BREAKOUT SESSION

Study of the Impact of Instructional Coaches on Middle School Teachers and Student Achievement

2009 Math and Science Partnership Learning Network Conference

Research Findings in Teacher Education:

New Approaches → Transformative Possibilities?

January 25-26, 2009 • Washington, DC

CONTENTS

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This documentation is part of the **MSPnet** project, funded by the National Science Foundation and designed and facilitated by **TERC Inc.**, a not-for-profit education research and development organization based in Cambridge, Massachusetts.

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Principal Investigators
Joni_Falk@terc.edu
Brian_Drayton@terc.edu

Conference Documentation
Catherine McEver

About This Summary

This documentation of the 2009 Math and Science Partnership Learning Network Conference offers a brief summary of the presentation that took place during one conference breakout session and focuses on questions, answers and discussions during the session.

Readers interested in pursuing information about the project discussed in this breakout session are encouraged to visit MSPnet to access the full PowerPoint presentation. The abstract for this presentation is posted in the Virtual Poster Hall.

Cover: M. Susana Navarro

Visit the MSP LNC 2009 Virtual Poster Hall

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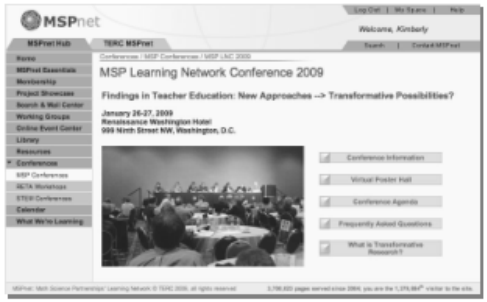

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STUDY OF THE IMPACT OF INSTRUCTIONAL COACHES ON MIDDLE SCHOOL TEACHERS AND STUDENT ACHIEVEMENT

Learning Network Conference Breakout Session Number: 4 - 39

MSP Project:
El Paso Math and Science Partnership

The El Paso Collaborative for Academic Excellence at the University of Texas, El Paso, was awarded an MSP Comprehensive grant in 2002 to improve teaching and learning in middle grades and high school mathematics and science. One of the central strategies of the project was the provision of on-the-job assistance to teachers by instructional coaches, or staff developers.

PI:
M. Susana Navarro

Discipline:
Math and Science

LNC Strand:
Teacher Leaders

Presenter:
M. Susana Navarro

Presentation Recap

Susana Navarro begins by offering a sense of the context for this MSP's work. El Paso is the largest cross-border area in the United States. Eighty-nine percent of the student population is Latino, and 28% have limited English proficiency, which may be a low estimate, Navarro notes, because over fifty percent of households in El Paso identify Spanish as the language of preference in their home. This is the fifth poorest congressional district in the U.S., so the percent of low income students may also be an underestimate.

Many of the schools are very large, Navarro observes, citing elementary schools with over 1,000 students, and high schools "too large to accommodate any reasonable work." The districts the MSP works with range from over 65,000 students to under 1,000 students.

Navarro then provides background on the El Paso Collaborative for Academic Excellence, based at the University of Texas at El Paso.

Context for El Paso's MSP

- K-12 Enrollment in twelve El Paso area school districts: 170,888
- Ethnic breakdown of student enrollment:
  - Hispanic: 89%
  - African-American ..... :3%
  - White: 8%
- Percent of students that are Limited English Proficient: 28%
- Percent of students that are low income: 64%
- Number of Schools:
  - Elementary: 139
  - Middle: 45
  - High: 41
- Number of School Districts:
  - Urban: 3
  - Rural: 9

