THE STORY OF THE APPALACHIAN RURAL SYSTEMIC INITIATIVE

Introduction

This is the story of the Appalachian Rural Systemic Initiative (ARSI), a five-year, National Science Foundation (NSF) funded effort to improve science and mathematics education in some of the poorest rural counties in the country. It is a story told from the perspective of a group of researchers who are "outsiders" to Appalachia and who were given the responsibility of documenting the work of the initiative.

Our research group, Inverness Research Associates, was contracted by ARSI to serve as the external evaluators to the project. Over the past five years, our job has been to help document the work of the project, the realities ARSI staff have been confronting in doing their work, and the accomplishments of the project. Our work has largely consisted of visiting a sample of districts at select times over the course of the project, and providing feedback to ARSI staff based on our observations and interviews. To that end, we have written several evaluation reports detailing our findings.[1]

This project portrait is not meant to be another evaluation report. Rather we are providing this summary so that readers might have an abbreviated story of ARSI's first five years. We want to try to capture and portray the Appalachian Rural Systemic Initiative in such a way that outsiders can understand the journey the project has taken, the nature of the challenges the project has faced along the way, and the progress the project has made in its efforts to assist districts in improving their math and science programs. The information used in this portrait is gathered from our five years of work with ARSI, as well as from additional interviews with key project leaders and a "lessons learned" conference held on rural systemic initiatives.[2]

In the first part of this story, we discuss the origins of the project and give a chronological (and simplified) accounting of the project's efforts and evolution. In addition, we share some of the more general lessons learned along the way. In the second half of the story, we summarize our impressions of the progress the project has made, and the challenges that remain.

Before we tell the ARSI story, however, it is important to discuss the region in which the project works.

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[1] Reports include: "The Evaluation of the Appalachian Rural Systemic Initiative (ARSI): An Interim Report," December 1997; "Annual Report on the Evaluation of the Appalachian Rural Systemic Initiative (ARSI), August 1998; and "The Appalachian Rural Systemic Initiative (ARSI): A Report from the Field," April 2000.

[2] In April 2000, Inverness Research Associates conducted a Rural Systemic Initiative "Lessons Learned" Conference, funded by NSF. 27 representatives from the then eleven funded RSIs attended the four day conference, discussing their work in rural regions and the strategies that are most effective in promoting math and science reform in those settings.

The Nature of Appalachia

While the Appalachian Mountains officially run from New York state to Mississippi, the region that is commonly referred to as "Appalachia" exists in the hills and hollows of Tennessee, North Carolina, Kentucky, Virginia, West Virginia, and Ohio. Many of the people who live in Appalachia have done so for generations. There is a palpable sense of pride among Appalachian people, as well as a commitment to community and family. In Appalachia there is a strong sense of "place;" people tend to grow up in one place and to remain there. Communities are small and people know each other well. While there is a shared sense of region, the people who live in Appalachia also tend to identify strongly with their own local communities and to value highly their local autonomy. The result is that it is often difficult to mount cooperative enterprises even within a single county. In these communities, poverty, isolation, and a lack of resources too often combine to create cultures where people suffer from low expectations and fatalistic attitudes.

The isolation and parochialism of rural life in Appalachia are further exacerbated by deeply entrenched class distinctions, where for generations, the "haves" have controlled the access of the "have nots" to limited resources, power, and the political process. In 1996, the poverty rate in the neediest counties in Appalachia was almost two times that of the rest of the country (24.12% vs. 13.9%).

The isolation of the people of Appalachia persists because of factors that are both geographical and social in origin. The unique geography of the mountains seems to play a key role in everything that happens in Appalachia. Towns are isolated from one another, and even within small towns, various sections are spread out through several valleys, separated by mountains and connected by poor roads. In the winter, even small amounts of snow can shut down school for weeks at a time and further isolate people in their own small localities. Thus, the concept of community is not necessarily associated with counties or towns, but rather with small sections defined by physiographic features (e.g. the local hollows or "hollers"). In addition, the region is culturally isolated in that many of the cultural and educational opportunities taken for granted in more suburban or rural areas, such as universities, zoos and museums, simply do not exist here. The social origins of isolation arise from a sense of pride in their own communities and a lack of interest in the nearby "cities". There are also differences of language and culture that tend to keep people within their own local settings.

The majority of jobs available in this region have historically been either hard labor (e.g. mining) or seasonal labor (e.g. farming). In recent years, advances in technology have left many Appalachian miners and workers unemployed. "Jobs are scarce, good jobs

very scarce, and virtually all jobs are controlled by a few powerful employers."[3] School districts are now the #1 employer in many rural Appalachian communities, with the result that the politics of school employment become an important factor in determining the nature and quality of education in the region.

The school systems in Appalachia still have vestiges of a history that involves heavy elements of patronage. In addition, there is a great deal of ambivalence towards education itself in the community; those who succeed in school and go on to attend colleges and universities find themselves in a difficult situation where they typically have to leave the community in order to better themselves through higher paying and professional employment. Even if job opportunities exist for them at home, those who leave are often so changed by their experiences outside of Appalachia that it is difficult for them to come back.

