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Moving Toward A Culture of Inquiry

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Keynote Address

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I am reminded of a story that could take place anywhere, but for our purposes let us set the location in Southeast Ohio. An out of town contestant wished to improve his shooting skills and was traveling the countryside in search of a legendary marksman. He followed the local directions and believed he was near his objective. The sides of several barns were covered with targets and the contestant noticed each showed the bullets had hit on a perfect bullseye. The contestant approached the nearest house and inquired if the marksman was available. A gentleman conceded he was the marksman who had shot all of the targets and agreed to demonstrate his technique. Shouldering his rifle, the marksman took careful aim at the side of a barn, squeezed the trigger, located where the bullet had hit, then picked up a bucket of paint and proceeded to paint a target around the bullet. I sometimes think we are much like the marksman. We know what we wish to accomplish in a project, but later discover the real target is something a bit different. Has this ever happened to you? This was the outcome of several teacher professional development and school improvement projects, and today I wish to share with you the real target that we discovered, and how we wished to improve our chances of hitting the target.

We

Throughout this address I will often refer to "we," simply because I did not act alone, the efforts were always larger than one person could ever manage, and the intellect that was required certainly exceed my capacity. The "we" refers to teachers, colleagues, graduate students, school leaders and school students, and community members who worked tirelessly to support teaching and learning in our schools so that the next generation of leaders will have an equitable opportunity to grow into those new roles.

Purpose

My purpose is to share some of the efforts, successes, challenges and lessons learned over approximately two decades of professional development projects both large and small. In retrospect it seems that efforts toward change, improvement and advancement were always bumping against culture. So, this address attempts to place the change effort of inquiry into a cultural context with some notion that change is possible, though it may be messy, cloudy and uncertain.

Culture refers to the behaviors, beliefs and characteristics of a particular social group. In this case the group is teachers and their students in Ohio's Appalachian region. The prevalent culture in our Appalachian schools has been shaped by local interpretations and good intentions about what kinds of efforts are necessary to drive students toward high passing rates on the high stakes high school graduation test. Every fall teachers are told by their principals to teach the academic content standards (rather than teach toward the standards), and each winter the teachers are convinced to set aside instructional time to prepare middle and high school students for the annual spring tests. "Drill and kill" seems to be the effort and the result. We believed teacher beliefs and teaching characteristics could be influenced, and student mental behaviors could be modified and their eventual test performances could be improved through education and training in the uses of inquiry.

Inquiry refers to activities that rely on cognitive, meta-cognitive, emotional, physical, and social processes to make sense of the physical world, or to construct conceptual understandings of key ideas in mathematics and science. The processes of inquiry typically involve strategic uses of questions to develop testable ideas in order to construct understandings of real-world ideas. In our case the ideas were rooted in mathematics and science. Inquiry involves investigating, analyzing, forming answers and explanations, and communicating outcomes, insights and conclusions (Martin, Sexton, & Franklin, 2009).

Decades of research and landmark meta-analyses in the science education community suggested that using more of the processes of inquiry helps schools and teachers to: 1) boost learner attitudes toward mathematics and science, 2) develop long-lasting thinking and reasoning skills necessary for a changing economy, and 3) improve academic achievement. Research devoted to problem-solving in mathematics suggested similar benefits. We believed the processes and the means for achieving them were clear enough, but we needed to find a way to impact the school culture so that inquiry became understood, valued, embedded, and widely used.

SEOCEMS' mission and its partnerships

The "we" that I now represent is called the *South East Ohio Center for Excellence in Mathematics and Science*. Called SEOCEMS, the center began in 2003 as a project funded by the Ohio Board of Regents. Ohio University is the fiscal agent, SEOCEMS receives administrative support from the College of Education and the College of Arts and Sciences. SEOCEMS is a collaboration of faculty from Ohio University, Shawnee State University, the University of Rio Grande and school leaders from the Coalition of Rural and Appalachian Schools (CORAS)—a consortium of school superintendents. As a regional center, SEOCEMS pursues funding for goals that support improvements in:

- Professional development in mathematics and science for teachers
- Pupils' access to quality mathematics and science
- Teacher preparation programs
- Applied research and evaluation focused on mathematics and science in rural Appalachia
- Recruitment and retention of mathematics and science teachers and faculty dedicated to mathematics and science teacher education

A Context

Our work is focused on helping the teachers and schools in the Appalachian region of Ohio. Generally this area is called South East Ohio, though our region ranges from nearby Cincinnati in a crescent along the Ohio River north and eastward toward Lake Erie. See Figure 1.

