UNIVERSITY OF PITTSBURGH
SCHOOL OF EDUCATION

Collaborative for Evaluation and Assessment Capacity
CLEAC

Guiding well-informed policy and practice

Math Science Partnership
of Southwest Pennsylvania

An Evaluation of Lenses on Learning & Eyes on Science

2003-2009

by

Ms. Ellen Botkin, Graduate Evaluator

Mr. Jonathan Adams, Undergraduate Evaluator

Ms. Rebecca Price, Editor

Dr. Cynthia Tananis, Director

Ms. Cara Ciminillo, Project Manager

May 2009

PROJECT SUMMARY

Lenses on Learning (LOL) is a research-based professional development opportunity funded by the National Science Foundation and developed by the Educational Development Center. LOL is designed to foster and deepen effective inquiry-based mathematics practices by engaging administrators in mathematical problem-solving, introducing observational methods for gathering evidence of student learning, and nurturing an iterative process of teacher supervision through co-inquiry questioning. Each series of LOL seminars begins in the summer months, prior to the start of the school year. Two full-day summer sessions are held first, followed by eight half-day sessions during the school year.

After successful completion of the LOL series, administrators can further their development by participating in **Eyes on Science (EOS)**. EOS, developed by the Math and Science Partnership of Southwest Pennsylvania (MSP), leads participants through the essential features of instruction in an inquiry-based science classroom. Its pedagogical foundations are rooted in the five essential areas of scientific inquiry as defined by the National Science Education Standards. Serving in a more condensed capacity, EOS consists of three seven-hour sessions held throughout the school year.

As is illustrated in the figures 1, 2 and 3 below, 81 districts, and 315 administrators have participated in approximately 8,569 hours of LOL since 2003. Since 2004, 36 districts, and 78 administrators have participated in approximately 745 hours of EOS.

Figure 1: Number of Participating Districts

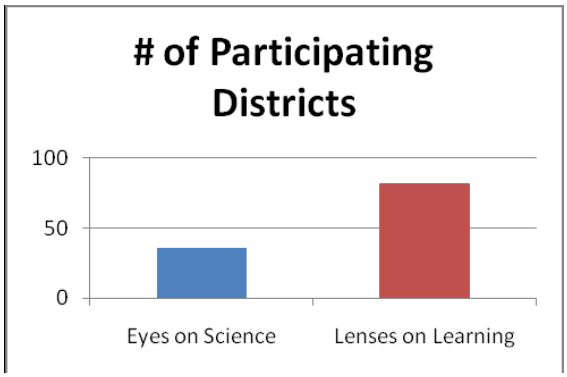


Figure 2: Number of Participating Administrators

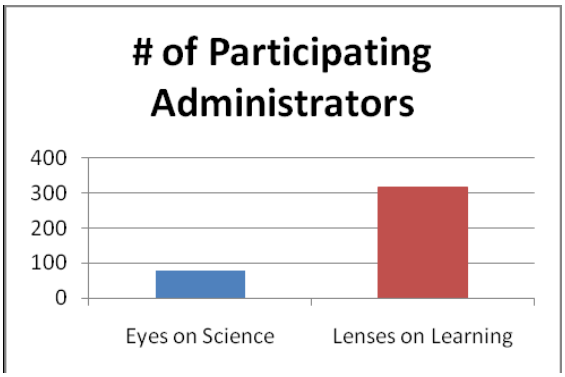
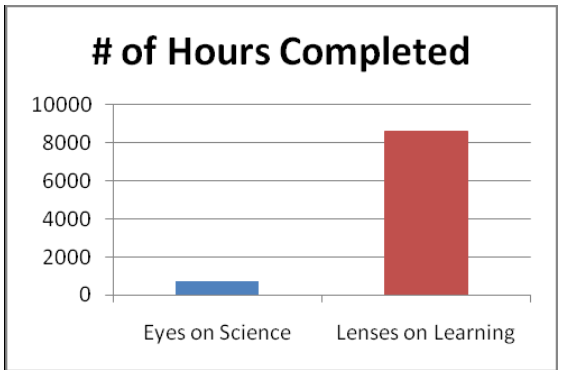


Figure 3: Number of EOS/LOL Hours Completed



Both LOL and EOS are intervention strategies identified in the overall Math and Science Partnership of Southwest Pennsylvania (MSP) logic model, (see Figure 4) which includes components designed to provide professional development to support participants' math and science content knowledge and instructional leadership. As support from district leadership is seen as an important component of instructional improvement, LOL and EOS are key intervention strategies of the MSP for gaining administrator support. Offered since Year One of the MSP (2003-2004), LOL became a required administrator activity for districts wishing to become a part of the MSP during the Year Three (2005-2006) expansion (Williams, Pane, Tananis & Olmsted, 2005).

