

# A Portrait of a Collaborative ARSI Team in Knott County, Kentucky

By Elizabeth Horsch

*Women, my name is Solomon Everidge. Some call me the granddaddy of Troublesome. Since I was a little shirttail boy, hoeing corn on the hillsides, I have looked up Troublesome and down Troublesome for somebody to come and larn us something.... When I heard the tale of you women, I walked the 22 miles acrost the ridges to search out the truth of it. I am now persuaded you are the ones I have looked for all my lifetime. Come over to Troublesome, women, and do for us what you are doing here.*

From "History and Families-Knott County," Kentucky 1995,  
published by Turner Publishing Co.  
Paducah, KY

Many of the people who live in Knott County today are direct descendants of the early settlers of the region. Looking at a roster of the current population one sees many of the same names that occur in the early county records. Today the people of Knott County share an identity that is grounded in the place they and their ancestors called home. In turn, their sense of place molds their vision and their actions in their personal, professional and civic lives.

Perhaps the public endeavor in which the influence of place is most evident is education. In Knott County education has always been strongly linked with the local geography, history, economics and culture. When the major education reform efforts of the 1990s came to Knott County, they were created and implemented by educators who were themselves products of this isolated region, and therefore the programs they developed were shaped by their sense of place.

In particular, the stories of the women who led this reform – Jane, Frieda, Evelyn, and Brenda – echo the stories of the early pioneer women who first established schools in the region in the early 1900s. The institutions and ways of working which these early educational pioneers created have influenced and are closely interwoven with the lives and careers of the present group of educational leaders.

A brief step back in time to look more closely at the region and how its geography and history have created a unique culture that defines the present, helps us better understand the ARSI leaders and their recent efforts to improve math and science education in Knott County.

### *The Place*

Unlike many other areas of Kentucky, Knott County has no large rivers, and as a result, no broad fertile river valleys. Instead the county is home to steep, timbered slopes of mountains, which abruptly rise on either side of small streams and creeks. The creek beds often comprise the only flat land that exists in the region. Knott County's rough terrain hinders the building of roads and railroads. As late as the 1930s, there were few gravel roads and the existing dirt roads were impassable in the winter and in the rainy seasons. Even today, winter storms often close mountain roads, forcing schools to close for days at a time.

Not surprisingly farming in Knott County has always been mainly subsistence. Areas which provided sufficient acreage for home building and farming were limited and widely dispersed. The average family farm had only 3-4 acres of flat land, and the hillsides were composed of heavy clay soils that tended to erode if the vegetation was removed. For food families grew small gardens and raised a few livestock. For fuel, they mined the shallow coal seams which striped the nearby mountains. Many built their own furniture, created musical instruments, wove fabric from fiber of the livestock they raised, and used native materials to weave baskets. Each family had to become a self-sustaining unit. Thus the terrain – Knott County's steep mountains and often impassable "hollers," – has historically impeded the growth of communities and local economies and contributed to the isolation of the inhabitants.

Today, according to Evelyn Mayer (one of the educational leaders portrayed in this report), "The two growth industries in the county are welfare and schools,"<sup>1</sup> Although coal and timber are the major natural resources in the region, they have not benefited Knott County's economic growth or stability. The coal reserves are considered significant, but in contrast to neighboring areas where economic development has occurred, less than 7% of the existing reserves have actually been mined because they are difficult to access. In addition, in the early days most of the landowners were persuaded to sell their mineral rights to large coal companies. Currently much of the coal is owned by out of state

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<sup>1</sup> We taped and transcribed interviews from the ARSI educational leaders and other interviewees presented in this report. The quotes we used are not always literal, direct quotes. Rather, we have at times used our best judgment to edit them lightly to either make them more readable, or to convey more accurately the intention of the remarks.

corporations that pay taxes on only 0.1% of the assessed value of the un-mined coal. The convergence of these geographical, historical and political factors does little to encourage the development of the coal reserves, and consequently, they do not provide much revenue for the local people or the public institutions in the county.

Through the years population growth and prosperity have bypassed Knott County. Today the population of the county is less than 18,000, a gain of only 100 inhabitants each year for the last 100 years. The median income in the county is \$20, 373 compared to the average income of \$33,600 in the state of Kentucky. Education in particular has been severely impacted by the lack of economic resources in Knott County. Although there have been ongoing educational improvement efforts stretching back almost a century, even now less than a third of the county's residents hold high school diplomas, and only 5% have a bachelor's degree. Though historically residents have recognized the need for education, their isolation and their lack of economic opportunity have limited their participation in education's benefits.

### **Bringing Education to Knott County: 100 Years Ago**

In the early 1900s, the first major educational improvement efforts came to Knott County. During this era, both Hindman Settlement School and Alice Lloyd were founded. These two remarkable and enduring educational institutions have continued to shape and influence education for over one hundred years. Both were envisioned and shepherded by the educated and strong-willed women of the day. And both have played significant roles in the professional lives of the women who have led the more recent educational reform movements in Knott County. We include the following brief description of their history to illuminate the work of the ARSI Teacher Partners who also sought to bring quality education to the county a century later.

#### *The Hindman Settlement School*

In the late 1800s, the Progressive Movement was sweeping the industrialized cities of the North. One of the key features of this urban social and political reform movement was the creation of settlement houses and schools to meet the needs of economically deprived families. Settlement facilities, with their focus on the welfare of women and children, offered the privileged and highly educated young females of the day a socially acceptable outlet for their intellectual and physical energies. Because this work was viewed as domestic activity, they could assume roles of leadership in the public arena, historically considered a male domain. And they could do so without alienating a society

that was organized around and comfortable with a male-dominated, hierarchical culture.