This 31 county region is rich in Appalachian culture, a tenacious work ethic, and a diverse economic history in coal mining, timber, transportation, brick making and clay products, farming and light-to-heavy industry. Employment in SE Ohio shifted during the 20th Century, and so did its economy. Now, the largest employers often are hospitals, school districts, universities, and power companies. To attract new employers a different type of work force is needed than the communities are used to providing, and this requires a different way of thinking and educating. This need motivates the work of SEOCEMS.

According to CORAS (2009), the Appalachian region of Ohio represents about 1/3 of Ohio's geography; population density is low with the number of inhabitants per square mile only 1/3 of the state average. Overall about 15% of the state's population lives in the Appalachian counties and unemployment is higher than the Ohio and national average. Political clout is limited. Many state education requirements spring from an urban context.

Median income is $5,300 less than the state median and the number of families who receive state aid is 60% higher than the state average. Local property valuation is low, generates limited local funding and typical school districts operate with $2.5 million per year less than suburban or urban districts of a similar size, though the Appalachian schools face many of the same challenges but with far fewer resources and infrastructure. School districts are larger in square miles than the state average, but significantly smaller in enrollment; huge portions of school district budgets are spent in

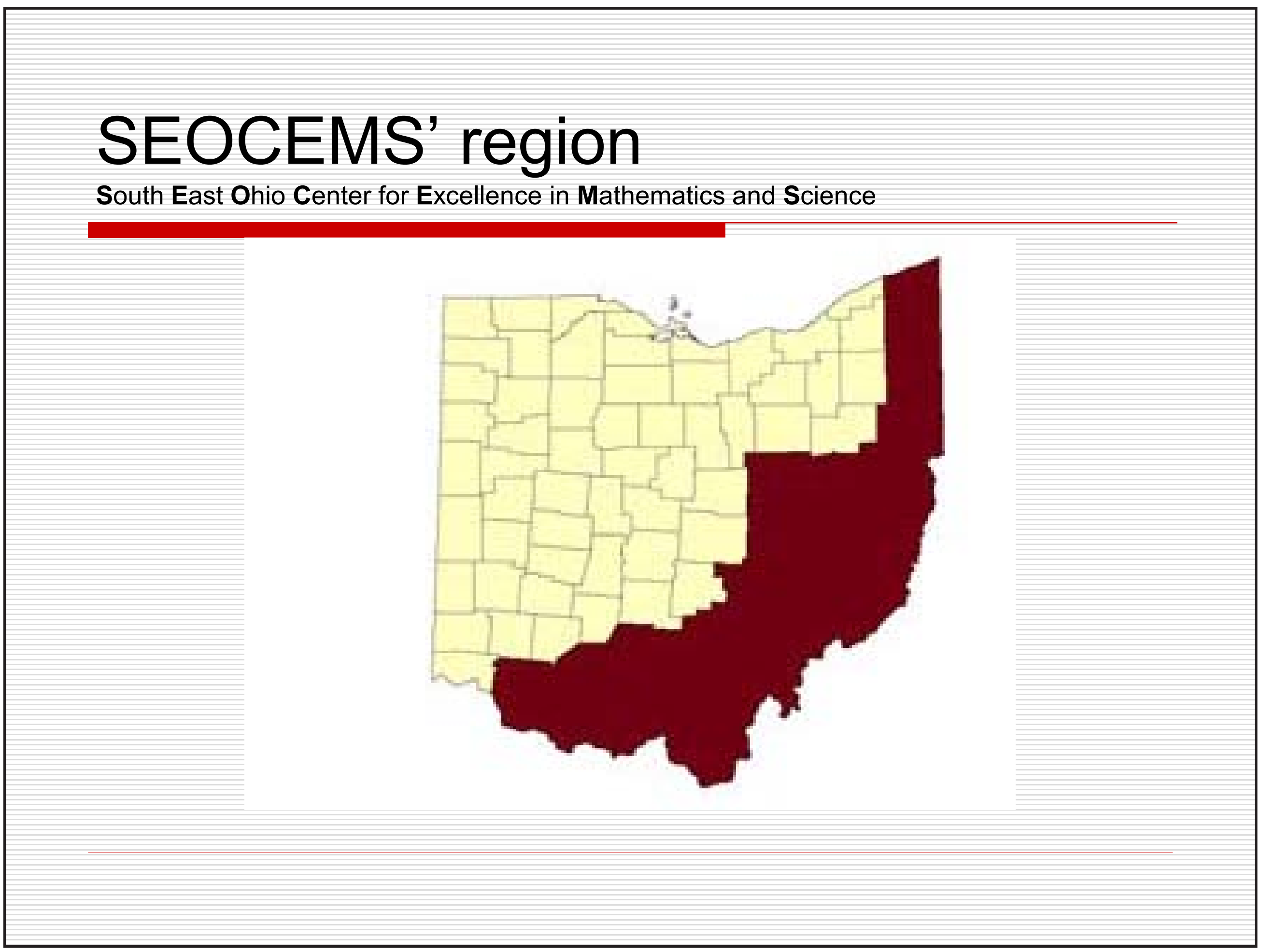

Figure 1.

transportation and it is not unusual for one school district to span an entire county. Some children may have a four-hour round-trip bus ride each school day. Teacher salaries are low to modest and over the course of their careers teachers in Ohio's Appalachian region may earn about $500,000 less than their urban counterparts. However, the teachers remain loyal to their schools and the children.

Still, despite the dire conditions and dim prospects for improvement, teachers are committed to their communities. Job changing occurs less frequently than in urban schools. Improvement and innovation efforts lack the technology infrastructure and support personnel. There are few specialists in any building. Attempts to consolidate professional development and support requires significant travel, time and effort—a large barrier due to geography. The teachers tend to shoulder additional responsibilities to lead and sustain mandated changes. Within a school, teacher supervision, curriculum and instructional support, and guidance may only be provided by a single school principal whose background, training and experience is rarely grounded in mathematics or science.

Though problems of geography, teacher isolation (often common to small schools), lack of funding, and lack of personnel and community support often exist, so do pockets of excellence. These pockets of excellence have potential for motivating and sustaining improvement. Mining those pockets of excellence eventually helped to design a more teacher-student centric model for improving teaching and learning, but only after we attempted a defined professional development effort.

