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Collaborative Partnership Helps Teachers Learn to Use Standards-Based Lessons and Analyze Data

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ABSTRACT:

This qualitative case study documented the presentation of a standards-based workshop to three groups of teachers. Collaboration of business, government and education groups created these professional development workshops for teachers. The sites for the workshops included one urban setting and one suburban setting. Three workshops composed of three once a month sessions were presented (two in the urban district, one in the suburban district) and analyzed to reveal the beliefs teachers held regarding: standards-based lessons, the use of technology for lesson plans and data analysis. The most glaring needs of these teachers were the abilities to collect and record data from student work, analyze the data, and reporting the conclusions reached from those analyses. Recommendations were made for incorporating more opportunities for teachers to engage in collaborative planning and examinations of teaching methods. The information gained from this study should be useful to any districts that are trying to answer the question "What is quality professional development and what are some creative ways to fund it?"

No Child Left Behind (NCLB) requires statistical evidence that students are improving their content mastery. Teachers are becoming anxious that more classroom instructional time will be sacrificed to standardized testing in order to provide data for school reports. In late September 2004, Secretary of Education Rod Paige stated "I think (NCLB) irreversibly changed the culture of K-12 education, I don't think it will ever … go back to the time when we did not focus on results"(Robelen, 2004). Teachers are spending hours of their personal time and their school planning time developing strategies to teach students how to be successful test takers. Issues surrounding "teaching to the test" are major concerns for teachers and administrators that affect instructional time, content depth, curriculum planning, and the scope and sequence of content as teachers prepare their yearly courses of instruction. How can teachers do what they are trained to do – teach – and respond to increasing demands to prepare students for multiple high stakes tests? Creative professional development is needed to help teachers make the transition into this new age of testing. The National Staff Development Council (NSDC) defines the ingredients necessary for quality professional development as results-driven, standards-based and job-embedded (Guskey & Sparks, 1991, Meyer, 2004). The Engineers Club of Dayton, Ohio, the Ohio Resource Center (ORC) and a mathematics educator joined forces to create a workshop focused on helping teachers learn how to use a new internet resource and to analyze their practice as well as student achievement using data from their students' work. All the work of the workshop is framed within the context of the teachers' regular instructional planning.

The intent of the federal legislation, NCLB, requires yearly standardized testing to measure student achievement. Teachers know that the results of high stake testing have dramatic impact upon the students, teachers, school buildings and school districts. Thus, it is imperative that teachers understand: 1) how to measure student success using data analysis; 2) how to collect data about their teaching; 3) how to analyze that data to improve their practice. To focus teachers on data throughout the workshop, the

workshop introduces teachers to the ORC as a source for standards-based lessons. Teachers can collect and analyze data regarding their teaching strengths and areas that need improvement as well as to help them analyze student achievement.

Background

The collaboration of educators, business professionals, and a university mathematics educator made it possible to offer this series of professional development workshops. Each group brought an essential element to the project that was valuable as a single entity, but potent when put in combination. The history of the creation of this project involved the collaboration of the ORC, the Ohio Mathematics and Science Coalition, the Ohio Board of Regents, the Engineers Club of Dayton, and the University of Dayton. The collective wisdom of these groups produced a workshop that enhanced student achievement through teacher professional development.

The Ohio Board of Regents, at the suggestion of the State University Education Deans, established a unique system--the ORC-- for teachers to access standards-based lesson plans in mathematics, science, and reading that reflect best practice. Many of the web sites have video clips of lessons that allow teachers to see the selected lesson presented to a class. The ORC is a web site that anyone with access to the internet can reach at www.ohiorc.org.

The Engineers Club of Dayton is a professional organization that promotes mathematics and science by funding educational projects in the community. Through the intervention of the Ohio Mathematics and Science Coalition, an independent advocacy group from business, education, and government that works to improve PK -16 mathematics and science education for Ohio, the ORC, and the Engineers Club of Dayton were linked. The collaboration between these groups provided the funding needed to conduct the workshops. The mathematics educator created the delivery method of three once-a-month workshops. Each day of the workshop focused on one major component of quality professional development. The workshop trained teachers to recognize the components of best practice, to use the ORC web site, to employ methods for collecting and analyzing data, and to develop skills in analyzing classroom practice, in basing pedagogical decisions on data, and in reporting the results to multiple groups.