In the spring of 2009, student researchers with the Collaborative for Evaluation and Assessment Capacity (CEAC) interviewed 12 LOL participants, 6 of whom also participated in EOS. These administrators were included in a sample of 23 participants suggested by the MSP K-12 Project Director. The sample was designed to provide a diverse selection of principals, assistant principals, and central office administrators who, according to the perceptions of the MSP K-12 Project Director, *found the trainings to be pertinent and useful* at the time of their involvement. Although a significant component of the professional development for administrators, a specific evaluation of LOL and EOS impact was not a component of the original evaluation plan. However, throughout the course of implementation evaluators became increasingly interested in the role LOL and EOS played in influencing administrator behaviors and beliefs, particularly given the outcomes of the principal survey reported in the Year 4 Report. Thus when additional staffing became available in the Fall of 2008, CEAC initiated this evaluation. Over the course of two months, phone interviews with participants were conducted for the purpose of gauging the impact of LOL and EOS trainings on the curricular, supervisory, evaluative, and leadership practices of participants.

FOCUS OF THE REPORT

The focus of this report is to discuss the impact of the LOL and EOS training on the instructional leadership practices of participants. Emphasis is given to discerning a change in practice, evidence of the efficacy of these new practices, and whether the participants attributed these improvements to their participation in LOL and EOS. Additionally, the ways in which administrators participating in LOL/EOS have made strides towards the overall outcomes identified in the MSP logic model will be identified.

ABSTRACT

LOL and EOS are professional development opportunities provided to administrators as a part of the Math and Science Partnership of Southwest Pennsylvania. The focus of these trainings is to increase awareness and understanding of inquiry-based math and science pedagogical practices, introduce an iterative process of teacher observation and teach the assessment of student learning through questioning and conversation. Interviews conducted with 12 LOL participants, 6 of whom also participated in EOS identified the change in practice these administrators made as a result of their engagement. Emergent themes include:

- A shift from a focus on teacher actions to student learning during classroom observations
- The value of engaging in inquiry-based math and science during professional development for administrators
- The importance of listening to student conversations as evidence of learning in classrooms
- Increased content area knowledge forms a stronger basis of administrator support of math and science reform

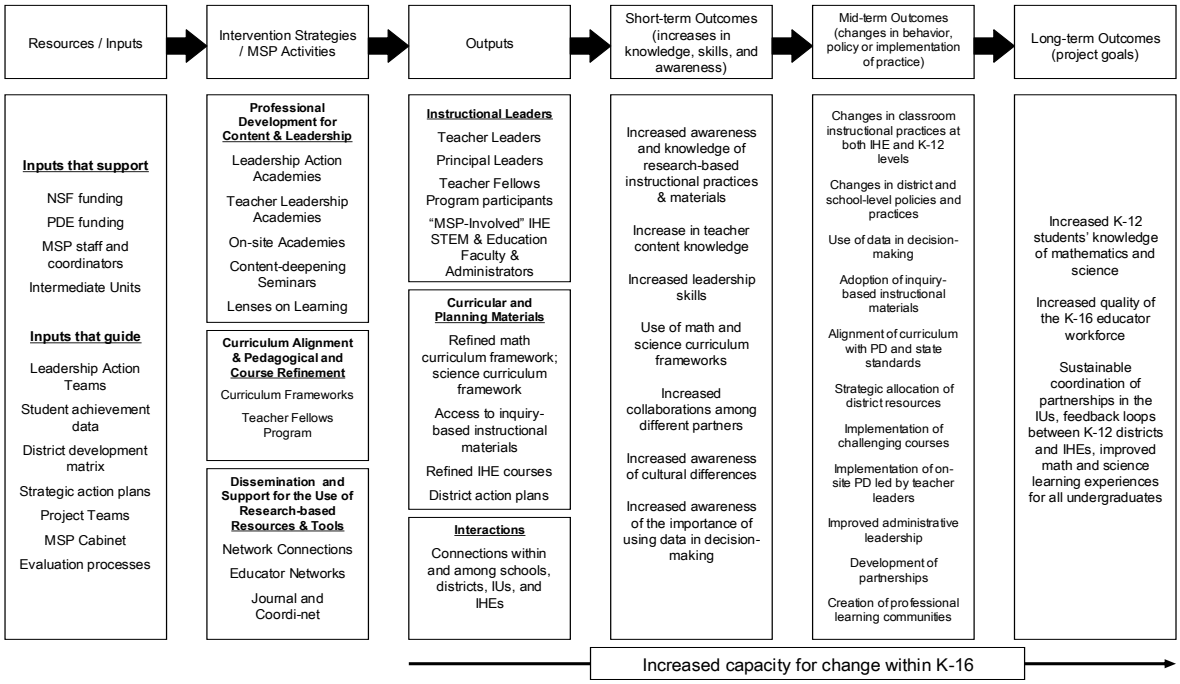
• Teacher "buy-in" is necessary for continued growth and innovation in inquiry-based instruction