In the summer of 1900, two intrepid young women, May Stone and Katherine Pettit, pitched their tents on the side of a hill overlooking the small village of Hindman, the county seat of the newly created Knott County. Loaded with books, games, and a small portable organ they preceded to hold “school” for the people of the mountains. The activities of the summer camp were practical in nature – crafts, reading, singing, learning to make biscuits and bread. When the summer ended, the local people implored the two women to remain and establish a permanent industrial school. The pleas resonated with Stone and Pettit, and so, in the words of Stone, “... with little experience and less money, we started a school.”

Adapting the urban settlement school concept to their rural Appalachian setting, they founded the Hindman Settlement School. There they promoted health care, rigorous academics, model agrarian practices and homemaking. To staff the school, Stone prevailed upon former classmates at Wellesley, where she had done graduate work, to come and give a year of their lives to teaching in the school. Many graduates from prestigious eastern women’s colleges worked at the school in the early years, providing a much-needed link to financial support for the school from wealthy Easterners.

A decade later, the school had expanded rapidly and had grown to serve more than 300 students. For many of those children, particularly those who came in from remote outlying areas, the Hindman Settlement School was their only opportunity for education. The school also developed an educational outreach program to train young local women as teachers for the rural schools. Over the next decade, most of the county’s fledgling elementary schools were staffed by teachers trained at the Settlement school. In 1910 the Hindmen Settlement School became the county’s only high school.

As the county grew, the public school system gradually took over the educational programs the Settlement School had provided in its early years. The Hindman School then shifted its mission and resources to provide supplementary services to the school system and to identify and serve community needs that were not being met by other agencies. It provided summer school and after school tutoring for students who were not performing well in the public school and also developed a full time school for severely learning-disabled children. It began a GED program for high school dropouts and a special literacy program for adults in the county who had never learned to read.

In addition, the Hindman School began focusing on the preservation of the indigenous culture of Knott County. Many of the early settlers were of Scot-Irish lineage that had fled oppression in their homelands, so that as they settled in the remote “hollers” of the mountains, their ballads, songs and stories reflected the persecution they and their ancestors had experienced. Their music and stories changed little over time because of their isolation. The Settlement School helped the people preserve their indigenous art, music and storytelling. Today it still continues to promote the unique heritage of the area through the Appalachian Family Folk Week, the Appalachian Writer’s Workshop, and the Appalachian Visual Arts week. Like the educational leaders who would follow, the Hindman Settlement School responded as the needs of the region changed, “...taking the resources it has and meeting the needs that aren’t being met.”<sup>2</sup>

### *Alice Lloyd College*

In 1915, when Alice Lloyd arrived in Knott County, the Hindman Settlement School was already firmly established as a force for social and educational improvement. Alice Geddes Lloyd was 39 years old when she arrived in Ivis, a village just four miles from Hindman. By this time she already had pursued a successful career in Boston as a journalist and free-lance writer. She had owned a newspaper, been an assistant editor on a small town weekly, and achieved considerable standing in the social and community affairs in the Boston area.

Alice Lloyd’s vision of social reform had many similarities with those of the women who established the Hindman School. In short order, she established a community center, a free school, and a public library full of books. She procured the services of a Red Cross nurse for her community center, and also supervised the creation of a demonstration farm. Along with her husband, who shared her work in the early years, she began an aggressive campaign to marshal outside support for her ventures. She tapped friends, acquaintances and interested outsiders for financial support. This brought her into fund raising competition with the earlier established Hindman Settlement School and created a breach between the two educational institutions that remained for decades.

Legend has it that a mountain patriarch, Abisha Johnson who we quoted earlier, walked 12 miles barefoot through sleet and rain to offer the Lloyds a piece of his land in Caney Creek to establish a school. Perhaps as a result of Abisha’s plea, the headquarters for the Lloyds’ work was formally chartered as the Caney Creek Community Center in 1922. Soon one room schoolhouses were

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<sup>2</sup> Mike Mullins, Troublesome Creek Times Centennial Addition (Hindman, KY: Troublesome Creek Times); information available via <http://www.troublesomecreektimes.com/pages/history/default.asp>.

established and staffed in nearby neighborhoods, and model houses were built and leased to families in the area who agreed to live according to Alice Lloyd's views of what comprised an acceptable lifestyle. She denounced drinking, fighting, idleness, late night partying, and premarital sex. Long afterwards a local resident shared his memory of the work of Alice Lloyd, "She knew what we needed better than we did."<sup>3</sup>

As with the Hindman Settlement School, over time the emphasis at Caney Creek evolved in response to changing circumstances and needs in Knott County. Moving away from community assistance to education, Lloyd shifted her focus to the training of leaders who would remain in the mountains. In her words from 1920, "People cannot advance farther than their leaders will take them," and she believed that "... the leaders are here, waiting to be trained if given a chance." In 1923, the Caney Junior College was opened.

In its first 25 years Caney Junior College produced two kinds of graduates – those who went on to complete a four-year degree program and those who completed the two years of college work necessary to obtain Kentucky State Department of Education certification to teach in elementary school. For many years more than 50% of the teachers in the schools in Knott County were Caney Junior College graduates. Outreach workers from the school started many one-room school houses within the region as well.