> *In our region in Appalachia, nobody goes back home. They leave if they get an education or if they are trained to do anything besides teach… You can almost get no doctors to work in Appalachia… We have a big shortage of engineers, a big shortage of trained people… because they have not had the culture engrained, they don't have the desire to go back.*[4] *-- RSI Lessons Learned Conference Participant*

Throughout the years, there have been many federal interventions in Appalachia to try to improve the socio-economic conditions as well as the functioning of the local education systems. Most of these efforts have not had lasting effects, and increasingly, outside interventions have been met by negative attitudes on the part of those whom they were intended to assist. As one person experienced in working in the region noted: "The challenges facing Appalachia today are rooted in a century of development that has left mountain communities economically dependent and lacking in the social and public resources for self-determination and sustainable growth."

However, there is also increasing recognition that education is the key to long-term growth. Now that many of the mines are closed, there is a new possibility and opportunity for these isolated communities to develop themselves economically. Thus, at least in some communities, there is a recognition that a skilled workforce is key to local economic growth, and that good education, particularly in math, science and technology, is key to creating that skilled local workforce.

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[3] Duncan, Cynthia M. World's Apart: Why Poverty Persists in Rural America. New Haven: Yale University Press, p. 17.

[4] The quotations here are extracted from phone interviews and focus group discussions. Some are edited and reconstructed, but we have made every effort to preserve their intended meaning.

The Origin and Goals of ARSI

In the fall of 1993, the National Science Foundation funded a conference that brought together educators, community members and business people from Kentucky, Ohio, West Virginia, Tennessee, North Carolina and Virginia. This conference also convened national level funders and policymakers to look at the barriers for teaching mathematics and science in high poverty rural areas. After this conference, NSF sent out a request for proposals for funding Rural Systemic Initiatives, and in 1994, the Appalachian Rural Systemic Initiative (ARSI) received what amounted to a planning grant. ARSI used those funds to survey the educational landscape through regional conferences, study groups, surveys, and interviews with a variety of key stakeholders across Appalachia.

Among other things, ARSI staff found in their early research that schools often served as nuclei for rural communities, playing a central and positive role in the economic and social life of many of these communities. On the other hand, they found schools with little capacity to improve themselves, limited resources within the small districts, and few connections to outside sources of support (e.g. large universities, regional and national organizations, etc.). And, despite the positive connotations associated with the schools, they found a lack of family and community involvement in the academic life of schools.

When ARSI staff applied the NSF criteria for the RSI program, they found that there were 66 counties eligible in six different states that bridged the Appalachian region. Drawing on the research carried out during the development grant period, ARSI then designed an overall strategy for assisting those counties. Following the guidelines of the NSF systemic change initiatives, ARSI placed a high priority on designing an approach that would ultimately develop the capacity of the systems they worked with – so that local education leaders could initiate and sustain their own local processes of improvement in their own schools. In 1995, ARSI was awarded a five-year grant. Basing itself in Lexington, Kentucky, ARSI began to work with districts in the heart of Appalachia and wrote out as its mission the following: (ARSI is working to) "accelerate improved performance in mathematics and science for all students through high-quality, standards-based teaching supported by aligned, coherent local and regional systems."

> *When I started this thing, I really wanted to improve the math and science abilities of the students, to make them more marketable – to make it easier for them to get jobs. I saw a great need for trying to boost the performance of all students and all teachers in mathematics and science. In turn, this would help raise the level of the economy and socio-economics of the communities if these workers could attract new businesses. So it really was a bottom-up kind of deal – from the schools out to the communities.*
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> *-- Wimberly Royster, ARSI Principal Investigator*

In the original model for the project, ARSI sought to involve districts in math and science reform through the incremental development of leadership and the slow building of understanding and commitment of local school and community leaders. The key steps in this process involved:

- Designating one school in each ARSI district to serve as a "catalyst school." This school would be a starting point for local improvements, provide a setting for the initial work of the Teacher Partner, and ultimately be models of reform in science and mathematics for the rest of the district.

- Selecting "Teacher Partners" in participating districts. Project staff envisioned the Teacher Partners as "brokers" who would be liaisons for the project, connecting other teachers in their schools and districts through technology to professional development and materials. They would also learn from and contribute to other ARSI Teacher Partners through an ongoing ARSI supported network.

- Providing resources and support to Teacher Partners via "Regional Resource Collaboratives". Created by the project, the Resource Collaboratives were housed in either major research universities or institutions within the target area, most with well-developed technology capacity and access to science and math expertise. Each had a full-time ARSI-supported director. Initially, they worked primarily with the Teacher Partners in their regions, brokering professional development, and creating and supporting a network of Teacher Partners.

- Helping the schools use the Internet and computer technology as a way of overcoming the isolation of the region. ARSI staff, along with the Collaborative Directors, focused their efforts on helping districts learn how to use technology to increase the math, science and technology resources available to both teachers and students. The original model included working with a technology coordinator in each district to enhance the districts' technology infrastructure.

- Creating a "community engagement team", headed by a community engagement facilitator, that could help to communicate to local community and school leaders the need for and nature of improved math, science and technology programs. ARSI staff believed that for math and science to become a priority in the schools, it wasn't just the school culture that would have to be addressed; members of the community would have to both buy in and be actively involved in these improvement efforts.