EVALUATION ACTIVITY

An evaluation of the specific impact of LOL and EOS was not a component of the original evaluation plan as designed by the evaluation team of CEAC at the University of Pittsburgh, the RAND Corporation, and the Evaluation, Grants and Data Division of the Allegheny Intermediate Unit (AIU), the evaluation team for the MSP. However, as the MSP began implementation and evaluations progressed, compelling information began to emerge, and alluding to the importance LOL and EOS had in supporting change in instructional leadership among participants. In 2003, participants expressed high praise for LOL and indicated that the trainings had been some of the most significant professional development of their career. (Williams, Pane, Tananis & Olmsted, 2005). Principal surveys conducted in 2004 and 2006 revealed higher values for LOL participants in the areas of administrative leadership skills and changes in district and school level policies (Tananis, et al, 2007). Most recently, Burgess (2009) conducted a quantitative analysis of MSP data in which administrator participation in LOL was positively correlated to the amount of site-based professional development offered in the same district. Recognizing the growing importance of LOL in fostering administrator support for instructional improvement, CEAC commissioned this evaluation to gauge the change in principal practice resultant from involvement in LOL.

The MSP Logic Model (Figure 4) illustrates the collective theory of action for the MSP and identifies LOL and EOS as one of the five professional development intervention strategies designed to impact content knowledge and instructional leadership. Engagement in LOL and EOS is designed to increase participant knowledge, skills and awareness of mathematical and science content, teaching and learning (short-term outcomes), leading to changes in behavior, policy or implementation of (mid-term outcomes) that will ultimately achieve the project goals of the MSP (long-term outcomes) (see Figure 4). Discussion included in the analysis section of this report will reflect the ways in which LOL and EOS impact goals included in the short-, mid-, and long-term outcomes.

Figure 4: MSP Logic Model



The interview protocol (see Appendix 1) was developed with particular attention to the scales identified by the Math and Science Partnership Principal Survey, included in the Year 4 report, as having a higher, more positive value for LOL participants-administrative leadership skills and changes in district and school level policies and practices (Tananis, et al, 2007) and the theories of action behind the LOL and EOS trainings. Questions were designed to elicit answers that identified changes in practice, the sustainability of that practice and whether the participant believed their change in practice was attributable to their participation in LOL/EOS and/or the MSP:

1. What was the most influential LOL or EOS experience as a participant?
    a. How did that impact your practice?
    b. Was that a practice you learned through LOL?
    c. Is this something you've been able to continue?
    d. Can you give me an example of this occurring in your district/school?
2. How would you describe your role as a leader of math and science reform?
3. Have you seen overall growth in math or science teaching and student learning in your school?
    a. If so, do you think this is related to the MSP and/or your participation in LOL and/or EOS?

The sample is comprised of individuals that were suggested by the LOL facilitator and MSP K-12 Project Director and reflect a diverse selection of school-based math coaches, principals, central office curriculum coordinators, school-based curriculum coordinators and central office administrators who at the time of their involvement, found the trainings to be pertinent and useful. These individuals were distributed evenly across grade levels, with three respondents working in elementary schools, two in middle schools, three in high schools and four in central office positions.

Given CEAC's desire to conduct in-depth phone interviews as the method of inquiry and the amount of time that had lapsed for some participants, it was decided that the list of participants suggested by MSP K-12 Project Director would be used as the source of interviewees. Out of the 23 participants initially contacted for participation, 12 administrators representing 10 different school districts responded, 6 of whom also attended EOS, providing a response rate of 52%.

After all interviews were conducted, responses were analyzed and seven emergent themes were identified. The following analysis section provides a brief listing of emergent themes, followed by a detailed description of each theme, as well as a visual representation depicting the degree to which each theme was referred to by participants (see Figure 5). Example participant quotes are used to reflect the data within each theme.

ANALYSIS

Feedback from the participants was generally quite positive and indicates that the intended objectives of the LOL and EOS trainings and MSP theory of action have been achieved in some capacity among respondents. The following are common themes that participants offered across both Lenses on Learning and Eyes on Science.