Pockets of Excellence—building blocks for a strong foundation

My first large project predates the formation of SEO-CEMS, but provided a foundation for the model we eventually developed. My thinking was based on the notion that SE Ohio schools had pockets of excellence: elementary teachers in each school district who accomplished great things with math and science. The National Science Foundation funded us to recruit 80 teachers (40 math and 40 science) and form two-person school teams (Martin, 1990). The teams of teachers and their school principals were asked to commit to work with us for three years. The effort was called the "Lead Teacher Project" and it was based on a synthesis of the "what works" research in mathematics and science, teaching and learning, professional development, and leadership.

Those teachers dedicated their time to become schooled in instructional leadership, and pledged to work with their school principals and fellow teachers to advance math and science in their schools. We experienced very little turn over. The teachers began with their own classrooms, learned inquiry and problem solving processes, gathered or built highly engaging learning manipulatives and impacted K-8 student learning in magnificent ways. Measures of pupil achievement, process skills and attitudes toward math and science improved to high levels. The efforts were extended to other classrooms via in-school workshops and in many places the positive impact was felt across school district and county lines. A number of the Lead Teachers developed strong reputations and became consultants for their districts and others. Unsolicited comments wandered back to us claiming the experience was a high point for many teacher careers. The inquiry model we developed in science arose from the most promising research about forming concepts and impacting conceptual change. The model was later modified and became the substance of several editions of college textbooks that shaped the preparation of future science teachers. The Lead Teachers helped us to find effective ways to prepare the next generation of educators.

The political climate shifted and a decade of high stakes testing drove rabid focus on standards. This was not necessarily a bad thing in principle. The positive attention brought initially to mathematics and science was a good thing. However, in practice the natural ways that children learned were stifled by misappropriations of energy and teachers had little time to devote to time-intensive learning opportunities, such as inquiry. A new culture overtook the schools and the notion became: buckle down! Pass the test. Quickly a new concern arose: the students left questions blank if they perceived they had not been taught the exact object of the question; learners had little or no confidence to attempt short answer and extended response items. In many schools' curricula math became a distant second to reading and science was hardly taught at all, and when it was, it resembled an exercise in reading and memorization, and violated all that decades of research had verified as "what works."