Thus, the original ARSI model had three levels connected by the thread of technology. The first level was of local reform, involving local schools and districts, the community and a community engagement team. The second level was one of ARSI services and supports, which involved "learning support services" provided to the districts by Resource Collaboratives, and community engagement services. The third level was the

ARSI administration and planning level, including the ARSI administration and operations, the internal and external evaluators, and advisory groups.

The Chronology and Evolution of the ARSI Project

From 1996 to 2000, ARSI worked directly in 72 different catalyst schools in 52 districts, within 47 of the 66 targeted counties. Over the five years the project, the original model evolved as ARSI staff learned more about the region in which they were working, the needs of those teaching and learning in the region, and the relative success of the different elements of the ARSI model. In addition, as the project developed, new leadership and staff were hired. They had the experience, expertise and range of perspectives needed to continue to evolve the overall ARSI strategy so that it became increasingly effective at helping the local districts.

In this section, we describe the key events that happened each year and how the overall ARSI model and strategies evolved.

Year One (1995-96): Laying the Groundwork

The ARSI project began in late fall of 1995 and was led by Wimberly Royster, Principal Investigator, and Dr. James Strom, Project Director. Much of this first school year was spent identifying the initial set of catalyst schools. ARSI contacted the superintendents of 88 school districts in 66 counties, laying out a general set of criteria for participation. The districts had to be willing to identify a catalyst school and a Teacher Partner who would be released half-time from teaching duties for the ARSI project. (ARSI paid for this release time and the support for the Teacher Partner constituted the major direct contribution that ARSI provided each district.)

During the spring of 1996, the first districts were chosen. Over the summer, additional districts were recruited to create the first cohort of 21 school districts. Teacher Partners were chosen in these districts, generally identified by a principal or superintendent; some of these Teacher Partners were primarily technology experts rather than teachers with expertise in mathematics and science. Due to being identified in the course of the school year, some of the Teacher Partners were not released half-time during that first spring, but were given time to attend ARSI meetings and professional development. The Teacher Partners worked on technology improvements and shared ARSI-identified math and science resources with their colleagues, primarily within their own schools.

In addition, three Resource Collaboratives were set up and staffed, at the University of Kentucky at Lexington; at Marshall University in Huntington, West Virginia; and at Appalachian State University, in Boone, North Carolina. In this first year, these Resource Collaboratives worked on helping Teacher Partners initiate their work, and on

setting up the networking and Internet connections with the first cadre of districts. They also assisted these districts in developing and writing "technology plans".

Year Two (1996-97): Key Resources in the Region and the Districts Are Established

In 1996-97, ARSI began to work in earnest with its first cohort of 21 districts. Much of the ARSI staff's efforts in this year were focused on continuing to support Teacher Partners in these districts, and helping the districts establish the technological capacities and components needed to carry out the work of the project.

ARSI staff learned in their work with these first districts that to be successful, they needed to be accepted and to earn the trust of the district leaders. And the way to gain trust was, they found, to strongly support the development of indigenous leadership, largely in the form of the Teacher Partner. They needed to identify local leaders, first at the teacher and local administrator level, and build their capacity, before slowly working outward from this core. During this second year, the Teacher Partners began to develop their own skills and engineer appropriate roles for themselves within their own schools and districts. [ARSI staff soon realized that the progress of the local work depended largely on the skill and energy of the Teacher Partner, and ARSI staff wisely became much more specific as to the criteria to be used in the selection of the Teacher Partner.]

ARSI staff also knew that one powerful way of overcoming the isolation that many Teacher Partners experienced was to connect them in a network. Summer institutes, monthly meetings, and professional development experiences, as well as ongoing contact via e-mail and visits from Resource Collaboratives, helped create a solid first cadre of Teacher Partners. These individuals enjoyed and benefited from working with their colleagues who came from across Appalachia.

In this second year, ARSI also continued to work on the notion of the catalyst schools that were meant to serve as models for improvement for the districts. The catalyst schools were (and still are) those schools where the Teacher Partner centers his or her work. The original intent in the ARSI model was that the catalyst school would be selected first, then the Teacher Partner would follow from that. As it played out in the first few years of the project, the Teacher Partner selection often came first, and the catalyst school was the school in which that teacher taught.

Technology was a key focus in the first few years of the ARSI project. ARSI staff believed that through technology, they could help districts and schools overcome the geographic isolation of the region. ARSI staff envisioned that using technology, teachers would connect with one another and with a broader professional development community. Moreover, ARSI strongly intended that the Teacher Partners and Resource Collaborative Directors would help schools and districts use technology to find a wide

range of resources that could be used to improve local mathematics and science programs.

Near the end of year two, a staffing change occurred at the administrative level, with Dr. James Strom leaving the director's position, and Dr. Keith Smith replacing him. Smith brought a focus on curriculum and district-level leadership to the project. His background in administration helped focus ARSI's attention on a new key player to be brought to and included in the ARSI model: the District Liaison.

While most district Superintendents liked what the Teacher Partner was doing within their own schools, they did not essentially see the ARSI work as intended to promote district-wide systemic changes. Thus, it was important for ARSI to continue to promote the vision of district-wide reform and to get the commitment and involvement of at least one high-level district administrator. This District Liaison was meant to champion the work of ARSI district wide. This meant, more specifically, providing direct support for the work of the Teacher Partner, being a public advocate for ARSI's efforts across the district, and helping to identify and pull together additional resources to carry out improvements in mathematics and science. In addition, the District Liaison was typically positioned well to identify the district-level policy supports needed to sustain improvements the mathematics and science programs. The project director explained the importance of identifying this key player, "We knew that in every district you will find one very capable or very political, and sometimes both, person... And the key was to find and train this person."