Emergent Themes from Lenses on Learning & Eyes on Science Series

You Want to Hear Them Thinking: Student Conversation as Evidence of Learning. Participants overwhelmingly indicated that LOL had shown them that student conversations are a rich source of information to assessing student learning. Developing an environment where students are encouraged and required to explain both their process as well as their answer was seen as a key component of good teaching.

Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform. Participants saw themselves as being a strong support to teachers by providing the materials, instructional leadership and trusting environment necessary for implementing school-wide reform in math and science instruction.

Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions. Participants placed significant emphasis on the influence LOL had in directing their attention to student learning as opposed to solely observing teacher actions during classroom observations, a practice either solely learned or professionally validated through their participation.

Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development. Participants found the hands-on activities focusing on inquiry-based practices extremely valuable in deepening their conceptual understanding of mathematics which supported their ability to recognize and support inquiry-based teaching and learning in their schools.

From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction. Participants believed that where there was administrator and teacher buy-in; there was growth in inquiry-based mathematics and science instruction. New and inventive methods of instruction and assessment were identified and seen as a positive result of MSP involvement.

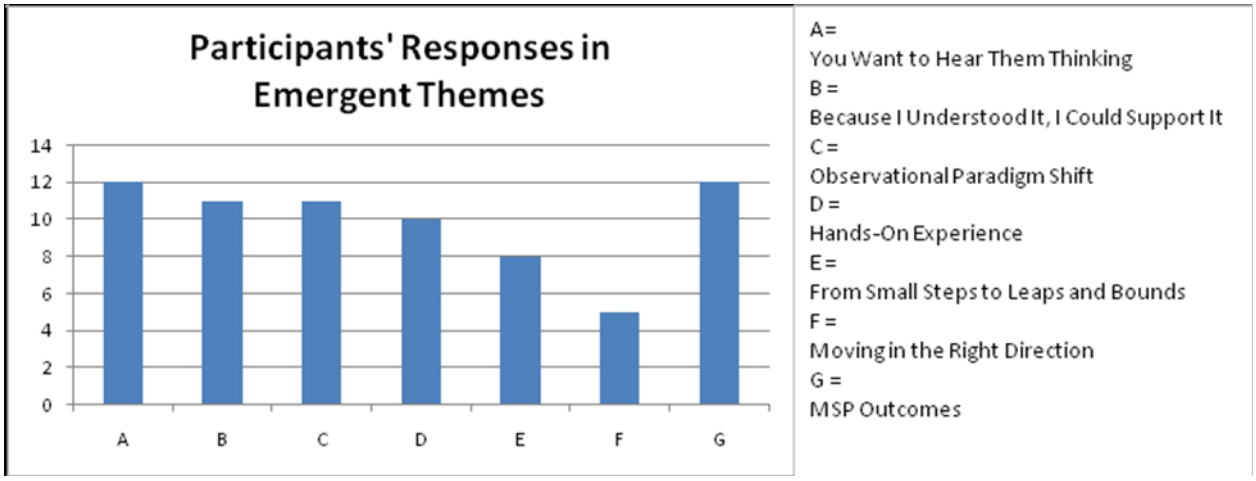
Moving in the Right Direction: Growth in Student Learning Outcomes. Several participants identified both a steady growth in assessment scores in math and science, an improvement they perceived to be

attributable to the adoption of an inquiry-based curriculum and the cumulative effect of their district's involvement in the MSP.

MSP Outcomes are Supported through Administrator Professional Development. Feedback from the participants was extremely positive and indicated that the areas targeted by LOL and EOS support the achievement of the short-, mid- and long-term goals established by the MSP logic model.

The figure below is a visual representation of the emergent themes and the degree to which each was referred by participants throughout the course of their interview.

Figure 5: Participants' Responses Evident in Emergent Themes



The next section details the emergent themes identified above, expanding upon each section to provide a thorough illustration of the impact LOL and EOS had upon participant practice.

Detailed Summary of Emergent Themes

Each identified theme is described and elaborated upon, drawing heavily from interviews conducted with program participants.

You Want to Hear Them Thinking: Student Conversation as Evidence of Learning Participants overwhelmingly indicated that LOL had shown them that student conversations are a rich source of information to assessing student learning. Developing an environment where students are encouraged and required to explain both their process as well as their answer was seen as a key component of good teaching.

The content and quality of both an individual student's explanation of mathematical concepts, as well as the conversations that take place among students throughout the course of a given exercise were identified as important evidence of student learning. A high school principal responded,

"I look for the talking and the questions kids are asking as much as the written work. How they're talking through the process of what's coming next and how they came to that point. [A] quiet classroom isn't always a good class. You want to hear the thinking."