The El Paso Collaborative for Academic Excellence

- Founded in 1991
- Goals:
  - To ensure academic success among all students, kindergarten-university
  - To ensure that all students graduate from high school prepared to succeed in a four-year college or university
  - To close the achievement gap between groups of students.
- Members:
  - President, The University of Texas at El Paso
  - President, El Paso Community College
  - Superintendent, El Paso Independent School District
  - Superintendent, Ysleta Independent School District
  - Superintendent, Socorro Independent School District
  - Executive Director, Education Service Center—Region 19
  - Lead Organizer, El Paso Interreligious Sponsoring Organization
  - President, Greater El Paso Chamber of Commerce
  - President, El Paso Hispanic Chamber of Commerce
  - President, El Paso Black Chamber of Commerce
  - Mayor, City of El Paso
  - County Judge, County of El Paso

The El Paso Collaborative for Academic Excellence

- Agenda
  - Attention to Standards - Uniformly high for all students
  - A Systemic Focus:
    - Whole Schools
    - Whole Districts
  - Simultaneous Renewal - K-16
  - Changing Policies and Practice
  - PD for Teachers and Administrators
  - Curriculum Alignment
- Funding:
  - National Science Foundation
    - Urban Systemic Program
    - Urban Systemic Initiative
    - Mathematics and Science Partnership
  - US Department of Education
  - Pew Charitable Trusts

What the Collaborative has worked to do over the past twenty-three years is based on fundamental commitment regarding what it means to bring about large-scale systemic change, Navarro explains. When the Collaborative began in 1991, the data revealed huge gaps in achievement, in course enrollment and completion, and in the state assessment between Latino and White students. These were the issues the Collaborative addressed, building on the notion of ensuring that teaching and learning be standards based, with standards set uniformly high for all students. The focus was systemic, working with whole schools and whole districts, and on K-16 simultaneous renewal. The work extended to professional development and curriculum quality and alignment.

The approach included changing policies and practices. Navarro recalls an example from the mid-90s, when the Collaborative focused on ensuring that all students were prepared for college, and determined that the best way to do that was ensure that districts committed to enrolling all students in the recommended high school program in Texas, the college preparatory program of study. Working with superintendents and school boards, the Collaborative managed to get policy changed ten years before the recommended high school program became the default curriculum for all high schools in Texas. They have continued to focus on other policies, including work on tenure and promotion policies at the university as part of this MSP project.

Navarro reviews the Collaborative's funding history, noting that work with teacher leaders began with funding from the NSF Urban Systemic Program, starting in 1995 with mentor teachers. "That's when we began to learn a bit about how to structure the work of teacher leaders, mentors, and coaches. We refined that as we moved into USI from USP, and refined it further in the MSP." In addition, Navarro states, they also gained knowledge from their Literacy Initiative, which heavily relied on school-based coaches provided by each school and trained by the Collaborative.

One important lesson that the Collaborative applied to its MSP work was the importance of qualifications.

Math/Science Staff Instructional Coaches Qualifications

- Bachelor of Science Degree in Mathematics or Science, or
- Bachelor of Science Degree in Education with Secondary Mathematics or Science Certification
- Advanced degree preferred
- Minimum of five years classroom teaching experience in either mathematics or science
- Experience providing professional development in the area of mathematics or science

Below is a chart of the background experience of the coaches, which offers a sense of the way the qualifications were distributed among the math and science coaches.

Background Experience of the Instructional Coaches

Subject	Degree in Field	Minor in Field	Advanced Degree in Field	Level of Teaching Experience	Instruction Support Experience
Mathematics (N=15)	50%	43%	14%	12.5	60%
Science (N=14)	100%	0%	27%	9	64%

CPRE, 2008.

Regarding advanced degrees in the field on the part of science coaches, Navarro explains that a number of those degrees were in biology, while the majority of the MSP work was in physics and chemistry. "Level of Teaching Experience" indicates the number of years of experience teaching at the middle or high school level. The MSP was initially focused only at the high school, extending to the middle school level within the last few years.

Over the years the Collaborative has learned about how to prepare math and science coaches, Navarro observes, and she outlines how those lessons translated into professional development in this MSP project.

Structuring the Work of the Math and Science Coaches

Professional development for the coaches was delivered over a two-week period in the summer and bi-weekly seminars during the academic year.