For a science educator the time seemed medieval and we were treated as undocumented aliens who were trying to cross the border into schools. Mathematics educators were tolerated. Though the fixation on testing was a distraction for teachers, the existence of academic content standards was a good thing, overall, though uses could be abused. That focus on standards did tend to narrow the curriculum's content, aroused teachers to discuss similar learning expectations, and provided an opening for applied research beneficial for teachers and learners. But a different approach was needed and the key concepts were found in Japan.

CSI

Fast-forward 10 years. After numerous projects it was clear that the specific needs and priorities within school districts continued to vary, as did the resources available among partners. However, consensus existed across the region to support the global needs for SE Ohio while accommodating school districts' desires to maintain independence, identity, and diversity. A series of regional meetings with focus groups revealed substantial variation among school participants respective to the degree to which the needs are embraced and priorities set. Clearly the participants could not be given a single professional development program or "one size fits all" intervention in order to satisfy perceived needs. We soon realized the school districts' desires as well as the Center's priorities may be better served through a system of operation that encourages carefully considered, data-driven, locally identified, problem-based inquiry.

We adapted the Japanese Lesson Study as a model we would try. Lesson Study has been used in Japan for decades for teacher professional development (*Lesson Study Research Group*, n.d.). The Lesson Study process typically involves a team of teachers sitting to design a lesson. The team observes while one teaches the lesson, the team then meets to discuss results, the team redesigns and a different teacher "re-teaches" the lesson. The peer collaboration, focus on results and meta-cognitive processes appealed to us. The model we formed relies upon carefully formed and prepared local Collaborative Study Investigation teams. We call them CSI teams. We envisioned those teams using science-like methodology and systematic approaches in identifying and formulating researchable problems of local interest and need, then undertaking deliberate steps to research, develop, implement, revise and disseminate findings and share products that are mutually compatible with the school district and Center goals. We believed the model would meet the urgent needs and priorities of different school districts while addressing the needs of university faculty, and would use the research interests and mathematical and science talents of higher education faculty in most appropriate ways.

The Model: Modified Japanese Lesson Study

The Lesson Study approach has recently been reported in U.S. journals in pure and adapted forms (Fernandez & Chokshi, 2002; North Central Regional Laboratory, 2002). As a model, Lesson Study is known for its effective professional development through collaborative, reflective, research-based actions, and for its positive effects on pupil learning.

The model, as modified for use in SEOCEMS (see Figure 2), consists of five key activities:

1. Forming and preparing Collaborative Study Investigation teams;
2. assembling and evaluating classroom and district data;
3. developing researchable problems based on local issues;
4. researching development of "treatments" and implementation processes; and
5. disseminating products and findings within and across the Center's region.