A central office curriculum coordinator emphasized that explanations and conversations were critical in determining whether students understood the underlying mathematical concepts, in addition to obtaining the correct answer.

"Listen to what they're saying to each other, not just seeing them work on paper. Getting children to understand the process more than to get the formula and correct answer, but rather how you manipulate the numbers. To see that you have to listen to how they're talking to each other- it shows they understand what they're doing."

Or as one central office administrator explicitly stated, "*You can use conversations as real-time assessments for student learning*."

Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform

Participants saw themselves as being a strong support to teachers by providing the materials, instructional leadership and trusting environment necessary for implementing school-wide reform in math and science instruction.

A current central office curriculum coordinator, who at the time of her participation in LOL was a principal, remarked,

"LOL made me a more supportive administrator. Walking into the middle of an integrated math curriculum, it gave me a better understanding of what was going on. Because I understood it, I could support it either through materials or sending them to MSP programs, participating in programs, and seeing it carry through into classrooms."

Understanding the pedagogical framework included in a district's adopted math and/or science reform was seen as a key in providing instructional leadership and support to teachers. "*LOL helped me understand what was going on in an integrated math classroom and understand what I would see during observations. It helped teachers because they had an administrator who understood where they were going- fostering an understanding, not just following a district mandate*," said one middle school principal.

As one elementary principal stated, "*Because of LOL I'm able to give more meaningful feedback to teachers and help coach teachers on better instructional practices*."

Respondents also recognized the need to provide a trusting, supportive environment in order that would foster a feeling of security for teachers trying new inquiry-based teaching practices. "*Trust has to be there. We trust each other and they [the teachers] aren't apprehensive or intimidated about trying new things- they're just practicing and trying new things. They [the teachers] are encouraged to try new things and visit each other's classrooms*."

One school-based math coach provided a vivid illustration of the importance of administrator support both in the form of pedagogical content knowledge and the creation of a trusting environment during a reform-based curricular change.

"At first teachers were hesitant to change their pedagogy when their district adopted Investigations because they thought principals were looking for the old style [of teaching]. Getting administrators on board first, so that teachers knew that they [the administrators] knew what they were looking for made a big difference in how the teachers delivered the lesson. LOL didn't cause us to go to the new curriculum, but it certainly helped us stay there!"

Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions Participants placed significant emphasis on LOL's influence in directing their attention to student learning as opposed to solely observing teacher actions during classroom observations, a practice either solely learned or professionally validated through participation in LOL.

The most frequent response to the first question posed to respondents, "What was your most influential experience as a participant in LOL or EOS" reflected the LOL principal of observing student learning, as opposed to teacher actions, as evidence of good instruction. As one middle school principal offered,

"For example, if I'm observing in a math class I'll get up, see what they're [the students] are working on, ask questions about what they're doing and their learning. Instead of capturing teacher behaviors and the scripting of the lesson I'll focus on what students are doing, conversations they're having, making sense of what they're learning. I have a much more active role in observation practice than before."

Observation guides (see appendices 2 and 3) included in both the LOL and EOS training were identified as helpful tools to support the administrator's newly developed shift in observational focus. An elementary math coach stated, "*The observation guide that we used in LOL was a great tool to look back and make sure I was covering my bases and not forgetting an important part of the lesson…The observation guide gave me language for having conversations about my observation, not criticizing it*." Information gained through this new style of classroom observation was used as a catalyst for conversations among fellow administrators regarding the type of feedback being provided to teachers and to inform future professional development presented. As a central office administrator stated,

"For me it [the shift from teacher actions to student learning] was a major change. When you looked at the student it was in reaction to the teacher. Now I look at and value what students are doing or not doing and how that information can be used in discussion starters and staff development to maximize student learning."

When all administrators in a particular district participated in LOL and looked at classroom observation through the same lens, those responsible for supervising instruction and learning across multiple buildings felt they had a better sense of the actual student learning occurring in each classroom across the district. "*All the elementary principals have gone through LOL*," said an elementary curriculum coordinator. "*It provides them with a common experience when talking about math instruction*." And as one central office administrator explained,

"When we do fill out 426 and 428 forms [PA Department of Education teacher evaluation forms] , I'm spending a lot more time talking to administrators about what's actually going on in the class. I want to see descriptions, and the descriptions need to talk about what the students are doing, saying, learning and what kinds of feedback we're giving teachers on improving and how it is related to data contained in the observation."

Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development Participants found the hands-on activities focusing on inquiry-based practices extremely valuable in deepening their conceptual understanding of mathematics which supported their ability to recognize and support inquiry-based teaching and learning in their schools.