The workshop used a modified lesson study design to create a collaborative learning experience for the teachers. Lesson study in its classic form is the development of a lesson over an extended period of time with input from multiple teachers. Lewis (2002) summarized the lesson study format as a spiral in which teachers present and perfect a specific lesson. Lewis's cycle of development starts with teachers' recognition of the learning styles of their students. It moves to the development of a content specific lesson that addresses the identified student needs. Peer reviewers observe the lesson and discuss the lesson elements for effectiveness and those parts of the lesson that need to be changed. A number of teachers in the group present the same lesson and with each presentation, a review occurs and adaptations are made to improve the lesson. Due to the diversity of grades and buildings of the teachers attending the workshops, the lesson study format described by Pong, Chik and Tang (n.d.) was used as a framework for this workshop. This format includes the elements of Lewis's (2001) cycle of lesson study but has more focus on data analysis. The Pong, Chik and Tang (n.d.) method allows for data analysis of a lesson by a single teacher. Thus, the workshops employed the lesson study format of Pong, Chik and Tang to help the teachers examine their pedagogy through data-based decisions.

Methodology

This study examined three workshop series regarding how the teachers from two sites varied in their responses to using a web-based resource for standards-based lesson plans and how they generated and analyzed data. A qualitative design was the methodology chosen for this research, including individual case studies and a cross-case analysis. Data were collected as the result of teacher pre-workshop and post workshop surveys, projects and teacher reflection papers submitted at the conclusion of the workshop.

Participants

The workshop was presented twice in an urban school district and once in a suburban district in 2003. Approximately 65 teachers attended these programs. On the first day of the workshop, a questionnaire was administered to gather demographic information and data regarding the prior knowledge the teachers had about: the ORC; using computer programs, application of academic content standards to lessons. (See Appendix A.) The mathematics educator used this information to tailor the workshop to the needs of the attending teachers. She focused the grade level web sites, academic content stan-

dards, and grouping of the teachers by the majority grade level present at the workshop.

The school districts offered the workshop to middle school teachers. Several secondary level teachers and special needs teachers attended. While the teachers' primary content area was mathematics, other content areas were present such as science, reading, and health. All participants were volunteers who received course credit or funds for classroom materials for their participation. The teachers ranged in years of experience from first year teachers to those who were in their 32nd year of the profession. The mean number of years of experience was 14.2 years of classroom teaching. Thirty of the teachers were at the bachelor's degree level and 35 held master's degrees. There were very low numbers of males in each group. Ten percent of the first urban group were males, the second group was held at the suburban site where 8% were males, and the last group at the urban site had 20% male participants. Of the 65 participants, 24 teachers reported that their best computer access was their home computer with 41 teachers preferring to use their school computers. Slightly more than half of the teachers had some knowledge of the ORC web site prior to the workshop. Forty-seven of the teachers were interested in using the whole lesson plan found on the web site; whereas only 18 viewed the web site as a source of lesson parts.

Procedure

The workshop consisted of three once a month meetings. The objectives of the workshop focused on:

1) Learning to use the Ohio Resource Center (www.ohiorc.org) web site as a source for peer reviewed, best practice lesson plans
2) Collecting and analyzing data from student work using spreadsheets and graphs
3) Reporting the pretest/post test results of the lessons to administrators and parents.

The design of the workshop encouraged teachers to work as teams. The teams were taught how to find lessons that use best practice pedagogical methods at the ORC web page. The teams of teachers collected and analyzed their students' data that was used to produce reflections on their students' achievement and their own teaching practice.