In 1962 the name of the college was changed to Alice Lloyd College to honor its founder. Still later it became a four year college, boosting its enrollment dramatically. Today the college still offers free tuition to all students in the 14-county region who have a high school GPA of 2.5 or above.

### *Foreshadowing the Future*

Alice Lloyd College and the Hindman Settlement School owed their genesis to the vision and hard work of highly educated, powerful women, who committed most of their lives to creating and sustaining educational opportunities for the children and adults of the mountain region. While their missions evolved over time, both institutions have continued to play important roles in the social and educational needs of this region and they have influenced and foreshadowed ARSI's more recent efforts to enhance education in Knott County. In particular, both pioneered the concept of identifying and supporting indigenous leadership, a concept that would also become the hallmark of the ARSI effort. Both institutions also steadfastly held to the vision of responding to local needs by creating opportunity for local residents to find their own solutions, again an

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<sup>3</sup> P. David. Searles, *A College for Appalachia: Alice Lloyd on Caney Creek*. (Lexington, KY: University Press of Kentucky, 1995).

approach that characterized the ARSI leaders' recent work to improve mathematics and science in the county schools.

## Bringing Educational Improvements to Knott County: A Century Later

Almost a century after the early days of the educational reform that resulted in the founding of the Hindman Settlement School and Alice Lloyd College, another wave of reform swept into Knott County. As a result of a Kentucky State Supreme Court mandate to equalize educational funding throughout the state, the Kentucky legislature passed the sweeping Kentucky Education Reform Act (KERA). Rural and impoverished regions now could lay claim to their fair share of state funding to build new schools and to refurbish buildings. The Knott School District that had long struggled to provide basic services could now tap special programs and initiatives to access money for materials, curriculum improvement and professional development. Thus, in the 1990s, the spotlight of educational improvement shown again on the isolated "hollers" of the Kentucky Mountains. The doors of opportunity opened wide, and as Alice Lloyd had observed many years previously, "The potential leaders were here, waiting to be trained if given a chance."

We focus now on this more recent wave of educational improvement in Knott County, specifically on ARSI and the four women who were empowered by it. They were four women who stepped out of traditional roles to re-envision their work and their lives to lead mathematics and science improvement in Knott County. All four – Jane, Frieda, Evelyn, and Brenda – all four initially were classroom teachers and have deep roots in this place. Each of them played a unique and important role in ushering educational improvement into the Knott County schools. Through their work they gave form and substance to an ARSI program that in the early years of the initiative was still seeking to define itself. As we describe their individual and collaborative efforts, we will also describe the teachers, the schools, the school systems and communities, which both influenced their work and were changed by it.

### *Administrators Bringing Improvement to Knott County in 2000: Jane Campbell and Frieda Mullins*

When ARSI came to Knott County in 2000, Jane Campbell, Knott County's school district curriculum coordinator, had already begun work in curriculum improvement, tapping the early Goals 2000 monies for professional development for the district's teachers. She had deep roots in the region and a personal history of finding resources to support her programs. After graduating from

Berea College and spending several years in other places, Jane returned to Knott County to teach in the Caney Creek Elementary School.

Desperate to bring technology into her classroom, she managed to raise funds to buy two Apple IIE computers. Neither she, nor any of the other teachers knew anything about computers so they were forced to enlist the help of a former student to show them how to turn the computers on. But Jane soon realized that having only two computers simply made the need for technology in the school more painfully obvious. When an anonymous donor offered to buy 15 computers for the school, Jane turned an unused storage room in the gymnasium into a computer lab. Soon every class in the school had a weekly scheduled time in the computer room and students were encouraged to invite a parent to share the scheduled lab time. A parent who had never set foot in the school before suddenly appeared at Jane's door, explaining his presence by his son's invitation, "He wanted me to come and do the computer with him."

After 20 years as a classroom teacher, Jane moved into the curriculum director position at the district level. Simultaneously, Wimberly Royster, the Principal Investigator of the Appalachian Rural Systemic Initiative, was traveling from district to district in eastern Kentucky, talking about his vision for reforming science and mathematics education in the schools. "When Dr. Royster outlined the opportunities for access to resources that would be available to schools, my heart just pounded," Jane recalled.

As more grant money became available, Jane initiated additional programs aimed at involving the teachers in curriculum improvement. Recognizing that curriculum expertise was lacking in the district, she enlisted the aid of respected leaders in the state to help district teachers analyze and critique their curriculum and instruction. She organized teacher study groups to develop capacity in the district to improve articulation of curriculum and instructional methodology. She said, "I want all teachers to understand their teaching fits into the continuum of a school curriculum." Later in the decade, as Goals 2000 monies became available, each district was required to develop a proposal, as well as a site-specific proposal for each school in the district. Knott County's proposal was funded and the district had access to \$250,000 each year for three years. Jane said, "For the first time, we had real money."

In the meantime, while Jane was working at the district level with Goals 2000 grants, Frieda Mullins, the principal at Jones Fork Elementary School was focused on bringing ARSI into Knott County. Frieda's background did not seem to make her a likely candidate for a leading role in school improvement. She had dropped out of college, married, spent some time out of state with her husband, and then returned with him to Alice Lloyd College, where he had a teaching



position. When he was hired as director of the Hindman Settlement School, together they started a local newspaper, "The Troublesome Creek Times." After five years of work on the newspaper, and the births of three children, Frieda decided to go back to college. At thirty- six years she received her B. S. in elementary education at Alice Lloyd College, and began her career. She taught in the primary grades for several years and then moved into administration. First she served as a primary school consultant at the regional service center, and then, for five years, as principal at Jones Fork Elementary School, a small isolated school of 122 students in an area of extreme poverty.