The second most influential experience as a participant in LOL was the first- hand experience of grappling with mathematical concepts in an inquiry-based context. In the Year Two MSP evaluation report, it was noted that LOL participants reported less familiarity with their district's mathematics curriculum than non-LOL principals. It was hypothesized by the MSP staff and LOL facilitator that "one of LOL's initial impacts is for participants to question their own knowledge of mathematics curricula and pedagogy, such that principals may be reporting an increased awareness off what they do not know. This may be an important precursor to becoming receptive to curricular and pedagogical reform." (Williams, Pane, Tananis & Olmsted, 2005) Responses provided by participants indicate that LOL was indeed a significant departure from their original pedagogical framework. As reflected in the statement below made by a central office curriculum coordinator, the hands on experience of working with mathematical problem solving deepened their understanding of and comfort with inquiry-based mathematics pedagogy.

"Working together in groups with manipulatives to solve given math problems and sharing answers where diverse methods of problem solving were accepted was something that I learned specifically through LOL. Before that I only knew of math instruction to be textbook, workbook, chalkboard or some type of activities where we did practice and drill with a student. But with this [inquiry based instruction] there was a whole different angle that I feel is motivating students to exceed in math."

While exposure to diverse methods of problem solving was an entirely new concept for some, others felt professional validation of the idea that one could obtain an answer to a given problem in a variety of ways. "*It validated my initial hunch that this [the concept of obtaining an answer a variety of ways] was okay, that depending upon how a child thinks they could use a variety of ways*," said a central office curriculum coordinator.

Parallels between the administrator's and student's experiences in grappling with mathematical concepts were made by several participants. Comments such as, "*We learned along with colleagues like the students- we didn't all progress at the same time- we would share discussions, thoughts, concerns which supported the process*," and **"***Doing the problems as the student would be, the discovery. The discovery was amazing*" reflect the appreciation participants had not only for the process of inquiry-based mathematics, but the inherent joy of discovery included therein.

From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction Participants believed that where there was administrator and teacher buy-in, there was growth in inquiry-based mathematics and science instruction. New and inventive methods of instruction and assessment were identified and seen as a positive result of MSP involvement.

School-based professional development was identified by an elementary level school-based math coach as an important component in decreasing teacher skepticism and increasing adoption of inquiry-based pedagogical practices.

"One teacher was very hesitant to have her come into the room. Was an experienced teacher and wasn't sure she had anything to learn. As we did staff development in the building, she attended several sessions that involved questioning. Her classroom used to be going over homework but over time she began to ask questions that didn't give away the mathematics and (the teacher) would say things like "Don't give me the answers yet, talk about it with your partner." And when students answer she would ask "who else thought about it in that way or a different way?"

Several respondents provided examples of innovative, engaging lessons presented by teachers who had "bought-in" to inquiry based mathematics and science instruction. Examples included:

- A geometry lesson wherein students built and tested the strength of a cube, a pyramid, and a cylinder by placing books on top of each structure. The cylinder, with its infinite number of support points, won by supporting a stack of books that almost touched the ceiling. The teacher facilitated a discussion as to why the cylinder was the strongest shape.
- An algebra lesson during which students created songs explaining mathematical theorems to the tune of "Gilligan's Island".
- A mathematical debate amongst 5th graders trying to prove, with various physical representations, whether 2/6 was the same as 1/3.
- A practical, hands-on assessment developed as an alternative to a written pre-calculus/trigonometry test wherein a student used a *Jenga* puzzle to prove a mathematical formula and presented his formula and findings to the class.

Further reinforcing the earlier theme of the importance of administrator content knowledge, the principal whose teacher developed the alternative hands-on assessment emphasized that "*Without LOL I would never have allowed it [the hands-on assessment], or been able to support why it was a good idea. I never would have been able to defend the alternative assessment to parents and other administrators without it*."

Moving in the Right Direction: Growth in Student Learning Outcomes

Several participants identified both a steady growth in assessment scores in math and science, an improvement they perceived to be attributable to the adoption of an inquiry-based curriculum and the cumulative effect of their district's involvement in the MSP.

Each respondent who identified growth in student learning outcomes connected their improvements to growth in inquiry-based instruction which they attribute to the cumulative effect of the various activities provided by the MSP.

Two central office curriculum coordinators and one central office administrator, each from different districts, saw improvement in student achievement scores as a reflection of improved inquiry-based instructional strategies.

"With teachers who have had buy-in with inquiry in math and science, the evidence is there that their students are consistently performing strongly. Our science curriculum is a 100% inquiry-based program and the PSSA science scores were 97-98 % proficient."