Day One — Learning How to Use the Ohiorc.org Web Site

Workshop Elements:

1) Discussion and definition of best practices for teaching mathematics
2) Using the Ohio Resource Center web site
3) Selecting a lesson plan to be taught between meetings that fit into their curriculum pacing charts
4) Writing a pretest for the selected lesson plan

The first day of the series began with a discussion focused on identifying the constituent parts of best practice lessons for teachers of mathematics, science, and reading. The groups reviewed the fifteen criteria rubric definition of best practice used by the ORC lesson reviewers to classify lessons. The teachers worked with partners or in groups to facilitate conversations focused on their practice and how their lessons affected student learning. To control for variations in the rigor of lesson planning, the teachers were trained in the use of the ORC and were limited to selecting lessons from only this web site. The lesson selection requirement stated that the chosen lesson content had to map into the curriculum sequence of each teacher's school. The teachers modified their selected lesson to address the needs and backgrounds of their students. From the content of the selected ORC lesson, they constructed a pretest of five to ten questions that were not overwhelming to students, but challenging enough to be used as the lesson content post test. At the end of the first day, the teachers left with their pretest/post test and an ORC lesson that was modified to meet the needs of their students. Between the first and second sessions, the teachers were required to pretest their students, teach the lesson and post test their students.

Day Two — Learning to Use EXCEL Spreadsheets and Graphs

Workshop Elements:

1) Review discussion of the selected lesson plans and how these plans met the needs of the teachers
2) Workshop facilitator models how to use EXCEL spreadsheets to compare pretest and post test data.
3) Teachers create spreadsheets of their students' data
4) Teachers analyze their students' data for students' strengths and weaknesses
5) Teachers analyze their students' data as a reflection on what areas their teaching needs to improve and/or change

The teachers returned with their pretest and post test data. The primary objective for the second session was to review and use EXCEL spreadsheets. Instruction included how to enter student scores and how to express those results by using graphs was explained and practiced. Our discussions focused on multiple methods of statistical representations. The teachers experimented with data entry and modes of presenting the material graphically. The suggested form for data collection used in the Pong, Chik and Tang (n.d.) method examined each question and identified the response as right or wrong, allowing for no partial credit. The graphed data for each question was cumulative for the whole class. The data identified how many students answered the problems correctly. This was a modification from the Pong, Chik, and Tang method, which graphed the number of incorrect responses. Culturally, this was not what the teachers in these workshops preferred. These teachers wanted a positive graph that recorded the success levels of the students. The scores for the pretest and the post test were displayed on one graph to illustrate how each tested question changed by improving or regressing in student understanding. The workshops provided time for the groups to discuss the effectiveness of the lesson, how the students responded, what issues remained, and what could be changed in the presentation of the lesson to increase student achievement.

The element of lesson study that required teachers to conduct data analysis in order to examine which lesson elements needed improvement opened the groups to make insightful observations about the unintended objectives in their lesson. By examining the questions asked in the pretest and post test with the students' scores, the teachers were able to inspect the possible contributing factors to those scores. The mathematics educator asked the teachers to consider what could be changed in their pedagogical content knowledge to increase student achievement. Was the math presented in a way that built off experiences of their students? Was the math presented in an age and grade appropriate manner? Was the math in this lesson scaffolded appropriately for their students? What additional content should be taught next? What content or presentation method would be needed to increase your student achievement the next time they taught this lesson? These topics motivated the teachers to examine their content knowledge and how they taught a lesson.

Day Three — Learning to Compose Reports for Different Audiences: Administrators and Parents

Workshop Elements:

1) Review analysis of data using EXCEL spreadsheets and graphs
2) Learning how to explain the data to administrators, local professional development committees, and to parents
3) Preparation of the reports
4) Compiling two lessons, the data, the analyses, and the reports and presented as workshop evidence.
5) Writing reflections on the workshop effectiveness