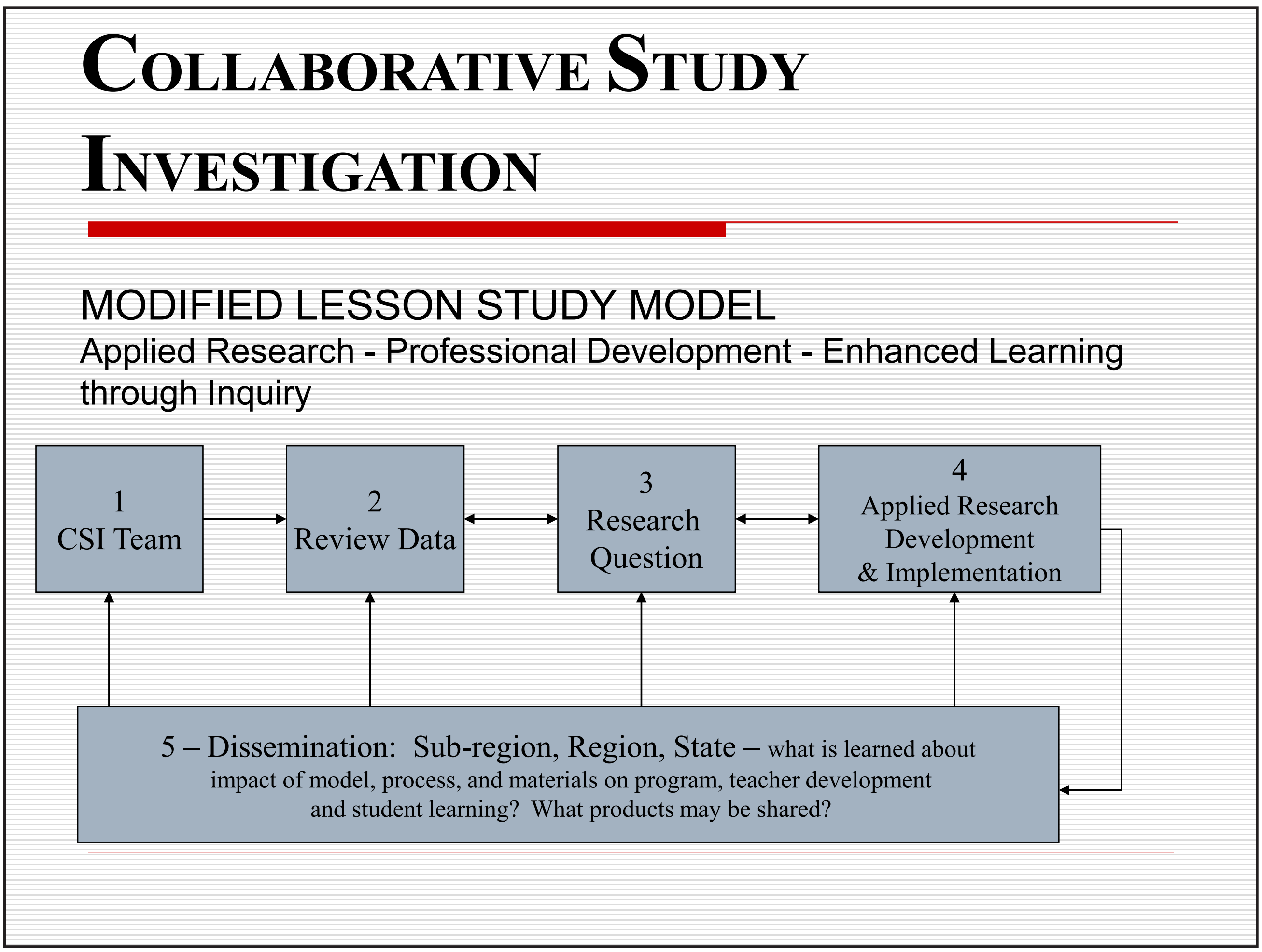

Figure 2.

SEOCEMS issued an RFP to begin the process. Middle and high school teachers were invited to form a CSI team with a university faculty member, whose role would be to become a full participant and offer special talents in support of the team. Grants ($10,000) were issued to support the work of 14 teams over a 6-year time frame. Money was available for released time, materials, consultants, travel, modest honoraria, equipment, etc. Teams agreed to work for up to two years and were supported by the center in the form of workshops, seminars, on-site support and web-based learning materials. These forms of support helped to guide the teams through the modified lesson study process, which was rich in inquiry. We presumed immersion into the inquiry research processes would bring a positive professional impact from reflection and stimulate professional growth in the spirit of Japanese Lesson Study.

Teams proposed their own problems, which were often based on observed difficulties or perceptions about the district's results shown on state tests. Typically, a team stated its intent to use an intervention as a means to produce immediate gains in annual state test scores without realizing the limits and ramifications of what they proposed to do. So, our intervention was to encourage them to sharpen their problem and consider appropriate sources of data that would shed light on the underlying causes and incremental improvements that may be observed. We found ourselves using much of the same lesson study model for planning our interactions with and providing support for the teams.

Overall, 65 teachers were involved and provided direct services to more than 3,400 students. The CSI teams' research often proposed to use a classical treatment and control group quantitative data design, but after considerable reflection and guidance soon evolved into mixed methods using both quantitative and qualitative data with repeated observations and assessments. Though one may critique the quality of the research, teachers did become passionate about their observations and expanded their professional reflection. Team reports suggest gains in test scores ranged from 8% to 95%. According to the team reports, student test scores typically improved by approximately 15 percentile points on the state test. Teachers regarded this as a large improvement in the number of students who were able to pass the Ohio Graduation Test. Teachers reported additional "softer" benefits such as improved pupil attendance, reduced tardiness, more attentiveness, and more thoughtful questions and answers. These things made the school leaders and the parents happy, and brought positive attention to the teachers' efforts.

What did the teams investigate?