Year Three (1997-98): The Role of Technology Changes

In 1997-98, ARSI expanded its work to include 39 catalyst schools in 36 districts. Several shifts in focus and strategy occurred during this time. ARSI began to downplay the primary focus on technology. Teacher Partners from the first cohort began to branch out and work with teachers in other schools in their districts. The District Liaisons were given more attention and explicit training. Resource Collaboratives moved more toward directly providing services in addition to brokering existing services. Districts started to pool funding from different sources in the service of math and science improvements. Also, a process for reviewing schools mathematics and science programs was initiated in some ARSI districts in Kentucky.

In this third year, the change in the vision of the role of technology was a key turning point in the history of ARSI. A year and a half into the project, two key things influenced this shift. The first was a finding from a NSF site visit, that NSF staff felt the ARSI project was focused too heavily on technology implementation and not enough on the reform of mathematics and science teaching. The second influence was that the six state departments of education had made available funds for districts to begin the technology improvements. With technological improvements coming from other

sources, the project decided to turn its focus more toward instructional issues in math and science education -- and less on the use of technology to gain access to resources. Thus, there was a shift from seeing itself as a program that used technology to locate resources, ARSI now looked more toward implementing standards-based mathematics and science instruction in the classrooms of Appalachia. This shift had both negative and positive implications.

On the negative side, those involved in ARSI from year one felt that ARSI was sending them mixed messages about the goals of the project. Staffing changes at the project and Resource Collaborative level were made to adjust for the shift; in some cases, technology coordinators were replaced with staff people who had greater expertise in science and mathematics curriculum. On the positive side, focusing on math and science education led to greater clarity about the direction of future ARSI efforts that would be needed to bring about these broader reforms. The role of technology in ARSI now focused on learning how to integrate technology into the classroom in the service of improving math and science instruction.

This is also the year in which ARSI was first faced with a decision about the long-term involvement of Teacher Partners. ARSI intended that once a school or district was involved in the project, they would stay involved, but ARSI would only pay for the release time for the Teacher Partners for two years, and (they hoped) the districts would pay for their release time after that. ARSI staff learned that after two years, most districts weren't invested enough in the project to make that kind of commitment. ARSI also knew that they had, by now, a very committed and strong core group of Teacher Partners that were important to the project. Consequently, ARSI decided to continue to fund the release time of the those Teacher Partners in the first cadre whose districts were not positioned to cover that cost beyond the initial two-year time frame.

ARSI began to see variations in how districts were using Teacher Partners and how the Teacher Partners were positioning themselves within their own districts. Some Teacher Partners were released full-time, with ARSI picking up half. Other districts decided to fund two half-time Teacher Partners -- with each working at different schools. The commitment of ARSI to continue its support for the first year cadre of Teacher Partners , in effect, limited the number of additional catalyst schools that ARSI could target in the region. ARSI decided that there was more value in extending and building upon the work of their trained Teacher Partners than in trying to cover all the counties in their target area. They chose, in essence, depth over breadth and in doing so acknowledged the need for a long-term capacity building process in each district.

Resource Collaboratives, brought on board at the end of the second year -- University of Tennessee in Knoxville; Ohio University in Athens; and at Clinch Valley College (now the University of Virginia's College at Wise) -- became fully operational in the third year . In addition, Appalachian State University phased out as a Resource Collaborative

with the addition of these new collaboratives who were located in more direct proximity to ARSI districts.

The role of the Resource Collaboratives also shifted. As the project evolved, the Resource Collaboratives became more active in directly providing services and technical support. Thus, rather than solely helping districts use technology to connect to greater resources, the Resource Collaboratives took on a more ambitious role, focusing on helping teachers use technology in the service of good instruction. Additionally, Resource Collaboratives also focused their work on national standards and inquiry-based instruction. In all of these areas the Resource Collaboratives focused on building and fostering the Teacher Partners and District Liaisons as a team in each of their districts, looking increasingly at the ways in which the district as a whole could improve their overall math and science programs.

> *It became apparent that there were issues beyond the classroom – issues of time, resources, support, stability, and direction – when there was a real need for someone with administrative ties to be involved in the project in a more direct way. So over time, the Resource Collaborative moved from their initial teacher orientation, which had been very beneficial at the start, into a larger focus on building and sustaining these leadership teams in the districts. - Keith Smith, ARSI Project Director*

At this time in the project, the Resource Collaborative in Kentucky began to implement a strategy for reviewing science and math programs in their districts. The Resource Collaborative in Kentucky had brought in a team from the Central Kentucky Educational Cooperative (CKEC) to help their districts with curriculum work. This team, Dr. Steve Henderson and Dr. Ron Pelfry, developed original instruments, based in part on the national standards in science and mathematics, to conduct curriculum audits specific to math and science. From this work the suggestion was made that the other ARSI schools in Kentucky might be interested in and benefit from these audits.