The teachers returned to the third workshop session with the data analysis of their first ORC lesson and the data from their second ORC lesson presentation. The workshop content focused on having the teachers provide evidence that they could interpret the graphical information that they created. The teachers composed three separate reports about the lesson data: one for administrators, another report for local professional development committees to provide evidence of professional development, and a third report for parents. Each report briefly described the goals of the lesson, the graphical data of the pretest and post test and explained what the included graph represented. The teachers shared their second lessons that they taught, their data analysis, conclusions that they reached about student achievement and their teaching methods. The lessons learned during teacher collaboration motivated teachers to examine their individual analysis of where they used best practices and helped them to address the learning needs of more of their students. The teachers shared several noteworthy web sites. The third session concluded with the teachers' reflections regarding the impact and usefulness of the workshops, and completed the post workshop exit surveys. The funders received copies of the reflections for their review. Modifications were made to subsequent workshop presentations based on the teachers' survey comments.

The purpose of this project was to share with teachers an effective means of using technology to increase student achievement, collect and analyze data, and peer review their pedagogical methods of teaching content. The data analysis of student scores caused the teachers to make changes to their pedagogy, which met the NSDC demand for research-based professional development. The standards-based criteria were met by using the ORC as the sole source for lesson content. Teachers were required to review their curriculum sequence and their daily content pacing

charts to select two timely lesson plans from the ORC web site, and to adapt the lessons for their students. This element satisfied the job-embedded requirement of staff development.

Procedure for Data Collection

A qualitative methodology was best suited for this study. The use of written documents (Patton, 1990) served as reliable sources of data collection. For the data collection, pre-workshop and post workshop surveys were developed. The design of the pre-workshop questions was to illuminate the experiences the teachers had using technology for lesson planning and to collect demographic data. (See Appendix A). The post workshop survey focused on teacher attitudes after working with presented materials. (See Appendix B). The documentation and information from the surveys supplied data for this study.

The researcher used sensitizing concepts to focus this study. Sensitizing concepts are starting points that guide data collections and direct a study where to examine data, what to examine, and they provide expectations about what will be produced (Denzin, 1989; Patton, 1990). Having taught at the high school level for 25 years, the researcher experienced many professional development in-service days and these experiences sensitized the focus of this study. The researcher's knowledge of relevant research and experiences with professional development served as an additional sensitizing concept and influenced the data analysis.

Results

In this section, the school districts are described, then a cross-case analysis follows that used the pre and post workshop surveys as data. A brief description of the demographics of the two school districts that offered the workshops provides the background for each site. The districts are identified with pseudonyms in order to maintain their anonymity. Two workshops were held in the Diversity district and one workshop occurred in the Target district.

Table 1

TWO SCHOOL DISTRICTS		
School Districts Characteristics	**Diversity**	**Target**
Student Population	26,000	8,000
Number of Teachers	1,700	458
Teacher – Years of Experience	15.3	15.0

Cross-Case Analysis

Based on a cross-case analysis of these three cases (workshops), three fields of information emerged: 1) themes found in the participants' reflections; 2) issues with the common requirements of the workshop where the teachers learned new methods; 3) post survey responses. Discussion of these three fields gave the researcher insights into how the teachers viewed professional development and the information presented in this workshop as well as what content areas needed additional information to be presented.

1) Participants Reflections

Four themes emerged from the participants reflections: a) ORC comments (ORC Lesson Plans), b) use of lesson study format (Lesson Study); c) how teachers plan to utilize the information from the workshop (Utilization); d) how the workshop encouraged teacher interactions and camaraderie (Camaraderie). Teacher responses to these themes are listed in Table 2 Teacher Reflection Themes.

2) Teachers Learning New Methods

The researcher observed four common areas within the structure of the workshop where the participants grappled with new pedagogical methods. The teachers focused their learning in the areas of: a) lesson adaptations, b) use of EXCEL spreadsheet program, c) reporting formats, d) lesson study where the teachers interacted when examining the lessons and student data.

a) Lesson Adaptations. The lesson adaptations made by the urban teachers for their students were cultural in nature and responded to urban student strengths. These adaptations included choral reading, additional group work, and oral reporting formats. The suburban teachers extended the lessons with additional assignments for those in their classes that needed greater challenges. Both groups of teachers added written assignments during the lessons in response to the Ohio Academic Content Standards requirements. All the teachers identified the importance of the ORC identifying specific academic content standards met in each lesson as helpful and time saving to their lesson planning.

