluable.

How can other schools build this kind of relationship? Begin by taking an inventory of community resources, suggests Janna Gordanier, project director of the Ozark RSI. "The first thing they need to do is find out what exits in their area that has an educational mission of some sort," she says. Like Ozark, it might be a state or national park. Focus on organizations with resources and skills most useful to the school. "Find out where your mission and their mission match," she continues. A shared commitment to science may be enough to start a conversation. But the next step is the most important. To build a lasting partnership, schools must offer something in return. "You need to figure out how you can help each other,"

Gordanier says. It's no good being a beggar, asking others to do your work. Collaboration succeeds when it serves both organizations.

"In the case of the national park, they were already doing a lot of curriculum development, making lesson plans, things like that," she says. "So we were benefiting them because we were helping them determine how to accomplish what they wanted." Park staff were introduced to standards-based curricula compatible with their interpretive programs. They did not have to reinvent the wheel of curriculum development at a time when so much good material was already available. Meanwhile, the schools gained a partner able to bring scientific concepts to life through field-based programs in botany, chemistry, physics, and other disciplines.

Gordanier urges schools to also seek partnerships with businesses. Many corporate leaders know it is in their best interest to support school improvement, especially in disciplines linked to economic growth, such as math and science. But she senses a growing impatience in the corporate world with the decades-old school reform movement. Businesses are still willing to help schools, but executives want to support projects that are tightly focused and lead to measurable improvement. Feel-good programs are shunned. For better or for worse, business leaders want schools to look and act like businesses. Gordanier recommends that educators approach businesses with brief, jargon-free presentations that focus on the bottom line task of strengthening academic programs.

Strategy Three: Make Place-Based Learning the Foundation of the Curriculum

When a third-grade class on the Flathead Indian Reservation of Montana recently completed a unit on African animals, teacher Mary Larson observed that some of her children worked with greater enthusiasm than others. What made the difference? "Kids who had been to a zoo did more sophisticated projects," she discovered. For them, the animals were real, and they were interesting. For the rest, elephants and giraffes were simply photos in a textbook and the assignment was just one more task to complete.

It's common knowledge that poverty and geographic isolation limit the experiences of students; it is one of the many ways in which rural children are perceived as "disadvantaged." But place-based education takes a very

different approach to learning. Rural children are not impoverished by their rural surroundings, argue proponents. Instead, schools are simply blind to the educational opportunities in their own back yards. Why study elephants in a textbook, for example, when there is a wealth of wildlife in a nearby forest, prairie, or ocean bay? Essential concepts of science (or nearly any other discipline) can be inculcated through experiences available in and around the school yard. Mary Larson found that excitement was shared by all students when she took them to the local biology station.

Place-based education also strengthens communities. For decades, educators have sent a clear message to rural residents that their knowledge and experiences are unimportant. Indeed, the whole purpose of rural school reform in the first decades of the twentieth century was to overcome the perceived ignorance and antiquated habits of rural residents. For Elwood Cubberly, the highly influential Progressive-era reformer of the early twentieth century, the rural school problem was, in fact, a part of what he considered the "rural life problem." And as Alan De Young writes in a 1995 *Phi Delta Kappan* article, the problem of rural life according to Cubberly was "that living in the countryside wasn't as good as living in the city." The goal was not to strengthen community and encourage civic pride, but the opposite. Schools succeeded when they taught children to reject what they saw around them.

This is clearly seen in Native American communities where, for centuries, schools worked deliberately to destroy culturally-based values on the assumption that Indians must learn to be "American," whether they liked it or not. Thomas Morgan, Commissioner of Indian Affairs during the late 1800s, argued strongly that educators should instill patriotism in their Native American pupils and believed teachers should "carefully avoid any unnecessary references to the fact that they are Indians." Not surprisingly, Native Americans had, for decades, the highest dropout rate of any ethnic group in the nation.

Even today, De Young continues, educators are rarely encouraged to see rural communities and rural values as worthy of respect or preservation. "Educators in the U.S. have rarely thought or been taught that saving or supporting rural communities as professionally appropriate, and even today such an idea remains virtually unmentioned in our colleges of education."