Frieda's tenure as the principal at Jones Fork marked a time of change for the school. Soon after Frieda became the principal at Jones Fork, Wimberly Royster introduced her to ARSI. A cornerstone of the ARSI vision of education improvement was the designation of a school as the district's catalyst school. The catalyst schools were selected to receive support to improve math, science and technology and to identify, train and support Teacher Partners. When Frieda Mullins heard about the ARSI catalyst schools and the provision for a Teacher Partner, her response was quick and definite, "We must have this and we will do it!"

*The ARSI Elementary Catalyst School and Teacher Partner:  
Evelyn Mayer at Jones Fork*

Jones Fork was the only elementary school that applied for the designation of catalyst school, so it became the catalyst elementary school in Knott County. As such Jones Fork received a significant infusion of grant money for technology and professional development. Although as principal Frieda, was committed to the catalyst school concept and convinced of the advantages the Teacher Partner position would bring to the school, her staff was less eager. No teacher responded to her request for applicants for the Teacher Partner role. Frieda said, "I looked around the room and called Miss Mayer into my office. When I shut the door and asked her to take the Teacher Partner position, she looked at me like I was crazy."

Although Evelyn Mayer was initially reluctant to assume the duties of Teacher Partner, she was already experienced in educational leadership in her school. Her early years were not spent in education, however. She was born in Knott County, the daughter of a coal miner, and completed high school in the county. After high school, she left the state with her husband and worked as a cosmetologist. When she returned to the state, she went to Alice Lloyd College. After completing her degree in Elementary Education, she then went on to get her Master's in the same field.

Following graduate school, Evelyn first worked as a reading teacher for Jones Fork and another school, Emmalena. Soon after, she became a classroom teacher when a third grade position became available at Jones Fork. There the principal had secured grant money to restructure teaching in the primary grades to meet the state mandate for ungraded primary classrooms. Describing the state of the primary curriculum at that time, Evelyn said:

*... Instruction in the primary grades was textbook oriented, time on task, and there was a test for every thing. Instruction was driven by the clock, not by evidence of student learning. The textbook was the Bible.*

Evelyn and her co-teachers set about changing the primary curriculum so that it centered on science and social studies themes. However there were no inquiry-based materials for the primary science and there was no core curriculum in the district nor the school, so Evelyn and her cohorts taught science by scrounging and stealing ideas and materials from multiple sources. About this time, she said, "We were flying before we had an airplane." But after six years of free-fall, Evelyn found her airplane when Frieda Mullins and Wimberly Royster brought ARSI to Knott County and she became a Teacher Partner.

The ARSI Teacher Partner position at Jones Fork was half time classroom teacher and half time ARSI Teacher Partner. To meet the requirements of both, Evelyn accepted an arduous schedule. In essence, she assumed responsibility for her own students and classroom, including the lesson planning, instruction and assessment. She taught the 5-7 grade science, 5<sup>th</sup> grade Language Arts, and 5<sup>th</sup> grade Practical Arts for two and a half days, while a substitute teacher stepped in for the rest of the week. It was then that Evelyn worked school-wide to improve math and science curriculum and instruction. In addition, she spent countless hours in the leadership training ARSI provided for the Teacher Partners.

Evelyn's vision of the school as an improvement community with a strong focus on the needs of students fit well with the powerful sense of place and kinship that characterizes Appalachia. Here ties exist that stretch across the generations, and they strongly influence the relationships that exist among adults and between adults and students. Teachers at Jones Fork School shared a sense of community with, and a deep concern for, the students. Most of the students were bused to school and 76% were eligible for free and reduced lunch. Life was hard for these children, both at home and at school. A first grade teacher explained, "We expect behaviors here at school that are not the norm in many of their homes. Students are punished here for behavior that is necessary for survival in their home culture."

The Family Resource Center Director at Jones Fork described the relationship between students and teachers in this way:

*It has to do with the attitude of teachers and how they can connect with every student. They want what is best for every student. The teachers are role models. They are trying to make (students) see that you can progress above and beyond what you have to deal with at home. It is the culture of the school and the closeness of the teachers, their willingness to work together on behalf of the students. If they don't think [an innovation] is something that will help the students, they don't jump on the bandwagon. But they are willing to take chances for the students at Jones Fork.*

Evelyn understood this commitment to students and she used her passion for science as a multipurpose vehicle to improve teaching and learning at the school. She renovated an unused science lab and worked with teachers and their classes to introduce them to hands-on activities. This approach to learning began to permeate other subject areas and the teachers began to utilize manipulatives to teach mathematics. One teacher explained, "Now we do math, lots of math. Addition, shapes, problem solving. Evelyn gets the foundation started, and (other teachers) build on it and keep it going".

Although volunteerism was firmly established in the culture of the school at Jones Fork, parental participation was limited. Evelyn saw science as a way to involve the larger community in the education of children at Jones Fork. An early ARSI strategy for improving science centered around community involvement and the Teacher Partners had received materials and training to implement Family Night Science in the schools. Evelyn developed hands-on activities that parents and students could do together, and then invited the parents to spend an evening "doing science" with their children. Although only 25 parents attended the initial session, within a year the number of parents who attended exceeded 75, and that number continued to increase. Soon there were nearly half as many adults taking part in Family Night Science as there were children enrolled in the school.