b) Using EXCEL Spreadsheet Program. Several teachers were hesitant using the EXCEL program. They never used a spreadsheet program or forgot the procedural sequence for using the program. The workshop provided step-by-step instructions, which the teachers followed using their own student data to create a single graph of the pretest

TABLE 2:
Teacher Reflection Themes

ORC LESSON PLANS	LESSON STUDY	UTILIZATION	CAMARADERIE
1. I thought best practice lessons would be more complete. 2. The workshop provided a wealth of resources for teachers. 3. I have seen a lot of lesson plans, but the ORC are the best. 4. My students were impressed with the information I found in the lessons. 5. The ORC offers lessons rich in content and links to others. 6. The ORC is useful in giving teachers ideas to write their own standards-based lessons. 7. It was beneficial to see what resources are available to them to reduce their time creating lessons. 8. I thought the ORC lessons would have pretests and post tests in each lesson.	1. The lesson study format taught to us will be a boost to my professional development. 2. The workshop provided excellent opportunities for teachers to brainstorm lesson plans and their components. 3. I can actually go into my computer and do graphs on each student. 4. The ability to analyze the results will be of great value. 5. I feel this will take time to get use to. 6. It was helpful in representing student data graphically to see gains in learning. 7. By doing a lesson study, teachers can look at areas for remediation and plan activities. 8. The refresher on plotting in Excel was most informative.	1. I will definitely continue to use the ORC. 2. I will share the ORC with my department. 3. I hold myself accountable to present this material to my department. 4. Using best practice lessons will better prepare students for their futures. 5. Directly utilizing so much information from the web was awesome. 6. Basically, I will use this workshop as a catalyst to use the internet. 7. Teachers need to share this information with their colleagues and students in order to improve the whole educational process. 8. I plan to continue to communicate my findings to administrators and parents. 9. As department chair, I plan to share the ORC with my teachers and encourage their use of it.	1. Teachers need to know that there are people that care and support them. 2. The workshop provided collaboration among teachers to share and learn across the curriculum. 3. The workshop brought together teachers socially and in sharing academic ideas. 4. It is enjoyable to view the lessons of others and to adapt them to the needs of my students. 5. Workshops are sometimes the only time that I can associate with other math teachers in the district.

and post test results for each lesson. After practicing with EXCEL, the teachers became comfortable with the program, if not at ease with how to record data and present it in graphical form.

c) Reporting Formats. Reporting formats required detailed information for administrators and parents. The reporting forms were designed to provide data-based evidence that the teachers clearly understood their collected and recorded data. The reporting format for parents required the teachers to do a great deal of work translating pedagogical information into lay terminology. Continuous communication with parents has been a key to academic success for students (NBPTS, n.d.). Providing reports to parents enabled on going communication between parents and teachers about what was happening academically in the classroom and what the students understood about a specific lesson. These three reports were clear demonstrations of what the teachers understood of the workshop process and data analysis.

d) Lesson Study Teacher Interactions. Once the teachers mastered how to use spreadsheets and graph their student scores rich discussions took place within the teacher groups as they examined the graphs. One set of teachers found that their students could easily identify a quadrilateral, but had no success identifying a quadrilateral with no 90 degree angles. Their discussion examined their presentation of the material, what methods they used and how they planned the presentation to develop cognitive understanding of the concept of the quadrilateral. The teachers examined why their students were not able to identify a quadrilateral with no 90 degree angles as a parallelogram. The teachers revisited their curriculum map and their methods of teaching this unit, They concluded that they needed to scaffold the attributes of shapes to help their students learn shapes rather than just memorize the words used to identify shapes.