Year Four (1998-99): The Program Improvement Reviews Emerge as a Key Strategy

In 1998-99, ARSI worked with 57 catalyst schools in 44 districts. Increasingly, Teacher Partners evolved from school-wide to district-wide roles. Some districts were successful with their efforts to engage the community in math and science improvement efforts, while others continued to struggle with this component. District Liaisons began to pay more deliberate attention to their use of other resources and funding for math and science, and to policy issues that affected their math and science programs. The focus of the project in the most advanced districts turned more toward the development of district-wide leadership teams. ARSI also looked closely at the curriculum audits began in Kentucky, and began to make that process available throughout ARSI.

Perhaps most significantly, as the Kentucky Resource Collaborative began the program improvement reviews, ARSI staff became aware that in most districts, the mathematics and science curriculum was, at best, put together in a piecemeal fashion. Curriculum was not aligned across the grade levels K-12, let alone aligned with national standards in science and mathematics. The notion of a district-wide science and mathematics program was largely absent. Therefore, ARSI needed a vehicle for helping districts take a broader look at the current state of instruction, curriculum and instructional materials; and the degree to which these matched a national vision for teaching science and mathematics. The curriculum audits seemed to be a good tool to accomplish this goal.

Thus, a key strategy for ARSI emerged – one that has since become more widely used throughout the project. The ARSI staff began referring to the audits as "program improvement reviews," so the districts would not feel the project was "checking up on them." To date, the program improvement review process has been adapted to and used in Kentucky, Ohio, Tennessee, Virginia, and West Virginia.

During these program improvement reviews, teams composed of ARSI leaders, Collaborative Directors, District Liaisons and Teacher Partners would visit and review the programs of other districts. These reviews are followed by the creation of action plans and follow-up site visits to help ensure that something productive happens. As the project director explained, these reviews proved to be beneficial in a number of ways:

> *First, these reviews gave people data about their school that was put together by people outside of their school. The people who did the reviews were trained, and they often learned a lot from those visits, getting ideas from what others were doing and reflecting on their own programs back home. The teams also made specific recommendations about the kinds of improvements that were needed, not just saying, "You need to improve your math program." So as the project went along, the program improvement reviews really became much more central to the work we were doing.*

The development of leadership teams

The concept of building the leadership capacity outward continued with the addition of superintendents and principals to the leadership teams in each district. These leadership teams attended summer academies together to focus on the work of improvements in science and math, and how to extend that work beyond the classrooms of the Teacher Partners -- and beyond the walls of the catalyst schools to other schools in the district and the community. Thus, the model which had started as one of ARSI and Resource Collaborative staff providing the leadership to Teacher Partners and District Liaisons evolved into ARSI and Resource Collaborative staff helping to pull together, and then provide support for, a district team of leaders.

Also, as the project continued to evolve, the growing group of ARSI Teacher Partners grew into their roles developing into leaders of both local and regional reform efforts in mathematics and science. In several districts, these Teacher Partners became the de facto, and in some cases, the official, district math and science supervisors. In their individual districts, some of these Teacher Partners built a supportive group of teacher leaders within their districts -- creating mini networks of teachers and local leadership teams who would meet regularly to discuss ideas. Many of the Teacher Partners as well as other teachers in their districts also were gaining access to and participating in extensive professional development within their states and region, and on a national level, (e.g., attending nationally recognized programs at the Exploratorium and the Woodrow Wilson Institute).

Community engagement

In this fourth year, the community engagement piece of the ARSI model continued to be one of the most challenging pieces of the model to implement. While some schools and districts embraced the idea of greater community involvement in math and science – and were able to reach out to the community through innovative events, such as science nights – the majority of Teacher Partners and community engagement facilitators found it difficult to engage already busy members of the community in an endeavor whose purpose was vague at best. Teacher Partners and Resource Collaboratives were so busy with their professional and leadership development and curriculum work that often there was little time for the community piece. Also, the amount of time ARSI had contracted for staff to lead the project's community engagement efforts, was insufficient for such a big task. ARSI ultimately did develop a guidebook to help districts conduct a needs assessment on the issue of community awareness of and involvement in math and science improvement efforts.

The position of community engagement facilitator also becomes somewhat problematic. Originally, the community engagement facilitator was intended to be someone from the community. However, in several districts, the Teacher Partner or another teacher was asked to be the community engagement facilitator. Thus, what was to be a community-led endeavor became dominated by school personnel in a number of districts.

Readiness for reform

As more districts came on board, ARSI became increasingly aware of the variations across the districts in terms of their overall functionality and hence their "readiness" for reform. Several districts were fairly "reform savvy" from the start and had individuals with the knowledge and sufficient expertise to push for reforms. These districts were functional and strong enough to encourage these individuals and find resources to support their work. Other districts were just barely surviving, able only to focus on providing the basic needs of safe school buildings and transportation. There were no

individuals to take the lead, and not much encouragement from the district leadership. In these districts, the infrastructure and community support for schooling was negligible and there were virtually no capacities for reform or improvement in place.

Throughout the course of the project, ARSI found appropriate ways to intervene and assist in every type of district. They modified their approaches along the way to keep their overall vision while matching their strategies to meet the needs and realities of individual districts. In the districts that were farther along, where there were leadership teams already in place, ARSI staff focused its efforts on helping them more clearly articulate a vision for improvements, or connecting them with national-level funding to help take their ideas to the next level. In the districts that were barely surviving, it meant finding good teachers and providing them with the supports and resources needed to become a school and district-wide advocate for reform.