A list of CSI Team Projects is provided in Figure 3. Five teams chose to investigate the effective uses of a chosen form of technology and its impact on student achievement and learning. One team of mathematics teachers leveraged SEOCEMS' modest grant to garner significant additional funding and placed "Smart board" technology in each high school mathematics classroom, and arranged for instruction in how to use them effectively. Its school leadership was convinced of the potential for learning and encouraged the science teachers to try similar efforts. Another team extended its emphasis on technology by refurbishing old computers to place in the homes of students who did not have them, so that all learners could have seamless ways to extend their school learning. A different team believed its attempts to use the Lon Capa learning system produced better teacher questions and caused instruction to become more focused and purposeful, thus producing increases in test scores.

Three teams investigated the impact of block schedules for improving achievement. This was not a topic we had anticipated and was certainly not a typical lesson study project. However, since the goal of the model was to support teacher-defined projects, we proceeded. One team's motives were to make a case for keeping a block schedule while its superintendent wished to drop it, and they were able to use data to make their case for retaining and expanding the block. Other school teams accumulated academic impact and student attitude data, which convinced additional teachers and principals to expand the practice school wide.

Four teams investigated the impact of specific instructional practices and two of those focused especially on the uses of graphics and organizers for improving student skills. These were crucial areas of low student performance and deemed essential for advancing test performance. The teams were correct; students became more confident in using graphs and were able to glean data from graphical images, and test scores improved.

One team attempted a unique arrangement combining science field studies and mathematics classes. Students in the math classes designed, piloted and revised the surveys and selected the statistical processes to be used to study the achievement, attitudes and process skills of the science students who needed to master the biology of benthic organisms while studying and mapping the water quality of local streams. The biological study was published in the Ohio Division of Natural Resources annual report and presented at a National Science Teachers Association conference. The collaborative inquiry processes are now embedded in the school's science curriculum, and there is a shared understanding across the departments about the mutual benefits to be gained for students when science and mathematics are linked. Another CSI project also discovered the benefits of coordinated math and science topics (e.g., slope in math and rate of change in science) through mutual support for each others' instruction and a clearer, durable impact on learners.

What were the benefits to the teachers?

When asked about the impact the CSI experience may have had on their professional development, teachers most often mentioned the value of the new insights they had formed. These insights revolved around exposure to previously unknown teaching materials, uses of instructional technologies (e.g., student response systems) and ways to conceptualize and improve their instruction. Appreciation was expressed for expanded skills they gained, again often in learning how to use technology as tools in their classrooms, and for acquiring and using data to make instructional decisions. Collaboration within and across academic disciplines was most mentioned and perhaps most valued.

After all of the teams efforts, what was sustained? Responses were mostly specific to the particulars of the team projects, but in a global sense the instructional improvements that yielded desirable changes in student behavior and achievement were maintained. Teachers continued to use more and different tools, drilled down to focus on student skills development, took appropriate measures, and planned strategic interventions to support learners' opportunities for successes.

When asked about their team projects and what they would do differently if they could have a "do-over," all teams acknowledged their focus questions were too broad, indistinct, overly ambitious or beyond their skills and capacity. Teams still wanted to impact student scores on the state test, but now realized that many intermediate steps could or should be taken in order to build, over time, toward elevating achievement as measured by the graduation test. Teachers confessed their need to understand how to plan and conduct simple research, and acknowledged their designs often were impractical and did not yield the types of controls they had hoped to put into place. Qualitative data became more respected within a school culture of quantification, and most understood the value of multiple measures. Though not their passions, the majority of the team members did acknowledge the value of doing place-based research and the benefits of using results to inform or drive decisions.

What did we learn about the CSI model that we adapted from Lesson Study? What benefits did the teachers identify from their two-year participation? On-site interviews with team members were conducted throughout their participation and during our annual conferences after their studies had been completed. As well, the teams' final reports provided insight, and these are some of the observations provided by the teachers:

- As tedious as they were to do (and seldom done by oneself), literature reviews and syntheses of research were helpful for discovering potential solutions. Time invested produced time saved as the literature provided concrete roadmaps that might be followed, and inspired perseverance toward change. After all, the teachers reasoned, if other schools had found value in a particular

CSI Team Projects

- Effective uses of technology
- Effectiveness of LON-CAPA for OGT science intervention
- How can technology improve student learning: SMART boards in the classroom
- Does technology have a positive influence on learning in the classroom?
- Does integration of technology into high school science classrooms improve student achievement?
- The effects of differentiated instruction on student achievement in middle and high school math and science classrooms
- Strategies for math and science based on Ohio academic content standards
- Using Japanese lesson study model to develop lessons for 80 minute mathematics classes
- Will improving students' skills in using graphic information affect student achievement?
- How will improving of graphs, charts, and tables skills affect student achievement across the curriculum?
- Developing high-quality field research using a modified lesson study format
- Block scheduling
- The effect of block scheduling on math and science achievement in the high school classroom

Figure 3.

technology or practice, might benefits also occur in an Appalachian school?