Training focused on three major topics:

- pedagogical content knowledge through content-based learning, lesson study, case studies, and the PCK Math/Science Effective Coaching Tools;
- cognitive/instructional coaching strategies to facilitate entrée into schools and classrooms, and to provide structures and processes for coaches to plan and work productively with teachers; and,
- analysis of student achievement data.

Preparation for middle school work:

- investigation of resources, and national and state standards for middle grade mathematics and science courses;
- analysis of state and local student achievement data to assess trends and identify critical academic needs of middle school students;
- examination of research on middle school culture and practice; and,
- in-depth discussions on the use of the Professional Teaching Model (PTM) lesson design process and the Classroom Observation Protocol to guide and advance their work with teachers.

Other Learning Opportunities:

- Peer observation, peer coaching, and expert coaching;
- Development of math/science case studies based on classroom experience and focused on common and relevant issues of practice;
- In-depth examination and discussion of research on math/science education, such as, the National Research Council's *How Students Learn: Math in the Classroom* and *How Students Learn: Science in the Classroom*; and,
- Co-development and co-delivery of math and science institutes with postsecondary faculty.

Another lesson the Collaborative gained from its Urban Systemic Initiative and Urban Systemic Program work was that for coaches to be successful, they needed a toolkit from the start. Navarro explains that these are tools that coaches could use either with teachers directly as a way of starting conversations, or ways in which they could structure the conversation in order to be of maximum use to the teachers.

Instructional Coaching Tools

Professional Teaching Model (PTM): The PTM is a lesson planning process that includes steps and procedures to assist teachers improve the quality of teaching and learning in the classroom. It begins with analysis of the state standards (Texas Essential Knowledge and Skills), identification of the concept or TEKS to be learned in the lesson(s) being planned and determination of the best way to assess student learning. It incorporates cognitive demand analysis to ensure that students are challenged to think at high levels.

Cognitive Coaching: This is a coaching model that provides a set of cognitive strategies, a way of thinking and a way of working with others to help them shape and reshape their thinking and problem solving capacities. The teacher, not the coach, analyzes and evaluates what is good or poor, appropriate or inappropriate, effective or ineffective about his/her work. The coach supports a process of cognitive development that leads the teacher to view his or her practice differently and to improve.

MSP Classroom Observation Protocol: This is a locally developed classroom observation tool that focuses attention on key aspects of instruction, cognitive demand of learning tasks, student engagement, and classroom discourse.

El Paso MSP Math and Science Curriculum Frameworks: The frameworks outline key math and science concepts that must be learned at each grade level. They are mapped to levels of cognitive demand and to state and national standards. In math, there are K through 8 frameworks, as well as algebra I and II, geometry, pre-calculus and calculus frameworks. In science, there are K through 8 frameworks, as well as biology, chemistry, and physics frameworks.

Pedagogical Content Knowledge (PCK) Tools for Effective Coaching: The Consortium of Policy Research in Education (CPRE), in collaboration with the Merck Institute for Science Education and the El Paso MSP produced a series of short literature reviews focused on key math and science concepts in the middle grades, that serve as a resource for conversation and study of the content. The purpose of the tools is to provide instructional coaches with strategies that address the most common student learning misconceptions. The PCK tools cover science topics such as energy, weather, light, density, and seasons; and math topics such as rational numbers, symbolic representation, graphs, and measurement.

Navarro then turns to the El Paso MSP's hypotheses regarding instructional coaches and reviews the project's research design.

El Paso MSP'S Hypotheses about Coaches/Staff Developers

- Well-prepared instructional coaches with strong math or science backgrounds and with a deep understanding of pedagogical content knowledge will have a positive impact on teacher practice and math/science student learning.
- Instructional coaches whose work and roles are supported by school principals will be more effective in impacting teacher instructional practice.
- Students in classes taught by teachers who have worked intensively with an instructional coach will have significantly higher math/science achievement levels.