Year Five (1999-2000): District-wide Leadership Teams Develop and the Project Looks to the Future

In 1999-2000, ARSI continued to work with 57 catalyst schools in 44 districts. Much of the work was similar to that done in year four; at the local level, efforts focused on conducting and following up on program improvement reviews and building leadership teams in the districts. Some districts were just beginning their efforts with ARSI, and others were benefiting from long-term participation. ARSI also focused more on gathering documentation of its first five years of progress, and on how to sustain their work thus far into the future.

The project also experienced turnover at the director level. Keith Smith left the project and Steve Henderson, came on board as the project director. As before when leadership changes happened, the Principal Investigator of the project proved to be very sensitive to the needs of the overall project in selecting new leadership. For example, Keith Smith came on board when the project began to move from a technology to a district focus. Similarly, Henderson brought his expertise with the program reviews and leadership team development when the project began to focus more on the work of district leadership teams. These careful hires were one of the things that have made the project as successful as it has been. It was able to take advantage of the opportunity that leadership changes provided to find people with specific characteristics that could best meet the needs of the evolving project at the time they were hired.

Project staff also focused more attention on documenting the overall impact of the project. Henderson focused on gathering both local and regional data not only to demonstrate the project's impact to NSF and other stakeholders, but also to reinforce to district personnel the importance of data-driven decision making.

The project also looked to the future, developing a proposal for a second round of funding from the National Science Foundation in order to continue their work in the region.

The Contributions of ARSI

We now turn our attention to the contributions ARSI has made to date. Over the past five years, our studies have involved annual intensive site visits to ARSI districts. Our most recent site visits to districts[5] focused on gathering data about how ARSI has contributed to local district and school capacity for sustaining the process of math, science and technology reform. We also carefully documented the quality of classroom practice in "ARSI" classrooms[6] within catalyst schools and districts. During these visits, Inverness researchers interviewed the key players in the ARSI effort within each district, and observed 54 math and science lessons at the elementary, middle and high school levels.

In this chapter of the story, we will draw on the data from our final site visits and discuss the overall progress of ARSI and the status of ARSI districts, schools and classrooms in year five. We will discuss the project's influence on local district capacity for reform[7], as well as the project's influence on classroom practice. In the final section, we will examine the challenges the project faces as it strives to continue its efforts in Appalachia.

Building Local District Capacity for Ongoing Improvements of Math and Science Programs

The ARSI project has clearly made a significant contribution to the internal capacity of participating districts. The six districts we visited in the fall of 1999 continue on an upward trajectory as they work to improve their math and science programs. ARSI is helping each district move forward, no matter their initial starting point. In addition, we found the districts to be well positioned to maintain and even continue to build their internal capacities in the coming years. Hence, we saw in the ARSI districts the beginnings of the long process of developing the leadership and the critical supports -- such as good curriculum, well-designed materials, professional development and

[5] In the fall of 1999, we visited six "best case" districts, selected for the noticeable strides they had made in their math, science and technology reform efforts. Four of these were part of the first cohort of districts, and four of these districts were ones we had visited previously.

[6] These classrooms were defined as those where: 1) the teaching is beginning to reflect the national standards and the qualities of teaching and learning that ARSI is promoting; and 2) where the teacher has been "influenced" by ARSI (i.e., attended ARSI professional development offerings, spent time working one-on-one with the teacher partner, used the teacher partner as a resource in some way, etc.).

[7] For a more detailed and thorough discussion of the study of ARSI's contribution to district capacities and classrooms, see Inverness Research Associates' report "The Appalachian Rural Systemic Initiative (ARSI): A Report from the Field."

appropriate assessments -- that were needed to initiate and sustain solid, well-designed mathematics and science programs.

In what follows we briefly describe the contributions of ARSI to key capacities that are requisite to further improvement efforts.

- The development of indigenous leadership

ARSI is a subtle reform effort that is steadily building within each district a grassroots group of teachers and district leaders – people who are knowledgeable about and increasingly advocates for inquiry-based, student-centered, hands-on teaching and learning. In most districts, a point person for science and mathematics reform would not exist without ARSI. The project has provided key supports to Teacher Partners so that they can grow in their skill and expertise. In addition, most of the districts we visited now have a core group of teachers and administrators who provide visible support and motivation for improving science and mathematics education. ARSI has also been a key vehicle in creating and supporting networks. The Teacher Partners and District Liaisons are now better connected in supporting each other's leadership.

- The development of shared vision

Through their work with ARSI districts and communities have become more committed to the idea of math and science reform. Through the dedicated work of the Teacher Partners, and increasing participation in ARSI by district administrators, most of the districts we visited had developed a more serious intention to improve their math and science programs.

Just as important, ARSI has allowed leaders in ARSI districts to know the reality of their districts better. The work of ARSI has led to greater awareness of both strengths and weaknesses and thus led to clearer understanding of the need to improve math and science teaching. Moreover, ARSI has provided district leaders with a way of thinking about and discussing science and mathematics education that is more in line with national standards. ARSI has helped these districts know what they do not know, and develop a more sophisticated vision of good teaching and seeing where they are now in that light.