Evelyn had a vision for good science education that extended beyond the parameters of the regular classroom and into the local community. When Knott County received a block grant to clean up waste dumps and streams within the county, Evelyn used the grant writing skills she had developed during her ARSI Teacher Partner training to help the school apply for Personal Responsibility for a Desirable Environment (PRIDE) grant. The science students at Jones Fork School spearheaded the clean up of 36 miles of stream in the area.

Evelyn also envisioned an outdoor classroom, complete with a pond, in the center courtyard around which the Jones Fork School was built. Unfortunately, the courtyard was completely encapsulated by the school building, with no access in and out except through the main building. Undaunted, Evelyn enlisted the vocational-technology and agriculture classes at the high school as partners. Although all the materials and supplies had to be hauled into the courtyard through the building, and the dirt from the pond excavation out through the same small hallway, eventually a full-scale outdoor classroom, with a pond and a greenhouse was completed. The outdoor classroom became an integral part of the science curriculum and a bridge to the larger school community. Students at Jones Fork raised and planted more than 2000 plants at school facilities throughout the district during the years that Evelyn worked as a Teacher Partner at the school.

For two years Evelyn continued working half time as the ARSI Teacher Partner at Jones Fork. When we visited the school and talked with teachers at Jones Fork, they gratefully acknowledged the power and influence of Evelyn's work. One teacher described the impact of her leadership in improving learning opportunities for children in the school:

*Teachers don't know a lot about all the new things that are coming out, and we have somebody (Evelyn) we actually can talk to and work with and who has the time to help us.*

And another said, "... if no one tells us, we just don't know that there is a better way."

The principal described Evelyn's influence at Jones Fork in the following words:

*She was well respected because she worked so hard. She produced quality work and wasted not a second of their time. The teachers knew that she knew what she was doing and she would do a super job.*

***The ARSI High School Catalyst School and Teacher Partner:  
Brenda Mullins and Knott County Central High School***

Soon after selecting Jones Fork Elementary as a catalyst school, the ARSI leadership decided to promote a catalyst school at the secondary level. As the major high school in the county, Knott County Central High School was the logical choice. However, the high school principal did not readily embrace the concept of the catalyst school and as Curriculum Director it became Jane Campbell's job to persuade him to accept the catalyst school designation and to select a teacher to fill the Teacher Partner role. Reluctantly, he agreed to release

Brenda Mullins, a math teacher, from one half of her teaching duties to lead the improvement of math and science.

Like Evelyn, Brenda did not follow a traditional path to become a teacher. She had attended school in Knott County, married right after finishing high school and was the mother of two children before she was 20. Although she enjoyed learning in high school and scored a 27/30 on her ACT, no one encouraged her to consider college. In her words, "No one had ever even suggested to me that a 27 was a good ACT score." However, a chance encounter with the dean of students at Alice Lloyd College, who encouraged her to enter a math and science education program at the college from where she subsequently graduated with a teaching degree in just three years, marked a turning point in her life. "I found my niche when I went back to school." She was hired to teach mathematics at Knott County Central High School in 1989. When she was tapped for the Teacher Leader position, she had been teaching mathematics at that school for 10 years.

Since Brenda had both science and mathematics certification, she was expected to lead the improvement effort in both disciplines. The curriculum was largely textbook-based in both disciplines. The teachers did not have access to any curriculum guides, and as one teacher described the science curriculum, "It was mainly hit and miss." Although the state testing had pointed out deficient areas in the curriculum, there had been little or no effort to articulate content between grades.

With Brenda's leadership, and the training and support offered by ARSI, the teachers at Knott County Central High School began the process of aligning the curriculum in both math and science across the grade levels. Summer workshops were held for each grade level, and teachers worked in teams to determine the content that would be taught at that grade level. During the year, teachers had additional time to work on the curriculum, and they developed units, which included content, instructional procedures, activities and assessment.

Brenda promoted hands-on learning in both math and science at the secondary level. Graphing calculators, science probes, and computers became an integral part of the curriculum. IMMEX, which offered access to computer-based problem solving, was incorporated into the science units. The science laboratory was integrated into every science course and all students participated in lab experiments on a weekly rotation. Using Goals 2000 money, Brenda equipped a technology cart for each classroom, complete with a computer, projector, color printer, and digital camera. ARSI provided the training for the teachers so that they became proficient in the use of the technology.

During these years of curriculum improvement, Brenda saw her Teacher Partner role as being that of a facilitator. She worked with the mathematics and science departments to help them determine what they should teach in each class, how to teach the content, and how to secure the resources they needed. Both departments developed detailed curriculum guides for their disciplines. Moreover, these high school teachers were openly proud of their departments and the work they had done under Brenda's leadership to improve the teaching and learning of mathematics and science at the high school. When we visited with them they were able to cite a long list of accomplishments.

In science, teachers noted their success with inclusion of all students in laboratory work. Previously students with disabilities and academic deficiencies did not have access to these experiences. They also pointed out that there were no gaps in their curriculum. Now they addressed all of the state standards through their articulated and aligned courses. In addition one of the challenges that the teachers had faced during the years when Brenda led their efforts in improving mathematics and science was how to structure the curriculum to take full advantage of their 90-minute block schedule. Particularly in mathematics, teachers had to re-think their instruction so that it became less textbook oriented and more student centered. Here again, the teachers expressed quiet pride in their success in including more inquiry activities and projects in the class periods. They indicated that data collection, manipulation and analysis had become a central part of the mathematics and science experience for high school students. Finally, as a capstone to high school's improvement work, the school counselor noted that every student in grades 9-11 was required to enroll in a mathematics and a science class each year.