"We've met or exceeded the state expectations (for math) - even as expectations have been more rigorous we've been able to keep up with or surpass that. I attribute it to the collaboration and (inquiry-

based) strategies I encouraged them to try, students have a deeper understanding of math concepts through problem solving, group work and the use of manipulatives."

"We've seen significant growth in math. We're talking about more kids taking algebra before leaving 8th grade. High school math scores have been improving significantly- the last two to three years 11th grade scores were higher than 8th grade scores which is not something that happens traditionally."

While more rigorous statistical analyses of student learning outcomes are beyond the scope of this report, the anecdotal information provided by a subset of respondents (n=3) indicate district support of MSP, faith in the overall goals projected by the MSP and that their engagement in MSP initiatives has indeed led to growth in student achievement.

MSP Outcomes Supported Through Administrator Professional Development The next level of analysis was to determine whether or not the emergent themes identified through interviews with program participants aligned with the overall outcomes of the MSP. In the MSP Year 5 evaluation report, Pane et. al (2008) assert that **"**the theory of action that underlies the MSP logic model is premised on the view that student achievement in mathematics and science can be enhanced by administrators and classroom teachers who are willing to become learners and deepen their own conceptual understanding of the big ideas in mathematics and science" (p. 7). LOL and EOS are the primary intervention strategies designed to provide professional development for content and leadership, for "in order for administrators to support effective teaching and learning in the classroom, they must first learn what good instruction is and how to recognize it. With these new "lenses", administrators are better prepared to support teacher-led instructional change, through improved teacher observation skills, support for professional development and the creation of strong learning communities within the schools and districts" (Tananis et. al, 2007, p. 9).

Much of the feedback from the participants elaborated upon throughout the body of this report indicate that the areas targeted by the LOL and EOS support progression towards the short, mid and long-term goals project goals established by the MSP**.** Tables 1, 2, and 3 below identify the emergent themes that align with each set of outcomes respectively, underscoring the efficacy with which LOL and EOS were able to evoke positive change in the participants interviewed for this report.

Table 1: Short Term Outcomes

Outcome Category	Specific Outcome	Emergent Themes Suggestive of Progression Towards Outcome
Short Term Outcomes: Increases in knowledge, skills, and awareness	Increased awareness and knowledge of research-based instructional practices and materials	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • Because I Understood it, I Could Support It: The Role of a Leader of a Math and Science Reform
	Increase in leadership skills	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction.
	Increased awareness of the importance of using data in decision making	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction

Table 2: Mid-Term Outcomes

Outcome Category	Specific Outcome	Emergent Themes Suggestive of Progression Towards Outcome
Mid Term Outcomes: Changes in behavior, policy or implementation of practice	Changes in classroom instructional practices at both IHE and K-12 levels	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction
	Changes in district and school-level policies and practices	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction.
	Adoption of inquiry-based instructional materials	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction.
	Improved administrative leadership	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction.
	Creation of professional learning communities	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform

Table 3: Long-Term Outcomes

Outcome Category	Specific Outcome	Emergent Themes Suggestive of Progression Towards Outcome
Long Term Outcomes: Project Goals	Increased K-12 students knowledge of mathematics and science	• You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction. • Moving in the Right Direction: Growth in Student Learning Outcomes
	Increased quality of the K-16 educator workforce	• Observational Paradigm Shift: Focusing on Student Learning vs. Teacher Actions • Hands-On Experience: The Value of Engaging in Inquiry-Based Math and Science During Professional Development • You Want to Hear Them Thinking: Student Conversation as Evidence of Learning • Because I Understood It, I Could Support It: The Role of a Leader of a Math and Science Reform • From Small Steps to Leaps and Bounds: Growth and Innovation in Inquiry-Based Instruction.

The important role that administrator professional development, such as LOL and EOS, play in supporting the overarching inquiry-based math and science reform movement initiated by the MSP was illustrated by a central office curriculum coordinator who emphasized the key tenant of LOL and EOS, "*If there was no administrative understanding of what was supposed to happen in the classrooms, the teacher's job would be next to impossible. Without LOL and EOS we wouldn't be where we are*."