In contrast, place-based education reflects a deep respect for rural life and honors the determination of residents to sustain rural communities. It's not inward looking or parochial; the world beyond is worth exploring. But children

can't enter that world with confidence and understanding without having a sense of identity and a sense of place. The global community is, in the end, an amalgam of local communities and efforts to strengthen the former by ignoring the latter is counterproductive. In Alaska and among the tribal college initiatives, especially, the focus on place-based learning was part of a larger effort to restore pride and focus on skills needed to sustain tribal communities. A village wracked by unemployment and alcoholism is in no position to engage in the "global economy."

At another level, placed-based learning is simply good education. Inherently interdisciplinary and project-based, it builds on local resources and expertise without great cost. When linked with strategies for building community partnerships, place-based learning is a way to more fully expand the classroom within rural communities. Instead of focusing on what rural schools lack (not enough computers, not enough books, not enough teachers), schools that aggressively embrace place-based learning have access to a rich array of resources and expertise (the local stream bed, the biology station, the Audubon club, tide pools, Master Gardeners, and so on.)

Examples of placed-based education are found in most RSI sites featured in this report. Successful integration of this kind of learning in the school is about more than taking a walk in the woods, however. Indeed, the experiences of RSI sites suggest that it requires a significant amount of planning and strong community support.

1. ***First, a commitment to place-based education requires familiarity with the local environment, history, and culture.***

   Teachers cannot integrate place-based learning if they are ignorant of the local community. It's an obvious point, but can be a significant hurdle in many rural communities where a large percentage of teachers are not local and not familiar with the regional history and culture. In Alaska, for example, most teachers are from the Lower 48 and only five percent are Alaska Native. And when turnover is high, few teachers stay long enough to develop any real understanding of the community and culture they serve.

   In these communities, the long term goal is to nurture more local teachers. The expectation is that teachers who serve in their own communities will better understand the needs of students, serve as role models, and create a more stable faculty. But as a practical matter, the focus

of most rural RSIs, especially those serving Alaska and reservation schools, was to promote awareness of the local culture and community among the current faculty. In both the Alaska and tribal RSIs, this was accomplished by offering a diverse range of workshops and immersion programs focusing on Native approaches to science. In the process, they also stressed a deeper understanding of Native culture and the Native philosophy of education.

In Alaska, a typical professional development program was recently held on Kodiak Island for about twenty elementary and high school teachers. A few had years of experience teaching in the Alaska bush. Many had only just completed their first year of teaching. Some arrived from schools accessible only by boat and were already sobered by the isolation and political intrigues of village life. Yet when facilitator Teri Schneider, a Kodiak native, quizzed them on what they knew about their surroundings, many (not all) struggled to answer even simple questions: "From where you are sitting, which way is north?" "Name five species of fish found in local waters."

The project was completed in good humor, but Schneider's point was clear. A roomful of science teachers knew very little about the natural world of this lush island and its ancient cultures. During the week, a crash course in Kodiak environmental and cultural education was offered; groups gathered and later sampled seaweed, identified medicinal plants, and listened to a powerful presentation by a Kodiak man who, as a child, was called a "dumb Indian" by a teacher, but went on to earn a PhD degree from Harvard in anthropology and now directs the island's museum.

One of the key barriers to the development of place-based education in these communities is hesitation among non-Native faculty to incorporate cultural knowledge in the classroom. After all, they are not Native and, even after a week of professional development, they are not experts. Who are they to teach the knowledge of a culture that is not their own? Their sensitivity leads to silence. On the other hand, fears are sometimes justified. Native leaders still debate what can be shared with non-Natives. Some believe traditional knowledge and beliefs should be widely taught, even by non-Natives, as a way to keep it alive and build bridges of understanding with the non-Native community. Others feel strongly that this knowledge is sacred and must be controlled. Bitterness has resulted when non-Native teachers, with the best of intentions, tried to incorporate Native knowledge

in the curriculum but were rewarded with harsh criticism by culturally-conservative community members.

What's the solution? Teachers who have successfully navigated the sometimes treacherous waters of cultural knowledge begin slowly, build trust within the community and, of special importance, identify mentors within the community who can provide advice. Elders rarely knock on schoolroom doors offering their services, but long-time teachers are usually rewarded when they seek out traditional leaders and allow a trusting relationship to build slowly.