### *The Evolving Roles and Influence of the Teacher Partners*

In 1999 the Knott County school system received a three year Goals 2000 grant for \$250,000 per year to improve science and mathematics education in 6 of the 9 K-8 elementary schools in the system. This grant, coupled with the existing ARSI funding, freed up both Evelyn and Brenda for full time work on the improvement effort. Their work as half time ARSI Teacher Partners had prepared them to take on even greater leadership roles.

For three years, from 1999-2002, Evelyn and Brenda worked as a team in six elementary (K-8) schools in Knott County. In addition to working with their home catalyst schools, they worked with teachers in the K-8 grades to align the curriculum in those grades, and to develop inquiry-based units of instruction. The focus of their work was to create an awareness of exemplary science and mathematics teaching among the teachers in these schools. Then when a Goals

2000 extension grant brought another \$250,000 into the district for one year, the school district had access to almost unlimited resources – materials, equipment, and released time for teachers to work together to improve teaching and learning. During this year, Brenda helped teachers utilize technology more fully in record keeping – recording grades, filing lesson plans, communicating with parents – while Evelyn worked with the remaining three elementary schools that had not participated in the early Goals 2000 grant.

By 2003-2004 however, the Goals 2000 monies were gone and the funds available through ARSI were also being depleted. The ARSI Teacher Partner positions reverted to half-time. At Knott County Central, Brenda retained her half time ARSI role, and worked the other half as the Technology Resource Teacher. As the TRT, she installed a fully functioning computer lab with stations for thirty students, which was utilized by all of the disciplines in the high school. A unique feature of the lab was its operation by students under Brenda's direction. These students spent part of their school day at the adjacent Vocational Tech Center, where they learned to repair and build computers. Two of the students who ran the computer lab rebuilt and networked old computers for the school's science lab, so that students in the science courses could collect and record data as well as access the Internet from the science lab.

Evelyn's role as a Teacher Partner was also changing. When a new principal was hired at Jones Fork, he did not choose to support the Teacher Partner position there and Evelyn was not asked to return to her school. However, a new position with new challenges became available to her through ARSI. She was one of five Teacher Partners selected to work in an expanded role as a Regional Teacher Partner (RTP). The goal of the RTP program was to keep the leaders that had been developed in the ARSI project working to continue the improvement of mathematics and science in five counties.

Evelyn was assigned to work at Carr Creek, one of the larger K-8 elementary schools in Knott County, to provide the professional development needed to change the teaching of science at the school. The energetic principal at the school was determined to raise low test scores by changing the curriculum and by providing intense professional support for teachers. Evelyn acknowledged that the first year at Carr Creek was difficult, because teachers were not accustomed to working as a team and were reluctant to share their classroom practice openly with their peers. But ultimately Evelyn's efforts paid off.

Evelyn helped teachers become more open, and eventually succeeding in restructuring the science curriculum at the school. When we interviewed the classroom teachers, they agreed that their instruction had become less "textbook driven," because Evelyn had helped them explore different ways to teach. One

teacher told us one of the lessons learned from Evelyn was the importance of engaging students in exploration. She said, “Students need time to do science before they are expected to learn the vocabulary of science.” Another teacher learned about the importance of access to multiple resources – “No matter how wonderful a teacher you are, without resources, you just can’t do the job.”

As a Regional Teacher Partner, Evelyn had expanded opportunities to build her own content knowledge and pedagogical skills in science. Through ARSI she attended the Exploratorium Institute for Inquiry workshops, one focused on inquiry and another on assessment. In addition, for two years, she had university mentors with content expertise. Her first mentor was a geology professor at Morehead State; later she had a mentor in biology and worked with that college professor to increase her content knowledge in that discipline. Evelyn describes her own personal content growth in these words, “I had only an elementary certification and no science background. Without ARSI, I would never have had the confidence to work with a college professor and say, ‘This is what I know – am I right?’”

Over a period of six years, Evelyn and Brenda worked with teachers in every elementary school in the district, and with teachers at Knott County Central High School, to improve the teaching and learning of science and mathematics. They spent countless hours in state and regional workshops and seminars, upgrading their own content knowledge and leadership skills, and feeding what they learned right back into the schools and classrooms where they did their work. By 2004, grant monies were becoming scarce and the school district faced the challenge of stretching declining revenues to support both the day-to-day operation of schools and the improvement effort.

## The Legacy of Educational Improvement in Knott County

One hundred years after the first wave of educational improvement came to Knott County, the enduring products of that reform, the Hindman Settlement School and Alice Lloyd College, continue to thrive. Although their missions have evolved and changed, their influence has been a constant factor in educational improvement in the county. Their legacy of meeting the educational needs of the children and adults in a region that is still characterized by isolation and poverty remains strong and viable.

Unlike the women who were the leaders in the early improvement efforts, the leaders of this latest educational improvement effort did not found institutions. Rather, their work centered on creating capacity within the existing educational



structures to change the nature of science, mathematics and technology education in Knott County.

The ARSI leaders we have described exerted considerable influence on the system through their hard work. They too have left a legacy. They created an awareness of the need for improvement, helped teachers change the curriculum and their instructional practices, introduced innovative programs, and developed a culture of collaboration and sharing among the teachers they led. And, just as importantly, they themselves were permanently changed in this process of helping others. Each of them increased their knowledge and skills. Each of them learned to work collaboratively with others, together building a stronger web of support for educational improvement than they could have created alone. And each of them, over the duration of their ARSI commitment, took on increasingly difficult challenges as opportunities and barriers were presented to them.