Research Design

The research design for evaluating the impact of the El Paso MSP instructional coaches on teaching and learning involved multiple measures and analyses. Data from coaches and others were linked in order to evaluate the degree to which the work of the coaches was associated with changes in teachers' content and pedagogical knowledge, their instructional practices, their collaboration with peers, and ultimately, student performance. The following is a listing of the primary measures that were used in the study:

- Mathematics/ Science Teacher Surveys
- Staff Developer Interviews
- Teacher Interviews
- Principal Interviews
- Measure of Pedagogical Content Knowledge for Teaching Mathematics
- Measure of Student Performance

Navarro concludes the presentation with a description of the project's process for data analysis (below) and an overview of the findings (sidebar). She notes the disparity in the findings betwen gains related to work with science coaches and lack of similar gains related to work with math coaches. By the end of February 2009 all of this information, including the tools utilized and reports from the various studies, will appear on the Web site (http://epcae.org/msp/msp.htm).

Questions and Answers

Tracking Teachers Pre and Post

- Do you have test scores for the year prior to the MSP work, and can you see a change for a given teacher who worked with a coach? • Participant
- Yes, that was factored into this analysis. • Susana Navarro

Data Analysis

Data analysis involved linkage and triangulation of multiple sources of baseline, year-one, and year-two data in an effort to describe changes in instruction and student performance associated with the MSP program in middle schools. Most of the analyses used multilevel modeling techniques, such as Hierarchical Linear Modeling or HLM, and separate analyses to explore hypotheses posited by El Paso MSP.

The four main impact analyses were:

- First, an analysis was conducted to determine the impact of the El Paso MSP instructional coaches on middle school math and science teacher practices. This included a quantitative analysis of the relationship between participation in professional development and changes in teacher practices and attitudes as measured by the teacher survey and as captured by classroom observations.
- Second, the impact of the EL Paso MSP coaches on middle school math teacher content knowledge was examined through analysis of the results from the content knowledge measure. The statistical model for this analysis was a two-level HLM model with teachers nested within schools.
- Third, two analyses were conducted to determine the impact of the El Paso MSP on middle school math and science achievement. The first linked student achievement data to teacher survey data to explore the links between student learning gains and the degree of participation by individual teachers in professional development provided by the coaches. The second analysis was longitudinal, employing a growth curve model to evaluate changes in student rates of learning that were hypothesized to occur after the implementation of the MSP professional development program.
- Finally, an analysis of the factors which may have mediated the impacts of the El Paso MSP instructional coaches, including principal support and activities as instructional leaders, and school conditions and context, was conducted.

Findings

- The practices and strategies of the coaches varied across schools and districts. Data from the logs and interviews revealed four distinct approaches among the 24 staff developers: Analyst (n=8), Proceduralist (n=4), Mentor (n=9), and Helper (n=3).
- Students taught by a science teacher who participated in intensive work with a coach scored 33 points higher on the Texas Assessment of Knowledge and Skills (TAKS) science test in 2007 than other students.
- Teaching practice improved in many of the classrooms in which the coaches were working, and it improved in the areas focused on by coaches.
- The analyses of specific staff development activities and student achievement revealed that the core strategies of the MSP science coaches were significantly positively related to improved student performance in science during the 2006-07 school year.
- School contexts varied and influenced the work of the coaches; critical variables included principals' stance towards the availability and role of coaches; the school schedule and department meeting times; the professional culture of the school; and teachers' perceptions of their areas of need.
- Coaches reported differing levels of interest in and support for their work, as well as different approaches to structuring and managing their work, by their districts.
- The application of the PCK survey to math teachers in 2006 and 2007 showed some significant growth in their pedagogical content knowledge, but that growth was not related to improvements in mathematics student achievement on TAKS.

Why More Improvement in Science than Math?