- The alignment of resources

In terms of ARSI's influence on the reform infrastructure in the districts, all of the districts we visited were resourceful in grant writing and obtaining the resources that are made available in many states to economically poor, rural schools. In addition, ARSI has encouraged and supported districts in converging resources, such as Title 1

and Title 2 funds, so that they use existing ones to support math and science reform in an increasingly coherent fashion.

- The creation of a "reform infrastructure"

Overall, ARSI has initiated the process of helping districts develop infrastructure. ARSI has had some influence on districts' knowledge about and exposure to "exemplary" curriculum; however, none of the districts we visited had officially adopted or implemented any of these curricula. We should note, also, that the program improvement reviews in Kentucky are leading districts to investigate more seriously changes in curriculum within schools and across districts. Also, in part because of ARSI's efforts and in part because of the increased focus and funding from the states, technology – equipment and software – is evident in all districts.

- The examination of district policies

Perhaps it is not surprising that we found ARSI's influence on broader policies that affect math and science to be quite limited in the districts. None of the districts we visited had instituted their own standards, assessment or policies vis-a-vis math and science education. Rather, they took the lead from the state they were located in. However, many of the districts we visited have policies in place that can be broadly supportive of reform, such as block scheduling, common planning time for teachers, and release time for professional development. And perhaps the most important district policies we noted were centered around the ongoing support for the Teacher Partner to continue working with ARSI, and the commitment to sustain a process of improving mathematics and science education within the district. In addition, those districts who are farther along in their reform effort were more likely to be proactive and thoughtful with regard to the impact (positive or negative) of the district policies on reform efforts.

- The development of resource collaboratives

Finally, the Resource Collaboratives have also been important for ARSI's success. While the role of the Resource Collaboratives has developed over time, ultimately, they have played a key role in assisting districts in the hiring and training of teacher partners and district liaisons and in providing them with on going professional development and support. In addition, the Resource Collaboratives have increasingly encouraged and guided ARSI districts to focus their work on national standards and inquiry-based instruction.

Influencing the Quality of Classroom Instruction

The second dimension of ARSI's contribution we want to discuss focuses on the nature and quality of classroom instruction. In examining the effects of ARSI on classroom instruction, it is important to keep several things in mind. First, ARSI's primary focus is not on classrooms but on building the capacity of and the leadership within districts so that they can understand, initiate, and sustain reform themselves. Second, ARSI is a relatively "thin" initiative, investing few dollars per student and teacher when the effort is "amortized" across all the districts it is serving. Third, ARSI has only been a presence in Appalachian districts for a few years. For all these reasons, it seems reasonable that it may take some time before the influence of ARSI "trickles down" into many classrooms.

However, our visit in the fall of 1999 indicated that the capacity building efforts of ARSI are beginning to influence classroom practice. In the classrooms we visited, the efforts of the ARSI project have meant that there are good teachers who are beginning to use ideas that are supported by and come from ARSI in their classrooms; simultaneously, there is increased recognition of and support for teachers who are already teaching in accordance with a standards-based vision.

We used an instrument developed for the NSF LSC initiative to assess the quality of ARSI classrooms. Overall, of the 54 lessons we observed, the most common lesson we saw (40%) was rated a "3" – at the beginning stages of effective instruction.[8] These were classrooms that were beginning to use cooperative learning, beginning to have student-centered instruction, and perhaps beginning to use a curriculum more in line with standards-based practices. Eleven percent of the teaching we saw displayed "exemplary instruction"; these teachers were doing wonderful lessons and were well supported by ARSI. However, 43% of the classrooms we visited were still below the beginning stages of effective instruction, and 17% of these were very weak.

Overall, in the classrooms we observed, lesson content came closer to reflecting best practice than either lesson design or implementation. In addition, the math lessons we observed were farther along in reflecting best practices than the science lessons. Almost half the lessons we observed were rated as having a positive impact on students' understanding of important science and math concepts. However, while the language of inquiry-based instruction is beginning to infiltrate the districts, the classroom practice is still more traditional in nature, even in those classrooms where ARSI feels it has had the greatest influence.

Thus, ARSI, even though it has been aimed primarily at the professional development of lead teachers in these districts, is beginning to recognize and contribute to the nature

[8] The rating instrument is designed specifically to measure the extent to which classroom practice reflects the vision of math and science instruction laid out in the national science and mathematics standards documents.

and quality of teaching and learning in the "ARSI" classrooms. While good instruction does not perhaps run wide or deep in these districts, given that the ARSI districts are faced with challenging circumstances, there are visible examples of good teaching, and these teachers are being recognized and supported by ARSI.

The Challenges That Remain and Suggestions for the Future

ARSI has made significant strides in the first five years of its funding. However, the region is large, the challenges are difficult, and much remains to be addressed if the efforts of the project are to make long-lasting contributions to the region. The challenges for ARSI are multiple. There is the sheer size of the area it is working with and the large number of isolated districts and schools it is trying to serve. ARSI districts are all at varying stages of development and readiness; also, ARSI has three cohorts of schools and districts, each of which has variation in the amount of exposure to the project. There are the difficulties it has in working with six different states and six different state level departments of education. And there is the ongoing challenge of working with districts, schools and teachers who have a strong sense of place, a commitment to maintaining local values and traditions, and who are, therefore, justifiably skeptical about the assistance of outside agencies.