### *Reflections of the Teacher Leaders*

Each of the four women we have described – Jane Campbell the curriculum coordinator, Frieda Mullins the principal of Jones Fork Elementary, Evelyn Mayer the elementary ARSI Teacher Partner, and Brenda Mullins the high school ARSI Teacher Partner – led the ARSI improvement of science and mathematics education in Knott County in the last decade. As they spoke to us about the legacy of their efforts on behalf of this improvement effort, their thinking reflected each of their own unique perspectives and experiences.

#### Jane Campbell

Jane's role at the district level allowed her to shape the vision of mathematics and science improvement for the district. She was the procurer of funds and the architect of the grants to support the improvement effort. Much of the success of the effort in the early years resided in Jane's ability not only to get funding, but also to articulate and communicate a vision of improvement to others in the district, and to engage others in the implementation of that vision.

From her district-level perspective, Jane's reflections about ARSI centered on two main topics. First she valued the organizational structures and strategies of ARSI, and second, ARSI's vision of high quality mathematics and science education. Jane talked about the integrity of the ARSI *modus operandi*, with its unwavering emphasis on building teacher capacity, and its simultaneous flexibility in using existing local human resources. Although ARSI held firm to certain fundamental principles of mathematics and science improvement, ARSI leaders supported each district and each school within the confines of who they

were and the expertise they had at their disposal. ARSI did not expect them to fit into a predetermined and superimposed mold. From her perspective, ARSI made great demands on the existing leadership in the district. Although ARSI helped district people get better, they had to meet the expectations through their own efforts. There were no available funds to hire additional people; the money was spent in increasing the capacity of the people who were there. She declared that ARSI was able to fuel the improvement because, in her words, "There is something very invigorating and empowering in knowing that someone else cares about your work. If someone cares about what I am doing, then my work must be valuable."

And finally, Jane believed that all those who worked in the ARSI enterprise shared a vision, and that this vision was the cornerstone of the ARSI work. She articulated the ARSI vision in the following words: "I am passionate about learning, and I believe that through learning every child has the power to transform who they are."

Frieda Mullins

Frieda experienced ARSI both as a principal, and later, as a district curriculum coordinator. As the principal at Jones Fork, she took the (then) still unformed concept of the catalyst school, and created a working reality. Similarly, she helped develop the concept of the Teacher Partner and the possibilities it offered for school improvement. When she moved into the District Central Office and became the district's curriculum coordinator, she was able to facilitate the continuation of the curriculum alignment and articulation and professional development that Jane Campbell had initiated. She explains ARSI's legacy in this way:

*One of the impacts of ARSI is that we have a curriculum that makes a lot more sense. We have had high quality professional development and ongoing support for teachers through the TPs. We have scads of materials that are useful because we knew what our needs were and what materials to buy. The math and science program audits (introduced by ARSI) at each school helped with this. Teachers now have everything they need to teach the curriculum. And we have a math and science curriculum on our website that is articulated K-12. We are working to map it out in 9-week periods. And we are beginning to develop unit lesson plans that include elements of exemplary instruction and assessment.*

Frieda Mullins also talked about a professional development model as an ARSI legacy.

*ARSI brought a marvelous professional development concept to the state – intense, targeted, high quality professional development coupled with ongoing continuous support. ARSI did not just bring in a workshop and leave. Instead ARSI identified the needs of the district, and thought carefully about how to meet those needs, and then how to sustain and support the reform effort.*

In her view, one of the lasting effects of the ARSI experience was that Knott County teachers would be more sophisticated and critical consumers of professional development. They had had the opportunity to experience professional development that was strategically targeted to meet their needs and to achieve well-defined goals; anything less thoughtful would not pass muster.

Evelyn Mayer

According to Evelyn, ARSI provided intense and ongoing professional development, both for herself and for the teachers in the district. Through ARSI they all learned about standards, standards-based instruction, inquiry, curriculum alignment and audits, science and mathematics content, and leadership. For Evelyn, ARSI also meant personal growth, especially much greater confidence in her ability to teach and to help others teach science.

As Evelyn reflected on her development and work as an ARSI TP, she acknowledged that in the early years, her lack of training caused her to rush ahead before teachers and students had the necessary understanding and skills to embrace a different kind of science teaching and learning. She said: “I jumped in too fast. I would say to students, ‘Here’s a question, now you design an activity to explore it.’ Students, on the other hand, were accustomed to being given step-by-step directions for an activity. They lacked the prerequisite skills to engage in inquiry even at introductory level.” In spite of the strong and continuous professional development that ARSI provided, she admitted that her own understanding of inquiry grew slowly and over time. And she also pointed out that improvement was a slow process, one that was characterized by both progress and regression.

Like Frieda, Evelyn considered the development and implementation of a district-wide curriculum the most lasting legacy of ARSI in the school district. She described the teachers’ role in that work.

*Teachers district-wide were involved in building the curriculum they are required to teach. They evidence a sense of ownership of the curriculum and the training that ARSI provided has helped them understand the need for a curriculum that is dynamic and evolving. Teachers now talk of the need for revising the curriculum*

*document to make it more cohesive and integrated so that students can see the connections between units.*

### Brenda Mullins

Of the four leaders, Brenda Mullins seemed to be the most profoundly affected by the ARSI experience. Before she became a Teacher Partner, she had never presented a workshop nor spoken to a group about mathematics improvement. In fact, her husband, who was also a fellow teacher at Knott County Central, declared that the ARSI experience had essentially changed her from a shy and retiring classroom teacher, “who refused to get her driver’s license until she was thirty,” into a passionate advocate for mathematics improvement, and a gentle yet outspoken leader in both her school and the district.