- When you look at the demographics of the teachers, 100% of the science teachers had a background in science, whereas the math teachers did not. I think that what you are seeing [in terms of disparity in impact] is the background having an influence. • Participant

- It was tempting for us to believe that was one of the factors except that so many of these coaches had backgrounds in biology, and we did very little in biology. One might say, well, they knew enough chemistry, they knew enough physics. It's possible. Since we did not have a measure of content knowledge in science, we were not really able to assess the coaches along those lines. But I do think that idea is possible. • Susana Navarro

Defining "Intensive" Work with Teachers; Changes in Teacher Behavior

- May I ask how "intensively" was defined? You had this one teacher who worked with one coach intensively and produced such a high difference, something like thirty-three percent from the previous year. Did you try to look at exactly what that teacher did that differed from what other coaches were doing with other teachers? • Participant

- I heard two questions there. First, with regard to "intensive," there was a dialogue in one of the one-day sessions with the coaches in which, through conversation, we had a discussion regarding what "intensive" meant to them. We did have specific information about the amount of time they had spent with various teachers from the teacher logs. So again it was kind of related, and again those data were triangulated.

  With regard to whether the teachers' behavior changed, the teachers' behavior did change along the lines of what the coaches were working on most intensively with those teachers. So they were being more reflective, they were being more thoughtful in the way that they structured lessons, they were being more analytical about looking at student work and trying to figure out what it meant. They were doing a range of things that had been focused on by the coaches.

  The curious thing again is that even though it led to improvements in student achievement in science, that was not the case for mathematics. • Susana Navarro

The TAKS Test

- A natural question would be, what was the nature of the test? • Participant

- Well, TAKS certainly has lots of problems. It has gotten better over time, and at the middle school level it has gotten stronger. It's still a very flawed assessment of student knowledge and skills. Typically it tests at lower levels, though if you talk to any middle school teacher they will say that they are now being focused on much higher level content. For example, in algebra they're testing at a higher level of cognitive demand in TAKS than they ever have before. Is it enough? I'm not sure. Whether there was enough alignment between what we were asking them to do, what they were focusing the teachers on, and what they were then able to do in the classroom, and ultimately the way it would translate to student learning and demonstration of that learning on TAKS is yet another question. There is not really very good alignment there. • Susana Navarro

- I had a question about the TAKS and the total number of points on the test and what significance a thirty-three point gain is. Does that move them to a proficiency level, or is there a category jump that we're talking about here? • Participant

- My colleague, Alicia Parra, could have discussed this but was unable to be here, and I

don't have the answer to that. For the most part, the TAKS tests have scale scores that are 2,100 points for "proficient" and 2,400 for "commended." We were trying to figure out whether they had used scale scores because we were trying to figure out the significance of the thirty-three points as well. I think we can see that it's an improvement, and it's a greater improvement than would have been expected for that group of students, but I don't have the answer to your question.
• Susana Navarro

Variations in Types of Coaches and Their Impact

- How do you look at your student achievement data when you desegregate for the nature of the coach? In your findings you talk about coaching styles and types of coaches. For example, would the students who were taught by a teacher with a mentor coach perform differently than students taught by teachers with other types of coaches? If you had a large enough student population, what if you desegregate the student population according to the nature of the coach? • Participant
- In all honesty I don't remember if we did that. I know that we looked at teachers who worked with the mentor type of coach, and I think we know that the mentor coaches had more of an impact on teacher practice. I don't know if we know the impact on student achievement, but you're right, that would be a good thing to look at. • Susana Navarro
- Did the science or math coaches tend to be more one type of coach or the other? • Participant
- Curiously enough it was distributed fairly evenly in both groups. • Susana Navarro
- I was interested in the first finding that described how you characterized coaches in different ways: analyst, proceduralist, mentor and helper. I know that you were dealing with twenty-four people, which is a small number to slice and dice, but given the differences that you were characterizing in terms of how coaches did their work, I'm interested in what differences you start to see in how the work was carried out or the influence it had on teacher practice. • Participant
- We're still looking at these data to try to get more of a sense of what's happening. Right now they're divided up this way and that was the case for both mathematics and science. I think we could learn more by dividing them up that way, but we haven't looked at it yet. Clearly they're doing some similar things, but the differences in the way that they're doing it is critically important to the teachers. • Susana Navarro
- Were they all using the same set of tools? • Participant
- They were no coaches who used all of the