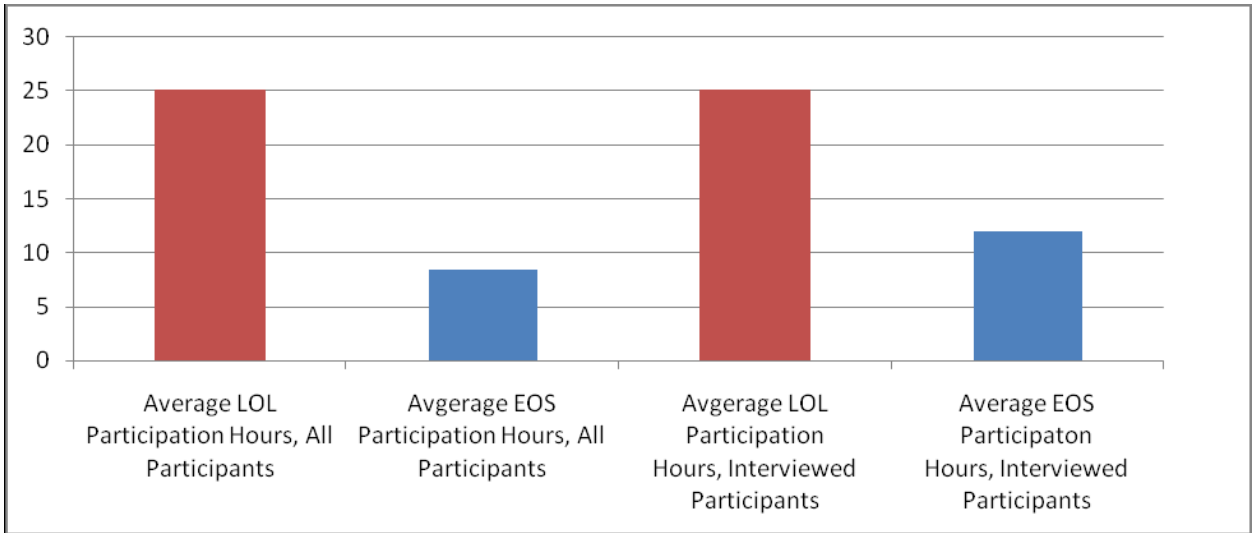
NEXT STEPS

While these outcomes were very positive, it is difficult to gauge whether or not the benefits identified by the participants in this report are generalizable to all LOL and EOS participants. We took an initial step in this analysis by comparing the number of hours of LOL and EOS participation experienced by the respondents in this report and compared to the overall LOL and EOS participant population. Interestingly, the average hours of LOL attendance was the same for both the sample of LOL participants and the overall population (25 hours) while the average hours of EOS participation for the sample included in this report was 8.4 as compared to 12 for the overall population (see Figure 6).

This distribution, as well as our earlier report of grade level of respondents, may indicate a potential for applicability across the larger population. Furthermore, research conducted by Burgess (2009) found that districts whose administrators attend LOL provide more time for site-based professional development, providing a statistically significant "connection between administrator attendance at their own professional development and increased time allotted for teacher led professional development" (p. 20).

However, the sample included in this report was heavily weighted by the specific selection of participants who indicated initial engagement and satisfaction. Further study is required to examine issues of generalizability as well as to explore a deeper understanding of how LOL and EOS operate as professional development with sustainable impact.

Figure 6: Participants' Responses Evident in Emergent Themes



References

Burgess, M. (2009). *Effects of administrative professional development on time for teacher led in-service*. Unpublished manuscript.

Pane, J.F., Williams, V.L., Olmsted, S.S., Yuan, K, Ciminillo,C., Yugar,Y., et al. (2008). *Math science partnership of Southwest Pennsylvania: Year five evaluation report*. Working Paper. Santa Monica, CA: Rand Corporation.

Tananis, C.A., Pane, J.F., Williams, V.L., Olmsted, S.S., Ciminillo, C., Tharp-Taylor, S. (2007). *Math science partnership of Southwest Pennsylvania: Year four evaluation report*. Working Paper. Santa Monica, CA: Rand Corporation.

Williams, V.L., Pane, J.F., Tananis, C.A., Olmsted, S.S. (2005). *Math science partnership of Southwest Pennsylvania: Year two evaluation report*. Working Paper. Santa Monica, CA: Rand Corporation.

For questions regarding this program or activity, contact the Math and Science Partnership of Southwestern Pennsylvania.

Samuel Shaneyfelt
Math and Science Partnership
K-12 Project Director
Math & Science Collaborative
475 East Waterfront Drive
Homestead, PA 15120
(412) 394-4598
samuel.shaneyfelt@aiu3.net
www.mspnet.org/swpa

For questions regarding the evaluation or report, contact the Collaborative for Evaluation and Assessment Capacity (CEAC).

Cynthia A. Tananis, Ed.D., Director
Collaborative for Evaluation and Assessment Capacity
School of Education
University of Pittsburgh
230 South Bouquet Street 4139
Wesley W. Posvar Hall
Pittsburgh, PA 15260
(412) 624-7240
www.ceac.pitt.edu