Brenda identified technology as a powerful entry and organizing point for curriculum improvement in mathematics and science at the high school level. Serendipitously ARSI’s early emphasis on technology and technology training for teachers supported her efforts to direct teachers toward more hands-on and activity-based mathematics and science lessons in their classrooms. She considered technology the great equalizer. Since few teachers had expertise in the use of technology in the classroom, it helped create a culture of collaboration and sharing among the teachers at the high school. In turn a more collegial tone at the school allowed teachers to work together more effectively, particularly in meeting the challenge of maximizing the opportunities that 90-minute periods offered for curriculum improvement. Brenda and the teachers at Knott County High School agreed that their ARSI inspired work changed their vision of how students should learn mathematics. They pointed to rising test scores, an increase in both the number of AP courses offered at the school, and the number of students enrolled in those courses as evidence of their successful improvement of the mathematics and science curriculum.

### *Reflections of a Researcher*

By any standards, ARSI was a modest initiative. It did not bring a great pool of funds into Knott County. However, it did provide something very important to a traditionally isolated and impoverished locale. It provided information and access. It connected the school district and the leaders to the larger world of educational improvement, providing a direct conduit to unlimited ideas, expertise, and powerful, proven ways of improving mathematics and science. In short, as the principal at Carr Creek Elementary told us, “ARSI was opportunity.” The potential leaders in Knott County recognized, embraced and leveraged this initiative to develop and build their own capacity and that of the district for improvement.

The flexibility of ARSI and its lack of a prescriptive program of educational improvement afforded individual educators of varying backgrounds and expertise diverse entry points into the improvement process. Each of the women who were the focus of our examination of the school improvement initiative in Knott County carved out a unique and individual role for herself. Each found her own way into this improvement effort. Jane used her ability to secure resources to lay the foundation for the work. Frieda developed the catalyst school and the Teacher Partner concepts and used this experience to create a district-wide curriculum. For Evelyn, her passion for science was her vehicle for helping teachers focus on inquiry. And for Brenda, her expertise and interest in technology gave her a way to reach both mathematics and science teachers at the high school level.

Much has changed since we first visited Knott County. Of the four women who played such powerful roles in the improvement effort generally and ARSI in particular, three are no longer in the district. Jane has moved to Pikeville where she is intensely involved in the Appalachian Math Science Partnership (AMSP) in that region. Evelyn also moved to another region. She did continue to work as a Regional Partner under contract in the schools in Knott County three days a month for a while. She is now a middle school curriculum resource consultant in Nelson County in Kentucky.

In 2004 the school administration made a unilateral decision to abolish block scheduling and the Technology Teacher position at the high school. The potential impact of this decision affected Brenda profoundly, and unable to reconcile her personal and professional commitment to science and mathematics improvement with these administrative changes, she elected to resign and seek new employment elsewhere. She is currently teaching mathematics at a high school in Montgomery. She describes her new school as “firmly traditional,” but she has already begun to seek out some of the AMSP innovations, like the EXCEL program, to integrate into the mathematics and science curriculum.

Of the four, only Frieda is still in Knott County. She remains heavily invested in the work of mathematics and science education improvement, and in her position at the district office, she wields considerable power over curriculum, professional development and the allocation of the district’s resources. As the second in command in the district, she helps the superintendent decide the district’s educational direction and she keeps the focus on improving teaching and learning. She expresses concern about the challenge of finding resources to continue the high quality professional development that has been the norm in the district since the advent of the Goals 2000 and the ARSI programs, an issue

that has become particularly critical as resignations and retirements result in a massive staff turnover.

The two catalyst schools have already undergone major changes in personnel. Only two of the current staff at Jones Fork Elementary were participants in the intense staff development effort led by Evelyn as the ARSI Teacher Partner. The current principal explained that the school was the victim of its own success. As long as student test scores were low and the school was considered at risk and state funds were allocated for school improvement – professional development, resources, and special services. As student test scores at Jones Fork showed steady improvement, building until they were the highest in the district and the school was no longer on the “needing improvement” list, the money for school improvement vanished. Now the school budget was barely adequate to fund the day-to-day expenses of running the school.

When we last visited Jones Fork, the impact of the change in resources was clearly evident. The library, which in previous years hummed with student activity at the computers, now seemed quiet and deserted. The science laboratory was in disarray. Science kits were randomly scattered around the room, and the area showed signs of disuse and neglect. Teachers spoke of limited funds for expendables, the lack of time to refurbish and maintain the science kits, and the demise of any time for collaborative planning and sharing. One teacher said, “For 5 or 6 years, we had Wednesday afternoons off, and it was fantastic, because we could talk with each other. Now all our meetings have to be after school. We talk at recess, whenever we can, but we have little time to plan together.”

As we left Jones Fork for the last time, two images reminded us of the power of forces both internal and external on the ARSI efforts to improve education. The first was that of the school principal, moving back and forth across the schoolyard dragging huge garbage bags behind him, as he worked to forestall the trash that threatened to overwhelm the schoolyard. The second was of flowers blooming profusely and beautifully in the courtyard and around the school – flowers that were in fact those planted by students as part of the outdoor classroom pioneered by Evelyn Mayer. The teacher who had made it her job to care for them said, “I just can’t let Evelyn’s flowers die.”