Variation in Teaching Styles

- I was curious as you look across the various schools, was it pretty even in terms of the teachers' teaching styles both in science and math? Were they all teaching pretty much the standard way or were some using inquiry? • Participant
- There was really a good amount of variability, which was clearl in the observations. One of the things we encouraged them to do was organize their classrooms in a way that would enable students, for at least a portion of the time, to engage in direct problem solving, to be reflective, that sort of thing. It didn't happen as much as we would have wanted. There were still about forty percent of the classrooms that looked pretty typical. Sixty percent did not, but there was that kind of range on many of these notions. Now those teachers who worked intensively with the coach did change their behavior along the lines we would have wanted, but still there was some fair amount of variability because obviously there was quite a number of teachers who did not work intensively with the coaches. We asked each coach to identify a handful of teacher with whom they worked most intensively. • Susana Navarro

Comparison Groups

- Did you have any comparison groups, either for the teacher performance according to the PCK or any of the student achievement data to see whether there was any difference between what other students were doing whose teachers didn't have access to coaches? • Participant

- No. All we did was control for the students' own achievement gains. We're very big supporters of accountability systems, even with the problems of assessment, but as noted earlier at this conference, when you are dealing with high needs school districts, especially in this accountability stressed environment, the pressures are very high to get everyone in.

  In fact, when we started talking to the superintendents about random assignment to the coaches the response was, "No way." Politically it is hugely problematic. They would say to us, "Are you going to go talk to the school board member who isn't going to get enough of his teachers and schools in with the coaches? I'm not." It was very clear that they would participate in the research, and we made them sign off on the research piece, but random assignment? Forget it. We stuck with it for months and finally had to back off. We were doing this not only in this intense accountability environment, but also with the tests having become more high level. Teachers felt very stressed and so did principals. Everybody did. • Susana Navarro

tools. For example, some of them used cognitive coaching a lot. Others said, "You know, I don't know if I'm using it wrong, but I just hardly use it." • Susana Navarro

Teasing Research Out of Large-Scale Systemic Change in High Needs Districts

- In the pedagogical content knowledge growth for your math teachers, was that in all three subareas of the measure? And was there any other professional development they were provided other than the coach? . • Participant

- Oh yes. • Susana Navarro

- So you have no idea whether that change in pedagogical content knowledge could be attributed to the coaching, level of intensity, or the other professional development. • Participant

- That's right. We tried as much as possible to take that into consideration, but the reality is that this was much less a research study than it was an evaluation. We were looking at the whole ball of wax, and we're trying to separate out these various elements. I will tell you that while I'm very much in favor of doing this thoughtful research of the kind you're talking about, remember that we started this as broad-scale systemic reform. We were really about trying to make sure that we were doing things that would ultimately help kids be more successful. Certainly if you look at the overall data, the kids in El Paso have been more successful than kids in other parts of the state.

  The truth of the matter, though, is that it's very hard to tease out these small things. You can do a great study, but you're looking at pretty little stuff. We know that if you're going to change opportunities for high quality education for kids in a very poor community where expectations have been traditionally quite low, we throw everything at it that we can. Admittedly that makes it more difficult to tell what is making a difference. I don't know how you reconcile those things, especially for people like us.

  I will tell you my own perspective, even though I have a Ph.D. in Ed. Psych. from Stanford and did the statistics and have the research background, I feel I'm primarily an advocate trying to change opportunities for minority and poor kids as opposed to being primarily a researcher. We felt we could bridge both of those things, but there is a lot of pressure in doing that when you're dealing with real-world districts and real-world pressures being felt by teachers, principals, superintendents and school board members. And yet I understand the importance of trying to figure out what works and what doesn't. • Susana Navarro