Another group of 6 inner city teachers introduced fractions, decimals and percents with a lesson that used the alphabet

shapes from a cereal box. They found that when the students did not eat their data pieces, the comparisons written as fractions, decimals and percents came quickly and easily to their students. They brought a second box of cereal for the students to eat while doing the calculations. Several of these teachers shared that their students extended the lesson because the students wanted to know the ratio of the letter R to the letter O in one cereal box. After analyzing the fractions, decimals, percents and ratios the students drew consumer conclusions as to whether the cereal content was worth the price. The teachers were excited that the students wanted to do more mathematics than was in the original lesson plan. The students' post test scores were all in the 90% range. All the teachers in this group were very encouraged by what they learned about student centered learning and seeing data that verified the student learning.

3) Post Survey Responses

Responses to the post workshop survey were uniform in the opinions of the participants. Almost all 65 teachers responded to each post survey question with a Yes response except question #2 about how well the ORC lessons matched the students' learning levels (See Appendix B). The participants selected *b. Close Match* as the most common response. Selection *c. Need some additional work by me* was the second preferred response.

Discussion

Darling-Hammond, et al (1995) noted that professional development can not be done in a one shot experience if new applications to pedagogical practice were to become embedded in daily practice. The collaborators in this project recognized the importance of teachers working over a period of time to develop habits of mind that would lead to enhanced professionalism and higher student achievement. The Engineers Club of Dayton and the ORC donated funds with the proviso that this workshop had multiple sessions over a period of time to train teachers in the use of a new technology resource. The mathematics educator added the ORC web site pieces with the data analysis and reporting elements. Specifically, the purpose of this project was to instruct teachers in an effective means of using technology to increase student achievement, collect data, analyze data and conduct a peer review of their pedagogical methods of teaching. Standards-based best practices helped the teachers to transition into using and creating a standards–based curriculum as a basis for planning the scope and sequence of a content area. Practice with those new techniques to perfect their use, and the applications of the new materials to their teaching styles required several workshop sessions. All of the workshops were conducted on Saturdays, which demonstrated the professional commitment of the attending teachers.

The reflection sheets provided insights to what the teachers thought of the workshop. The teachers participated with great energy. They enjoyed learning new approaches to lesson presentation, data collection and earning their professional development credits while doing work that would enhance their classes. The teachers stated in their exit reports that they were excited to find a web site that would save them time searching for teaching materials that aligned with the Ohio Academic Content Standards and were engaging for students. Some teachers had difficulty using the computers, but with peer assistance and the workshop presenter motivating the teachers, they pushed themselves to learn how to access the ORC, search the site, find and extract lesson plans, and how to use spreadsheets to graph the results.

The question for future examination: Did the teachers who attended these sessions continue to use the format presented to examine their teaching and their student learning? The teachers who took part in these workshops could be surveyed next year. They could be asked if they employed the methodology presented in this workshop and, if so, how did they use the process, for what purpose, how often, and what modifications did they make to the process to best serve their schools. The collaboration of the business, government, and educational communities resulted in a workshop that enhanced teacher professional development and demonstrated to teachers that the community they serve values them.

Implementing long-term professional development for teachers is a time management issue. According to the National Staff Development Council (Meyer, 2004), 25% of a teacher's day should be focused on professional development. While this number is the ideal, implementing this much time for teachers away from students is not practical in today's schools. Conducting workshops on Saturdays was the alternative to finding substitute teachers and having teachers out of their classrooms. The number of teachers who attended the workshops was testament to how seriously teachers take professional development when they believe it will be a benefit to their teaching.

What can other groups of mathematics supervisors take away from this study? Educators need to be aware that the business community is vitally committed to helping improve the education of all children. Government agencies want schools to graduate productive citizens who can contribute to the economic development of their state. These groups are willing to help educators fund professional development when that development produces evidence of improved teaching. While a mathematics educator designed the content and delivery method of this workshop, professional organizations were the concept formulators. A key to keeping teachers returning to complete the workshop was that the requirements of the workshop respected the teachers' classroom requirements and curriculum. Addressing the needs of today's classroom teachers for models of standards-based lessons and data analysis skills rather than adding extraneous work on to their plates helped to make this workshop successful.

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