However, we should also point out that ARSI now has assets in place that it did not have five years ago. There is a strong network of competent and committed Teacher Partners. There are administrators who both understand and are willing to promote the work of ARSI. There are Resource Collaboratives who have developed productive and ongoing working relationships with many of the poorest districts in Appalachia. And, finally, there are structures and ways of working –these have evolved over time and through experience, and they provide ARSI and local districts with mechanisms for furthering their own reform work.

- Sustaining the progress that has been made

First and foremost, the most successful structures of the project – the Teacher Partners and Resource Collaboratives – need to continue their work beyond the limited time of the grant. Several of the Resource Collaboratives have already found secure homes within the departments of education at the universities in which they are housed, and several are becoming more integrated into the programs offered within those departments. But this is not yet true across the board. The Resource Collaboratives were not initially part and parcel of the universities in which they were housed, nor were the Resource Collaborative staff people hired from the university. Thus, additional attention needs to be paid to the relationship between the Resource Collaboratives and their host universities.

Related to that, ARSI could perhaps find additional ways to work more closely with both the universities which house the Resource Collaboratives and local community colleges throughout the region. ARSI could do more to increase the linkages to higher education and other initiatives within the various states to use as resources for technical assistance, and professional development. ARSI started out as broker, then moved to being a provider of services. Now that ARSI has built the infrastructure and helped districts be more savvy consumers, the role of broker may be more appropriate.

Second, some districts find it difficult to sustain the position of the Teacher Partners without additional outside funding. Moreover, some Teacher Partners struggle to teach half time and do ARSI half time – they find themselves working two full time jobs instead of one. As one Teacher Partner stated:

> *I teach math half a day and am a Teacher Partner the other half. I am supposed to have two half-time jobs, that is what I am supposed to do. The reality is, I have two full-time jobs and a half a day to do each one of those.*

Teacher Partners need more release time to fully immerse themselves in their role as lead teachers, and to become part of the funded structure of the districts in which they work. The best cases we saw are those in which Teacher Partners worked themselves into a district-level job as a full-time resource teacher and district specialist.

- Finding ways to develop community understanding and support

Community engagement remains one of the greatest challenges to the project, even though everyone agrees on the importance of involving the community in making real changes come about in Appalachia. There are multiple dimensions to be found within the whole idea of "Community engagement". One aspect certainly involves finding ways to help key community leaders understand the specific work of ARSI – and then support it. Another aspect involves finding ways to use the ARSI work to generate greater commitment of the community to education more broadly – helping them see the real community benefits that might accrue from improved teaching and learning in their schools. Finally, there is the fact that ARSI itself can learn a great deal from a well-designed process of interacting with local community members.

ARSI's work to date has certainly highlighted the complexity of community engagement. ARSI learned during the project that it can not use just one model or one approach to community engagement. Sometimes it works best when ARSI creates its own community engagement team; there are many other times when it is better for ARSI to infuse its work into existing school-community committees. In this area we think best practices and case studies of successes still need to be gathered and shared, and a more sophisticated, but also concrete, vision about what "community engagement" really means still needs to be developed.

- Working within existing state contexts

Also, ARSI works in a problematic environment of trying to institute reforms within six very strong and different state contexts. These state contexts of accountability and testing are intense forces that shape the entire educational endeavor. While project staff indicate that they have had good support from the six states, it is still challenging to be a strong outside voice for reform efforts within these already existing noisy environments.

Related to that, we found that most districts participating in ARSI still need concrete visions for math and science reforms that go beyond raising test scores. While ARSI has tried to turn districts' attention to the national standards, the state testing programs and accountability issues are so pervasive that it is difficult for districts to develop strong shared visions of improvement efforts that look beyond immediate test results.

In addition, most of the states with which ARSI works have spent the last five years investing substantial sums of money in upgrading the technology in all of their districts. However, teachers and administrators in the districts we visited still need a great deal of help in learning how best to use this technology in the service of improving math and science instruction. Technology tends to be used as an end in itself, or as a tool for reinforcing basic skills, rather than as an integrated part of standards-based instruction in mathematics and science.

- Strengthening curriculum

In general, Appalachian districts have been weak in terms of curricular support. Often teachers have been left without curriculum and without access to high quality instructional materials. While ARSI has influenced districts' knowledge of and exposure to "exemplary" curriculum, there is little history or knowledge that resides within districts as to the whole process of adopting and implementing curricular programs. Despite the fact that a wealth of science and mathematics materials funded by NSF and others now exist – materials that are supportive of the vision of science and math teaching and learning espoused in the national standards - we saw little evidence of wide-scale use of these "exemplary" curricula in ARSI districts. We believe that putting good curricular programs and materials in place would make a significant difference in the districts; conversely, we believe that without such programs and materials the progress made in these districts will remain limited to practices of the best teacher leaders.

Summary

The ARSI story, we believe, is both inspiring and daunting. It is inspiring in the way that it has empowered local teachers, administrators, and communities to work hard to improve their own programs. It is daunting in that it shows that there are no shortcuts or substitutes for the long-term process of building up the capacity these districts need to provide their students with high-quality mathematics, science and technology programs. We hope that this telling of the ARSI story will help others learn from their efforts, and help all of us understand better the needs that exist and the nature of the work that is required to address them.