- Teacher access to an array of tools for assessment helped to reduce some of the stress of the study rather than construct new, untested tools. More confidence was placed in the reliability of the data that may be harvested, and deeper, more thoughtful teacher insights about content, teaching and learning were acquired.
- The dialogues among team members helped teachers to uncover misconceptions about content, and misassumptions about student learning were set aside. The availability of classroom tested resources and peer support systems helped to strengthen teacher confidence in their subject matter and in learning to use a different technology.
- The iterative processes of the model and the need for planned, consistent communication helped teachers to improve instruction.
- Though it was often difficult for teachers to put into words or support with succinct data, qualitatively they perceived important gains in the quality of student classroom and laboratory work.
- The collaborative processes required by the model helped to develop a type of collegial respect and professional understanding that had been missing, and teachers vowed to continue the practice.
- Teacher-constructed assessments improved and the understandings that supported those improvements were linked to aspects of the model.
- Inquiry processes experienced by teachers were modified and used in their own classrooms. Teachers reported improvements in student answers for short and extended response test items, which they attributed to their own more thoughtful approaches to content sequences and to clearer purposes while teaching.
- Teacher dialogue about instruction with other teachers became more centered on effective conditions for learning. This was a large departure from the prior school culture and the residual effects of professional dialogue provided many benefits for learners, according to teacher testimony.

What did we learn?

An honest appraisal of a model is required from its architects. What did we learn and conclude from our synthesis of teacher practice? While it was nice to find that teacher positive comments outweighed any that may be negative, and early teacher "failures" later became successes, we were often nagged by the teachers' views of research and those of the mathematics and science university faculty. The research methodology of math and science is quite different from the methodology used in the social sciences and education, and the math and science faculty members sometimes had difficulty in advising teams regarding research.

We eventually experienced limits in extending the model to additional schools. School economies, changing political landscapes, limits to our own funding, and growing teacher weariness over high stakes testing eventually became impediments. Yet the teachers' views of research seemed to spring to the forefront. When oriented to the research aspect of the CSI model, many team members would often appear as deer transfixed in headlights. As we nudged them to share their impressions, we detected an undercurrent of edgy questions like: What value is research? Isn't that something professors have to do get tenure? Why should I (teacher) do research? I don't need to publish! Why is research important for me? My concern is getting my students to: _________ (fill in the blank with almost any academic task).

As we reflected on these notions, we thought a different approach may be an improvement and maybe a lesson can be learned from almost any physics teacher in a U.S. school. Students often perceive physics to be very difficult, abstract, mathematically intensive, and driven by complicated equations that must be memorized. Often placed in the senior year of the school curriculum, physics can be avoided by all but the students who most wish to get into a good college with marks earned in rigorous courses or those who wish to major in the sciences. More than 30 years ago an approach to physics was tried that helped to overturn impressions that physics must be difficult, will reduce your GPA, and does not affect "me." The inventor of this approach is lost to history, but high profile groups (such as NASA and AAPT) now support the approach, and more than 200,000 entries are found when Googled. It probably began like this: how would you like to take a field trip to an amusement park and ride the coasters? Riding the coasters, feeling the forces and energy transformation, and experiencing micro-gravity and then discussing the forces behind the sensations set up real-world questions and those questions became the sources for investigations that eventually layered on some science. After it was all over the teacher could say, by the way, we were doing physics. The label that conjured up images of boredom, irrelevance and difficulty was removed as a barrier and the learners were free to focus on the important stuff and become turned on by the investigations that they helped to design. Images of physics were replaced by exciting experiences through *Amusement Park Physics* programs.

I think we might try a similar approach; remove the words "research" and "research paper." Just by changing the name of the task we could get past a psychological barrier of doing "research." As an alternative, we could focus on the teachers' questions and use those questions to pose more questions about how we might pursue answers, identify what evidence we might need, think about how we might make sense of the evidence, and plan how we might share what we know or think we know. The "we" is the team and supporters from the Center working with the teachers. After a time we could ask, by-the way, do you know what we have been doing? We have been doing "research."