Where teacher turnover is high, new teacher orientation programs have special value. While some village schools in Alaska have 100 percent turnover every year, week-long orientation programs introducing new teachers to the community and its culture not only support place-based education, it also encourages stability. Teachers who are provided this kind of welcome feel more connected to the community and, as a result, stay longer. This is a lesson useful not only to a village school in the Arctic, but any small school serving an enclave community.

2. ***Encourage development of activities and courses integrating place-based learning through minigrants and other incentives.***

With increased knowledge of the community they serve, teachers are prepared to integrate what they know into the curriculum. But this requires time and, often, financial support. In the Rural Systemic Initiative, the task of local curriculum development was frequently supported through competitive minigrants to teachers. On the Flathead Reservation, for example, many of the new courses and units described in this report—forensic science and river ecology, for example—require at least a few supplies and some preparation time. Costs are not extraordinarily high; a few hundred dollars is often enough to cover expenses and provides at least a small incentive to teachers willing to grow professionally.

RSI sites found that minigrants offered one of the most cost-effective strategies for curricular innovation. While the impact of each grant is often small, the cost of nurturing this kind of incremental change is modest and every cent offers something tangible for students. Other rural reform initiatives came to the same conclusion. South Dakota's program for Rural School and Community Renewal made minigrants a key component of

its six-year initiative (ending in 2000). Assessing the outcomes of that project, Larry Rogers, a professor of education at South Dakota State University, wrote that "minigrants were the most important way that we fostered teacher involvement in place-based curriculum." Grants in that initiative ranged from $150 to $1,000 (for a total cost of $130,000), yet led to "167 teacher-made, student-centered curriculum programs aimed at strengthening community and enriching community."

Minigrants are only the first step. They are inevitably piecemeal and, as one informant reported, only "scrape the surface" of curricular reform. But they do provide an affordable entry point for schools nurturing place-based education and help show both educators and community members what can be achieved. It also encourages the kind of community involvement and teacher empowerment that, collectively, supports the larger goal of systemic reform.

The impact of minigrants can be extended with little effort or cost by compiling and distributing lesson plans developed by teachers. On the Flathead reservation a thick binder of lesson plans developed by local teachers demonstrates just how much a small cadre of committed teachers can accomplish. In Alaska, the Alaska Native Knowledge Network Web site (www.ankn.uaf.edu) includes an impressive collection of projects and course ideas based on the work of educators across the state. Collectively, these publications and Web sites provide a rich resource for educators nationwide.

Admittedly, these are small initiatives. But one of the greatest impediments to change is inertia, a feeling that nothing will change, that rural communities are forever disadvantaged and that solutions must come from distant, metropolitan regions. By pursuing even the smallest projects described here—perhaps a small collaboration with a park, the development of a new science unit, a breakfast meeting with the Chamber of Commerce—the first step is taken toward the enrichment and empowerment of rural schools and, by extension, the communities they serve.

Building Community

by Paul Boyer

Reforming Math and Science Education in Rural Schools

The goal of America's twenty-five-year-old education reform movement is to prepare students for a more competitive, more global economy. And nothing symbolizes the need for reform more than the average schoolchild's lackluster mastery of math and science. In a technology-based economy, these are the skills needed to succeed, many assert. Yet compared to other Western nations—including America's greatest economic competitors in Europe and Asia—students simply don't measure up. Unless the nation can build proficiency, America's children will not be prepared for the future.

The goal of the National Science Foundation's Rural Systemic Initiative is to promote greater math and science achievement in the most rural regions of the United States. Following the patterns of persistent rural poverty, these regions include coastal Virginia and the Carolinas, the Gulf Coast, Appalachia, the Ozark region, Alaska, rural Hawaii, much of Texas, and nearly two dozen Native American reservations across the southwest and Northern Plains. Here the performance gap is substantial and, in general, past reform efforts have had little impact. Schools in these regions typically offer fewer and less challenging math and science courses, have fewer qualified teachers, and have inadequate classroom resources. As a result, rural students—even those who successfully earn a diploma—are less prepared to enter college or the workforce than students from metropolitan schools.

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BAR CODE TO COME

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