This process could become similar to the Elements of Research offered by Roberts, Bove, and van Zee in their book *Teacher Research: Stories of Learning and Growing* (2007). The elements of research are embedded in the normal teaching practices of the classrooms, and over time have the potential to become more intentional before becoming more formal in practice like those of us generally use when preparing for a conference, such as this one, or when writing for publication. This type of progression could become natural for educators. Rooted in the elements of inquiry, a curiosity drives a desire to know and eventually produces a culture that does not necessarily think about inquiry simply because of the habits of mind have become a natural way of thinking and behaving. Collaboration and communication becomes a basis for professional bonding. The processes of inquiry are very much in the Sense and Sense-Making standards proposed by the National Council of Teacher of Mathematics, and remain the core of science standards and 21st Century Skills, which benefit all learners.

In closing, I leave you with an excerpt from Eleanor Duckworth's (1987) essay on *Teaching as Research*. I think she captured the importance of inquiry and its potential for nudging a cultural change when she wrote:

> I am not proposing that school teachers single-handedly become published researchers in the development of human learning. Rather I am proposing that teaching, understood as engaging learners in phenomena and working to understanding the sense they are making, might be the sine qua non of such research.
>
> This kind of researcher would be a teacher in the sense of caring about some part of the world and how it works enough to want to make it accessible

Teacher Research: Stories of Learning and Growing by Deborah Roberts, Claire Bove and Emily van Zee (Eds) (2007). Arlington, VA: NSTA Press, p. x

Table 1: Elements of Research

Elements of Research Embedded in Normal Teaching Practices	**Intentional Research Practices**	**Formal Research Practices**
QUESTIONING		
Noticing and wondering in the act of teaching	Generating issues to be explored Becoming aware of relevant literature	Formulating a formal research question Developing a theoretical framework within which that question will be examined
COLLECTING EVIDENCE		
Having stacks of student work	Choosing and copying examples of student writings and drawings	Audio- and video-taping instruction
Noting what happened and ideas for changes in a lesson plan book	Keeping anecdotal records of student progress	Archiving lesson plans, student work email messages, and other artifacts
Having students assemble portfolios of their work	Writing a reflective journal	Generating data such as responses on surveys
MAKING SENSE OF THE EVIDENCE		
Thinking about what happened Talking with colleagues	Discussing copies of student work Writing descriptive accounts of what happened Making connections to others' relevant findings	Watching and discussing video clips of students in action Writing analyses of students' actions and utterances Analyzing survey responses Writing about ways that findings support or disconfirm results reported elsewhere
SHARING		
Talking with colleagues	Meeting with a teacher inquiry group Facilitating discussion of student learning during a staff meeting	Presenting at a conference Writing for publication

Figure 4.

> to others. He or she would be fascinated by the questions of how to engage people in it and how people make sense of it and would have time and resources to pursue these questions to the depth of his or her interest, to write what he or she learned, and to contribute to the theoretical and pedagogical discussion on the nature and development of human learning. (p. 140)

Inquiry inspires and supports a journey that can change the culture of a profession, particularly if the profession values the habits of mind that are necessary to nurture an ability to think critically.

References

Coalition of Rural and Appalachian Schools. (2009, May). *Ohio Appalachian school districts vital statistics report (Fiscal Year 2008)*. Athens, OH: Author.

Duckworth, E. (1987). Teaching as research. In "*The having of wonderful ideas" and other essays on teaching and learning* (p. 122-140). New York: Teachers College Press.

Fernandez, C., & Chokshi, S. (2002). A practical guide to translating lesson study for a U.S. setting. *Phi Delta Kappan*, *84*(2), 128-134

Lesson Study Research Group. (n.d.). Retrieved September 30, 2009, from http://www.tc.columbia.edu/lessonstudy/

Martin, R. (1990). *Lead teacher project: K-6 mathematics and science teacher enhancement.* Washington, DC: National Science Foundation.

Martin, R., Sexton, C., & Franklin, T. (2009). *Teaching science for all children: An inquiry approach*. Boston: Allyn & Bacon.

North Central Regional Educational Laboratory (2002). *Teacher to teacher: Reshaping instruction through lesson study.* Naperville, IL: Author.

Roberts, D., Bove, C., & van Zee, E. (Eds.). (2007). *Teacher research: Stories of learning and growing* (p. x). Arlington, VA: NSTA Press.